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PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	Not yet assigned
	Filing Date	Herewith
	First Named Inventor	Samuel English Anthony
	Art Unit	Not yet assigned
	Examiner Name	Not yet assigned
	Practitioner Docket No.	35447-45618/US

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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I am the

☐ applicant.

☑ attorney or agent of record. Registration number 63,165.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Rajendra Panwar/ — Signature

January 30, 2020 — Date

Rajendra B. Panwar — Typed or printed name

650-335-7107 — Telephone Number

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Application Number	Not yet assigned
Filing Date	Herewith
First Named Inventor	Samuel English Anthony
Title	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
Art Unit	N/A
Examiner Name	N/A
Attorney Docket Number	35447-45618/US

SIGNATURE of Applicant or Patent Practitioner

Signature	/Rajendra Panwar/	Date (Optional)	January 30, 2020
Name	Rajendra B. Panwar	Registration Number	63,165
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	Perceptive Automata, Inc.		

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Title	Chief Executive Officer		

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NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefits of priority under 35 USC 119(e) to U.S. Provisional Application No. 62/798,978 filed on January 30, 2019, U.S. Provisional Application No. 62/800,416 filed on February 1, 2019, and U.S. Provisional Application No. 62/822,269 filed on March 22, 2019, each of which is incorporated herein by reference in its entirety for all purposes.

TECHNICAL FIELD

The present disclosure relates generally navigating an autonomous vehicle through traffic and more specifically to routing of an autonomous vehicle through traffic based on modulation of a world model representing traffic entities.

BACKGROUND

An autonomous vehicle uses different types of sensors to receive input describing the surroundings (or environment) of the autonomous vehicle while driving through traffic. For example, an autonomous vehicle may perceive the surroundings using camera images and lidar scans. The autonomous vehicle determines whether an object in the surroundings is stationary, for example, buildings or trees or the object is non-stationary, for example, a pedestrian, a vehicle, and so on. The autonomous vehicle system predicts the motion of non-stationary objects to make sure that the autonomous vehicle is able to navigate through non-stationary obstacles in the traffic.

Conventional systems predict motion of pedestrians and other vehicles to determine whether they are likely to come in the path of the autonomous vehicle. The autonomous vehicle navigates through traffic so as to avoid collisions with any pedestrians or other vehicles. However, conventional techniques fail to accurately predict motion of certain non-stationary objects for example, pedestrians, bicyclists, and so on. For example, if the autonomous vehicle detects a pedestrian standing in a street corner, the motion of the pedestrian does not help predict whether the pedestrian will cross the street or whether the pedestrian will remain standing on a street corner. Similarly, if the autonomous vehicle detects a bicyclist in a lane, the current motion of the bicycle does not help the autonomous vehicle predict whether the bicycle will change lanes.

Failure of autonomous vehicles to accurately predict motion of non-stationary traffic objects results in unnatural movement of the autonomous vehicle, for example, as a result of the autonomous vehicle suddenly stopping due to a pedestrian moving in the road or the autonomous vehicle continuing to wait for a person to cross a street even if the person never intends to cross the street.

SUMMARY

[0006] Embodiments of the invention predict hidden context attributes associated with traffic entities that determine behavior of these traffic entities in the traffic. The traffic entities represent non-stationary objects in the traffic in which the autonomous vehicle is driving, for example, a pedestrian, a bicycle, a vehicle, a delivery robot, and so on. Hidden context includes factors that affect the behavior of such traffic entities, for example, a state of mind of a user represented by a traffic entity such as a pedestrian. A hidden context may represent a task that a user represented by the traffic entity is planning on accomplishing, for example, crossing the street or stepping on to the street to pick up some object. The hidden

context may represent a degree of awareness of the autonomous vehicle by a user represented by the traffic entity. An example of a degree of awareness of the existence of the autonomous vehicle in the vicinity is whether a bicyclist is aware of the existence of the autonomous vehicle in the proximity of the bicyclist. The bicyclist may navigate the bicycle differently depending on the degree of awareness of the existence of the autonomous vehicle in the vicinity. The system uses the hidden context to predict behavior of people near a vehicle in a way that more closely resembles how human drivers would judge the behavior. The hidden context may represent a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval. For example, the goal may represent crossing the street to reach the other side of the street within the next few seconds.

[0007] In one embodiment, a group of users (or human observers) view sample images of traffic entities near streets and/or vehicles and indicate or are measured for their understanding of how they believe the people will behave. These indicators or measurements are then used as a component for training a machine learning based model that predicts how people will behave in a real-world context. The machine learning based model is trained based on the reactions of human observers to sample images in a training environment. The trained machine learning based model predicts behavior of traffic entities in a real-world environment, for example, actual pedestrian behavior in traffic as a vehicle navigates through the traffic.

[0008] According to an embodiment, an autonomous vehicle identifies traffic entities, for example, based on the sensor data. For each traffic entity, motion parameters describing movement of the traffic entity are determined. A hidden context is determined based on a machine learning based model. The machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic

scenarios to the users. The autonomous vehicle is navigated based on the motion parameters and the hidden context of each of the traffic entities.

[0009] According to an embodiment, an autonomous vehicle receives sensor data from sensors mounted on the autonomous vehicle. Traffic entities from the traffic are identified based on the sensor data. For each of traffic entity, a hidden context is determined based on a machine learning based model. The machine learning based model is trained based on feedback received from users presented with images or videos showing traffic scenarios. The output of the machine learning based model comprises a measure of statistical distribution of the hidden context. An activation threshold value is determined for a braking system of the autonomous vehicle based on the measure of statistical distribution of the hidden context. A prediction is made that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval. Responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, the braking system of the autonomous vehicle is activated.

[0010] In an embodiment, the activation threshold value for the braking system of the autonomous vehicle has a value inversely proportionate to the degree of uncertainty in determining the hidden context.

[0011] In an embodiment, the activation threshold value for braking system of the autonomous vehicle is determined based on the distribution of the hidden context. Accordingly, a measure of kurtosis of the output distribution of the hidden context is determined. The activation threshold value for braking system of the autonomous vehicle is determined to be a value inversely proportionate to the measure of kurtosis of the output distribution of the hidden context.

[0012] According to another embodiment, an autonomous vehicle modifies a world model based on the hidden context predicted by a machine learning based model. A point cloud representation of the surroundings of an autonomous vehicle is generated, for example, based on sensor data obtained by sensors of the autonomous vehicle. Traffic entities are identified based on the sensor data. For each traffic entity, motion parameters describing movement of the traffic entity are determined. A hidden context is predicted using a machine learning based model trained based on feedback received from users presented with images or videos showing traffic scenarios. A region of the point cloud where the traffic entity is expected to reach within a threshold time interval is determined. The region is modified based on the hidden context. The autonomous vehicle is navigated so that the autonomous vehicle stays at least a threshold distance away from the modified region of each traffic entity.

[0013] In an embodiment, the region is in the direction determined based on a motion vector of the traffic entity. The region is modified based on the hidden context as follows. If a determination is made that the hidden context indicates that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, the region is extended along the direction of the motion vector. If a determination is made that the hidden context indicates that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, the size of the region is decreased along the direction of the motion vector.

[0014] In an embodiment, the autonomous vehicle is navigated by generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities. The generated signals are sent to controls of the autonomous vehicle.

[0015] The sensor data may represent images captured by cameras mounted on the autonomous vehicle or lidar scans captured by a lidar mounted on the autonomous vehicle.

BRIEF DESCRIPTION OF FIGURES

[0016] Various objectives, features, and advantages of the disclosed subject matter can be more fully appreciated with reference to the following detailed description of the disclosed subject matter when considered in connection with the following drawings, in which like reference numerals identify like elements.

[0017] FIG. 1 is a system diagram of a networked system for predicting human behavior according to some embodiments of the invention.

[0009] FIG. 2 is the system architecture of a vehicle computing system that routes an autonomous vehicle based on prediction of hidden context associated with traffic objects according to an embodiment of the invention.

[0010] FIG. 3 is a system diagram showing a sensor system associated with a vehicle, according to some embodiments of the invention.

[0011] FIG. 4 is a flowchart showing a process of training a machine learning based model to predict hidden context information describing traffic entities, according to some embodiments of the invention.

[0012] FIG. 5 is a flowchart showing a process of predicting the state of mind of road users using a trained learning algorithm, according to some embodiments of the invention.

[0013] FIG. 6 is a diagram showing an example of an application of a context user prediction process in an automobile context, according to some embodiments of the invention.

[0014] FIG. 7 represents a flowchart illustrating the process of navigating the autonomous vehicle based on hidden context, according to an embodiment.

[0015] FIG. 8 represents a flowchart illustrating the process of modulating the world model for navigating the autonomous vehicle, according to an embodiment.

[0016] FIG. 9 represents a flowchart illustrating the process of using the modulatory signals to reduce false positives while navigating the autonomous vehicle, according to an embodiment.

[0017] FIG. 10 illustrates sensor data captured by the autonomous vehicle illustrating traffic entities, according to an embodiment.

[0018] FIG. 11 illustrates various objects surrounding the autonomous vehicle, according to an embodiment.

[0019] FIG. 12 illustrates an occupancy grid representation of objects surrounding the autonomous vehicle, according to an embodiment.

[0020] FIG. 13 illustrates segmentation of various traffic entities in the occupancy grid representation of the surroundings of the autonomous vehicle, according to an embodiment.

[0021] FIG. 14 illustrates determination of safe distance from traffic entities while navigating through the traffic by the autonomous vehicle, according to an embodiment.

[0022] FIG. 15 illustrates determination of safe distance based on trajectory of traffic entities, according to an embodiment.

[0023] FIG. 16 illustrates modulation of safe distance based on predicted hidden context associated with traffic entities, according to an embodiment.

[0024] FIG. 17 is a block diagram illustrating components of an example machine able to read instructions from a machine-readable medium and execute them in a processor (or controller).

DETAILED DESCRIPTION

Determining a Stable Signal for Predicting Behavior of Traffic Entities

[0025] A pedestrian consumes information about the world that the pedestrian is walking in. The sensory apparatus of a traffic entity, for example, a pedestrian ingests many

gigabytes of information about the world. This information is converted into a vast range of inferential judgments. Those judgments are used to update and execute moment-by-moment motion plans that propel the pedestrian through the traffic, and allow it to reach the pedestrian's target.

[0026] A human brain is able to negotiate complex situations with many contingent factors. This flexibility and capacity that makes human behavior very difficult to model using a computer. Even given a consistent goal structure the complexity of predicting human inference scales with the complexity of the inputs to the human perceptual system. In a complex environments, such as a pedestrian navigating a busy intersection, the number of perceptual inputs with high valence to moment-by-moment motion planning is extremely large. At any time the pedestrians actions at the next moment are influenced by many hundreds of different aspects of the scene. These can include moving agents, contextual cues, distractions, fixed obstacles, newly noticed scene aspects, and the internal process of reflection. Because of this, predicting the behavior of a pedestrian at any time that is not extremely close to the present is intractable. Even with a complete world model, the number of possible actions at, say, one second from the present moment are subject to a combinatorial explosion.

[0027] Embodiments of the invention extract a stable signal of potential behavior of a traffic entity, for example, pedestrian that is not subject to the combinatorial explosion of inputs. In one embodiment, this stable signal is used to modulate the performance envelope of a vehicle under full or partial automatic control. In another embodiment, this stable signal is used to inform the human operator of a vehicle that the behavior of upcoming road users may require their attention.

[0028] In an embodiment, the stable signal is a computational model of the mental state of the pedestrian. Humans look at other humans and with a high degree of reliability and

make estimates of their internal mental states as they apply to behavior. Embodiments of the invention train a model by leveraging indirect but highly reliable measurements of human theory of mind reasoning. This allows the model to make predictions about the internal mental states of others.

[0029] Embodiments of the invention predict an internal mental state of a pedestrian as a stable signal. The internal mental state of a pedestrian comprises a goal-oriented planning and evaluation system with short and long-term memory. A pedestrian on the sidewalk has come to occupy the sidewalk in pursuance of a specific goal (for example, to get to the other side). This goal has a duration that is (in general) far longer than the amount of time in which a computing system of an automatic vehicle would have to consider that pedestrian's state of mind. If a pedestrian has the goal of eventually reaching a destination on the other side of the street down which the vehicle in question is traveling, that goal will obtain until they have reached that destination. This goal will not generally be changed by transient conditions like the appearance of a "do not walk" sign. However, the likelihood that the pedestrian steps into the street at any given moment is very contingent on that transient condition. Embodiments of the invention predict estimates of state of mind, which aim to predict the internal goal and belief structure of the pedestrian, are therefore not subject to the combinatorial explosion of contingent factors.

[0030] A non-stationary object may also be referred to as a movable object. An object in the traffic may also be referred to as an entity. Systems for predicting human interactions with vehicles are disclosed in U.S. Patent Application Number 15/830,549, filed on December 4, 2017 which is incorporated herein by reference in its entirety.

System Environment

[0031] FIG. 1 is a system diagram of a networked system for predicting human behavior according to some embodiments of the invention. FIG. 1 shows a vehicle 102, a network

104, a server 106, a user response database 110, a client device 108, a model training system 112 and a prediction engine 114.

[0032] The vehicle 102 can be any type of manual or motorized vehicle such as a car, bus, train, scooter, or bicycle. As described in more detail below, the vehicle 102 can include sensors for monitoring the environment surrounding the vehicle. In one implementation, the sensors can include a camera affixed to any portion of the vehicle for capturing a video of people near the vehicle.

[0033] The network 104 can be any wired and/or wireless network capable of receiving sensor data collected by the vehicle 102 and distributing it to the server 106, the model training system 112, and, through the model training system 112, the prediction engine 114.

[0034] The server 106 can be any type of computer system capable of (1) hosting information (such as image, video and text information) and delivering it to a user terminal (such as client device 108), (2) recording responses of multiple users (or human observers) to the information, and (3) delivering such information and accompanying responses (such as responses input via client device 108) back to the network 104.

[0035] The user response database 110 can be any type of database or data storage system capable of storing the image, video, and text information and associated user responses and subsequently recalling them in response to a query.

[0036] The model training system 112 can be implemented in any type of computing system. In one embodiment, the system 112 receives the image, video, and/or text information and accompanying, or linked, user responses from the database 110 over the network 104. In some embodiments, the text segments are discrete values or free text responses. The model training system 112 can use images, video segments and text segments as training examples to train an algorithm, and can create labels from the accompanying user responses based on the trained algorithm. These labels indicate how the algorithm predicts

the behavior of the people in the associated image, video, and/or text segments. After the labels are created, the model training system 112 can transmit them to the prediction engine 144.

[0037] The prediction engine 114 can be implemented in any computing system. In an illustrative example, the prediction engine 114 includes process that executes a model that has been trained by the model training system 112. This process estimates a label for a new (*e.g.,* an actual "real-world") image, video, and/or text segment based on the labels and associated image, video, and/or text segments that it received from the model training system 112. In some embodiments, this label comprises aggregate or summary information about the responses of a large number of users (or human observers) presented with similar image, video, or text segments while the algorithm was being trained.

[0038] FIG. 2 is the system architecture of a vehicle computing system that routes an autonomous vehicle based on prediction of hidden context associated with traffic objects according to an embodiment of the invention. The vehicle computing system 120 comprises the prediction engine 114, a future position estimator 125, a motion planner 130, a vehicle control module 135, a world model modulation module 145, and a false positive reduction module 155. Other embodiments may include more or fewer modules than those shown in FIG. 2. Actions performed by a particular module as indicated herein may be performed by other modules than those indicated herein.

[0039] The sensors of an autonomous vehicle capture sensor data 160 representing a scene describing the traffic surrounding the autonomous vehicle. Examples of sensors used by an autonomous vehicle include cameras, lidars, GNSS (global navigation satellite system such as a global positioning system, or GPS), IMU (inertial measurement unit), and so on. Examples of sensor data includes camera images and lidar scans.

[0040] The traffic includes one or more traffic entities, for example, a pedestrian 162. The vehicle computing system 120 analyzes the sensor data 160 and identifies various traffic entities in the scene, for example, pedestrians, bicyclists, other vehicles, and so on. The vehicle computing system 120 determines various parameters associated with the traffic entity, for example, the location (represented as x and y coordinates), a motion vector describing the movement of the traffic entity, and so on. For example, a vehicle computing system 120 may collect data of a person's current and past movements, determine a motion vector of the person at a current time based on these movements, and extrapolate a future motion vector representing the person's predicted motion at a future time based on the current motion vector.

[0041] The future position estimator 125 estimates the future position of a traffic entity. The motion planner 130 determines a plan for the motion of the autonomous vehicle. The vehicle control module 135 sends signals to the vehicle controls (for example, accelerator, brakes, steering, emergency braking system, and so on) to control the movement of the autonomous vehicle. In an embodiment, the future position estimates for a traffic entity determined by the future position estimator 125 based on sensor data 160 are provided as input to the motion planner 130. The motion planner 130 determines a plan for navigating the autonomous vehicle through traffic, and provides a description of the plan to the vehicle control module 135. The vehicle control module 135 generates signals for providing to the vehicle controls. For example, the vehicle control module 135 may send control signals to an emergency braking system to stop the vehicle suddenly while driving, the vehicle control module 135 may send control signals to the accelerator to increase or decrease the speed of the vehicle, or the vehicle control module 135 may send control signals to the steering of the autonomous vehicle to change the direction in which the autonomous vehicle is moving.

[0042] FIG. 3 is a system diagram showing a sensor system associated with a vehicle, according to some embodiments of the invention. FIG. 3 shows a vehicle 306 with arrows pointing to the locations of its sensors 300, a local processor and storage 302, and remote storage 304.

[0043] Data is collected from cameras or other sensors 300 including solid state Lidar, rotating Lidar, medium range radar, or others mounted on the car in either a fixed or temporary capacity and oriented such that they capture images of the road ahead, behind, and/or to the side of the car. In some embodiments, the sensor data is recorded on a physical storage medium (not shown) such as a compact flash drive, hard drive, solid state drive or dedicated data logger. In some embodiments, the sensors 300 and storage media are managed by the processor 302.

[0044] The sensor data can be transferred from the in-car data storage medium and processor 302 to another storage medium 304 which could include cloud-based, desktop, or hosted server storage products. In some embodiments, the sensor data can be stored as video, video segments, or video frames.

[0045] In some embodiments, data in the remote storage 304 also includes database tables associated with the sensor data. When sensor data is received, a row can be added to a database table that records information about the sensor data that was recorded, including where it was recorded, by whom, on what date, how long the segment is, where the physical files can be found either on the internet or on local storage, what the resolution of the sensor data is, what type of sensor it was recorded on, the position of the sensor, and other characteristics.

[0046] FIG. 4 is a flow chart showing a process of predicting human behavior, according to some embodiments of the invention. In one implementation, video or other data is captured by a camera or sensor mounted on the vehicle 102. The camera or other sensor can

be mounted in a fixed or temporary manner to the vehicle 102. Of course, the camera does not need to be mounted to an automobile, and could be mounted to another type of vehicle, such as a bicycle. As the vehicle travels along various streets, the camera or sensor captures still and/or moving images (or other sensor data) of pedestrians, bicycles, automobiles, *etc.* moving or being stationary on or near the streets. In step 402, this video or other data captured by the camera or other sensor is transmitted from the vehicle 102, over the network 104, and to the server 106 where it is stored.

[0047] Then, in step 404, video frames or segments are extracted from the stored video or other data and are used to create stimulus data including derived stimulus (or stimuli). In one implementation, the derived stimulus corresponds to a scene in which one or more humans are conducting activities (*e.g.,* standing, walking, driving, riding a bicycle, *etc.*) beside or on a street and/or near a vehicle. As explained in more detail below for example in step 214 and in the text accompanying FIG. 9, as part of the training process for the prediction algorithm, human observers view the derived stimulus and predict how they believe the humans shown in the derived stimulus will act. In yet a further implementation, after the video frames or segments are extracted from the stored data, the derived stimulus is generated by manipulating the pixels or equivalent array data acquired from the camera or other sensor in step 204, producing a new data file that conveys a portion of the information from the original video with certain aspects highlighted or obscured.

[0048] In step 406, the derived stimulus is transmitted from the server 106 and displayed to a large number of users (or human observers) on the client device 108 (or multiple client devices 108). The client devices(s) 108 prompt the human observers to predict how the people shown in the derived stimulus will act, and upon viewing the displayed stimulus, the observers input their responses corresponding to their predictions. For example, the human observers may predict that a bicyclist will continue riding, whether a first person in the

stimulus will cross the street, whether another person will remain standing on a street corner, and yet another person will change lanes on his or her bicycle. In an illustrative embodiment, the human observers may make a continuous or ordinal judgment about the state of mind or the predicted behavior of the people shown in the derived stimulus and record that judgment. For example, the human observers may select an appropriate icon displayed on the client devices(s) 108 by clicking a mouse or by pressing a key to indicate their judgment or prediction. The judgment or prediction may correspond to the human observers' assessment of the state of mind of the person in the derived stimulus or other awareness or intention that would be relevant to a hypothetical driver who sees the person in the derived stimulus while driving. In step 408, the derived stimulus and associated human observer responses are transmitted from the client device(s) 108 to the server 106 and recorded in the user response database 110.

[0049] In step 410, summary statistics are generated based on the user responses. For example, the statistics may characterize the aggregate responses of multiple human observers to a particular derived stimulus. For instance, if the derived stimulus shows a pedestrian walking on a sidewalk towards an intersection, the response can be categorized in terms of how many human observers believe that the pedestrian will stop upon reaching the intersection, continue walking straight across the intersection, turn a corner and continue walking along the sidewalk without crossing the intersection, *etc.* These summary statistics can characterize the human observer responses in terms of certain parameters associated with the statistics, such as a content of a response, a time associated with entering a response, and a position of an eye of a human observer associated with the response. The parameters can also be associated with a (1) central tendency, variance, skew, kurtosis, scale, or histogram. For example, the amount of time users took to input their responses can be characterized in terms of central tendency, variance, skew, kurtosis, scale, histogram. Also, the statistics can

include a parameter that additionally or alternatively characterizes the movement of the human observers' eyes relative to a display when making the judgments in terms of central tendency, variance, skew, kurtosis, scale, histogram or two-dimensional distribution. In one embodiment, the statistics are stored in the user response database 110 with an index that identifies the raw video or sensor data from which the derived stimulus was generated. In a further embodiment, the statistics stored in the database 110 cover a large set of images of people on or near roads and are categorized in a number of different categories, such as pedestrian, driver, motorcyclist, bicyclist, scooter driver, self-balancing scooter rider, unicyclist, motorized wheelchair user, skateboarder, or others. Moreover, the statistics are respectively stored along with, or linked to, the images of the derived stimuli corresponding to the statistics.

[0050] In step 412, the stored statistics and corresponding images (*e.g.,* the video frames or segments that were extracted from the video or other data (captured from the camera or sensor of the vehicle 202)) are sent over the network 104 to the model training system 112 and used to train a prediction algorithm. For example, the collection of images and statistics can be used to train a supervised learning algorithm, which can comprise a random forest regressor, a support vector regressor, a simple neural network, a deep convolutional neural network, a recurrent neural network, a long-short-term memory **(LSTM)** neural network with linear or nonlinear kernels that are two dimensional or three dimensional, or any other supervised learning algorithm which is able to take a collection of data labeled with continuous values and adapt its architecture in terms of weights, structure or other characteristics to minimize the deviation between its predicted label on a novel stimulus and the actual label collected on that stimulus using the same method as was used on the set of stimuli used to train that network. The model is given data which comprises some subset of the pixel data from the video frames that the summary statistics were generated from. In one

implementation, this subset includes the pixel data contained in a bounding box drawn to contain the boundaries of the person, cyclist, motorist and vehicle, or other road user, including their mode of conveyance. In some other implementations, it also includes the entire pixel data from the rest of the image. In one of those implementations, that pixel data is selected according to criteria such as the salience of those features in terms of contrast, lighting, presence of edges, or color. In an additional implementation, the features can include descriptive meta-data about the images such as the dimensions and location of the bounding box, the shape of the bounding box or the change in size or position of the bounding box from one frame to the next.

[0051] In step 414, the prediction engine 114 uses the trained model from the model training system 112 to predict the actual, "real-world" or "live data" behavior of people on or near a road. In one embodiment, the prediction engine 114 receives "live data" that matches the format of the data used to train the trained model. For example, if the trained model was trained based on video data received from a camera on the vehicle 102, the "live data" that is input to the algorithm likewise is video data from the same or similar type camera. On the other hand, if the model was trained based on another type of sensor data received from another type of sensor on the vehicle 102, the "live data" that is input to the prediction engine 114 likewise is the other type of data from the same or similar sensor.

[0052] The trained model or algorithm makes a prediction of what a pedestrian or other person shown in the "live data" would do based on the summary statistics and/or training labels of one or more derived stimulus. The accuracy of the model is determined by having it make predictions of novel derived stimuli that were not part of the training images previously mentioned but which do have human ratings attached to them, such that the summary statistics on the novel images can be generated using the same method as was used to generate the summary statistics for the training data, but where the correlation between

summary statistics and image data was not part of the model training process. The predictions produced by the trained model comprise a set of predictions of the state of mind of road users that can then be used to improve the performance of autonomous vehicles, robots, virtual agents, trucks, bicycles, or other systems that operate on roadways by allowing them to make judgments about the future behavior of road users based on their state of mind.

[0053] The server 106 generates derived stimuli from raw camera or sensor data of the vehicle for presenting to human observers. As described above, sensor data can include video segments or specific frames. These frames can either be contiguous or non-contiguous, and can be in the original order, in a permuted order, in reverse order, or in random order. Some of the frames can be repeated once or more than once.

[0054] Some of the frames may be manipulated. The frames can be manipulated by adjusting pixel values. These manipulations can include blurring, the addition or one or more occluding bars, bands, or shapes, sharpening, the removal of color information, the manipulation of color information, the drawing of non-occluding or highlighting shapes on the image, other manipulations, or a combination of the manipulations listed here, or a combination of the manipulations listed here with other manipulations, or other manipulations of the pixels not listed combined with each other. The manipulations serve the purpose of highlighting, occluding or degrading portions of the image, so that when the images are shown to the human observers, they are directed to people or specific portions of the image when predicting what the people in the images will do. For example, using the highlighting described above, a certain pedestrian in a scene can be isolated such that a human observer's feedback can be more reliably associated with the pedestrian. Frames may be recombined to form a derived stimulus. In some embodiments, if there is only one frame, that frame comprises the derived stimulus. If there is more than one frame those frames may then be recombined.

[0055] Predictions and other information is collected from human observers based on derived stimuli. Human observers are given detailed instructions about how to answer questions about derived stimuli. Those observers are presented with derived stimuli and asked to answer questions about them. The observers respond to the stimuli and those responses are recorded. The recorded responses are aggregated and logged in a database, for example, the user response database 110.

[0056] Human observers are recruited to participate on one or several crowdsourcing websites, such as Amazon's Mechanical Turk or at a physical location provided with a display. The observers are given detailed written and pictorial instructions explaining the task that they are about to complete. These instructions give examples of situations that might be depicted in the derived stimuli, and the kinds of responses that would be appropriate for those situations. For example, if human observers are asked to judge the intention of a pedestrian to walk in front of a car, the instructions may be: "In this test, we want you to pretend you're driving a car. You'll see road scenes with cyclists highlighted, and you'll have to decide what they're planning to do. Try to answer as quickly as you can."

[0057] The human observers may be shown a display which includes the derived stimulus. The display also includes a mechanism for making a judgment about the stimulus. The mechanism for making the judgment can be a continuous indicator such as a ribbon on which the observer could drag a control to a certain point. The mechanism can also be an ordinal measure such as a Likert scale where the observer can make a judgment about a degree of certainty of the judgment. The mechanism can also be a control that the human observer drags with their mouse to draw a trajectory onscreen indicating a judgment. The mechanism can also be a text entry field where the observer types a description of their judgment.

[0058] The judgment that the human observer makes is a hidden context attribute that may represent an evaluation of the state of mind of a road user depicted in the derived stimulus. The evaluation can be of the intention, awareness, personality, state of consciousness, level of tiredness, aggressiveness, enthusiasm, thoughtfulness or another characteristic of the internal mental state of the pictured road user. If the ratings collected are on an ordinal scale they can describe the characteristic using language of probability, such as "the other driver may be attentive" or "the other driver" is definitely attentive" or "the other driver is definitely not attentive".

[0059] The ratings of large numbers of human observers are collected. Summary statistics are generated based on the responses of all of the observers who looked at an image. Individual variability in responses to a given stimulus can be characterized in the information given by the observers to the learning algorithm. The summary statistics might include unweighted information from all observers, or might exclude observers based on extrinsic or intrinsic criteria such as the time it took an observer to respond, the geographical location of an observer, the observer's self-reported driving experience, or the observer's reliability in making ratings of a set of other images.

[0060] The explicit response of the observer is recorded as well as implicit data. The implicit data can include how long the subject took to respond, if they hesitated in their motions, if they deleted keystrokes, if they moved the mouse anywhere other than the location corresponding to the response they eventually chose, where their eyes moved, or other implicit measures.

[0061] The responses are aggregated and recorded in a data structure, such as the user response database 110. This data structure is then sent as a text field to a networked computer system running database software and logged in a database.

[0062] For each stimulus rated by each human observer, a response is recorded that could be a continuous, discrete, or ordinal value. This value may refer to the probability of the pictured human road user has a given state of mind — e.g. that a pedestrian is likely to cross the street or that an oncoming vehicle is unlikely to be willing to yield to the vehicle containing the sensor if the vehicle containing the sensor needs to tum. In some embodiments, a higher ordinal value (e.g., the ordinal 4 as shown in FIG. 6) indicates that a human observer believes that there is a higher probability that the pictured human road user has a given state of mind or will perform a particular action. On the other hand, a lower ordinal value (e.g., the ordinal 1) indicates that the human observer believes that there is a lower probability that the pictured human road user has the state of mind or will perform the particular action. On the other hand, in some embodiments, a lower ordinal value can indicate a higher probability of an action, and a higher ordinal value can indicate a lower probability of an action.

[0063] An amount of time associated with a subject responding to the derived stimulus may also be recorded. In some embodiments, this time is associated with the overall reliability of the human observer's rating. For example, a response associated with a lower response time may be weighted higher and a response associated with a slower response time may be weighted lower.

[0064] Summary statistics of a video frame or derived stimulus is generated. These summary statistics could include measurements of the central tendency of the distribution of scores like the mean, median, or mode. They could include measurements of the heterogeneity of the scores like variance, standard deviation, skew, kurtosis, heteroskedasticity, multimodality, or uniformness. They could also include summary statistics like those above calculated from the implicit measurements of the responses listed

above. The calculated summary statistics are linked to the video frame or sensor data frame associated with the responses from which they were calculated.

[0065] The summary statistics is used for training machine learning based models. The machine learning based model may be any type of supervised learning algorithm capable of predicting a continuous label for a two or three dimensional input, including but not limited to a random forest regressor, a support vector regressor, a simple neural network, a deep convolutional neural network, a recurrent neural network, a long-short-term memory (LSTM) neural network with linear or nonlinear kernels that are two dimensional or three dimensional.

[0066] In one embodiment of the model training system 112, the machine learning based model can be a deep neural network. In this embodiment the parameters are the weights attached to the connections between the artificial neurons comprising the network. Pixel data from an image in a training set collated with human observer summary statistics serves as an input to the network. This input can be transformed according to a mathematical function by each of the artificial neurons, and then the transformed information can be transmitted from that artificial neuron to other artificial neurons in the neural network. The transmission between the first artificial neuron and the subsequent neurons can be modified by the weight parameters discussed above. In this embodiment, the neural network can be organized hierarchically such that the value of each input pixel can be transformed by independent layers (e.g., 10 to 20 layers) of artificial neurons, where the inputs for neurons at a given layer come from the previous layer, and all of the outputs for a neuron (and their associated weight parameters) go to the subsequent layer. At the end of the sequence of layers, in this embodiment, the network can produce numbers that are intended to match the human summary statistics given at the input. The difference between the numbers that the network output and the human summary statistics provided at the input comprises an error signal. An

algorithm (e.g., back-propagation) can be used to assign a small portion of the responsibility for the error to each of the weight parameters in the network. The weight parameters can then be adjusted such that their estimated contribution to the overall error is reduced. This process can be repeated for each image (or for each combination of pixel data and human observer summary statistics) in the training set. At the end of this process the model is "trained", which in some embodiments, means that the difference between the summary statistics output by the neural network and the summary statistics calculated from the responses of the human observers is minimized.

[0067] FIG 5. is a flowchart showing a process of predicting the state of mind of road users using a trained learning algorithm, according to some embodiments of the invention. In step 500, the training algorithm receives a "real world" or "live data" video or sensor frame. Then in step 502, the trained algorithm analyzes the frame, thus enabling the algorithm in step 504 to output a prediction of summary statistics on the frame.

[0068] The "real world" or "live data" video or other sensor frames from a car-mounted sensor are delivered to the trained learning algorithm in step 500. These frames have the same resolution, color depth and file format as the frames used to train the algorithm. These frames are delivered as individual frames or as sequences according to the format used to train the original algorithm.

[0069] Each of these frames is analyzed by being passed through the trained model in step 502. In one embodiment, the data from the frame that was passed through the model would comprise the pixel data from a camera. This data would be transformed by a trained artificial neural network. At the final stage of the processing in the artificial network, it would produce an output. This output is the model output in step 504.

[0070] The model outputs a number or set of numbers that comprise the predicted summary statistics for the "real world" or "live data" image in step 504. The predicted

summary statistics are the model's best estimation of what the summary statistics would be on the image if the image had human annotations collected. The prediction is generated automatically by passing the sensor data through the model, where the information is transformed by the internal mechanisms of the model according to the parameters that were set in the training process shown in step 804. Because these summary statistics characterize the distribution of human responses that predict the state of mind of a road user pictured in the stimulus, the predicted statistics are therefore a prediction of the aggregate judgment of human observers of the state of mind of the pictured road user and thus an indirect prediction of the actual state of mind of the road user.

[0071] FIG. 6 is a diagram showing an example of an application of a context user prediction process in an automobile context, according to some embodiments of the invention. In this example intention 606 618 means that the road user 602 614 has the goal of moving into the path of the vehicle 600 before the vehicle 600 (on which the system is mounted) reaches their position. Awareness 604 616 in this example means that the road user 602 614 understands that the vehicle on which the system is mounted 600 is present in their vicinity. In this example, when cyclist 602 rides into the field of view of a camera mounted on vehicle 600, the pixel data of the camera image of the cyclist is fed to a trained machine learning based model as described above in step 900. The trained machine learning based model analyzes the image as described above in step 902. The trained machine learning based model predicts summary statistics as in step 904. These summary statistics are an estimate of what the summary statistics would be for a collection of human observers who were shown a derived stimulus of the camera data as in step 504. The estimates summary statistics are therefore the system's best answer to the question "does this cyclist intend to enter the path of the vehicle." The vehicle is therefore able to make a guess 606 about the intention of the cyclist that is closely matched to the guess that a human driver would make in

that same situation. In this example, the intention of the cyclist 606 is relatively high, as indicated by the number of horizontal bars in the display. The system installed on an automobile 600 also makes predictions about the awareness 604 of cyclists of the vehicle 600, by the same method described for intention. It also makes predictions about the willingness of an automobile 608 to yield 610 or its desire to turn across the system-containing vehicle's path 612 by the same method described above. In the case of the automobile the questions that human subjects answered that would be predicted by the algorithm are "would the vehicle be willing to yield" 610 and "does the vehicle wish to turn across your path" 612. It also makes predictions about the likelihood of pedestrians 614 to cross in front of the vehicle 618, and whether those pedestrians are aware of the vehicle 616, by the same method described above.

[0072] The models described above may be implemented as a real-time module that makes predictions of behavior of traffic entities based on input from cameras or other sensors installed on a car 600. In the case of an autonomous car, these predictions may be used to make inferences about the intent of road users such as cyclists 602, other motorists 608, and pedestrians 614 to cross into the path of the car, as well as whether the road users are aware of the car and its future path. They can also be used to predict whether other road users would be surprised, welcoming, or aggressively unwelcoming if the car were to engage in maneuvers which would take it into the path of another road user (e.g., would an oncoming car yield if the car implementing the systems and methods described herein were to turn left).

Navigating Autonomous Vehicle Based on Hidden Context

[0073] The vehicle computing system 120 predicts hidden context representing intentions and future plans of a traffic entity (e.g., a pedestrian or a bicyclist). The hidden context may represent a state of mind of a person represented by the traffic entity. For example, the hidden context may represent a near term goal of the person represented by the traffic entity,

for example, indicating that the person is likely to cross the street, or indicating that the person is likely to pick up an object (e.g., a wallet) dropped on the street but stay on that side of the street, or any other task that the person is likely to perform within a threshold time interval. The hidden context may represent a degree of awareness of the person about the autonomous vehicle, for example, whether a bicyclist driving in front of the autonomous vehicle is likely to be aware that the autonomous vehicle is behind the bicycle.

[0074] The hidden context may be used for navigating the autonomous vehicle, for example, by adjusting the path planning of the autonomous vehicle based on the hidden context. The vehicle computing system 120 may improve the path planning by taking a machine learning based model that predicts the hidden context representing a level of human uncertainty about the future actions of pedestrians and cyclists and uses that as an input into the autonomous vehicle's motion planner. The training dataset of the machine learning models includes information about the ground truth of the world obtained from one or more computer vision models. The vehicle computing system 120 may use the output of the prediction engine 114 to generate a probabilistic map of the risk of encountering an obstacle given different possible motion vectors at the next time step. Alternatively, the vehicle computing system 120 may use the output of the prediction engine 114 to determine a motion plan which incorporates the probabilistic uncertainty of the human assessment.

[0075] In an embodiment, the prediction engine 114 determines a metric representing a degree of uncertainty in human assessment of the near-term goal of a pedestrian or any user representing a traffic entity. The specific form of the representation of uncertainty is a model output that is in the form of a probability distribution, capturing the expected distributional characteristics of user responses of the hidden context of traffic entities responsive to the users being presented with videos/images representing traffic situations. The model output may comprise summary statistics of hidden context, i.e., the central tendency representing the

mean likelihood that a person will act in a certain way and one or more parameters including the variance, kurtosis, skew, heteroskedasticity, and multimodality of the predicted human distribution. These summary statistics represent information about the level of human uncertainty.

[0076] In an embodiment, the vehicle computing system 120 represents the hidden context as a vector of values, each value representing a parameter, for example, a likelihood that a person represented by a traffic entity is going to cross the street in front of the autonomous vehicle, a degree of awareness of the presence of autonomous vehicle in the mind of a person represented by a traffic entity, and so on.

Overall Process of Navigating an Autonomous Vehicle Through Traffic

[0077] FIG. 7 represents a flowchart illustrating the process of navigating the autonomous vehicle based on hidden context, according to an embodiment. The steps illustrated in the flowchart may be performed in an order different from that illustrated in FIG. 7. For example, certain steps may be performed in parallel. The steps may be performed by modules other than those indicated herein.

[0078] The vehicle computing system 120 receives 700 sensor data from sensors of the autonomous vehicle. For example, the vehicle computing system 120 may receive lidar scans from lidars and camera images from cameras mounted on the autonomous vehicle. In an embodiment, the vehicle computing system 120 builds a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data. The point cloud representation includes coordinates of points surrounding the vehicle, for example, three dimensional points and parameters describing each point, for example, the color, intensity, and so on.

[0079] The vehicle computing system 120 identifies 702 one or more traffic entities based on the sensor data, for example, pedestrians, bicyclists, or other vehicles driving in the

traffic. The traffic entities represent non-stationary objects in the surroundings of the autonomous vehicle.

[0080] In an embodiment, the autonomous vehicle obtains a map of the region through which the autonomous vehicle is driving. The autonomous vehicle may obtain the map from a server. The map may include a point cloud representation of the region around the autonomous vehicle. The autonomous vehicle performs localization to determine the location of the autonomous vehicle in the map and accordingly determines the stationary objects in the point cloud surrounding the autonomous vehicle. The autonomous vehicle may superimpose representations of traffic entities on the point cloud representation generated.

[0081] The vehicle computing system 120 repeats the following steps 704 and 706 for each identified traffic entity. The vehicle computing system 120 determines 704 motion parameters for the traffic entity, for example, speed and direction of movement of the traffic entity. The vehicle computing system 120 also determines 706 a hidden context associated with the traffic entity using the prediction engine 114.

[0082] The vehicle computing system 120 navigates 708 the autonomous vehicle based on the motion parameters as well as the hidden context. For example, the vehicle computing system 120 may determine a safe distance from the traffic entity that the autonomous vehicle should maintain based on the motion parameters of the traffic entity. The vehicle computing system 120 modulates the safe distance based on the hidden context. The vehicle computing system 120 may adjust the safe distance based on whether the near-term goal of the person indicating that the person intends to reach a location in the direction of the movement of the traffic entity or in a different direction.

[0083] For example, based on the motion parameters, the vehicle computing system 120 may determine that the autonomous vehicle can drive within X meters of the traffic entity. However, the hidden context indicates that the person represented by the traffic entity intends

to cross the street in a direction different from the direction indicated by the motion parameters. In this situation, the vehicle computing system 120 adjusts the safe distance such that the autonomous vehicle is able to drive closer to the traffic entity than the distance X. On the other hand, if the hidden context indicates that the person represented by the traffic entity intends to cross the street in a direction same as the direction indicated by the motion parameters, the vehicle computing system 120 adjusts the safe distance such that the autonomous vehicle maintains a distance greater than X from the traffic entity.

[0084] In an embodiment, the vehicle computing system 120 further modulates the safe distance based on the distributional nature of model outputs. In an embodiment, the vehicle computing system 120 uses the kurtosis of the output distribution for modulating the safe distance. In cases where the kurtosis is very low, and the distribution approaches uniform, the vehicle computing system 120 determines that human uncertainty is high, thereby assigning a low measure of confidence in using the measurement of central tendency as the output. Accordingly, in this situation, the vehicle computing system increases the safe distance from the traffic entity by certain factor.

[0085] On the other hand, in cases with high kurtosis the vehicle computing system 120 determines a high measure of confidence indicating that the central tendency is likely to represent substantial human agreement that the output intention or awareness value accurately reflects the internal mental state of the detected human road user. In this situation the vehicle computing system may not increase the safe distance from the traffic entity or may increase it only by a small factor.

[0086] Accordingly, the factor by which the safe distance is increased is inversely proportionate to a measure of variation in the distribution of the predicted output. Accordingly, high variation in the distribution of the predicted values of the hidden context variables by human observers indicates low confidence in using the mean as the prediction

and results in increasing the safe distance by a larger factor compared to situations in which the variation in the distribution of the predicted output is low indicating high confidence in using the mean as the prediction.

World Model Modulation

[0087] In a lattice planner-based autonomous driving stack, the world model modulation module 145 of the vehicle computing system 120 generates a world model from sensor data received by the sensors mounted on the autonomous vehicle. In an embodiment, the generated world model comprises one or more layers of perceptual inference about the state of the road around the vehicle. The world model modulation module 145 modulates the existing world model to make it more accurately represent the probabilistic likelihood of safe driving across the modeled grid.

[0088] The informational layer of a world model is an occupancy grid. An occupancy grid comprises a binary random variable for each point in a discretized topological rendering of the autonomous robot's local environment. The posterior estimate of occupancy at a given time step can be constructed with a Bayesian estimator that takes into account not just the outputs of depth sensitive sensors like LIDAR, but also semantically-aware estimates of minimum safe distance around moving agents (e.g., the maximum distance a human agent on foot can be expected to be able to move). When a vehicle is simulating proposed motion paths, the semantically-aware minimum safe distance estimates for moving agents can be biased by the output of the uncertainty-characterizing system. So, for instance, for a pedestrian with high intention, the minimum safe distance region would be stretched towards the current vehicle path and squeezed in other directions, preserving total area.

[0089] FIG. 8 represents a flowchart illustrating the process of modulating the world model for navigating 808 the autonomous vehicle, according to an embodiment. The vehicle computing system 120 repeats the steps 812 and 814 for each traffic entity identified. The

future position estimator 125 of the vehicle computing system 120 estimates the future position of the traffic entity where the traffic entity is expected to move within a threshold time interval, for example, within the next few seconds. Accordingly, the vehicle computing system 120 determines 812 a region R of the world model in which the traffic entity is expected to move within the threshold time interval.

[0090] The future position estimator 125 in conjunction with the world model modulation module 145 modulates 814 the determined region R where the traffic entity is likely to move within the threshold time interval based on the hidden context. For example, if the hidden context indicates an intention of the person represented by the traffic entity to perform a task that requires the traffic entity to move in the direction D that was predicted by the future position estimator 125, the world model modulation module 145 further stretches the determined region R along the direction D. On the other hand, if the hidden context indicates an intention of the person represented by the traffic entity to perform a task that requires the traffic entity to move opposite to (or away from) the direction D that was predicted by the future position estimator 125, the world model modulation module 145 reduces the size of determined region R along the direction D. In an embodiment, the world model modulation module 145 modulates the region R so that the overall area of the region R remains substantially the same. For example, if the region R is stretched along a particular direction, the region R is made thin along other directions, thereby preserving the overall area of the region R.

[0091] The motion planner 130 generates 816 a motion plan for the autonomous vehicle to navigate the autonomous vehicle safely around the traffic entities. For example, the motion planner 130 generates 816 a motion plan that makes sure that the autonomous vehicle travels such that it does not get within a safe threshold distance of any traffic entity.

[0092] The vehicle control module 135 generates 818 control signals for navigating the autonomous vehicle based on the motion plan. For example, the vehicle control module 135 may control the direction of the vehicle in accordance with the motion plan. The vehicle control module 135 may also slow down the autonomous vehicle or accelerate the autonomous vehicle to ensure that the autonomous vehicle does not get within a safe threshold distance of any traffic entity.

[0093] The vehicle computing system determines the amount by which the region R is modulated based on the hidden context values. The vehicle computing system may also determine the amount by which the region R is modulated based on the distributional nature of model outputs. In an embodiment, the vehicle computing system 120 determines the amount by which the region R is modulated based on the kurtosis of the output distribution used as a tuning parameter that represents uncertainty.

[0094] In cases where the kurtosis is very low, and the distribution approaches uniform, the vehicle computing system 120 determines that human uncertainty is high, and a measurement of central tendency would not be useful for prediction, thereby assigning a low measure of confidence in using the measurement of central tendency as the output for determining the amount by which the region R is modulated. On the other hand, in cases with high kurtosis the vehicle computing system 120 determines a high measure of confidence indicating that the central tendency is likely to represent substantial human agreement that the output intention or awareness value accurately reflects the internal mental state of the detected human road user. The vehicle computing system 120 determines the amount by which the region R is modulated based on the measure of confidence. In an embodiment, the vehicle computing system 120 modulates the region by a larger factor if measure of confidence in the predicted output is low and modulates the region by a smaller factor if the measure of confidence in the predicted output is high.

[0095] The measure of confidence in a predicted output may be determined using various statistical measures. In an embodiment, the vehicle computing system 120 determines a mean and a variance measures for the distribution of the output values. The vehicle computing system 120 determines high confidence in predicting the output as the mean value if the variance is low, thereby indicating high certainty in the prediction. Similarly, vehicle computing system 120 determines low confidence in predicting the output as the mean value if the variance is high, thereby indicating low certainty in the prediction. The vehicle computing system 120 determines the amount by which the region R is modulated as a factor that is directly related to the measure of confidence in the predicted output value. Accordingly, if the vehicle computing system 120 determines a high measure of confidence, the vehicle computing system 120 modulates the region R by a high factor. Similarly, if the vehicle computing system 120 determines a low measure of confidence, the vehicle computing system 120 modulates the region R by a smaller factor.

False Positive Reduction

[0096] In autonomous vehicles and advance driver-assistance systems in which the driver is in control, the vehicle computing system 120 uses modulatory signals based on hidden context to reduce false positives. For instance, in the case of a braking system such as an automatic emergency braking (AEB) system, the vehicle computing system 120 modulates the activation threshold for the braking system based on a weighted linear combination of model outputs predicting estimates of values for hidden context attributes.

[0097] The vehicle computing system 120 determines the activation threshold for the emergency braking system based on the certainty of evidence required before brakes are applied. The vehicle computing system 120 determines the activation threshold for the emergency braking system to be higher in cases where the vehicle computing system 120 determines hidden context attributes with high certainty, e.g., hidden context attribute

indicating whether the pedestrian in the roadway intended to cross the street or whether a bicyclist was aware of the vehicle. The vehicle computing system 120 adjusts the activation threshold to effectively remove or reduce false positive emergency braking scenarios, for example when a pedestrian enters the roadway for reasons other than intending to cross the road.

[0098] As an example, if the vehicle computing system 120 determines with a very high certainty that a pedestrian does not intend to cross the street, the vehicle computing system 120 adjusts the weightings and thresholds to decrease the likelihood of initiating the emergency breaking system when the pedestrian walks towards the street. On the other hand, if the vehicle computing system 120 determines with a very low certainty that the pedestrian does not intend to cross the street, the vehicle computing system 120 adjusts the weightings and thresholds to increase the likelihood of initiating the emergency breaking system if the pedestrian walks towards the street.

[0099] FIG. 9 represents a flowchart illustrating the process of using the modulatory signals to reduce false positives while navigating the autonomous vehicle, according to an embodiment. The vehicle computing system 120 performs the steps 922 and 924 for each traffic entity identified. The vehicle computing system 120 determines 922 a measure of statistical distribution of a hidden context for the traffic entity. In an embodiment, the prediction engine 114 executes a machine learning based model (e.g., a neural network) that predicts distribution associated with hidden context, for example, mean and variance of a likelihood that a person represented by a traffic entity wants to cross the street. The vehicle computing system 120 determines 924 an activation threshold value for the braking system of the autonomous vehicle based on the measure of statistical distribution of the hidden context. In an embodiment, the activation threshold represents a threshold time to collision between the traffic entity and the vehicle. Accordingly, if the vehicle computing system 120

determines that the time to collision with a traffic entity is below the activation threshold, the vehicle computing system 120 activates emergency brakes of the autonomous vehicle.

[00100] The vehicle computing system 120 periodically predicts the time to collision for each traffic entity. If the vehicle computing system 120 determines 926 at any point in time that the time to collision of the autonomous vehicle within the activation threshold of a traffic entity, the vehicle computing system 120 activates the braking system.

[00101] The vehicle computing system 120 uses lower activation thresholds if the model outputs indicate higher uncertainty in values of hidden context attributes, for example, estimates of state of mind of a user represented by a traffic entity or estimates of degree of awareness of information such as the presence of the autonomous vehicle in the mind of a user represented by a traffic entity. Accordingly, in situations where the hidden context attribute indicates a high degree of uncertainty indicating a likelihood of a collision, the vehicle computing system 120 is more likely to initiate emergency maneuvers than in situations where the hidden context attribute is determined with lower certainty indicating a likelihood of collision.

[00102] In an embodiment, the weightings and the amount of threshold modulation is set by a user. In other embodiments, the weightings and the amount of threshold modulation is adjusted based on simulation results. Accordingly, different weightings and threshold values are set and the results of navigation of an autonomous vehicle are determined based on simulation of traffic. The weightings and amounts of threshold values are adjusted, so as to minimize the likelihood of collision as well as provide a driving experience close to the driving experience when a human is driving the vehicle. In an embodiment, the results of simulation are provided to an expert for evaluation, for example, to rank the driving experience from the perspective of a human.

[00103] An additional tuning parameter that is used by the vehicle computing system 120 is the distributional nature of model outputs. The models of the prediction engine 114 predict the distributional characteristics of human responses to the presented video/image of traffic scenario comprising one or more traffic entities. In an embodiment, the vehicle computing system 120 uses the kurtosis of the output distribution as a tuning parameter that represents uncertainty for adjusting the activation thresholds of the AEB system. Accordingly, the vehicle computing system 120 determines the value of an activation threshold of the AEB system based on the kurtosis of the output distribution of the machine learning based model.

[00104] In cases where the kurtosis is very low, and the distribution approaches uniform, the vehicle computing system 120 determines that human uncertainty is high, and a measurement of central tendency would not be useful for prediction, thereby assigning a low measure of confidence in using the measurement of central tendency as the output. On the other hand, in cases with high kurtosis the vehicle computing system 120 determines a high measure of confidence indicating that the central tendency is likely to represent substantial human agreement that the output intention or awareness value accurately reflects the internal mental state of the detected human road user. The vehicle computing system 120 determines the activation thresholds for AEB based on the measure of confidence. In an embodiment, the vehicle computing system 120 uses low activation thresholds for the braking mechanism if the measure of confidence in the predicted output is low and high activation thresholds for the braking mechanism if the measure of confidence in the predicted output is high.

[00105] In some situations, the kurtosis of the output distribution is very low, and kurtosis value indicates that the distribution approaches uniform. In these situations, the vehicle computing system 120 determines a low measure of confidence in a specific value of output representing the central tendency. Accordingly, in these situations the vehicle computing system 120 uses low activation thresholds. This is so because in this situation, the human

uncertainty is determined to be high, and a measurement of central tendency is not useful for prediction.

[00106] On the other hand, in some situations the kurtosis of the output distribution is high. In these situations, the vehicle computing system 120 determines a high measure of confidence in a specific value of output representing the central tendency. Accordingly, in these situations the vehicle computing system 120 uses high activation thresholds since the central tendency is likely to represent substantial human agreement that the output intention or awareness value accurately reflects the hidden context value, for example, the internal mental state of a detected human road user.

[00107] The measure of confidence in a predicted output may be determined using various statistical measures. In an embodiment, the vehicle computing system 120 determines a mean and a variance measures for the distribution of the output values. The vehicle computing system 120 determines high confidence in predicting the output as the mean value if the variance is low, thereby indicating high certainty in the prediction. Similarly, vehicle computing system 120 determines low confidence in predicting the output as the mean value if the variance is high, thereby indicating low certainty in the prediction. The vehicle computing system 120 determines the value of the activation threshold as a value that is directly related to the measure of confidence in the predicted output value. Accordingly, if the vehicle computing system 120 determines a high measure of confidence, the vehicle computing system 120 determines a high value of the activation threshold. Similarly, if the vehicle computing system 120 determines a low measure of confidence, the vehicle computing system 120 determines a low value of the activation threshold.

[00108] A high value of activation threshold indicates that the vehicle is less likely to engage the automatic braking system and apply brakes within a distance of a traffic entity compared to a low value of activation threshold. A low value of activation threshold

indicates that the vehicle is more likely to engage the automatic braking system and apply brakes within a distance of a traffic entity compared to a high value of activation threshold.

[00109] FIG. 10 illustrates sensor data captured by the autonomous vehicle illustrating traffic entities, according to an embodiment. The sensor data may be captured by various sensors such as camera, lidar, infrared sensors, and so on. In an embodiment, the vehicle computing system 120 captures sensor data from a plurality of sensors and combines the sensor data to build a representation of the surroundings of the autonomous vehicle, for example, a point cloud representation. The vehicle computing system 120 identifies one or more traffic entities 1010a, 1010b, 1010c, for further analysis. The vehicle computing system 120 selects traffic entities that are capable of moving through the traffic, for example, pedestrians, bicyclists, or any other vehicle that is driving in the traffic. In an embodiment, the vehicle computing system 120 uses machine learning based models configured to recognize objects in an image/sensor data to identify traffic entities for further analysis. FIG. 12 shows a representation of the sensor data that is annotated with information 1020a, 1020b, 1020c derived from the raw sensor data.

[00110] FIG. 11 illustrates various objects surrounding the autonomous vehicle, according to an embodiment. FIG. 11 represents a bird's eye view of the objects surrounding the autonomous vehicle 1120. There are several traffic entities 1110a, 1110b, 1110c, that are around the autonomous vehicle 1120. There may be objects that are stationary, for example, trees 1130. The vehicle computing system 120 identifies traffic entities that represents objects in the traffic that are likely to move. The traffic entities A and B shown in FIG. 11 correspond to pedestrians 1210a and 1220b respectively.

[00111] FIG. 12 illustrates an occupancy grid representation of objects surrounding the autonomous vehicle, according to an embodiment. The occupancy grid represents the surroundings of the autonomous vehicle using three dimensional (3D) points. The occupancy

grid allows determination of areas where there are objects filling the space surrounding the autonomous vehicle. The 3D point may be determined based on sensor data that includes a depth of each object, for example, lidar scan. The occupancy grid represents all data points that are within line of sight of the sensors of the autonomous vehicle. The occupancy grid does not include representations of objects such as object 1220 that is occluded by other objects and therefore not visible from the autonomous vehicle. The occupancy grid representation includes sets 1210a, 1210b of data points corresponding to the traffic entities 1210a, 1210b.

[00112] FIG. 13 illustrates segmentation of various traffic entities in the occupancy grid representation of the surroundings of the autonomous vehicle, according to an embodiment. The vehicle computing system 120 identifies non-stationary objects 1310 in the occupancy grid representation, i.e., objects in the surrounding of the vehicle that are likely to move, for example, traffic entities 1210a, 1210b. In an embodiment, the vehicle computing system 120 provides the occupancy grid representation as input to a machine learning based model configured to predict a likelihood of an object in the traffic to move.

[00113] FIG. 14 illustrates determination of safe distance from traffic entities while navigating through the traffic by the autonomous vehicle, according to an embodiment. In an embodiment, the vehicle computing system 120 determines a region 1410a, 1410b around each selected traffic entity that the autonomous vehicle needs to avoid in order to drive safely. In an embodiment, the vehicle computing system 120 the region around a traffic entity based on known characteristics of the traffic entity, for example, based on a typical speed of a traffic entity of that type (pedestrian, bicyclist, and so on).

[00114] FIG. 15 illustrates determination of safe distance based on trajectory of traffic entities, according to an embodiment. The vehicle computing system 120 further determines motion parameters of the traffic entity, for example, motion parameters representing the

speed and direction in which the traffic entity is moving. The vehicle computing system 120 determines additional regions 1510 based on the trajectory of the traffic entity. These regions represent regions that the traffic entity could reach given its current trajectory. Accordingly, the autonomous vehicle needs to avoid these regions 1510 while navigating through the traffic.

[00115] FIG. 16 illustrates modulation of safe distance based on predicted hidden context associated with traffic entities, according to an embodiment. The vehicle computing system 120 determines a hidden context for each traffic entity based on the prediction engine 114. The hidden context may represent a state of mind of a person represented by the traffic entity, for example, a pedestrian. The hidden context may represent a near term goal of the person represented by the traffic entity, for example, indicating that the pedestrian has the goal to get to the other side of the street or the pedestrian has the goal to pick up an object (say a wallet) that the pedestrian dropped on the street. The vehicle computing system 120 determines regions 1610 representing a modulated safe distance. The regions 1610 are determined based on the motion parameters of the traffic entity as well as hidden context associated with the traffic entity determined using the prediction engine 114.

Computing Machine Architecture

[0100] FIG. 17 is a block diagram illustrating components of an example machine able to read instructions from a machine-readable medium and execute them in a processor (or controller). Specifically, FIG. 17 shows a diagrammatic representation of a machine in the example form of a computer system 1700 within which instructions 1724 (e.g., software) for causing the machine to perform any one or more of the methodologies discussed herein may be executed. In alternative embodiments, the machine operates as a standalone device or may be connected (e.g., networked) to other machines. In a networked deployment, the machine

may operate in the capacity of a server machine or a client machine in a server-client network environment, or as a peer machine in a peer-to-peer (or distributed) network environment.

[0101] The machine may be a server computer, a client computer, a personal computer (PC), a tablet PC, a set-top box (STB), a personal digital assistant (PDA), a cellular telephone, a smartphone, a web appliance, a network router, switch or bridge, or any machine capable of executing instructions 1724 (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute instructions 1724 to perform any one or more of the methodologies discussed herein.

[0102] The example computer system 1700 includes a processor 1702 (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), one or more application specific integrated circuits (ASICs), one or more radio-frequency integrated circuits (RFICs), or any combination of these), a main memory 1704, and a static memory 1706, which are configured to communicate with each other via a bus 1708. The computer system 1700 may further include graphics display unit 1710 (e.g., a plasma display panel (PDP), a liquid crystal display (LCD), a projector, or a cathode ray tube (CRT)). The computer system 1700 may also include alphanumeric input device 1712 (e.g., a keyboard), a cursor control device 1714 (e.g., a mouse, a trackball, a joystick, a motion sensor, or other pointing instrument), a storage unit 1716, a signal generation device 1718 (e.g., a speaker), and a network interface device 1720, which also are configured to communicate via the bus 1708.

[0103] The storage unit 1716 includes a machine-readable medium 1722 on which is stored instructions 1724 (e.g., software) embodying any one or more of the methodologies or functions described herein. The instructions 1724 (e.g., software) may also reside,

completely or at least partially, within the main memory 1704 or within the processor 1702 (e.g., within a processor's cache memory) during execution thereof by the computer system 1700, the main memory 1704 and the processor 1702 also constituting machine-readable media. The instructions 1724 (e.g., software) may be transmitted or received over a network 1726 via the network interface device 1720.

[0104] While machine-readable medium 1722 is shown in an example embodiment to be a single medium, the term "machine-readable medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, or associated caches and servers) able to store instructions (e.g., instructions 1724). The term "machine-readable medium" shall also be taken to include any medium that is capable of storing instructions (e.g., instructions 1724) for execution by the machine and that cause the machine to perform any one or more of the methodologies disclosed herein. The term "machine-readable medium" includes, but not be limited to, data repositories in the form of solid-state memories, optical media, and magnetic media.

Additional Considerations

[00116] Although embodiments disclosed describe techniques for navigating autonomous vehicles, the techniques disclosed are applicable to any mobile apparatus, for example, a robot, a delivery vehicle, a drone, and so on.

[00117] The subject matter described herein can be implemented in digital electronic circuitry, or in computer software, firmware, or hardware, including the structural means disclosed in this specification and structural equivalents thereof, or in combinations of them. The subject matter described herein can be implemented as one or more computer program products, such as one or more computer programs tangibly embodied in an information carrier (e.g., in a machine readable storage device) or in a propagated signal, for execution by, or to control the operation of, data processing apparatus (e.g., a programmable processor,

a computer, or multiple computers). A computer program (also known as a program, software, software application, or code) can be written in any form of programming language, including compiled or interpreted languages, and it can be deployed in any form, including as a stand-alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment. A computer program does not necessarily correspond to a file. A program can be stored in a portion of a file that holds other programs or data, in a single file dedicated to the program in question, or in multiple coordinated files (e.g., files that store one or more modules, sub programs, or portions of code). A computer program can be deployed to be executed on one computer or on multiple computers at one site or distributed across multiple sites and interconnected by a communication network.

[00118] The processes and logic flows described in this specification, including the method steps of the subject matter described herein, can be performed by one or more programmable processors executing one or more computer programs to perform functions of the subject matter described herein by operating on input data and generating output. The processes and logic flows can also be performed by, and apparatus of the subject matter described herein can be implemented as, special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application specific integrated circuit).

[00119] Processors suitable for the execution of a computer program include, by way of example, both general and special purpose microprocessors, and any one or more processor of any kind of digital computer. Generally, a processor will receive instructions and data from a read only memory or a random access memory or both. The essential elements of a computer are a processor for executing instructions and one or more memory devices for storing instructions and data. Generally, a computer will also include, or be operatively coupled to receive data from or transfer data to, or both, one or more mass storage devices for storing data, e.g., magnetic, magneto optical disks, or optical disks. Information carriers

suitable for embodying computer program instructions and data include all forms of nonvolatile memory, including by way of example semiconductor memory devices, (e.g., EPROM, EEPROM, and flash memory devices); magnetic disks, (e.g., internal hard disks or removable disks); magneto optical disks; and optical disks (e.g., CD and DVD disks). The processor and the memory can be supplemented by, or incorporated in, special purpose logic circuitry.

[00120] To provide for interaction with a user, the subject matter described herein can be implemented on a computer having a display device, e.g., a CRT (cathode ray tube) or LCD (liquid crystal display) monitor, for displaying information to the user and a keyboard and a pointing device, (e.g., a mouse or a trackball), by which the user can provide input to the computer. Other kinds of devices can be used to provide for interaction with a user as well. For example, feedback provided to the user can be any form of sensory feedback, (e.g., visual feedback, auditory feedback, or tactile feedback), and input from the user can be received in any form, including acoustic, speech, or tactile input.

[00121] The subject matter described herein can be implemented in a computing system that includes a back end component (e.g., a data server), a middleware component (e.g., an application server), or a front end component (e.g., a client computer having a graphical user interface or a web browser through which a user can interact with an implementation of the subject matter described herein), or any combination of such back end, middleware, and front end components. The components of the system can be interconnected by any form or medium of digital data communication, e.g., a communication network. Examples of communication networks include a local area network ("LAN") and a wide area network ("WAN"), e.g., the Internet.

[00122] It is to be understood that the disclosed subject matter is not limited in its application to the details of construction and to the arrangements of the components set forth

in the following description or illustrated in the drawings. The disclosed subject matter is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[00123] As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods, and systems for carrying out the several purposes of the disclosed subject matter. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the disclosed subject matter.

[00124] Although the disclosed subject matter has been described and illustrated in the foregoing exemplary embodiments, it is understood that the present disclosure has been made only by way of example, and that numerous changes in the details of implementation of the disclosed subject matter may be made without departing from the spirit and scope of the disclosed subject matter, which is limited only by the claims which follow.

We claim:

1. A method comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context;

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

2. The method of claim 1, wherein the region is in the direction determined based on a motion vector of the traffic entity, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

3. The method of claim 1, wherein the region is in the direction determined based on a motion vector of the traffic entity, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing the size of the region along the direction of the motion vector.

4. The method of claim 1, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

5. The method of claim 1, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

6. The method of claim 1, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

7. The method of claim 1, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

8. The method of claim 1, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

9. The method of claim 1, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

10. A non-transitory computer readable storage medium storing instructions, that when executed by a processor, cause the processor to perform steps comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context;

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

11. The non-transitory computer readable storage medium of claim 10, wherein the region is in the direction determined based on a motion vector of the traffic entity, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

12. The non-transitory computer readable storage medium of claim 10, wherein the region is in the direction determined based on a motion vector of the traffic entity, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing the size of the region along the direction of the motion vector.

13. The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

14. The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

15. The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

16. The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

17. The non-transitory computer readable storage medium of claim 10, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

18. The non-transitory computer readable storage medium of claim 10, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

19. A computer system comprising:

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a processor; and

a non-transitory computer readable storage medium storing instructions that when executed by a processor, cause the processor to perform steps comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context;

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

20. The computer system of claim 19, wherein the region is in the direction determined based on a motion vector of the traffic entity, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

ABSTRACT

An autonomous vehicle uses machine learning based models to predict hidden context attributes associated with traffic entities. The system uses the hidden context to predict behavior of people near a vehicle in a way that more closely resembles how human drivers would judge the behavior. The system determines an activation threshold value for a braking system of the autonomous vehicle based on the hidden context. The system modifies a world model based on the hidden context predicted by the machine learning based model. The autonomous vehicle is safely navigated, such that the vehicle stays at least a threshold distance away from traffic entities.

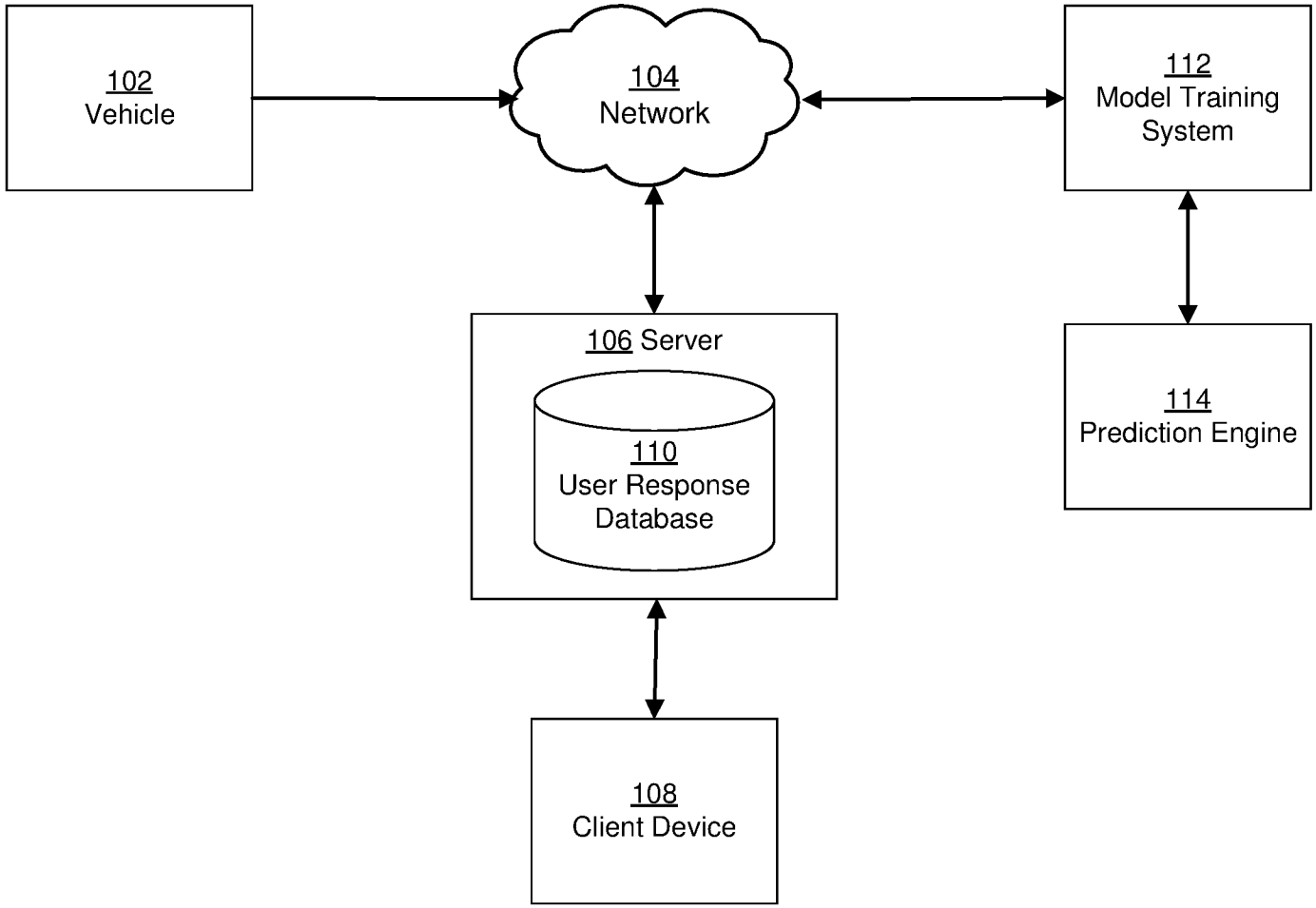


FIG. 1

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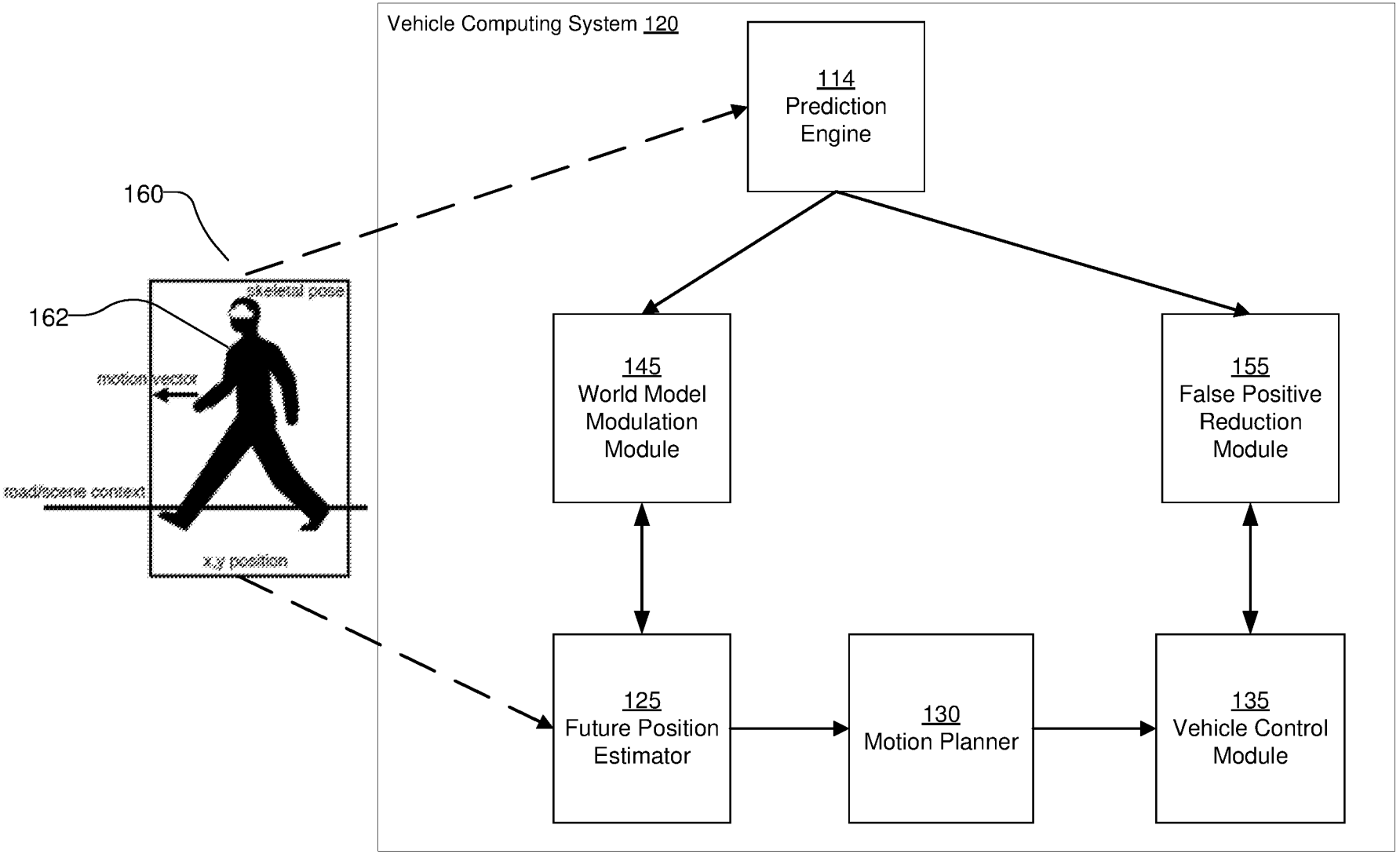


FIG. 2

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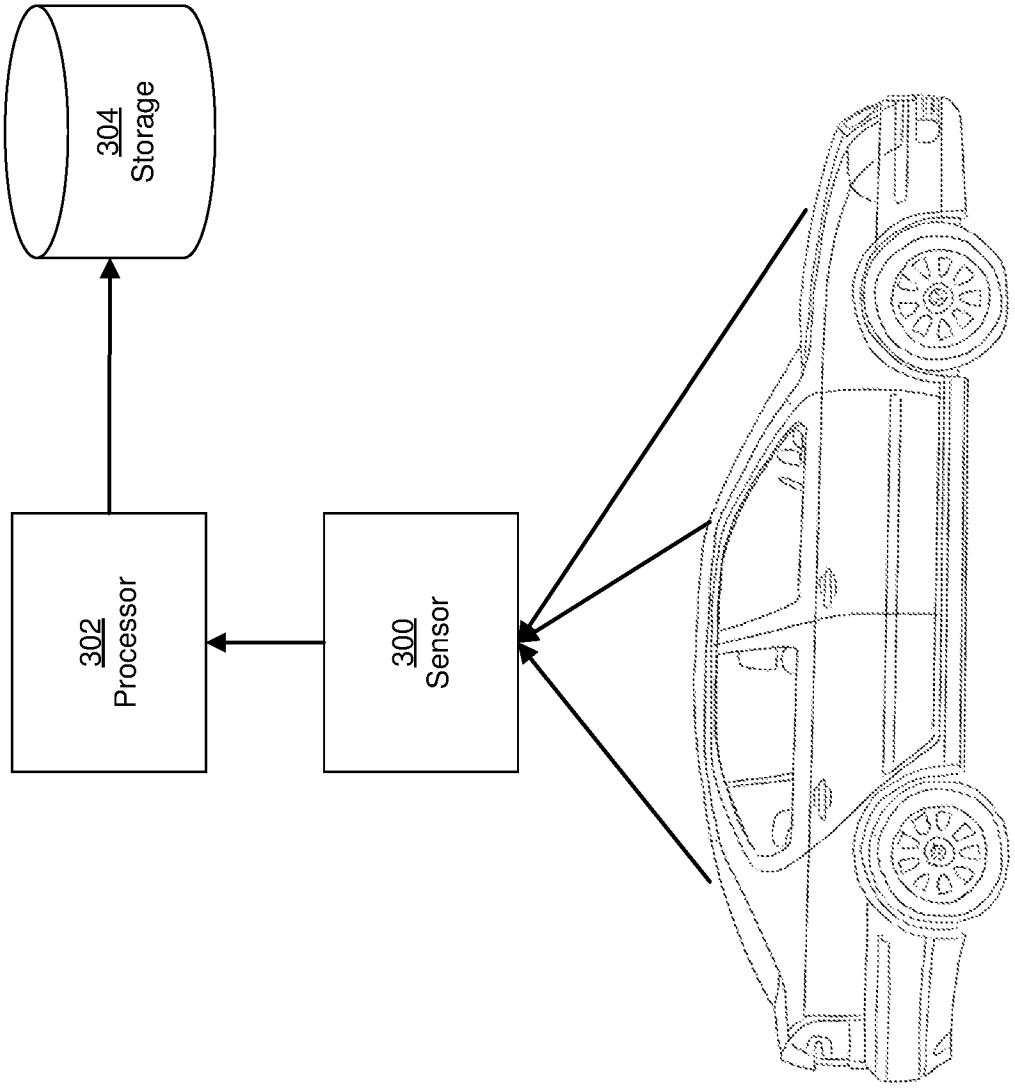


FIG. 3

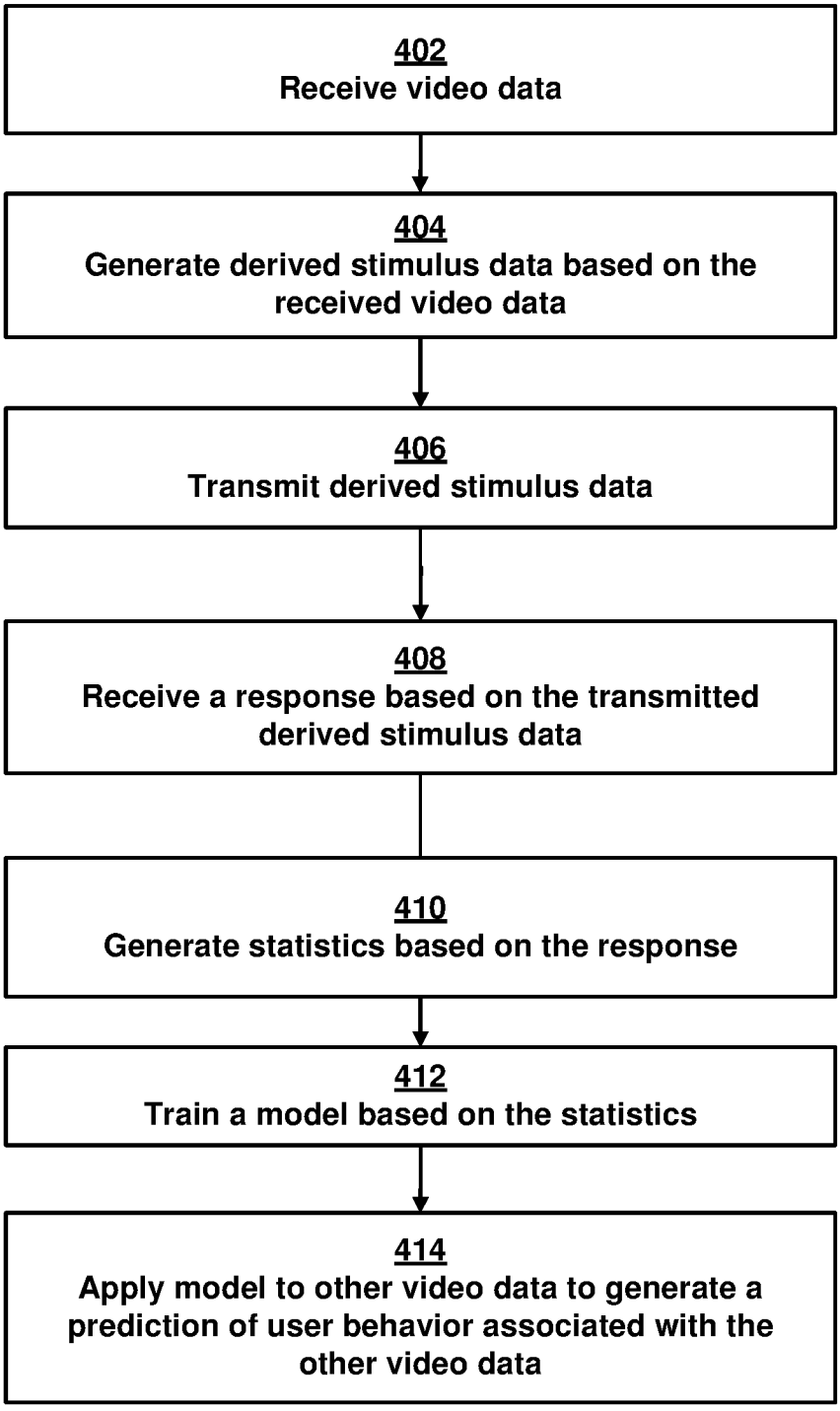

402
Receive video data
404
Generate derived stimulus data based on the received video data
406
Transmit derived stimulus data
408
Receive a response based on the transmitted derived stimulus data
410
Generate statistics based on the response
412
Train a model based on the statistics
414
Apply model to other video data to generate a prediction of user behavior associated with the other video data

FIG. 4

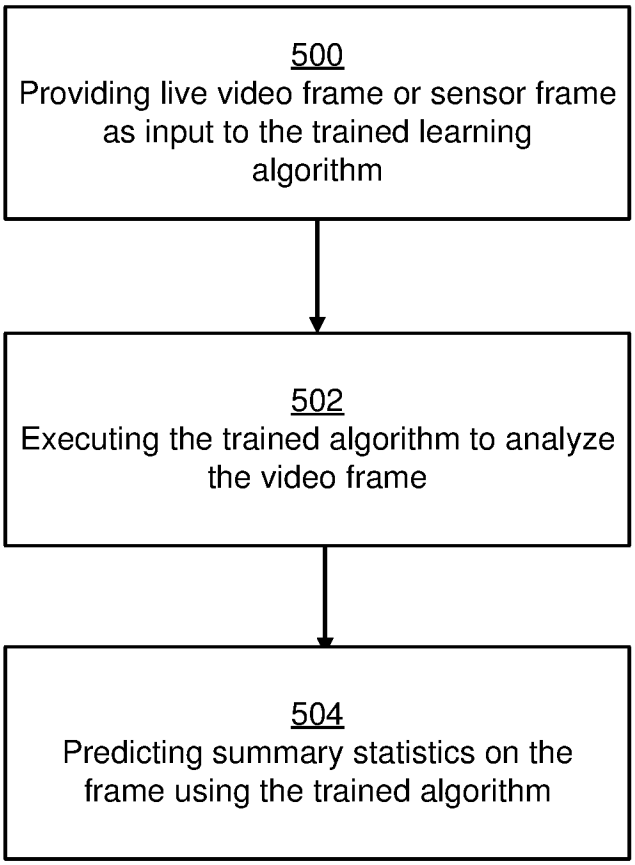

500
Providing live video frame or sensor frame as input to the trained learning algorithm
502
Executing the trained algorithm to analyze the video frame
504
Predicting summary statistics on the frame using the trained algorithm

FIG. 5

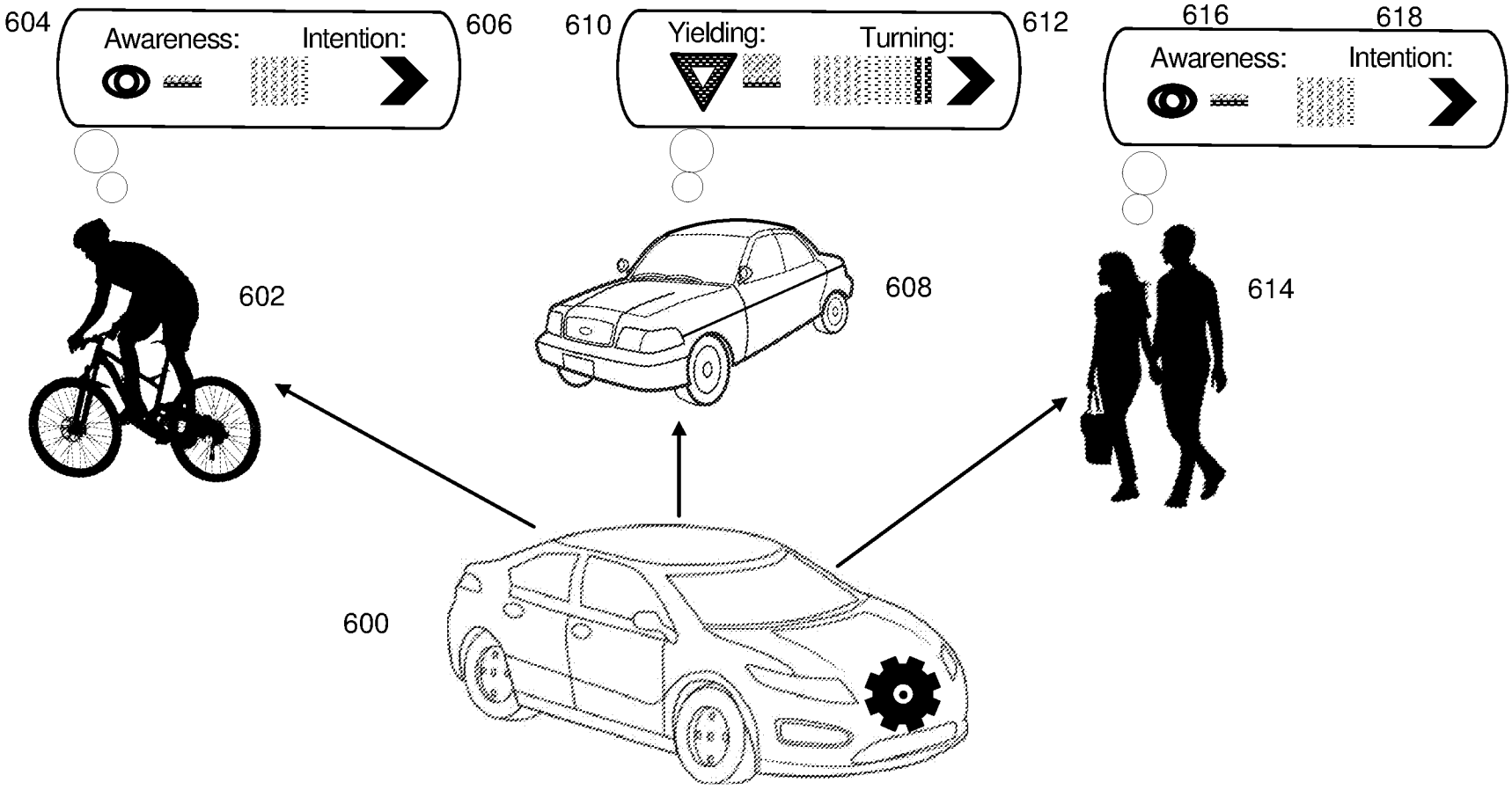


FIG. 6

TESLA EXHIBIT 1002, Page 64

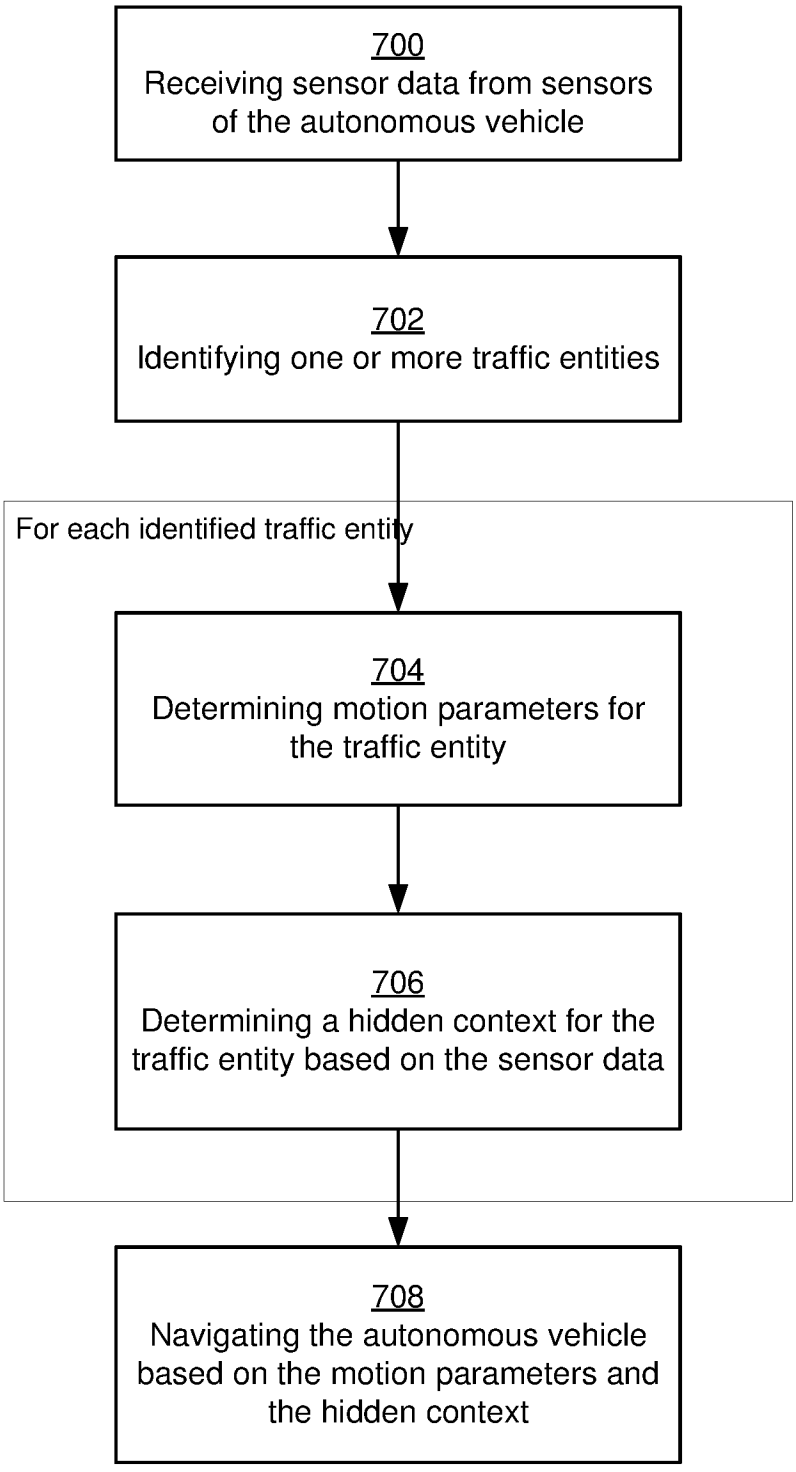

700
Receiving sensor data from sensors of the autonomous vehicle
702
Identifying one or more traffic entities
For each identified traffic entity
704
Determining motion parameters for the traffic entity
706
Determining a hidden context for the traffic entity based on the sensor data
708
Navigating the autonomous vehicle based on the motion parameters and the hidden context

FIG. 7

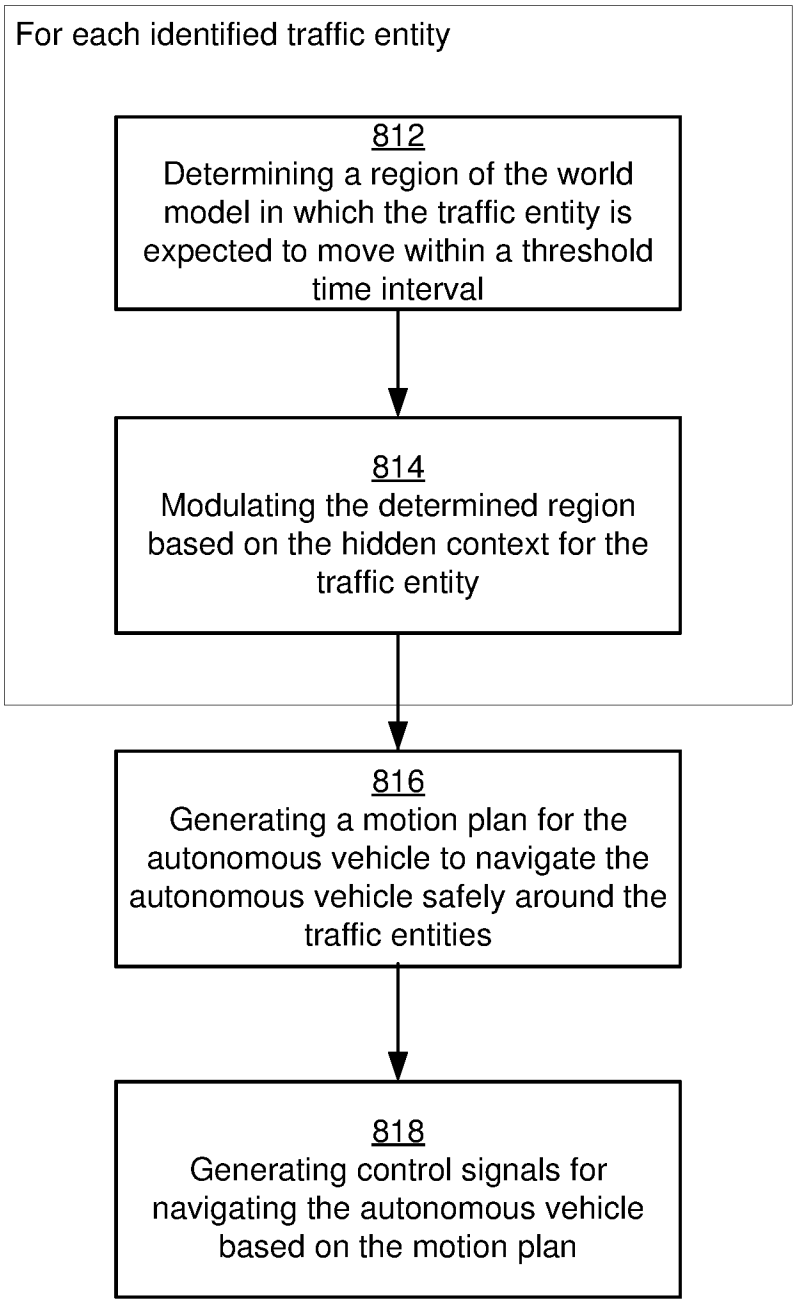

For each identified traffic entity
812
Determining a region of the world model in which the traffic entity is expected to move within a threshold time interval
814
Modulating the determined region based on the hidden context for the traffic entity
816
Generating a motion plan for the autonomous vehicle to navigate the autonomous vehicle safely around the traffic entities
818
Generating control signals for navigating the autonomous vehicle based on the motion plan

FIG. 8

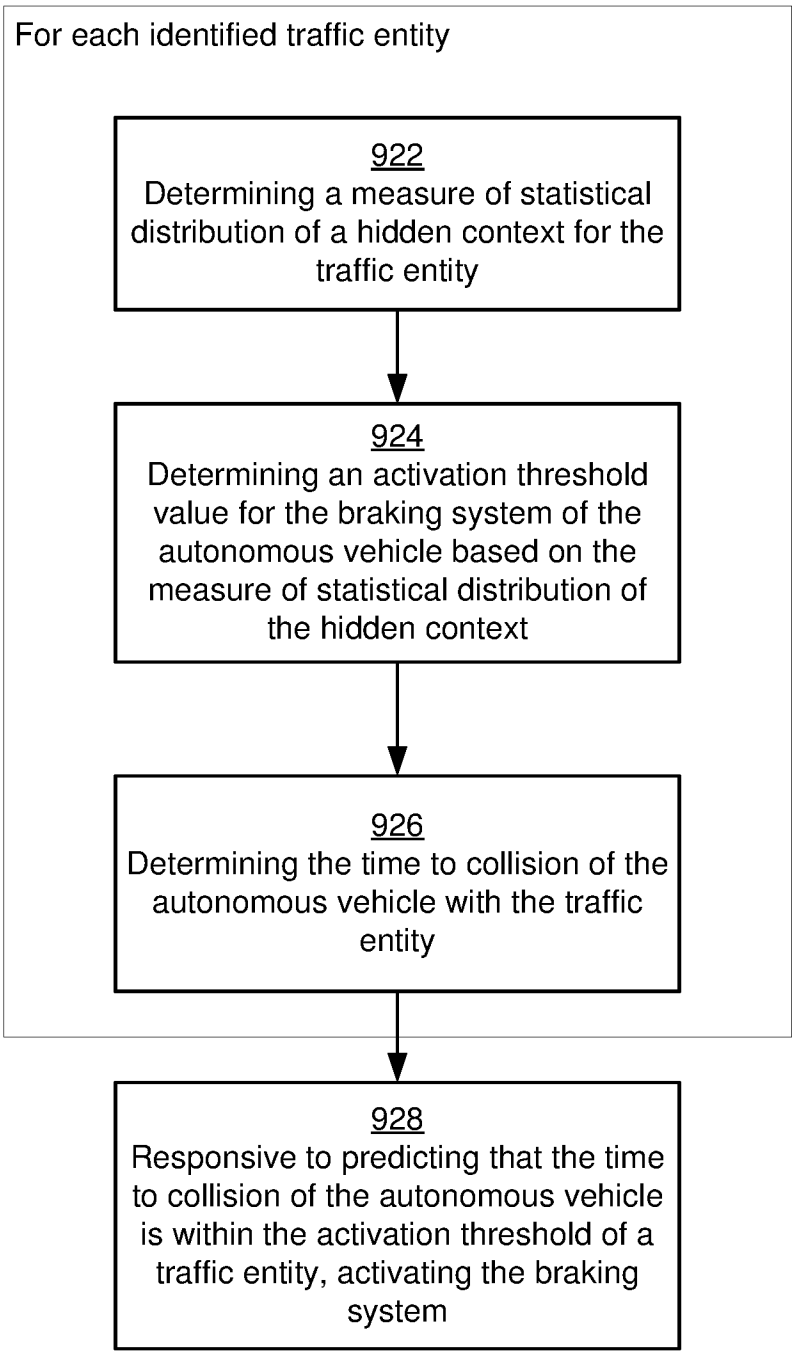

For each identified traffic entity
922
Determining a measure of statistical distribution of a hidden context for the traffic entity
924
Determining an activation threshold value for the braking system of the autonomous vehicle based on the measure of statistical distribution of the hidden context
926
Determining the time to collision of the autonomous vehicle with the traffic entity
928
Responsive to predicting that the time to collision of the autonomous vehicle is within the activation threshold of a traffic entity, activating the braking system

FIG. 9



FIG. 10

TESLA EXHIBIT 1002, Page 68

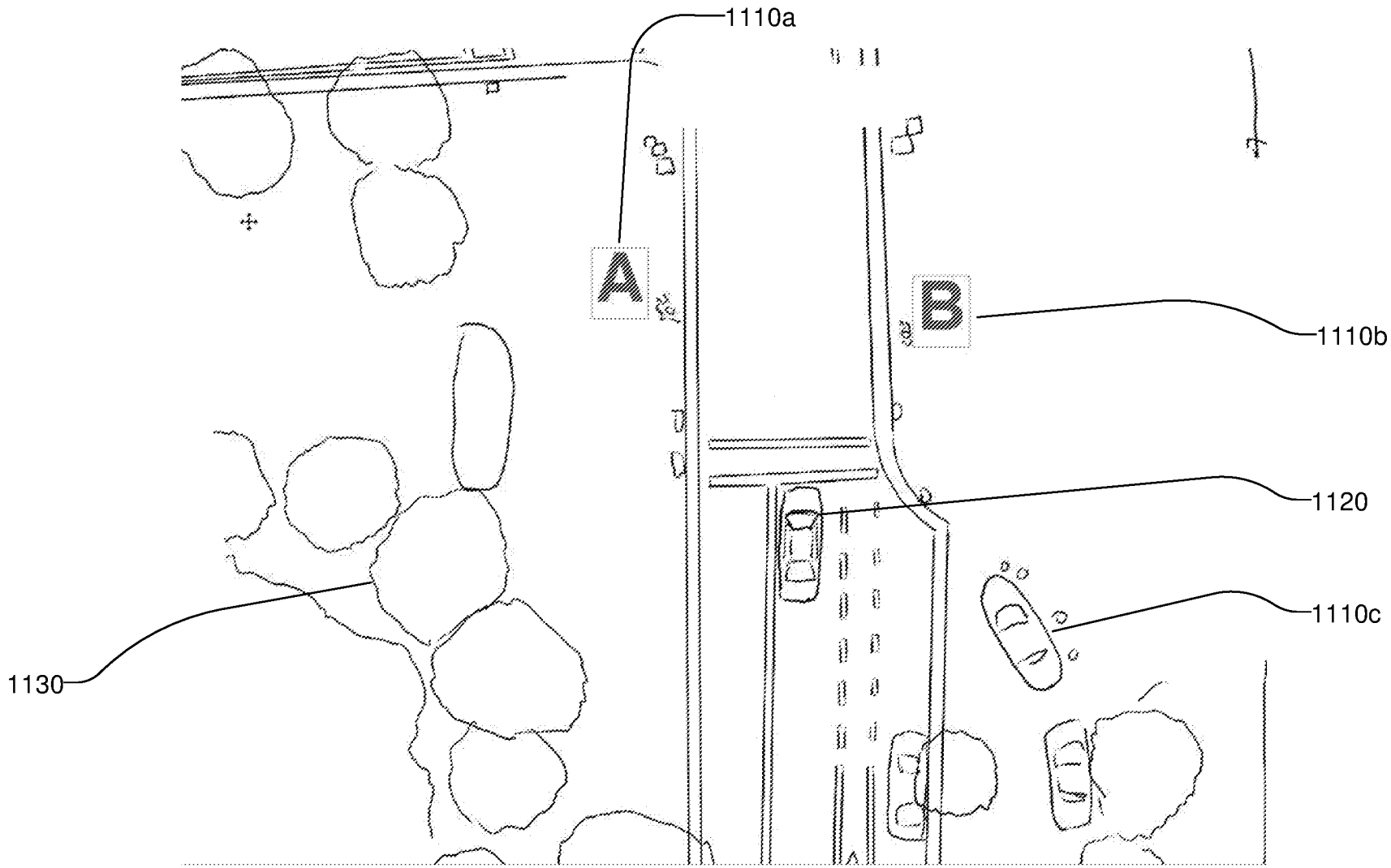


FIG. 11

TESLA EXHIBIT 1002, Page 69

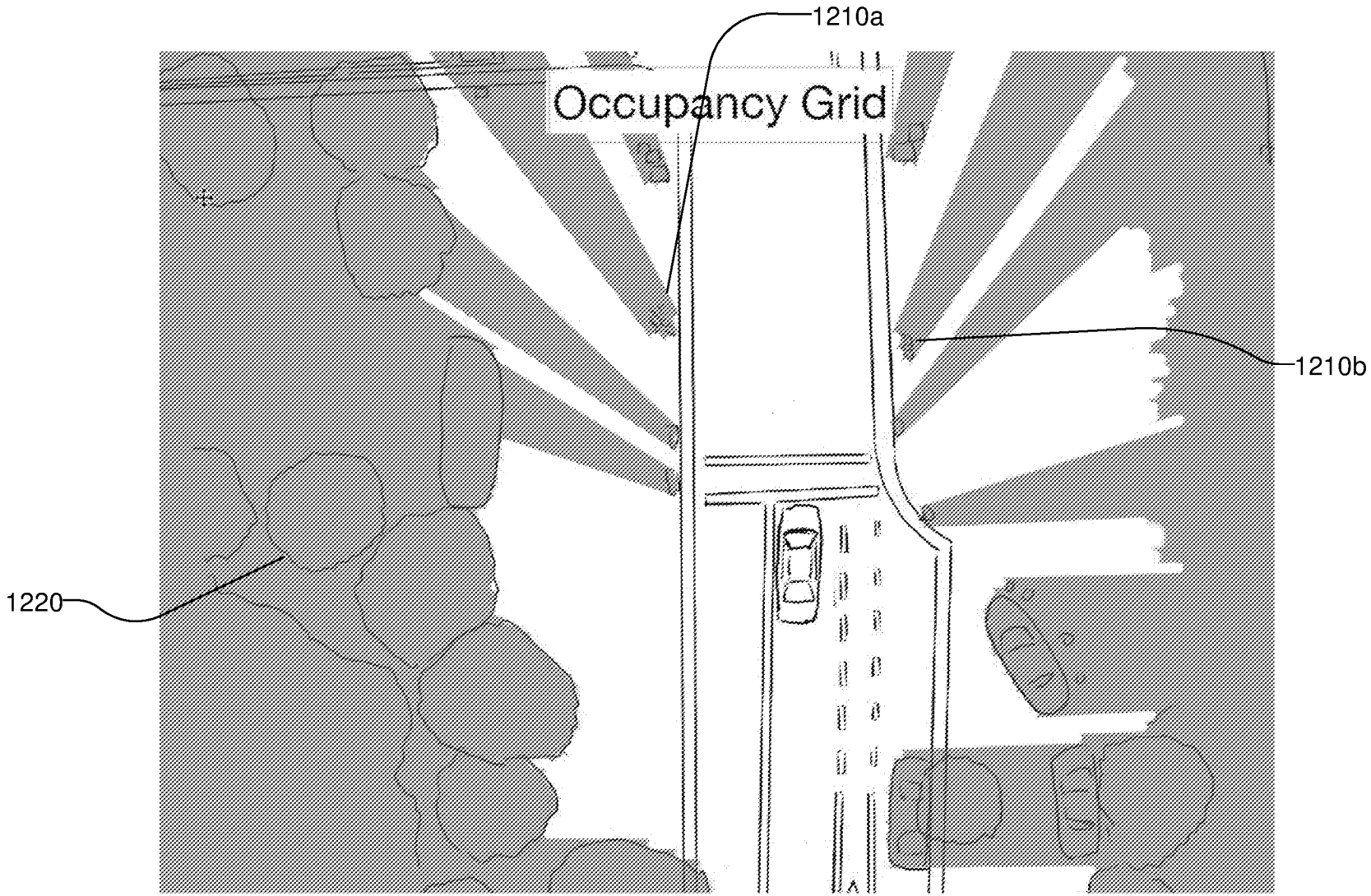


FIG. 12

TESLA EXHIBIT 1002, Page 70

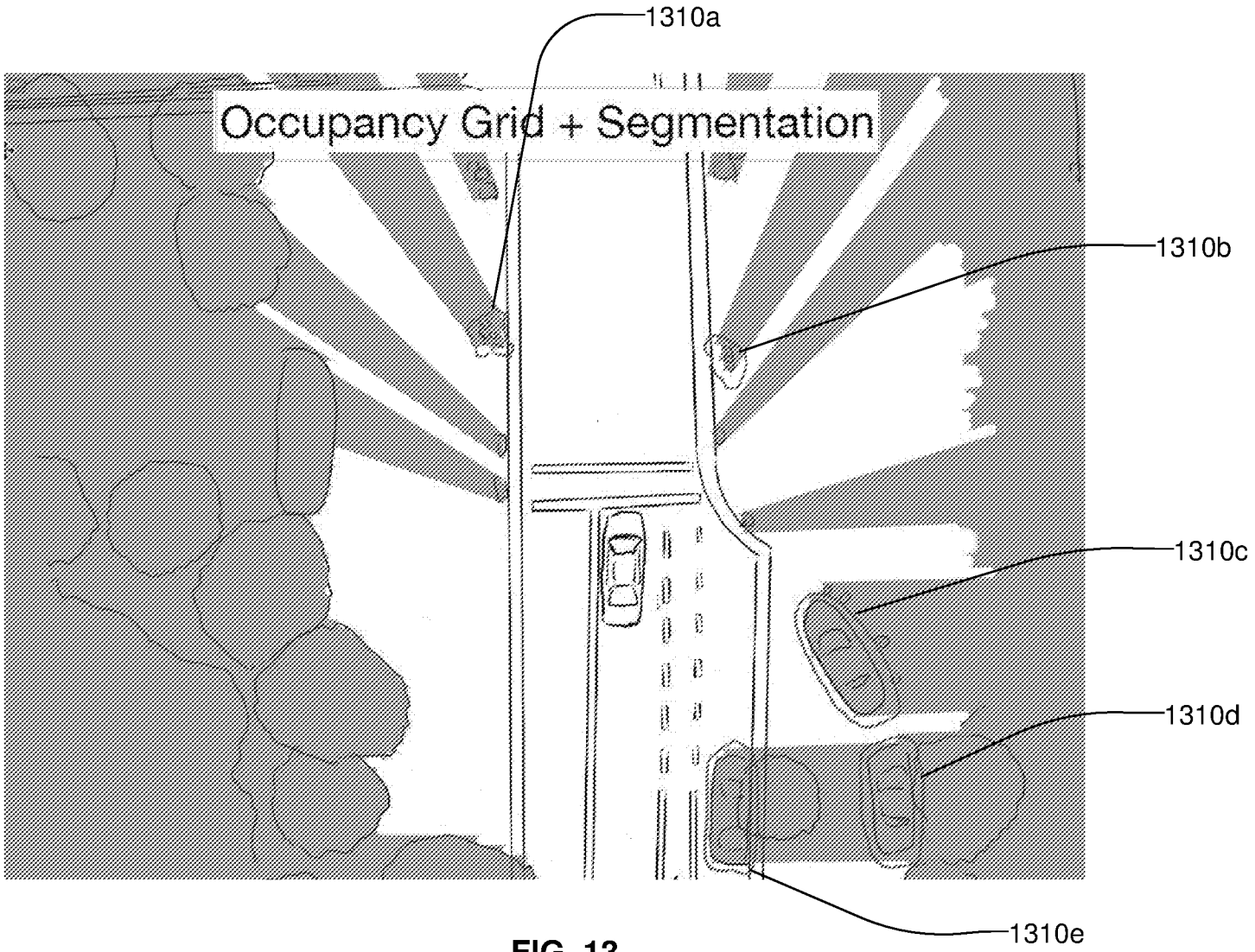


FIG. 13

TESLA EXHIBIT 1002, Page 71

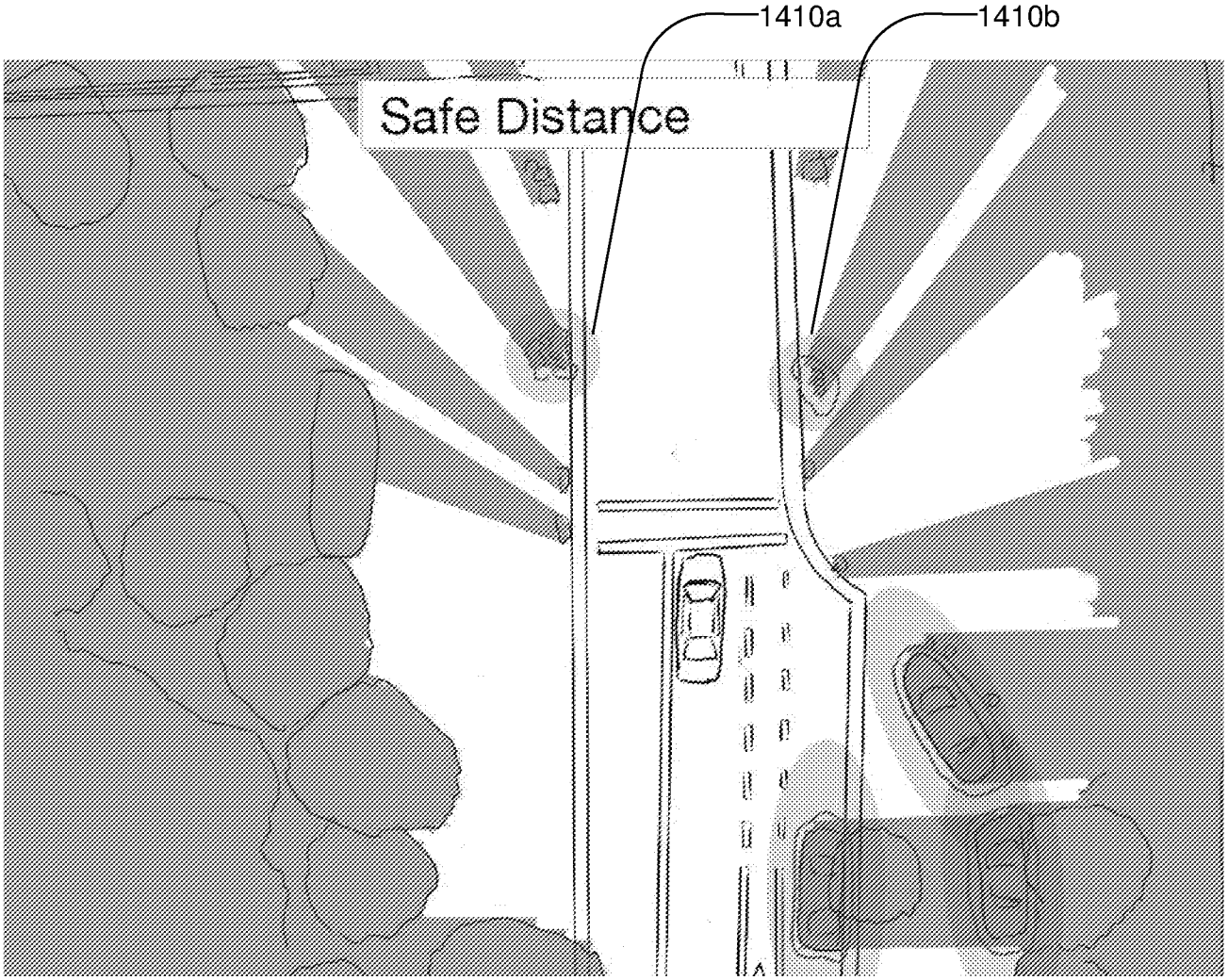


FIG. 14

TESLA EXHIBIT 1002, Page 72

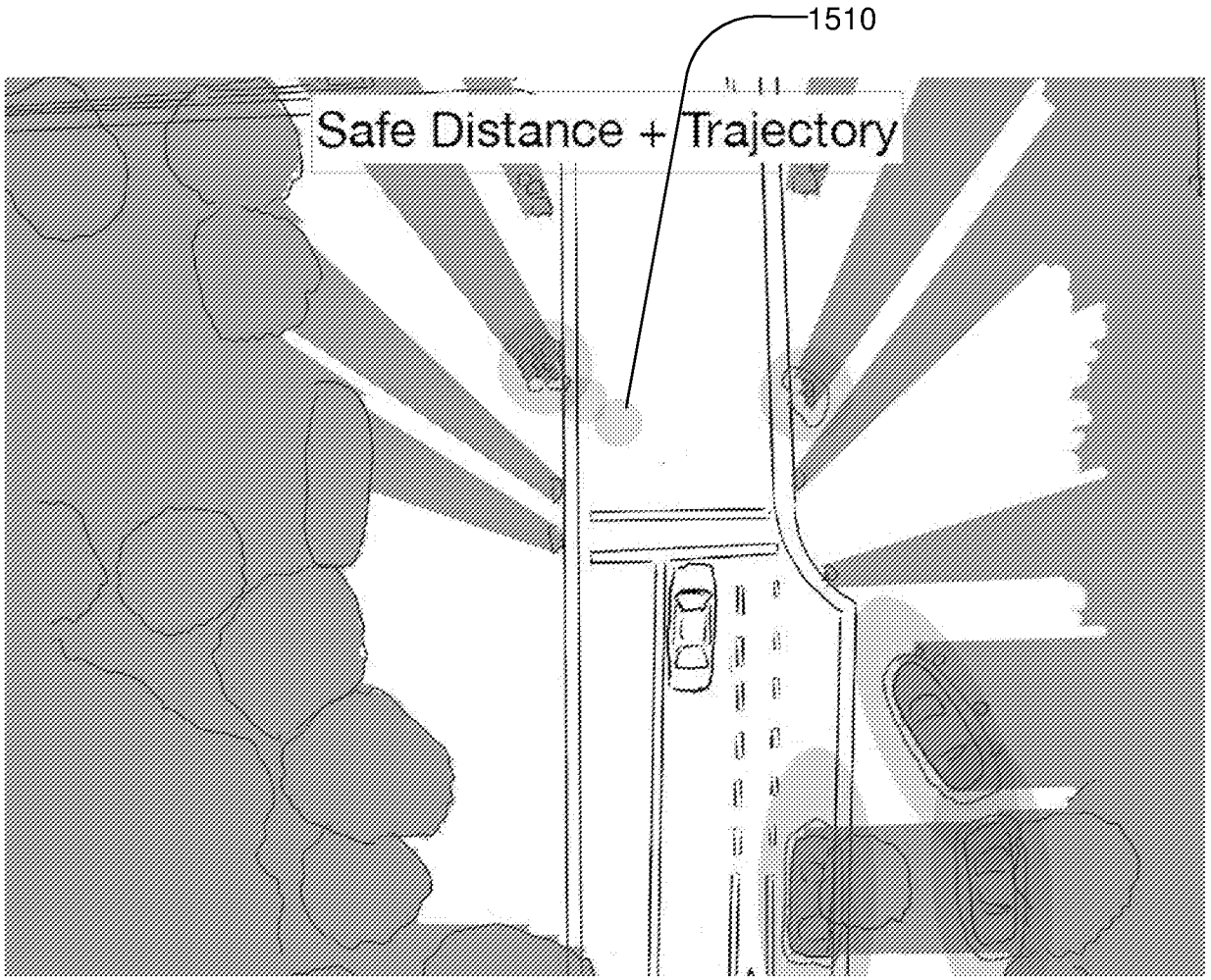


FIG. 15

TESLA EXHIBIT 1002, Page 73



FIG. 16

TESLA EXHIBIT 1002, Page 74

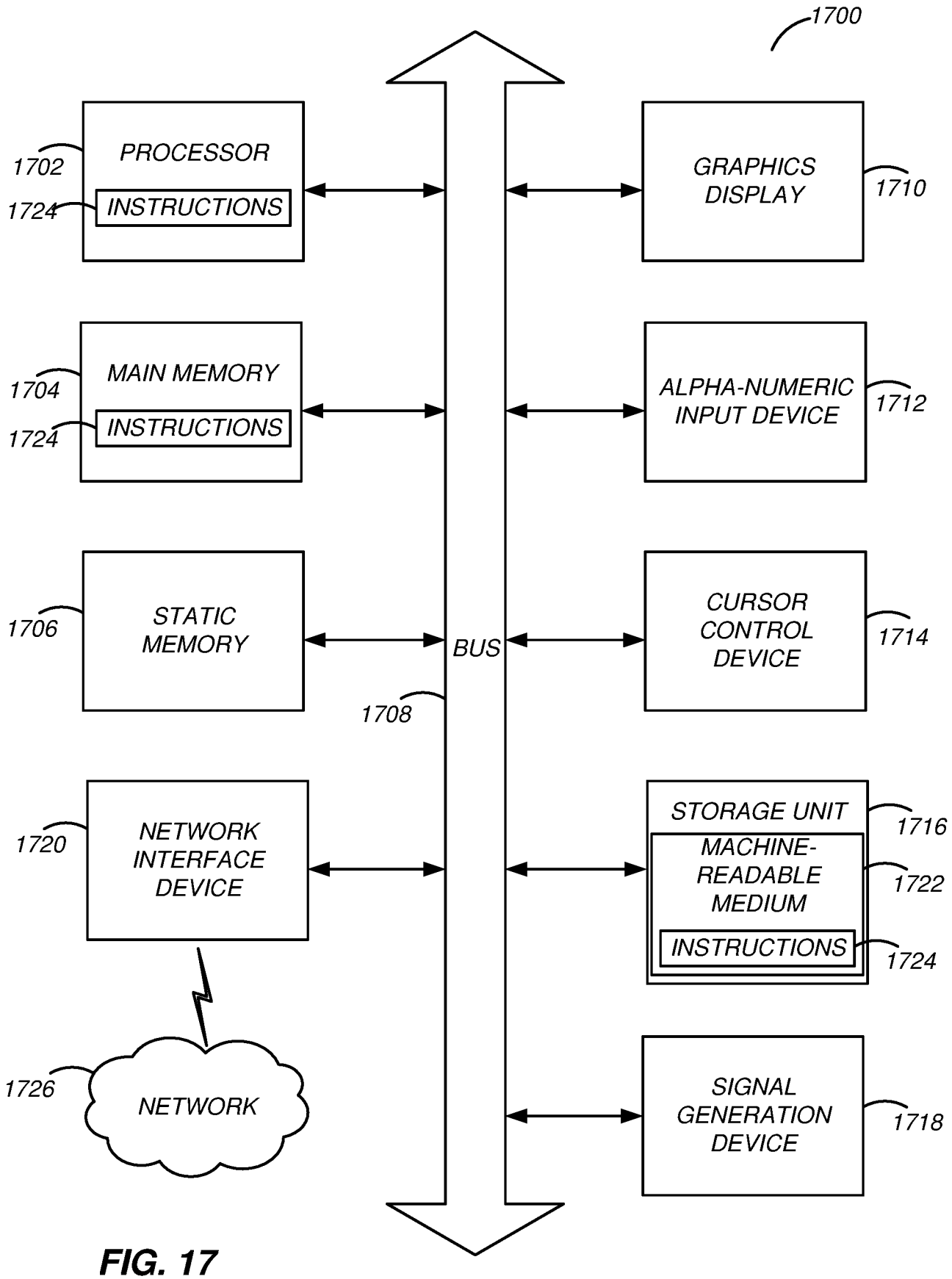

1700
PROCESSOR
1702
INSTRUCTIONS
1724
MAIN MEMORY
1704
INSTRUCTIONS
1724
STATIC MEMORY
1706
NETWORK INTERFACE DEVICE
1720
NETWORK
1726
BUS
1708
GRAPHICS DISPLAY
1710
ALPHA-NUMERIC INPUT DEVICE
1712
CURSOR CONTROL DEVICE
1714
STORAGE UNIT
1716
MACHINE-READABLE MEDIUM
1722
INSTRUCTIONS
1724
SIGNAL GENERATION DEVICE
1718

FIG. 17

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar/Natasha Pasciucco
Attorney Docket Number:	35447-45618/US

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**865**

Electronic Acknowledgement Receipt

EFS ID:	38450409
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar
Filer Authorized By:	
Attorney Docket Number:	35447-45618/US
Receipt Date:	30-JAN-2020
Filing Date:	
Time Stamp:	18:51:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$865
RAM confirmation Number	E20201TI52156954
Deposit Account	192555
Authorized User	Rajendra Panwar

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	45618_US_ADS.pdf	1256245 a870731c6f64a9b4f12a2af6a419f2981cc93bda	no	8
Warnings:					
Information:					
2	Internet Communications Authorized	45618_US_AIC.pdf	75313 de9296df77cb60a70b639f900bd93565334ae4b9	no	2
Warnings:					
Information:					
3	Power of Attorney	45618_US_POA.pdf	768887 234db5431ffd287190e867c23c339c5f8cfb2309	no	2
Warnings:					
Information:					
4		45618_US_SPEC.pdf	242833 c67cf3b99edb4292bc8c37847dcc6883366ad10d	yes	53

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	45
Claims	46	52
Abstract	53	53

Warnings:					
Information:					
5	Drawings-only black and white line drawings	UTL_FIGS.pdf	746039 1cd3a6813c2c01fcab4b14e48f8546b5ca0d8f3a	no	17

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	37229 93fd4a7e98acc371d05c52cb872cd99eee9608d1	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	3126546	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Samuel	English	Anthony	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	Somerville	State/Province	MA	Country of Residence	US

Mailing Address of Inventor:

Address 1	Perceptive Automata, Inc.
Address 2	201 Washington Street, 35th Floor

City	Boston	State/Province	MA
Postal Code	02108	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. — Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	00758		
Email Address	ptoc@fenwick.com	Add Email	Remove Email

Application Information:

Title of the Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES		
Attorney Docket Number	35447-45618/US	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	17	**Suggested Figure for Publication (if any)**	

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	00758		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62/822269	2019-03-22

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62/800416	2019-02-01
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62/798978	2019-01-30
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
● Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	Perceptive Automata, Inc.		
Mailing Address Information For Applicant:			
Address 1	201 Washington Street, 35th Floor		
Address 2			
City	Boston	**State/Province**	MA
Country	US	Postal Code	02108
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Rajendra Panwar/			Date (YYYY-MM-DD)	2020-01-30
First Name	Rajendra B.	Last Name	Panwar	Registration Number	63165

Additional Signature may be generated within this form by selecting the Add button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	35447-45618/US
	Application Number	
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT5947993

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
SAMUEL ENGLISH ANTHONY	01/31/2020

RECEIVING PARTY DATA

Name:	PERCEPTIVE AUTOMATA, INC.
Street Address:	ONE BOSTON PLACE, 201 WASHINGTON STREET, 35TH FLOOR
City:	BOSTON
State/Country:	MASSACHUSETTS
Postal Code:	02108

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	16777673

CORRESPONDENCE DATA

Fax Number: (650)938-5200

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 6509888500
Email: npasciucco@fenwick.com
Correspondent Name: RAJENDRA PANWAR
Address Line 1: 801 CALIFORNIA STREET
Address Line 4: MOUNTAIN VIEW, CALIFORNIA 94041

ATTORNEY DOCKET NUMBER:	35447-45618/US
NAME OF SUBMITTER:	RAJENDRA B. PANWAR, REG NO 63165
SIGNATURE:	/Rajendra Panwar/
DATE SIGNED:	02/05/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 2
source=45618 US Combined Declaration Assignment#page1.tif
source=45618 US Combined Declaration Assignment#page2.tif

COMBINED DECLARATION AND ASSIGNMENT

For good and valuable consideration, the receipt of which is hereby acknowledged, the person(s) named below (referred to as "INVENTOR" whether singular or plural) has sold, assigned, and transferred and does hereby sell, assign, and transfer to **Perceptive Automata, Inc.**, a Delaware Corporation, having a place of business at **One Boston Place, 201 Washington Street, 35th Floor, Boston MA 02108** ("ASSIGNEE"), for itself and its successors, transferees, and assignees, the following:

1. The entire worldwide right, title, and interest in all inventions and improvements ("SUBJECT MATTER") that are disclosed in any of the following patent application(s), Registered Community Design(s), international application(s) filed according to the Patent Cooperation Treaty (PCT), or U.S. national phase application(s) (collectively, the "APPLICATION"), and any patents issuing thereon ("PATENT RIGHTS"):

U.S. Application No. **16/777,673**, entitled **NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES**, filed on **January 30, 2020**, which claims priority from Provisional Application No. 62/822,269, filed on March 22, 2019, Provisional Application No. 62/800,416, filed on February 1, 2019, and Provisional Application No. 62/798,978, filed on January 30, 2019.

2. The entire worldwide right, title, and interest in and to:
(a) the APPLICATION; (b) all applications claiming priority from the APPLICATION; (c) all provisional, utility, divisional, continuation, substitute, renewal, reissue, and other applications related thereto that have been or may be filed in the United States or elsewhere in the world; (d) all patents (including reissues and re-examinations) that may be granted on the applications set forth in (a), (b), and (c) above; and (e) all right of priority in the APPLICATION and in any underlying provisional or foreign application, together with all rights to recover damages for infringement of provisional rights.

INVENTOR agrees that ASSIGNEE may apply for and receive patents for SUBJECT MATTER in ASSIGNEE's own name.

INVENTOR agrees to do the following, when requested, and without further consideration, in order to carry out the intent of this Assignment: (1) execute all oaths, assignments, powers of attorney, applications, and other papers necessary or desirable to fully secure to ASSIGNEE the rights, titles and interests herein conveyed; (2) communicate to ASSIGNEE all known facts relating to the SUBJECT MATTER; and (3) generally do all lawful acts that ASSIGNEE shall consider desirable for securing, maintaining, and enforcing worldwide patent protection relating to the SUBJECT MATTER and for vesting in ASSIGNEE the rights, titles, and interests herein conveyed. INVENTOR further agrees to provide any successor, assign, or legal representative of ASSIGNEE with the benefits and assistance provided to ASSIGNEE hereunder.

Title:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES		
Filed:	January 30, 2020	Attorney Docket #:	35447-45618/US
Application #:	16/777,673	Client Ref #:	

INVENTOR represents that INVENTOR has the rights, titles, and interests to convey as set forth herein, and covenants with ASSIGNEE that the INVENTOR has not made and will not hereafter make any assignment, grant, mortgage, license, or other agreement affecting the rights, titles, and interests herein conveyed.

INVENTOR grants the attorney of record the power to insert on this Assignment any further identification that may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office or other authority for recordation of this document.

This Assignment may be executed in one or more counterparts, each of which shall be deemed an original and all of which may be taken together as one and the same Assignment.

By signing below, INVENTOR further attests to the following:

- The APPLICATION was made or authorized to be made by INVENTOR.
- INVENTOR believes that INVENTOR is the original inventor or an original joint inventor of a claimed invention in the APPLICATION.

INVENTOR hereby acknowledges that any willful false statement made in this document is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name and Signature	Date of Signature (REQUIRED)
Samuel English Anthony	1/31/2020
Samuel English Anthony	

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/777,673

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	785		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/777,673	01/30/2020	3646	865	35447-45618/US	20	3

CONFIRMATION NO. 9420

FILING RECEIPT

758
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041
UNITED STATES OF AMERICA

Date Mailed: 02/20/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Samuel English Anthony, Somerville, MA;

Applicant(s)

Perceptive Automata, Inc., Boston, MA

Power of Attorney: The patent practitioners associated with Customer Number 00758

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/822,269 03/22/2019
and claims benefit of 62/800,416 02/01/2019
and claims benefit of 62/798,978 01/30/2019

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/18/2020
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/777,673**
Projected Publication Date: 07/30/2020
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****
Title

NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

Preliminary Class

342

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				*Complete if Known*	
				Application Number	16/777,673
				Filing Date	January 30, 2020
				First Named Inventor	Samuel English Anthony
				Applicant	Perceptive Automata, Inc.
				Art Unit	3661
				Confirmation Number	9420
				Examiner Name	Not Yet Assigned
Sheet	1	of	2	Attorney Docket Number	35447-45618/US

U.S. PATENT DOCUMENTS				
		Document No.		
Examiner Initials*	Cite No.[1]	Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-9,766,336 B2	09-19-2017	Gupta et al.
	A2	US-9,415,777 B2	08-16-2016	Clarke et al.

FOREIGN PATENT DOCUMENTS					
		Foreign Patent Document			
Examiner Initials*	Cite No.[1]	Country Code[3] – Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T[6]
	B1				

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[6]
	C1	International Search Report and Written Opinion, Patent Cooperation Treaty Application No. PCT/US2020/15889, 16 June 2020, 23 pages.	
	C2	Invitation to Pay Additional Fees, Patent Cooperation Treaty Application No. PCT/US2020/15889, 13 April 2020, 2 pages.	

EXAMINER SIGNATURE	
Examiner Signature	
Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (option). [2] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [3] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

[5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
				Application Number	16/777,673
				Filing Date	January 30, 2020
				First Named Inventor	Samuel English Anthony
				Applicant	Perceptive Automata, Inc.
				Art Unit	3661
				Confirmation Number	9420
				Examiner Name	Not Yet Assigned
Sheet	2	of	2	Attorney Docket Number	35447-45618/US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/ Rajendra B. Panwar/	Date (YYYY-MM-DD)	2020-06-29
Name/Print	Rajendra B. Panwar	Registration Number	63,165

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: Antonia Sequeira
Fenwick & West LLP
Silicon Valley Center
801 California Street
Mountain View, CA 94041
United States of America

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 35447-45544/WO	Date of mailing *(day/month/year)* 16 JUN 2020 **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US20/15889	International filing date *(day/month/year)* 30 January 2020 (30.01.2020)
Applicant Perceptive Automata, Inc.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau preferably through ePCT, or on paper to:
   The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland

   For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/220 (revised January 2020)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference		FOR FURTHER ACTION
35447 -45544/WO		see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US20/15889	30 January 2020 (30.01.2020)	30 January 2019 (30.01.2019)
Applicant		
Perceptive Automata, Inc.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☒ **Certain claims were found unsearchable** (see Box No. II).

3. ☒ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 6

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US20/15889

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 4-10, 14-20, 24-31
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

-***-Continued within extra sheet-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-3

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US20/15889

A. CLASSIFICATION OF SUBJECT MATTER

IPC - G08G 1/017, 1/16; B60W 30/08, 30/085, 30/09; G06N 3/02, 3/08, 20/00 (2020.01)

CPC - G06K 9/00785, 9/00791, 9/00805; B60W 30/08, 30/085, 30/09; G08G 1/0104, 1/0125, 1/16, 1/165, 1/166; G06N 3/02, 3/08, 20/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2019/0012574 A1 (PERCEPTIVE AUTOMATA) 10 January 2019; the entire document	1-3
A	US 9,415,777 B2 (MOBILEYE VISION TECHNOLOGIES LTD.) 16 August 2016; the entire document	1-3
A	US 9,766,336 B2 (HERE GLOBAL B.V.) 19 Septemebr 2017; the entire document	1-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2020 (23.03.2020)	16 JUN 2020
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/210 (second sheet) (July 2019)

-***-Continued from Box No. III - Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-3 are directed towards a method to control the braking system of an autonomous vehicle based on an activation threshold.
Group II: Claims 11-13 and 21-23 are directed a method of navigating an autonomous vehicle based on the motion parameters of a traffic entity.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include at least wherein: wherein the output of the machine learning based model comprises a measure of statistical distribution of the hidden context; determining an activation threshold value for braking system of the autonomous vehicle based on the statistical distribution of the hidden context; predicting that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval; and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, activating the braking system of the autonomous vehicle, which are not present in Group II.

The special technical features of Group II include at least wherein determining one or more motion parameters describing movement of the traffic entity; navigating the autonomous vehicle based on each of the traffic entities, which are not present in Group I.

The common technical features shared by Groups I-II are a method comprising: receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle; identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving; for each of the one or more traffic entities: determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users.

However, these common features are previously disclosed by US 2019/0012574 A1 to PERCEPTIVE AUTOMATA (hereinafter "PERCEPTIVE"). PERCEPTIVE discloses a method comprising (a method; abstract): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle 1000 sensor data from sensors mounted on the autonomous vehicle 1000; figure 10, paragraph [0070]); identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (identifying traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle 1000 is driving as shown in figure 10; figure 10, paragraphs [0069], [0070], claim 1 of PERCEPTIVE); for each of the one or more traffic entities (for each of the traffic entities; paragraphs [0030], [0031], [0033]-[0037]): determining a hidden context based on a machine learning based model (determining an action to be performed (hidden context) based on a supervised learning based model (machine learning); paragraphs [0030], [0031], [0033]-[0037]), wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (the supervised learning model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users; paragraphs [0030], [0031], [0033]-[0037]).

Since the common technical features are previously disclosed by the PERCEPTIVE reference, these common features are not special and so Groups I-II lack unity.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: Antonia Sequeira
Fenwick & West LLP
Silicon Valley Center
801 California Street
Mountain View, CA 94041
United States of America

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	16 JUN 2020
Applicant's or agent's file reference 35447-45544/WO	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US20/15889	30 January 2020 (30.01.2020)	30 January 2019 (30.01.2019)

International Patent Classification (IPC) or both national classification and IPC

IPC - G08G 1/017, 1/16; B60W 30/08, 30/085, 30/09; G06N 3/02, 3/08, 20/00 (2020.01)

CPC - G06K 9/00785, 9/00791, 9/00805; B60W 30/08, 30/085, 30/09; G08G 1/0104, 1/0125, 1/16, 1/165, 1/166; G06N 3/02, 3/08, 20/00

Applicant

Perceptive Automata, Inc.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	23 March 2020 (23.03.2020)	Shane Thomas PCT Help Desk Telephone No. 571-272-4300

Form PCT/ISA/237 (cover sheet) (revised January 2019)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US20/15889

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US20/15889

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 4-10, 14-20, 24-31

because:

☐ the said international application, or the said claims Nos. _____ relate to the following subject matter which does not require an international search *(specify)*:

☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 4-10, 14-20, 24-31 are so unclear that no meaningful opinion could be formed *(specify)*:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

☐ the claims, or said claims Nos. _____ are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no international search report has been established for said claims Nos. 4-10, 14-20, 24-31

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing in the form of an Annex C/ST.25 text file, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.
- ☐ furnish a sequence listing on paper or in the form of an image file complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.
- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13*ter*.1(a) or (b).

☐ See Supplemental Box for further details.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US20/15889

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:

   ☐ paid additional fees.

   ☐ paid additional fees under protest and, where applicable, the protest fee.

   ☐ paid additional fees under protest but the applicable protest fee was not paid.

   ☒ not paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-3 are directed towards a method to control the braking system of an autonomous vehicle based on an activation threshold.
Group II: Claims 11-13 and 21-23 are directed a method of navigating an autonomous vehicle based on the motion parameters of a traffic entity.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include at least wherein: wherein the output of the machine learning based model comprises a measure of statistical distribution of the hidden context; determining an activation threshold value for braking system of the autonomous vehicle based on the statistical distribution of the hidden context; predicting that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval; and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, activating the braking system of the autonomous vehicle, which are not present in Group II.

The special technical features of Group II include at least wherein determining one or more motion parameters describing movement of the traffic entity; navigating the autonomous vehicle based on each of the traffic entities, which are not present in Group I.

The common technical features shared by Groups I-II are a method comprising: receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle; identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving; for each of the one or more traffic entities: determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users.

However, these common features are previously disclosed by US 2019/0012574 A1 to PERCEPTIVE AUTOMATA (hereinafter "PERCEPTIVE"). PERCEPTIVE discloses a method comprising (a method; abstract): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle 1000 sensor data from sensors mounted on the autonomous vehicle 1000; figure 10, paragraph [0070]); identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (identifying traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle 1000 is driving as shown in figure 10; figure 10, paragraphs [0069], [0070], claim 1 of PERCEPTIVE); for each of the one or more traffic entities (for each of the traffic entities; paragraphs [0030], [0031], [0033]-[0037]): determining a hidden context based on a machine learning based model (determining an action to be performed (hidden context) based on a supervised learning based model (machine learning); paragraphs [0030], [0031], [0033]-[0037]), wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (the supervised learning model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users; paragraphs [0030], [0031], [0033]-[0037]).

Since the common technical features are previously disclosed by the PERCEPTIVE reference, these common features are not special and so Groups I-II lack unity.

4. Consequently, this opinion has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-3

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US20/15889

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-3	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-3	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-3	YES
	Claims	NONE	NO

2. Citations and explanations:

Claim 1 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest determining an activation threshold value for braking system of the autonomous vehicle based on the statistical distribution of the hidden context; predicting that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval; and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, activating the braking system of the autonomous vehicle.

In the closest reference, US 2019/0012574 A1 to PERCEPTIVE AUTOMATA (hereinafter "PERCEPTIVE") discloses a method comprising (a method; abstract): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle 1000 sensor data from sensors mounted on the autonomous vehicle 1000; figure 10, paragraph [0070]); identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (identifying traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle 1000 is driving as shown in figure 10; figure 10, paragraphs [0069], [0070], claim 1 of PERCEPTIVE); for each of the one or more traffic entities (for each of the traffic entities; paragraphs [0030], [0031], [0033]-[0037]): determining a hidden context based on a machine learning based model (determining an action to be performed (hidden context) based on a supervised learning based model (machine learning); paragraphs [0030], [0031], [0033]-[0037]), wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (the supervised learning model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users; paragraphs [0030], [0031], [0033]-[0037]); wherein the output of the machine learning based model comprises a measure of statistical distribution of the hidden context (the output of the supervised learning based model comprises a measure of statistical distribution of the action; paragraphs [0030], [0031], [0033]-[0037], [0058], [0064], [0065]).

In another reference, US 9,415,777 B2 to MOBILEYE VISION TECHNOLOGIES LTD. (hereinafter "MOBILEYE") discloses a method comprising (a method; abstract): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle images (sensor data) from image capture devices (sensors) mounted on the autonomous vehicle; figure 2A, column 68, lines 22-40); identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (identifying encroaching vehicle (traffic entities) based on the images, the encroaching vehicle represents non-stationary objects in traffic in which the autonomous vehicle is driving; column 58, line 66-column 59, line 17); for each of the one or more traffic entities: determining an activation threshold value for braking system of the autonomous vehicle based on the hidden context (for the encroaching vehicle determine a collision threshold (activation threshold value) which when crossed activates the braking system of the autonomous vehicle based on the distance (hidden context); column 58, line 66-column 59, line 36); responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity, activating the braking system of the autonomous vehicle (responsive to determining that the autonomous vehicle is crossing the collision threshold of the encroaching vehicle taking an evasive action including activating the braking system; column 58, line 66-column 59, line 36).

In a further reference, US 9,766,336 B2 to HERE GLOBAL B.V. (hereinafter "HERE") discloses a method comprising (a method; claim 1 of HERE): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle data (sensor data) from data acquisition device comprising sensor circuitry (sensors) mounted on the autonomous vehicle; figures 4, 5A, column 4, line 25-54); identifying, one or more traffic entities based on the sensor data (identifying an obstruction (traffic entities) based on the data; figure 2, column 6, lines 20-29); for each of the one or more traffic entities: determining an activation threshold value for braking system of the autonomous vehicle (for the obstacle determining a distance threshold value (activation threshold) to trigger action like stopping (braking system) of the autonomous vehicle; figure 2, column 7, line 62-column 8, line 38); a threshold time interval (a threshold time value; figure 2, column 7, line 62-column 8, line 38); and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold, activating the braking system of the autonomous vehicle (responsive to determining that the distance is less than the distance threshold value trigger stopping of the autonomous vehicle; figure 2, column 7, line 62-column 8, line 38).

-***-Continued Within the Next Supplemental Box-***-

TESLA EXHIBIT 1002, Page 107

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

-***-Continued from Box V: Citations and Explanations-***-

PERCEPTIVE, MOBILEYE and HERE fail to disclose determining an activation threshold value for braking system of the autonomous vehicle based on the statistical distribution of the hidden context; predicting that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval; and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, activating the braking system of the autonomous vehicle. It would not have been obvious to one of ordinary skill in the art at the time the invention was made to have employed this method because none of the references uncovered disclosed the nuances of the instant claim in a cumulative manner while still allowing for a plausible motivation to combine said references. Although PERCEPTIVE discloses most of the claim limitations, including training the model based on sensor input to generate outputs to predict object behavior patterns, the reference doesn't include calculating thresholds to further navigate the vehicle. Furthermore, in reference MOBILEYE, the collision threshold is based on both the distance and the time to collision threshold and does not serve as two separate thresholds to be compared to before taking an action and in reference HERE, the thresholds disclose a activation threshold and a time threshold, but these serve as separate criteria to trigger a certain action and don't disclose them as being dependent on each other to produce a braking action and none of the references disclose predicting a time threshold before determining and taking a corrective action and modifying the references further to meet the limitations add no benefit. The references taken solely, or in combination, fail to provide the required limitations, and modification of any complementary combination of the references of record would be impermissible and not provide any advantages over the present application.

Claims 2 and 3 meet the criteria set out in PCT Article 33(2)-(3), because they depend on claim 1.

Claims 1-3 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

PCT Recordation of Search History

Case/PCT Application Number: PCT/US20/15889

CLIN Number/Technical Field of PCT Application: 5

Dates During Which the Search was Conducted: 22-23 March 2020

Date of Completion of Recordation of Search History Form: 23 March 2020 (23.03.2020)

Research Analyst Initials: M2S

Search Approval Official (SAO) Initials: BSS

Field of Search/Classification Information:

IPC(8) Classifications: G08G 1/017, 1/16; B60W 30/08, 30/085, 30/09; G06N 3/02, 3/08, 20/00 (2020.01)

CPC Classifications: G06K 9/00785, 9/00791, 9/00805; B60W 30/08, 30/085, 30/09; G08G 1/0104, 1/0125, 1/16, 1/165, 1/166; G06N 3/02, 3/08, 20/00

Databases Searched (Patent and Non-Patent Literature (NPL), Including Sub-Databases and Files Searched) and Search Terms Used:

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google; Google Scholar; EBSCO, IEEE Xplore.

Keywords: autonomous vehicle, object, sensor, traffic, machine learning statistical measure, hidden feature, activation threshold, braking, time threshold.

Database Search String Recordation, Including Dates of Searches:

Patent Database Search Strategy/Results:

PatSeer

ID	Search String	Deduped	Records	Created Date
L33	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak* OR length*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*)) AND IC: (B60W30/08 OR B60W30/085 OR G08G1/017 OR G08G1/16 OR G06N3/02 OR G06N3/08 OR G06N20/00)	ALL	16	23-Mar-20
L32	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak* OR length*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR	ALL	25	23-Mar-20

	deviat* OR SD) WP (user* OR feedback*)) AND CPC: (G06K9/00785 OR G06K9/00791 OR G06K9/00805 OR B60W30/08 OR B60W30/085 OR B60W30/09 OR G08G1/0104 OR G08G1/0125 OR G08G1/16 OR G08G1/165 OR G08G1/166 OR G06N3/02 OR G06N3/08 OR G06N20/00)			
L31	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak* OR length*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*))	ALL	176	23-Mar-20
L30	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*))	ALL	170	23-Mar-20

L29	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*))	ALL	29	23-Mar-20
L28	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (aware* OR state W2 mind* OR ind* OR notic*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt* OR avoid* OR evasiv*) AND (collision* OR crash*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*))	ALL	19	23-Mar-20
L27	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (aware*	ALL	1	23-Mar-20

	OR state W2 mind* OR ind* OR notic*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*))			
L26	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (aware* OR state W2 mind* OR ind* OR notic*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP (user* OR feedback*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND IC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	1	23-Mar-20
L25	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (aware* OR state W2 mind* OR ind* OR notic*) AND (ml or nn OR learn* OR neural*) WP (statistic* OR mean* OR median* OR center* OR deviat* OR SD) WP	ALL	1	23-Mar-20

	(user* OR feedback*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)			
L24	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam* OR aquisit*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl* OR obstruct* OR non_station*) WP (aware* OR state W2 mind* OR ind* OR notic*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	118	23-Mar-20
L23	L22 NOT L21 NOT L20	ALL	61	23-Mar-20
L22	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND iC:	ALL	301	23-Mar-20

	(G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)			
L21	L20 NOT L18 NOT L16 NOT L13 NOT L11	ALL	265	23-Mar-20
L20	TACD: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	359	23-Mar-20
L19	L18 NOT L16 NOT L14 NOT L13 NOT L9	ALL	1	23-Mar-20
L18	TAC: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	82	23-Mar-20
L17	L16 NOT L9 NOT L14 NOT L13	ALL	5	23-Mar-20
L16	TAC: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (predict* OR estimat* OR probabilit* OR chanc*) WP (threshold* OR limit* OR cut W5 off* OR	ALL	66	23-Mar-20

	bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval* OR instan*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND IC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)			
L15	L9 NOT L14 NOT L13	ALL	78	23-Mar-20
L14	L13 NOT L11 NOT L6	ALL	258	23-Mar-20
L13	TAC: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND IC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	300	23-Mar-20
L12	L11 NOT L6	ALL	61	23-Mar-20
L11	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*)) AND IC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	163	23-Mar-20
L10	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (threshold* OR	ALL	32	23-Mar-20

	limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND IC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)			
L9	TAC: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	311	23-Mar-20
L8	L7 NOT L6	ALL	0	23-Mar-20
L7	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit* OR obstacl*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) AND (collision* OR crash*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	38	23-Mar-20
L6	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit*) WP (threshold* OR limit* OR cut	ALL	185	23-Mar-20

	W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)			
L5	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*) WP (train* OR ML OR learn* OR neural*)) AND CPC: (G06K9* OR B60W30* OR B60W50* OR G06K9* OR G06N3* OR G06N20*)	ALL	3	23-Mar-20
L4	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) WP (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit*) WP (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) WP (activat* OR action* OR trigger* OR start* OR control*) W20 (brak* OR stop* OR halt*))	ALL	998	23-Mar-20
L3	TA: ((auto* OR vehicl* OR car*) WP (sens* OR detect* OR cam*) AND (object* OR subject* OR vehicl* OR mov* OR pedestrian* OR traffic* OR entit*) AND (threshold* OR limit* OR cut W5 off* OR bar*) WS (distanc* OR brak*) AND (tim* OR period* OR interval*) WS (threshold* OR limit* OR cut W5 off* OR bar*) AND (activat* OR action* OR trigger* OR start* OR	ALL	1715	23-Mar-20

	control*) W20 (brak* OR stop* OR halt*))			
L2	inv: (samuel W1 english W1 anthony)	ALL	2	22-Mar-20
L1	ASN: ("PERCEPTIVE AUTOMATA INC.")	ALL	4	22-Mar-20

Non-Patent Literature (NPL) Search Strategy/Results:

Google Scholar/ Google Patents

Search Terms	Date
Autonomous vehicle sensors capture images identify obstruction machine learning model determine statistical distribution obstacle velocity distance threshold time threshold braking system trigger	22 March 2020
Vehicle camera video identify pedestrian neural network model statistical mean distribution user feedback trained motion value distance threshold time threshold vehicle control system trigger	22 March 2020
Autonomous vehicle sensors data obstacle machine learning model obstacle awareness distance threshold time threshold braking system trigger	22 March 2020

IEEE Xplore

Search Terms	Date
Autonomous vehicle sensors capture images identify obstruction machine learning model determine statistical distribution obstacle velocity distance threshold time threshold evasive control	22 March 2020
Vehicle camera video identify pedestrian neural network model statistical mean distribution user	22 March 2020

feedback trained motion value distance threshold time threshold vehicle control system trigger	
Autonomous vehicle sensors data obstacle machine learning model obstacle noticeability distance limit time interval limit stop vehicle	22 March 2020

Ebsco

Search Terms	Date
Autonomous vehicle sensors capture images identify obstruction machine learning model statistical values vehicle traffic velocity distance threshold time threshold braking system trigger	22 March 2020
Vehicle camera video identify pedestrian neural network statistical standard deviation distribution user feedback trained motion value distance threshold time threshold vehicle halt control system trigger	22 March 2020
Autonomous vehicle sensors data obstacle machine learning model obstacle state of mind distance threshold time threshold braking system trigger	22 March 2020

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: Antonia Sequeira
Fenwick & West LLP
Silicon Valley Center
801 California Street
Mountain View, CA 94041
United States of America

PCT

INVITATION TO PAY ADDITIONAL FEES
AND, WHERE APPLICABLE, PROTEST FEE

(PCT Article 17(3)(a) and Rules 40.1 and 40.2(e))

Applicant's or agent's file reference 35447-45544/WO	Date of mailing *(day/month/year)* 13 APR 2020 **PAYMENT DUE** within **ONE MONTH** from the above date of mailing
International application No. PCT/US20/15889	International filing date *(day/month/year)* 30 January 2020 (30.01.2020)
Applicant Perceptive Automata, Inc.	

1. This International Searching Authority

   (i) considers that there are 2 *(number of)* inventions claimed in the international application covered by the claims indicated below/on an extra sheet:

   Group I: Claims 1-3; Group II: Claims 11-13 and 21-23

   (ii) therefore considers that **the international application does not comply with the requirement of unity of invention** (Rules 13.1, 13.2 and 13.3) for the reasons indicated below/on an extra sheet:

   -***-Please See Supplemental Page-***-

   (iii) ☐ has carried out a partial international search (see Annex) ☒ will establish the international search report on those parts of the international application which relate to the invention first mentioned in claims Nos.:

   Group I: Claims 1-3

   (iv) will establish the international search report on the other parts of the international application only if, and to the extent to which, additional fees are paid.

2. Consequently, the applicant is hereby **invited to pay**, within the time limit indicated above, additional fees in the amount indicated below:

   $2,080.00 (Fee per additional invention) x 1 (number of additional inventions) = $2,080.00 (See Item 2 of next sheet) (total amount of additional fees/currency)

3. The applicant is informed that, according to Rule 40.2(c), **the payment of any additional fees may be made under protest**, that is, a reasoned statement to the effect that the international application complies with the requirement of unity of invention or that the amount of the required additional fees is excessive, where applicable, subject to the payment of a protest fee.

   Where the applicant pays additional fees under protest, the applicant is hereby invited, within the time limit indicated above, to pay a protest fee (Rule 40.2(e)) in the amount of _____ *(amount/currency)*

   Where the applicant has not, within the time limit indicated above, paid the required protest fee, the protest will be considered not to have been made and the International Searching Authority will so declare.

4. ☒ Claim(s) Nos. 4-10, 14-20, 24-31 have been found to be unsearchable under Article 17(2)(b) because of defects under Article 17(2)(a) and therefore have not been included with any invention.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300

Form PCT/ISA/206 (July 2019)

Item 2 (continued). For International Applications filed on or after 01 January 2014, Applicant is reminded that the search fee per additional invention indicated in item 2 is the undiscounted fee per additional invention. An Applicant may pay the search fee per additional invention fee reduced by 50% (small entity assertion) or 75% (micro entity certification), as appropriate. See 37 CFR 1.27 and 1.29.

-***-Continued from 1.(ii)-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-3 are directed towards a method to control the braking system of an autonomous vehicle based on an activation threshold.
Group II: Claims 11-13 and 21-23 are directed a method of navigating an autonomous vehicle based on the motion parameters of a traffic entity.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include at least wherein: wherein the output of the machine learning based model comprises a measure of statistical distribution of the hidden context; determining an activation threshold value for braking system of the autonomous vehicle based on the statistical distribution of the hidden context; predicting that the autonomous vehicle is likely to reach within the activation threshold of a particular traffic entity within a threshold time interval; and responsive to determining that the autonomous vehicle is likely to reach within the activation threshold of the particular traffic entity within the threshold time interval, activating the braking system of the autonomous vehicle, which are not present in Group II.

The special technical features of Group II include at least wherein determining one or more motion parameters describing movement of the traffic entity; navigating the autonomous vehicle based on each of the traffic entities, which are not present in Group I.

The common technical features shared by Groups I-II are a method comprising: receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle; identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving; for each of the one or more traffic entities: determining a hidden context based on a machine learning based model, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users.

However, these common features are previously disclosed by US 2019/0012574 A1 to PERCEPTIVE AUTOMATA (hereinafter "PERCEPTIVE"). PERCEPTIVE discloses a method comprising (a method; abstract): receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (receiving by an autonomous vehicle 1000 sensor data from sensors mounted on the autonomous vehicle 1000; figure 10, paragraph [0070]); identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (identifying traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle 1000 is driving as shown in figure 10; figure 10, paragraphs [0069], [0070], claim 1 of PERCEPTIVE); for each of the one or more traffic entities (for each of the traffic entities; paragraphs [0030], [0031], [0033]-[0037]): determining a hidden context based on a machine learning based model (determining an action to be performed (hidden context) based on a supervised learning based model (machine learning); paragraphs [0030], [0031], [0033]-[0037]), wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (the supervised learning model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users; paragraphs [0030], [0031], [0033]-[0037]).

Since the common technical features are previously disclosed by the PERCEPTIVE reference, these common features are not special and so Groups I-II lack unity.

Electronic Acknowledgement Receipt

EFS ID:	39860310
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar/Julie Eng
Filer Authorized By:	Rajendra Bhagwatisingh Panwar
Attorney Docket Number:	35447-45618/US
Receipt Date:	29-JUN-2020
Filing Date:	30-JAN-2020
Time Stamp:	17:45:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	45618_US_Information_Disclosure_Statement.pdf	189394 4305f9f5c1dee2b034a73e73c350b81cd99756eb	no	2

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Other Reference-Patent/App/Search documents	45544_ISRWO_PCTUS202015889_16June2020.pdf	3071925 2c589d750bf27a048e4c667e644dbdfb6b69b8ce	no	23
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Invitation_to_Pay_Additional_Fees_PCTUS202015889_13April2020.pdf	367994 20ac68733693fffe8273429f4bb4657c9308bee3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3629313		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US

CONFIRMATION NO. 9420

758
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

PUBLICATION NOTICE

OC000000118843268

Title:NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

Publication No.US-2020-0239026-A1
Publication Date:07/30/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

758 7590 09/30/2021

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER	
WEBER, TAMARA L	

ART UNIT	PAPER NUMBER
3667	

NOTIFICATION DATE	DELIVERY MODE
09/30/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTOC@Fenwick.com

Office Action Summary	Application No. 16/777,673	Applicant(s) Anthony, Samuel English	
	Examiner TAMARA L WEBER	Art Unit 3667	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 1/30/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-20 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 1/30/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 6/29/2020.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

Claim Status

This action is in response to applicant's filing on 1/30/2020. Claims 1-20 are pending and considered below.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1, 4-10 and 13-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777386. Although the claims at issue are not identical, they are not patentably distinct from each other because navigating the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities of Application No. 16/777386 is equivalent to navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities of the instant application. This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 8-12 and 17-20 are rejected under 35 U.S.C. 103 as being unpatentable over Cheng et al. (US-2020/0193829-A1, hereinafter Cheng) in view of Tran et al. (US-2017/0318360-A1, hereinafter Tran).

Regarding claim 1, Cheng discloses:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (paragraphs [0065-0066] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

generating a point cloud representation of the surroundings of the autonomous vehicle (paragraphs [0065-0066]); [A LIDAR sensor produces a 3D point cloud. The generation of a point cloud representation is inherent with the use of a LIDAR sensor.]

based on the sensor data (paragraphs [0111-0123]; FIG. 7, vulnerable road user (VRU) - 702, vehicle A - 704, and vehicle B - 706; and FIG. 8, VRU-702, vehicle A - 704, and vehicle B - 706);

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (paragraphs [0048-0049] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

for each of the one or more traffic entities: (paragraphs [0120-0123]);

determining one or more motion parameters describing movement of the traffic entity (paragraph [0120], location, speed, heading size of VRU; FIG. 10, VRU-702, vehicle A - 704, and vehicle B - 706; and FIG. 11, VRU-702, vehicle A - 704, and vehicle B - 706);

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval (paragraphs [0120-0123]);

modifying the region based on the hidden context (paragraph [0067] and FIG. 1, sensor data-142, intent indicator-143, intent derivation component-144, and user equipment (UE) - 148,149); and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities (paragraphs [0120-0123]).

Cheng does not disclose a machine learning model trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users. However, Tran discloses a system for controlling a vehicle to maintain a predetermined distance from neighboring vehicles, including the following features:

determining a hidden context based on a machine learning based model (paragraphs [0281-0298]); and

wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (paragraph [0298]).

Tran teaches that a library of rules about what objects will do in various situations may be built manually or by the vehicle's observation of other vehicles (paragraph [0298]). It would have been obvious for a person of ordinary skill in the art at the time of the effective filing date of the claimed invention to incorporate the manual input into a machine learning model of the behavior of a moving obstacle of Tran into the machine learning model for predicting intent based on a scenario of Cheng. A person of ordinary skill would have been motivated to do so, with a reasonable expectation of success, for the purpose of providing a machine learning algorithm with adequate data to anticipate a variety of situations. A person of ordinary skill would be familiar with building machine learning algorithms with manually entered and/or vehicle observed data.

Regarding claims 2, 11 and 20, Cheng further discloses:

wherein the region is in the direction determined based on a motion vector of the traffic entity (paragraphs [0120-0123]);

wherein modifying the region based on the hidden context comprises: (paragraph [0067] and FIG. 1, sensor data-142, intent indicator-143, intent derivation component-144, and user equipment (UE) - 148,149);

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector (paragraph [0067]); and

extending the region along the direction of the motion vector (paragraphs [0120-0123] and FIG. 11, A moves left, B moves right).

Regarding claims 3 and 12, Cheng further discloses:

wherein the region is in the direction determined based on a motion vector of the traffic entity (paragraphs [0120-0123]);

wherein modifying the region based on the hidden context comprises: (paragraph [0067] and FIG. 1, sensor data-142, intent indicator-143, intent derivation component-144, and user equipment (UE) - 148,149);

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector (paragraph [0067]); and

decreasing the size of the region along the direction of the motion vector (paragraphs [0120-0123] and FIG. 11, A moves left, B moves right).

Regarding claims 8 and 17, Cheng further discloses:

generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities (paragraphs [0067] and [0120-0123]); and

sending the generated signals to controls of the autonomous vehicle (paragraphs [0120-0123]).

Regarding claims 9 and 18, Cheng further discloses:

wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle (paragraphs [0065-0066] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149).

Regarding claim 10, Cheng further discloses:

A non-transitory computer readable storage medium storing instructions, that when executed by a processor, cause the processor to perform steps comprising: (paragraphs [0145-0146] and FIG. 23, user equipment (UE) - 104, interactive communication component-140, sensor data-142, intent indicator-143, intent derivation component-144, processor(s) - 812, and memory-816);

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (paragraphs [0065-0066] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

generating a point cloud representation of the surroundings of the autonomous vehicle (paragraphs [0065-0066]); [A LIDAR sensor produces a 3D point cloud. The generation of a point cloud representation is inherent with the use of a LIDAR sensor.]

based on the sensor data (paragraphs [0111-0123]; FIG. 7, vulnerable road user (VRU) - 702, vehicle A - 704, and vehicle B - 706; and FIG. 8, VRU-702, vehicle A - 704, and vehicle B - 706);

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (paragraphs [0048-0049] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

for each of the one or more traffic entities: (paragraphs [0120-0123]);

determining one or more motion parameters describing movement of the traffic entity (paragraph [0120], location, speed, heading size of VRU; FIG. 10, VRU-702, vehicle A - 704, and vehicle B - 706; and FIG. 11, VRU-702, vehicle A - 704, and vehicle B - 706);

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval (paragraphs [0120-0123]);

modifying the region based on the hidden context (paragraph [0067] and FIG. 1, sensor data-142, intent indicator-143, intent derivation component-144, and user equipment (UE) - 148,149); and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities (paragraphs [0120-0123]).

Cheng does not disclose a machine learning model trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users. However, Tran further discloses:

determining a hidden context based on a machine learning based model (paragraphs [0281-0298]); and

wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (paragraph [0298]).

Tran teaches that a library of rules about what objects will do in various situations may be built manually or by the vehicle's observation of other vehicles (paragraph [0298]). It would have been obvious for a person of ordinary skill in the art at the time of the effective filing date of the claimed invention to incorporate the manual input into a machine learning model of the behavior of a moving obstacle of Tran into the machine learning model for predicting intent based on a scenario of Cheng. A person of ordinary skill would have been motivated to do so, with a reasonable expectation of success, for the purpose of providing a machine learning algorithm with adequate data to anticipate a variety of

situations. A person of ordinary skill would be familiar with building machine learning algorithms with manually entered and/or vehicle observed data.

Regarding claim 19, Cheng further discloses:

a processor (paragraphs [0145-0146] and FIG. 23, processor(s) - 812);

a non-transitory computer readable storage medium storing instructions that when executed by a processor, cause the processor to perform steps comprising: (paragraphs [0145-0146] and FIG. 23, user equipment (UE) - 104, interactive communication component-140, sensor data-142, intent indicator-143, intent derivation component-144, processor(s) - 812, and memory-816);

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle (paragraphs [0065-0066] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

generating a point cloud representation of the surroundings of the autonomous vehicle (paragraphs [0065-0066]); [A LIDAR sensor produces a 3D point cloud. The generation of a point cloud representation is inherent with the use of a LIDAR sensor.]

based on the sensor data (paragraphs [0111-0123]; FIG. 7, vulnerable road user (VRU) - 702, vehicle A - 704, and vehicle B - 706; and FIG. 8, VRU-702, vehicle A - 704, and vehicle B - 706);

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving (paragraphs [0048-0049] and FIG. 1, sensor data-142, and user equipment (UE) - 148,149);

for each of the one or more traffic entities: (paragraphs [0120-0123]);

determining one or more motion parameters describing movement of the traffic entity (paragraph [0120], location, speed, heading size of VRU; FIG. 10, VRU-702, vehicle A - 704, and vehicle B - 706; and FIG. 11, VRU-702, vehicle A - 704, and vehicle B - 706);

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval (paragraphs [0120-0123]);

modifying the region based on the hidden context (paragraph [0067] and FIG. 1, sensor data-142, intent indicator-143, intent derivation component-144, and user equipment (UE) - 148,149); and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities (paragraphs [0120-0123]).

Cheng does not disclose a machine learning model trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users. However, Tran further discloses:

determining a hidden context based on a machine learning based model (paragraphs [0281-0298]); and

wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users (paragraph [0298]).

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Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Matti et al, *Combining LiDAR Space Clustering and Convolutional Neural Networks for Pedestrian Detection,* 2017 14th IEEE International Conference on Advanced Video and Signal Based Surveillance, discloses using LiDAR data to generate region proposals by processing a 3D point cloud. Candidate regions are further processed by convolutional neural networks for pedestrian detection.

Lipson et al., *Driverless: Intelligent Cars and the Road Ahead*, Massachusetts Institute of Technology, 2016, p. 177-180, discloses that, in a driverless car, the data generated by a lidar is fed to software that arranges the information in a digital model called a point cloud.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TAMARA L WEBER whose telephone number is (303)297-4249. The examiner can normally be reached on 8:30-5:00 MTN.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Faris Almatrahi can be reached on 3134464821. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-

my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TAMARA L. WEBER
Examiner
Art Unit 3667

/TAMARA L WEBER/
Examiner, Art Unit 3667

Notice of References Cited	Application/Control No. 16/777,673	Applicant(s)/Patent Under Reexamination Anthony, Samuel English	
	Examiner TAMARA L WEBER	Art Unit 3667	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20170318360-A1	11-2017	Tran; Bao	B33Y80/00	1/1
*	B	US-20200193829-A1	06-2020	Cheng; Hong	G08G1/162	1/1
	C					
	D					
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Matti et al., "Combining LiDAR Space Clustering and Convolutional Neural Networks for Pedestrian Detection", 2017 14th IEEE International Conference on Advanced Video and Signal Based Surveillance (Year: 2017)
	V	Lipson et al., "Driverless: Intelligent Cars and the Road Ahead", Massachusetts Institute of Technology, 2016, p. 177-180 (Year: 2016)
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/24/2021								
	1	✓								
	2	✓								
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	17	✓								
	18	✓								
	19	✓								
	20	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

CPC - Searched*		
Symbol	**Date**	**Examiner**
B60W30/09;095 text limited	09/24/2021	TLW
B60W40/09 text limited	09/24/2021	TLW
B60W60/0015;0027;00274;00276 text limited	09/24/2021	TLW
B60W2420/42;52 text limited	09/24/2021	TLW
B60W2554/40;402;4045;4047 text limited	09/24/2021	TLW
G05D1/0088;0214;0221;0231 text limited	09/24/2021	TLW
G05D2201/0213 text limited	09/24/2021	TLW
G06N7/005 text limited	09/24/2021	TLW
G06N20/00 text limited	09/24/2021	TLW

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

Search Notes		
Search Notes	**Date**	**Examiner**
inventor search	09/15/2021	TLW
STIC/NPL	09/22/2021	TLW
see attached search history report	09/24/2021	TLW
IEEE Xplore/NPL	09/24/2021	TLW

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
EAST		09/24/2021	TLW

/TAMARA L WEBER/ Examiner, Art Unit 3667	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	16/777673.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:25
S2	122	Samuel NEAR3 Anthony.inv.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:29
S3	12,346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:34
S4	5,821	B60W40/09.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:35
S5	1,852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:38
S6	10,454	(B60W2420/42 B60W2420/52).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:40
S7	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:43
S8	27,220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:47
S9	16,581	G05D2201/0213.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:49
S10	22,924	G06N7/005.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 12:50
S11	70,746	G06N20/00.cpc.	US-PGPUB; USPAT;	OR	ON	2021/09/15 12:51

			EPO; JPO; DERWENT			
S12	72	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:36
S13	53	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:38
S14	122	Samuel NEAR3 Anthony.inv.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:39
S15	0	S13 AND S14	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:39
S16	12,346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S17	5,821	B60W40/09.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S18	1,852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S19	10,454	(B60W2420/42 B60W2420/52).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S20	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S21	27,220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	US-PGPUB; USPAT;	OR	ON	2021/09/15 16:40

			EPO; JPO; DERWENT			
S22	16,581	G05D2201/0213.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S23	22,924	G06N7/005.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S24	70,746	G06N20/00.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S25	46	S13 AND (S16 S17 S18 S19 S20 S21 S22 S23 S24)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 16:40
S26	0	("10841563").URPN.	USPAT	OR	ON	2021/09/15 17:30
S27	1	("20140152839").PN. OR ("10841563").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2021/09/15 17:31
S28	0	S12 AND S14	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 17:32
S29	510	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 17:33
S30	2	S29 AND S14	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 17:34
S31	233	S29 AND (S16 S17 S18 S19 S20 S21 S22 S23 S24)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 17:38
S32	96	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 17:39

S33	1,426	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 18:19
S34	698	S33 AND (S16 S17 S18 S19 S20 S21 S22 S23 S24)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 18:20
S35	588	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 18:20
S36	294	S35 AND (S16 S17 S18 S19 S20 S21 S22 S23 S24)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/15 18:21
S37	1	15/833715.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 15:43
S38	1	16/428810.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 15:48
S39	2	15/812645.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 15:51
S40	2	"10730531".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 15:58
S41	4	"10216189".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:02
S42	251	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:39

		AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)				
S43	12,431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S44	5,856	B60W40/09.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S45	1,876	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S46	10,529	(B60W2420/42 B60W2420/52).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S47	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S48	27,389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S49	16,691	G05D2201/0213.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S50	23,065	G06N7/005.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S51	71,529	G06N20/00.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S52	177	S42 AND (S43 S44 S45 S46 S47 S48 S49 S50 S51)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 16:40
S53	2	15/624014.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 17:57

S54	1	15/407248.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 18:03
S55	1	15/144773.app.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 18:04
S56	2	"20200193829".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/23 18:50
S57	2	"20200193829".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 14:51
S58	2	"20170318360".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 14:51
S59	2	(mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) AND (S57 S58)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 14:58
S60	69	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) WITH context	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:03
S61	12,431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S62	5,856	B60W40/09.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S63	1,876	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	US-PGPUB; USPAT;	OR	ON	2021/09/24 15:05

			EPO; JPO; DERWENT			
S64	10,529	(B60W2420/42 B60W2420/52).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S65	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S66	27,389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S67	16,691	G05D2201/0213.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S68	23,065	G06N7/005.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S69	71,529	G06N20/00.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S70	58	S60 AND (S61 S62 S63 S64 S65 S66 S67 S68 S69)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:05
S71	69	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:19
S72	58	S71 AND (S61 S62 S63 S64 S65 S66 S67 S68 S69)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2021/09/24 15:20

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S73	2	((autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context).clm.	US-PGPUB; USPAT	OR	ON	2021/09/24 15:16

9/24/2021 4:37:17 PM
C:\Users\tweber\Documents\EAST\Workspaces\16777673Anthony.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

	Complete if Known
Application Number	16/777,673
Filing Date	January 30, 2020
First Named Inventor	Samuel English Anthony
Applicant	Perceptive Automata, Inc.
Art Unit	3661
Confirmation Number	9420
Examiner Name	Not Yet Assigned
Attorney Docket Number	35447-45618/US

Sheet 1 of 2

U.S. PATENT DOCUMENTS

		Document No.		
Examiner Initials*	Cite No.[1]	Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-9,766,336 B2	09-19-2017	Gupta et al.
	A2	US-9,415,777 B2	08-16-2016	Clarke et al.

FOREIGN PATENT DOCUMENTS

		Foreign Patent Document			
Examiner Initials*	Cite No.[1]	Country Code[3] – Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T[6]
	B1				

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[6]
	C1	International Search Report and Written Opinion, Patent Cooperation Treaty Application No. PCT/US2020/15889, 16 June 2020, 23 pages.	
	C2	Invitation to Pay Additional Fees, Patent Cooperation Treaty Application No. PCT/US2020/15889, 13 April 2020, 2 pages.	

EXAMINER SIGNATURE

Examiner Signature	/TAMARA L WEBER/
Date Considered	09/15/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (option). [2] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [3] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

[5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.L.W/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
				Application Number	16/777,673
				Filing Date	January 30, 2020
				First Named Inventor	Samuel English Anthony
				Applicant	Perceptive Automata, Inc.
				Art Unit	3661
				Confirmation Number	9420
				Examiner Name	Not Yet Assigned
Sheet	2	of	2	Attorney Docket Number	35447-45618/US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/ Rajendra B. Panwar/	Date (YYYY-MM-DD)	2020-06-29
Name/Print	Rajendra B. Panwar	Registration Number	63,165

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.L.W/

IEEE Xplore®

Search History

Sep 24, 2021, 6:59:18 PM

Set #	Search Query	Details Results | Date & Time
5	("All Metadata":"point cloud") AND ("All Metadata":LIDAR) AND ("All Metadata":vehicle), pedestrian **You Refined By:** Year: 2009-2018	14 | Sep 24, 2021, 6:44:10 PM
4	("All Metadata":"point cloud") AND ("All Metadata":LIDAR) AND ("All Metadata":vehicle), pedestrian	30 | Sep 24, 2021, 6:43:41 PM
3	("All Metadata":"point cloud") AND ("All Metadata":LIDAR) AND ("All Metadata":vehicle), context **You Refined By:** Year: 2009-2018	4 | Sep 24, 2021, 6:37:43 PM
2	("All Metadata":"point cloud") AND ("All Metadata":LIDAR) AND ("All Metadata":vehicle), context	16 | Sep 24, 2021, 6:37:06 PM
1	("All Metadata":"point cloud") AND ("All Metadata":LIDAR) AND ("All Metadata":vehicle)	460 | Sep 24, 2021, 6:35:17 PM

Examiner	Weber, Tamara
Art Unit	A.U. 3667
Serial #	16/777,673
Date Completed	09/22/2021
Assigned EIC	EIC 3600
Searcher	Steve Chung, Chickasaw
Tracking #	642,997

This document includes the following content:

Search Histories

Complete lists of all files searched within each database collection, along with all keyword/synonym strings and any applicable chemical structure or biosequence queries used by the Searcher in completing the prior art search are included in this report.

Search Results

Results related to your search request are included. While not all references may be useful for a rejection or other office action, they are included for the Examiner's review.

For 1600 Examiners

Your search results will be available in PE2E on the next business day at approximately noon. For detailed instructions on how to access your search results in PE2E, please see this guide.

If you have any questions about this search, or about how to interpret this search report, or if you need assistance retrieving the full text of any of the references contained in this report, please do not hesitate to contact your assigned EIC:

EIC	Phone	Email
1600	571-272-0473	STIC-EIC1600/2900@uspto.gov
1700	571-272-2530	STIC-EIC1700@uspto.gov
2100	571-272-4225	STIC-EIC2100@uspto.gov
2400	571-272-4225	see EIC 2100
2600	571-272-4235	STIC-EIC2600@uspto.gov
2800	571-272-2540	STIC-EIC2800@uspto.gov
2900	571-272-4240	see EIC 3700
3600	571-272-3488	STIC-EIC3600@uspto.gov
3700	571-272-4240	STIC-EIC3700@uspto.gov

Thank you for using the EIC, and we look forward to your next search!

Search Request

Examiner want to search for following:

An autonomous vehicle predicts the motion of objects (pedestrian, bicyclist, other vehicle) in order to maintain a threshold distance from these objects.
A machine learning model is trained based on the reactions of human observers to sample images of the objects. The model develops motion predictions based on human intuition and experience of the intention and awareness of the objects (based on context, will a person walk into the road or stay on the sidewalk).
The autonomous vehicle evaluates sensed data from the environment (the scenario) based on the machine learning model.

Effective Filing Date: 01/30/2019

IP.com InnovationQ - Patent

US Patents, US Designs, US Applications, EPO Patents, EPO Applications, China Patents, China Applications, Japan Patents, Japan Applications, Korea Patents, Korea Applications, WIPO Applications, Argentina Patents, Argentina Applications, Brazil Patents, Brazil Applications, Canada Patents, Canada Applications, Chile Patents, Chile Applications, Colombia Applications, Costa Rica Applications, Cuba Patents, Cuba Applications, Dominican Republic Applications, Ecuador Patents, Ecuador Applications, El Salvador Applications, Guatemala Applications, Honduras Applications, Mexico Patents, Mexico Applications, Nicaragua Patents, Panama Applications, Peru Applications, Trinidad & Tobago Patents, Uruguay Applications, Austria Patents, Austria Applications, Belarus Patents, Belgium Patents, Belgium Applications, Bosnia & Herzegovina Patents, Bosnia & Herzegovina Applications, Bulgaria Patents, Bulgaria Applications, Croatia Patents, Croatia Applications, Czech Republic Patents, Czech Republic Applications, Czechoslovakia Patents, Czechoslovakia Applications, Denmark Patents, Denmark Applications, Estonia Patents, Estonia Applications, EUIPO Patents, Finland Patents, Finland Applications, France Patents, France Applications, Germany Patents, Germany Applications, Great Britain Patents, Great Britain Applications, Greece Patents, Greece Applications, Hungary Patents, Hungary Applications, Iceland Patents, Iceland Applications, Ireland Patents, Ireland Applications, Italy Patents, Italy Applications, Latvia Patents, Latvia Applications, Lithuania Patents, Lithuania Applications, Luxembourg Patents, Malta Patents, Monaco Patents, Montenegro Patents, Montenegro Applications, Netherlands Patents, Netherlands Applications, Norway Patents, Norway Applications, Poland Patents, Poland Applications, Portugal Patents, Portugal Applications, Republic of Moldova Patents, Republic of Moldova Applications, Romania Patents, Romania Applications, San Marino Patents, San Marino Applications, Serbia Patents, Serbia Applications, Slovakia Patents, Slovakia Applications, Slovenia Patents, Spain Patents, Spain Applications, Sweden Patents, Sweden Applications, Switzerland Patents, Switzerland Applications, Ukraine Patents, Yugoslavia/Serbia and Montenegro Patents, Yugoslavia/Serbia and Montenegro Applications, Armenia Patents, Australia Patents, Australia Applications, Cyprus Patents, Gulf Cooperation Council Patents, Hong Kong Patents, India Patents, India Applications, Indonesia Patents, Indonesia Applications, Israel Applications, Jordan Patents, Kyrgyzstan Patents, Macao Applications, Malaysia Patents, Mongolia Patents, New Zealand Patents, Philippines Patents, Philippines Applications, Saudi Arabia Patents, Singapore Patents, Singapore Applications, Taiwan Patents, Taiwan Applications, Tajikistan Patents, Tajikistan Applications, Thailand Applications, Uzbekistan Patents, Vietnam Patents, Algeria Patents, ARIPO Patents, ARIPO Applications, Egypt Patents, Kenya Patents, Malawi Patents, Morocco Patents, Morocco Applications, OAPI Patents, South Africa Patents, Tunisia Applications, Zambia Patents, Zimbabwe Patents, EAPO Patents, EAPO Applications, Georgia Patents, Georgia Applications, Kazakhstan Patents, Kazakhstan Applications, Russia Patents, Russia Applications, Turkey Patents, Turkey Applications

	Concept Searched for:
L1	Main Concept Document ========== US20200239026 Title: Navigating autonomous vehicles based on modulation of a world model representing traffic entities
L2	Filters (3) ========== Application Date: To 2019-01-29 Classic Syntax limited to: (threshold near5 distance) same object* Classic Syntax limited to: motion near5 object
L3	Options ======= De-dup: Extended Family Numbers Cut-off: None

	Sort: Relevance

IP.com InnovationQ - Patent Search Results

US10671076 Trajectory prediction of third-party objects using temporal logic and tree search

PUBLICATION NUMBER: US 10671076 B1
PUBLICATION DATE: 02-Jun-2020
APPLICATION NUMBER: US 15/833,715
FILING DATE: 06-Dec-2017
SIMPLE FAMILY: 70855942 (size 1)
EARLIEST PRIORITY DATE: 01-Mar-2017

Abstract (English):
Techniques for generating trajectories for autonomous vehicles and for predicting trajectories for third-party objects using temporal logic and tree search are described herein. Perception data about an environment can be captured to determine static objects and dynamic objects. For a particular dynamic object, which can represent a third-party vehicle, predictive trajectories can be generated to represent possible trajectories based on available options and rules of the road. Operations can include determining probabilities that a third-party vehicle will execute a predictive trajectory and updating the probabilities over time as motion data is captured. Predictive trajectories can be provided to the autonomous vehicle and commands for the autonomous vehicle can be based on the predictive trajectories. Further, determining a trajectory can include utilizing a Monte Carlo Tree Search (MCTS) to search for possible trajectories, while using Linear Temporal Logic (LTL) formulas to validate or reject the possible trajectories.

Inventors:
Kobilarov, Marin (Mountain View, CA, US) • Caldwell, Timothy (Mountain View, CA, US) • Raman, Vasumathi (San Francisco, CA, US) • Paxton, Christopher (Mountain View, CA, US)
Applicants:
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Assignees:
Zoox, Inc. (Foster City, CA, US)

In one example, predictive trajectories can include: 1) the pedestrian **610** crossing the crosswalk **606**; and 2) the pedestrian **610** continuing along the sidewalk **612** without crossing the crosswalk **606**. In some instances, the perception system can capture data associated with motion of the pedestrian **610** and can update a probability that a predictive trajectory can be executed based on the position and/or motion of the pedestrian. In some instances, the prediction module **402** can determine that the second trajectory presents minimal interaction with the autonomous vehicle **604** (other than maintaining a safe distance between the autonomous vehicle **604** and the pedestrian **610**), while the autonomous vehicle **604** can update a trajectory based on the pedestrian **610** crossing the crosswalk **606**. Thus, the prediction module **402** can determine which predictive trajectories to consider with respect to motion of the subject object (e.g., the pedestrian **610**).

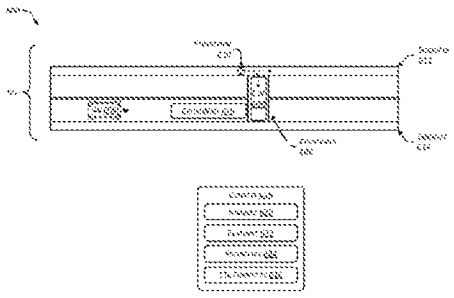


FIG. 6

US20190283746 Navigation Based on Detected Response of a Pedestrian to Navigational Intent

PUBLICATION NUMBER: US 2019/0283746 A1
PUBLICATION DATE: 19-Sep-2019
APPLICATION NUMBER: US 16/428,810
FILING DATE: 31-May-2019
SIMPLE FAMILY: 64277931 (size 3)
EARLIEST PRIORITY DATE: 30-Oct-2017

Abstract (English):
The present disclosure relates to a navigation system for a host vehicle. The system may include a processing device programmed to receive, from a camera, a plurality of images representative of an environment of the host vehicle; analyze the plurality of images to identify at least one pedestrian in the environment of the host vehicle; cause at least one adjustment of a navigational system of the host vehicle to signal to the pedestrian a navigational intent of the host vehicle; analyze the plurality of images to detect a potential reaction of the pedestrian to the at least one adjustment of the navigational system of the host vehicle; determine a navigational action for the host vehicle based on a detected potential reaction of the pedestrian; and cause at least one adjustment of a navigational actuator of the host vehicle in response to the determined navigational action for the host vehicle.
Inventors:
Shalev-Shwartz, Shai (Jerusalem, IL) • Shashua, Amnon (Mevaseret Zion, IL) • Shammah, Shaked (Jerusalem, IL)
Applicants:
Mobileye Vision Technologies Ltd. (Jerusalem, IL)
Assignees:
Mobileye Vision Technologies Ltd. (Jerusalem, IL)

[0193] In another embodiment, processing unit **110** may compare the leading vehicle's instantaneous position with the look-ahead point (associated with vehicle **200**) over a specific period of time (e.g., 0.5 to 1.5 seconds). If the distance between the leading vehicle's instantaneous position and the look-ahead point varies during the specific period of time, and the cumulative sum of variation exceeds a predetermined threshold (for example, 0.3 to 0.4 meters on a straight road, 0.7 to 0.8 meters on a moderately curvy road, and 1.3 to 1.7 meters on a road with sharp curves), processing unit **110** may determine that the

leading vehicle is likely changing lanes. In another embodiment, processing unit **110** may analyze the geometry of the snail trail by comparing the lateral distance traveled along the trail with the expected curvature of the snail trail. The expected radius of curvature may be determined according to the calculation: $(\delta_z^2+\delta_x^2)/2/(\delta_x)$, where δ_x represents the lateral distance traveled and δ_z represents the longitudinal distance traveled. If the difference between the lateral distance traveled and the expected curvature exceeds a predetermined threshold (e.g., 500 to 700 meters), processing unit **110** may determine that the leading vehicle is likely changing lanes. In another embodiment, processing unit **110** may analyze the position of the leading vehicle. If the position of the leading vehicle obscures a road polynomial (e.g., the leading vehicle is overlaid on top of the road polynomial), then processing unit **110** may determine that the leading vehicle is likely changing lanes. In the case where the position of the leading vehicle is such that, another vehicle is detected ahead of the leading vehicle and the snail trails of the two vehicles are not parallel, processing unit **110** may determine that the (closer) leading vehicle is likely changing lanes.

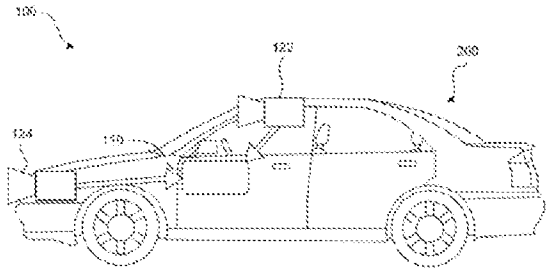


FIG. 2A

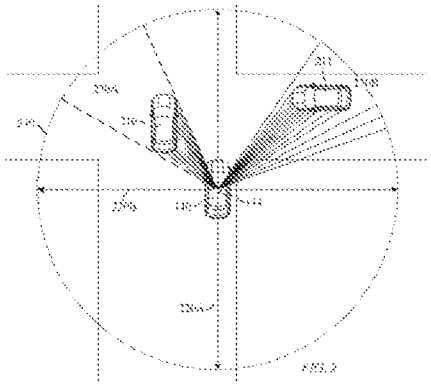
US20180136000 Identifying Objects for Display in a Situational-Awareness View of an Autonomous-Vehicle Environment

PUBLICATION NUMBER: US 2018/0136000 A1
PUBLICATION DATE: 17-May-2018
APPLICATION NUMBER: US 15/812,645
FILING DATE: 14-Nov-2017
SIMPLE FAMILY: 62107714 (size 7)
EARLIEST PRIORITY DATE: 14-Nov-2016

Abstract (English):
In one embodiment, a method includes receiving autonomous-vehicle sensor data from a sensor array of an autonomous vehicle. The autonomous-vehicle sensor data indicates an object in an external environment of the autonomous vehicle. The method also includes accessing secondary data associated with the object from one or more secondary-data sources that are independent of the sensor array of the autonomous vehicle. The method also includes determining, based on the autonomous-vehicle sensor data and the secondary data, an object graphic to visually represent the object. The method also includes providing for display a visual representation of the external environment of the autonomous vehicle that includes the determined object graphic to visually represent the object.
Inventors:

Rasmusson, JR., Robert Earl (San Francisco, CA, US) • Matthiesen, Taggart (Kentfield, CA, US) • Dehner, Craig (San Francisco, CA, US) • Dong, Linda (San Francisco, CA, US) • Yoo, Frank Taehyun (San Carlos, CA, US) • van Schaardenburg, Karina (San Francisco, CA, US) • Tighe, John (San Francisco, CA, US) • Vitelli, Matt (San Francisco, CA, US) • Guo, Jisi (San Francisco, CA, US) • Guerron, Eli (San Francisco, CA, US)
Applicants:
Lyft, Inc. (San Francisco, CA, US)

[0034] A situational-awareness view may be a representation of an environment of the autonomous vehicle that is updated in real time. For example, FIGS. 3 and 5 show example situational-awareness views. In a situational-awareness view, graphical representations of objects that exist in the external environment of the autonomous vehicle may be displayed on the display screen of autonomous-vehicle UI device **148**. As an example and not by way of limitation, autonomous vehicle **140** may be driving along a city street. Autonomous vehicle **140** may approach a traffic signal that changes from green, to yellow, to red. After the light changes to red, several pedestrians may cross the street in front of autonomous vehicle **140**. Autonomous-vehicle UI device **148** may display a situational-awareness view that includes graphical representations of the traffic signal, the pedestrians, and any other objects (e.g. cars, street signs) within a threshold proximity of sensor array **144** (e.g. 100 meters). To render the situational-awareness view, one or more computing devices associated with autonomous vehicle **140** may use autonomous-vehicle sensor data, and in particular embodiments, secondary data such as map data in addition to the autonomous-vehicle sensor data. The map data may be obtained from a third-party system **170** or may be generated by the dynamic transportation matching system **160**. The map data may be stored by the autonomous-vehicle UI device prior to a given ride and/or may be periodically updated for a neighborhood, city, region, etc. This may enable faster processing by the autonomous-vehicle UI device because there may not be a need to access a third-party system **170** during a given ride.



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	Concept Searched for:
L1	Main Concept Document ========== US20200239026 Title: Navigating autonomous vehicles based on modulation of a world model representing traffic entities
L2	Filters (3) ========== Publication Date: To 2019-01-29 Classic Syntax limited to: (threshold near5 distance) same object* Classic Syntax limited to: motion near5 object

IP.com InnovationQ – NPL Search Results

Tracking and classification of arbitrary objects with bottom-up/top-down detection

ISBN (ELECTRONIC): 978-1-4673-2118-1
ISBN (PAPER): 978-1-4673-2119-8
ISBN (CD-ROM): 978-1-4673-2117-4
ISSN (PAPER): 1931-0587
ISSN (CD-ROM): 1931-0587
DIGITAL OBJECT IDENTIFIER: 10.1109/IVS.2012.6232181
CONFERENCE ACRONYM: IV
LAST UPDATE DATE: 27-Jul-2012
PUBLICATION DATE: 01-Jun-2012
ELECTRONIC PUBLICATION DATE: 03-Jul-2012
CONFERENCE START DATE: 03-Jun-2012
CONFERENCE END DATE: 07-Jun-2012
How we process NPL dates
Published in: 2012 IEEE Intelligent Vehicles Symposium (Page(s): 577-582)

Authors:
M. Himmelsbach • H.-J. Wuensche [+details]
Affiliations:
Department of Aerospace Engineering, Autonomous Systems Technology (TAS), University of the Bundeswehr München, Neu-biberg, Germany

Abstract:
Recently, the introduction of dense, long-range 3D sensors has facilitated tracking of arbitrary objects. Especially in the context of autonomous driving, other traffic participants driving the streets usually stay well-segmented from each other. In contrast, pedestrians or bicyclists do not always stay on the road and they often get close to static structure of the environment, e.g. traffic lights or signs, bushes, parking cars etc. These objects are not as easy to segment, often resulting in an under-segmentation of the scene and wrong tracking results. This paper addresses the problem of tracking moving objects that are hard to segment from their static surroundings by utilizing top-down knowledge about the geometry of existing tracks during segmentation. This includes methods for discerning static from moving objects to reduce the rate of false positive tracks as well as a classification of tracks into pedestrian, bicyclist, motor bike, passenger car, van and truck classes by considering an objects appearance and motion history. The proposed tracking system is experimentally validated in challenging real-world inner-city traffic scenes.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6232181

A multi-sensor fusion system for moving object detection and tracking in urban driving environments

ISBN (ELECTRONIC): 978-1-4799-3685-4
DIGITAL OBJECT IDENTIFIER: 10.1109/ICRA.2014.6907100

CONFERENCE ACRONYM: ICRA
LAST UPDATE DATE: 10-Oct-2014
PUBLICATION DATE: 01-May-2014
ELECTRONIC PUBLICATION DATE: 22-Sep-2014
CONFERENCE START DATE: 31-May-2014
CONFERENCE END DATE: 07-Jun-2014
How we process NPL dates
Published in: 2014 IEEE International Conference on Robotics and Automation (ICRA)
(Page(s): 1836-1843)
Authors:
Hyunggi Cho • Young-Woo Seo • B. V. K. Vijaya Kumar • Ragunathan Raj Rajkumar [+details]
Affiliations:
ECE Dept., Carnegie Mellon Univ., Pittsburgh, PA, USA
Robot. Inst., Carnegie Mellon Univ., Pittsburgh, PA, USA
Abstract:
A self-driving car, to be deployed in real-world driving environments, must be capable of reliably detecting and effectively tracking of nearby moving objects. This paper presents our new, moving object detection and tracking system that extends and improves our earlier system used for the 2007 DARPA Urban Challenge. We revised our earlier motion and observation models for active sensors (i.e., radars and LIDARs) and introduced a vision sensor. In the new system, the vision module detects pedestrians, bicyclists, and vehicles to generate corresponding vision targets. Our system utilizes this visual recognition information to improve a tracking model selection, data association, and movement classification of our earlier system. Through the test using the data log of actual driving, we demonstrate the improvement and performance gain of our new tracking system.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6907100

Detection, Estimation and Avoidance of Mobile Objects Using Stereo-Vision and Model Predictive Control

ISBN (ELECTRONIC): 978-1-5386-1034-3
ISSN (ELECTRONIC): 2473-9944
DIGITAL OBJECT IDENTIFIER: 10.1109/ICCVW.2017.245
CONFERENCE ACRONYM: ICCVW
PUBLICATION DATE: 01-Oct-2017
ELECTRONIC PUBLICATION DATE: 19-Jan-2018
CONFERENCE START DATE: 22-Oct-2017
CONFERENCE END DATE: 29-Oct-2017
How we process NPL dates
Published in: 2017 IEEE International Conference on Computer Vision Workshops (ICCVW)
(Page(s): 2090-2099)
Authors:
Helene Roggeman • Julien Marzat • Maxime Derome
Abstract:

We propose a complete loop (detection, estimation, avoidance) for the safe navigation of an autonomous vehicle in presence of dynamical obstacles. For detecting moving objects from stereo images and estimating their positions, two algorithms are proposed. The first one is dense and has a high computational load but is designed to fully exploit GPU processing. The second one is lighter and can run on a standard embedded processor After a step of filtering, the estimated mobile objects are exploited in a model predictive control scheme for collision avoidance while tracking a reference trajectory. Experimental results with the complete loop are reported for a micro-air vehicle and a mobile robot in realistic situations, with everything computed on board.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8265455

Dialog – Patents

Search Strategy

Databases: Argentina Patents Fulltext, Australia Patents Fulltext, Austria Patents Fulltext, Belgium Patents Fulltext, Brazil Patents Fulltext, Canada Patents Fulltext, China Patents Fulltext, Denmark Patents Fulltext, Derwent World Patents Index®, Eurasia Patents Fulltext, European Patents Fulltext, Finland Patents Fulltext, France Patents Fulltext, Germany Patents Fulltext, Global Patents Bibliographic, Great Britain Patents Fulltext, India Patents Fulltext™, Ireland Patents Fulltext, Italy Patents Fulltext, Japan Patents Fulltext, JAPIO - Patent Abstracts of Japan, Korea Patents Fulltext, Luxembourg Patents Fulltext, Mexico Patents Fulltext, Monaco Patents Fulltext, Netherlands Patents Fulltext, Norway Patents Fulltext, Portugal Patents Fulltext, Russia Patents Fulltext, Spain Patents Fulltext, Sweden Patents Fulltext, Switzerland Patents Fulltext, United States Patents Fulltext, WIPO PCT Patents Fulltext

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S1	(autonom* or autono* or automa* or automat* or intelligent*)	36295791
S2	(vehicle$1 or car$1 or motorcar$1 or (motor* p/1 car$1) or motorvehicle$1 or (motor* p/1 vehicle$1) or automobile$1 or (auto* p/1 mobile$1) or EV$1 or (electric* p/1 vehicle$1) or HEV$1 or PHEV$1 or PSHEV$1 or SHEV$1)	45583666
S3	(predict* or determin* or probab* or likelihood or theoretic* or stochastic* or assum* or estimat*)	61027114
S4	(motion or trave* or commut* or trip$1 or journey* or moving or moves or movement$1)	62188415
S5	(object$1 or pedestrian or bicyclist or vehicle or material$1 or element$1 or suppl* or component$1 or member$1 or substance$1 or item$1 or thing$1 or composite$1 or wood* or metal* or plywood$1 or resource$1 or commodit*)	183909003
S6	(order or mean$1 or suppos* or toward$1 or conducive or pursuance)	111930169
S7	(maintain* or stay or sustain* or preserv* or retain* or keep* or hold* or conserv* or retent* or kept or upkeep*)	83489319
S8	(threshold* or margin* or boundar* or capacity or limit$1 or maximum or border$1 or perimeter* or toleran* or deviat* or (set p/1 point) or setpoint or range$1)	92034278
S9	(distanc* or range$1 or spac* or gap or interval or separat* or interspac* or plenum or proxim* or length or displac*)	123778048

S10	((Machine p/1 Learning$1) or ML$1 or (artificial p/1 intelligence$1) or machine$1 or AI$1 or (Machine p/1 intelligence$1) or MI$1 or (Virtual p/1 intelligence$1) or VI$1 or (Computer p/1 intelligence$1) or CI$1 or Siri or Alexa)	118000268
S11	(model$1 or framework$1 or template$1 or blueprint$1 or parameter$1 or guide$1 or guidelin* or (guide p/1 line$1) or outline$1 or format$1 or standard$1 or profile$1 or figure$1 or foundation* or outline$1 or structur* or composit* or configurat*)	180507931
S12	(train* or learn* or ascertain* or stud* or educat* or explor* or understand* or assimilat* or acquir* or memoriz* or lucubrat* or attain* or heuristic* or teach*)	54918401
S13	(based or dependen* or relianc* or bases or base or basing or conditional or relian* or rely or relied or relies or relying)	91761188
S14	(reaction$1 or feedback or respons* or repl* or acknowledg* or answer* or respond*)	67411267
S15	(observ* or visible or seeable or percept* or preceiv* or notice* or detect* or discern* or recogniz*)	62262876
S16	(evaluat* or determin* or analy* or test* or calcula* or estimat* or judg* or deduc* or comput* or assess* or pars* or check* or extrapolat* or diagnos* or analiz*)	118284159
S17	(information$1 or data$1 or info$1 or file$1 or object$1 or record$1 or content$1)	175340194
S18	((s1 n/3 s2) n/3 s3)	61561*
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S20	s18 n/5 s19	5110*
S21	(s6 n/3 s7)	9457132*
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S23	s21 n/5 s22	6854*
S24	((s10 n/3 s11) n/5 s12)	373431*
S25	((s13 n/3 s14) n/5 s15)	142297*
S26	s24 n/5 s25	204°
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S28	(s13 n/5 (s10 n/3 s11))	533043*
S29	s27 n/5 s28	115°
S30	cpc("G05D 1/0221") or cpc("G06N 20/00") or cpc("B60W 60/0015") or cpc("B60W 60/0027") or cpc("B60W 30/09") or cpc("B60W 30/095") or cpc("B60W 40/09") or cpc("G05D 1/0088") or cpc("G05D 1/0214") or cpc("G05D 1/0231") or cpc("B60W 2554/40") or cpc("B60W 2420/42") or cpc("B60W 2420/52") or cpc("B60W 2201/0213")	241916*
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S33	s32 and apd(<=20190129)	6°
S34	s20 and s23 and s26 and s29	0°
S35	s20 and s23 and s24 and s27	0°
S36	s20 and s22 and s24 and s27	193°
S37	s36 and apd(<=20190129)	85°
S38	inv("Anthony, Samuel English")	15°
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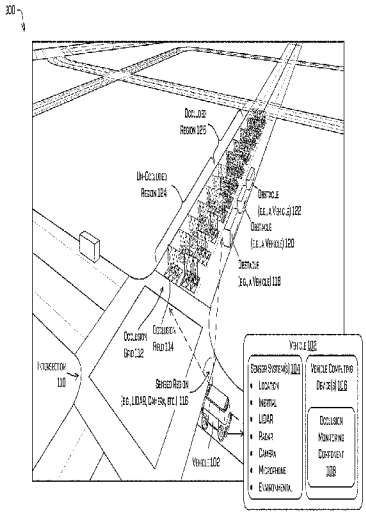
* Duplicates are removed from the search, but included in the result count.
° Duplicates are removed from the search and from the result count.

Dialog – Patents Search Results

Occlusion aware planning

Inventor: Silva, William AnthonySan Francisco, CA, USPatent rights: US OnlyAnguelov, Dragomir DimitrovSan Francisco, CA, USPatent rights: US OnlyZwiebel, Benjamin IsaacBurlingame, CA, USPatent rights: US OnlyKangaspunta, JuhanaSan Francisco, CA, USPatent rights: US Only
Assignee: Zoox, Inc.Foster City, CA, USUS (Residence)Patent rights: US Only
Publication info: Silva, William Anthony; Anguelov, Dragomir Dimitrov; Zwiebel, Benjamin Isaac; Kangaspunta, Juhana (Inventors). Zoox, Inc. (Assignee). US 11048265 B2 . (Published 29 Jun 2021).
Abstract (summary): Techniques are discussed for controlling a vehicle, such as an autonomous vehicle, based on occluded areas in an environment. An occluded area can represent areas where sensors of the vehicle are unable to sense portions of the environment due to obstruction by another object. An occlusion grid representing the occluded area can be stored as map data or can be dynamically generated. An occlusion grid can include occlusion fields, which represent discrete two- or three-dimensional areas of driveable environment. An occlusion field can indicate an occlusion state and an occupancy state, determined using LIDAR data and/or image data captured by the vehicle. An occupancy state of an occlusion field can be determined by ray casting LIDAR data or by projecting an occlusion field into segmented image data. The vehicle can be controlled to traverse the environment when a sufficient portion of the occlusion grid is visible and unoccupied.

Front page drawing:



Publication number: US 11048265 B2 (29 June 2021)
Application number: US 201811436 (18 June 2018)
Keywords in context:

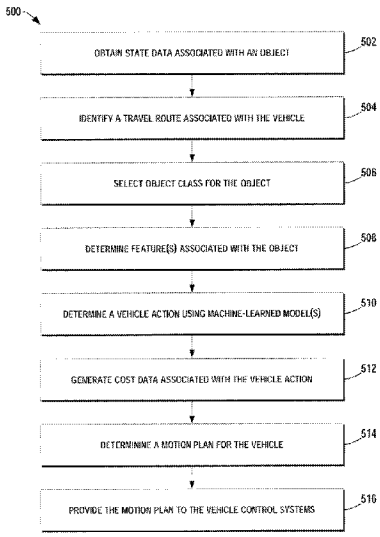
Specification: ... flight, etc.), wheel encoders, microphones, environment sensors (e.g., temperature sensors, humidity sensors, light sensors, pressure sensors, etc.), etc. The sensor system(s) **104** can generate sensor data, which can be utilized by vehicle computing device(s) **106** associated with the vehicle **102**. In at least one example, the vehicle computing device(s) **106** can utilize sensor data in an occlusion ... about the states of an occlusion grid. In some instances, LIDAR data can be used to determine states of occlusion fields that are within a threshold distance to the vehicle **102**, while the image data can be used to determine states of occlusion fields that meet or exceed a threshold distance from the vehicle **102**. Of course, the examples described herein are not intended to be limiting, and other implementations are considered within the scope of the disclosure. ... data, wheel encoder data, and the like to accurately determine a location of the autonomous vehicle. In some instances, the localization component **420** can provide data to various components of the vehicle **402** to determine an initial position of an autonomous vehicle for generating a trajectory and/or for determining to retrieve map data including an occlusion grid from memory, as ... in an environment. For example, the prediction component **430** can generate one or more predicted trajectories for vehicles, pedestrians, animals, and the like within a threshold distance from the vehicle **402**. In some instances, and as discussed in connection with FIG. 8, the prediction component **430** can measure a trace of an object and ... reduce the amount of data transferred by the system. In some instances, aspects of some or all of the components discussed herein can include any models, algorithms, and/or machine learning algorithms. For example, in some instances, the components in the memory **418** (and the memory **452**, discussed below) can be implemented as a neural ... (e.g., a pedestrian) proximate to the occlusion region **808**. In some instances, the operation **810** can include determining that a dynamic object (e.g., a pedestrian) **812** is within a threshold distance of the occlusion region **808**. In some instances, the operation **810** can include receiving LIDAR data, image data, and/or other sensor data to measure, ... the vehicle **102** based at least in part on the one or more predicted trajectories **818**. In some instances, if a trajectory of the vehicle **102** is within a threshold distance of at least one predicted trajectory, the vehicle **102** can be controlled to wait until additional information about the dynamic object can be determined. In ... In some instances, the operation **1002** can include determining a location of the vehicle in an environment and accessing map data that is within a threshold distance of the vehicle (e.g., a receding horizon). As discussed herein, in some instances, the occlusion grid can comprise a plurality of occlusion fields, with each occlusion field representing ... autonomous vehicle and the environment proximate to the autonomous vehicle comprises an intersection, the method further comprising: determining a distance of the intersection for the autonomous vehicle to traverse; determining a speed limit associated with the intersection; and determining an extent of the occlusion grid based at least in part on: the distance of the ... least in part on the predicted trajectory of the dynamic object. AE: The method of any of paragraphs Z-AD, further comprising: determining that the autonomous vehicle is within a threshold distance to a topographic occlusion region; and determining, as a topographic occlusion grid, the occlusion grid based at least in part on the map data associated ...

Machine-learning based vehicle motion control system

Inventor: Phillips, Michael L.Pittsburg, PA, USPatent rights: US OnlyBradley, David M.Pittsburgh, PA, USPatent rights: US Only

Assignee: UATC, LLCSan Francisco, CA, USUS (Residence)Patent rights: US Only
Publication info: Phillips, Michael L.; Bradley, David M. (Inventors). UATC, LLC (Assignee). US 10730531 B1 . (Published 04 Aug 2020).
Abstract (summary): Systems and methods for controlling the motion of an autonomous are provided. In one example embodiment, a method includes obtaining, by one or more computing devices on-board an autonomous vehicle, state data descriptive of a current state of an object that is proximate to the autonomous vehicle. The method includes determining, by the one or more computing devices, one or more features associated with the object based at least in part on the state data. The method includes determining, by the one or more computing devise, a vehicle action for the autonomous vehicle based at least in part on a machine-learned model and the one or more features associated with the object. The vehicle action includes stopping a motion of the autonomous vehicle or moving the autonomous vehicle past the object.

Front page drawing:



Publication number: US 10730531 B1 (04 August 2020)
Application number: US 2017423215 (02 February 2017)
Keywords in context:
Abstract: ... The method includes determining, by the one or more computing devise, a vehicle action for the autonomous vehicle based at least in part on a machine-learned model and the one or more features associated with the object. The vehicle action includes stopping a motion of the autonomous vehicle or moving the autonomous ...

Specification: FIELD The present disclosure relates generally to using machine-learned model(s) to improve the motion control of an autonomous vehicle. BACKGROUND An autonomous vehicle is a vehicle that is capable of sensing its environment and ... The method includes determining, by the one or more computing devise, a vehicle action for the autonomous vehicle based at least in part on a machine-learned model and the one or more features associated with the object. The vehicle action includes stopping a motion of the autonomous vehicle or moving the autonomous ... object based at least in part on the state data. The operations include inputting the one or more features associated with the object into a machine-learned model. The

operations include receiving data indicative of a vehicle action as an output of the machine-learned model. The vehicle action includes stopping a motion of the autonomous vehicle or moving the autonomous vehicle past the object. Yet another example aspect of the present disclosure is directed to an autonomous vehicle. The autonomous vehicle includes a machine-learned model that has been trained to determine a vehicle action based at least in part on one or more features associated with an object that is proximate to the autonomous ... or more features **124** associated with the object based at least in part on the state data **122** descriptive of the current state of the object that is proximate to the vehicle **102**. The computing device(s) **106** can also, or alternatively, determine the feature(s) **124** based at least in part on other information. For example, the computing device(s) **106** can ... the travel way boundaries and/or markings (e.g., distance from the left and/or right lane markings, other markings), a width of the largest gap between the object and a travel way boundary, distance from a cross walk (e.g., designated by cross walk markings), etc. The map-related features can be determined based at least in part on one or ... the computing device(s) **106** can include, employ, and/or otherwise leverage a model **126**. In particular, in some implementations, the model **126** can be a machine-learned model. For example, the machine-learned model can be or can otherwise include one or more various model(s) such as, for example, models utilizing boosted random forest techniques, support vector machines, neural ... neural networks, and/or other forms of neural networks. For instance, supervised training techniques can be performed to train the model **126** (e.g., using driving log data) to determine a vehicle action based at least in part on the feature(s) **124** associated with the object **202** (e.g., pedestrian or other object), as further described herein. FIG. 3 depicts an example implementation **300** of a machine-learned model according to example embodiments of the present disclosure. As shown, the computing device(s) **106** can provide input data **302** to the model **126**. The ... **302**) that the vehicle **102** would collide with the object **202** given the vehicle's travel route and/or speed. As such, the model **126** can determine that the vehicle **102** should stop for the object **202** (e.g., decelerate to a stopped position **406**). For the scenario depicted in FIG. 4A, the output of the model **126** (e.g., data **304 ...** the object **202** (e.g., there are no predicted intersection points before the vehicle **102** would pass the object **202**). Accordingly, the model **126** can determine that the vehicle **102** should ignore the object **202** (e.g., continue on its current, planned travel route). For the scenario depicted in FIG. 4B, the output of the model **126** (e.g., data **304 ...** lane **422**. The model **126** can determine that the vehicle **102** would come close to colliding with the object **202** (e.g., come within a threshold distance of the object **202**) or that the vehicle **101** would collide with the object **202** based at least in part on one or more of the location ... **202**, the travel route of the vehicle **102**, the speed of the vehicle **102**, and/or other features. Accordingly, the model **126** can determine that the vehicle **102** should move past the object **202** by, for example, adjusting the trajectory, speed, heading, etc. of the vehicle **102**. For the scenario depicted in FIG. 4C, the output of ... that the object **202** will be closer to the center of the current travel lane **422** when the vehicle **102** approaches (e.g., based on the pedestrian's heading, speed, distance from lane boundary markings), the model **126** can determine that the vehicle **102** should pass the object **202** with a wider distance margin (e.g., within the travel lane **422**), at a lower rate of passing speed **432**. In some implementations, the computing device(s) **106** (e.g., using ... object **202** that is stationary on a sidewalk, away from the travel route of the vehicle **102**. As such, the computing device(s) **106** can determine that the vehicle **102** can pass the object **202** without increasing (or only slightly increasing) the passing distance margin **430** between the vehicle **102** and the object **202**. Moreover, the computing device(s) **106** can determine that the vehicle **102** can pass the object at a higher rate of passing speed **432** (e.g.,

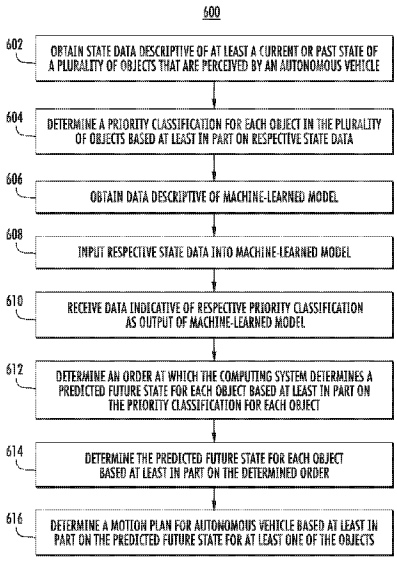
current speed, only slight slowing), given the higher confidence score. However, in the event that the object **202** is closer to the center of current travel lane **422** of the vehicle **102**, the computing device(s) **106** can determine that the vehicle **102** should pass the object **202** with a wider passing distance margin **430** (e.g., within the travel lane **422**), at a lower passing speed **432**. FIG. 4B depicts another example diagram of an example travel ... and/or other object. In some implementations, the object **440** can be associated with a predicted path **446**. In some implementations, the model **126** can determine that the vehicle **102** should pass the object **440** (e.g., a parked vehicle, slowly moving bicycle in the bicycle lane). In some implementations, the model **126** can determine that the vehicle **102** should stop for the object **440** and/or queue behind the object **440** for travel. In some implementations, the model **126** can determine that the vehicle **102** should ignore the object **440** when controlling vehicle motion. In this way, the model **126** can help to plan the motion of the vehicle **102** with respect to objects ... the cost data. For instance, the computing device(s) **106** (e.g., the motion planning system **116**) can implement an optimization algorithm that considers the cost data associated with the vehicle action determined by the model **126** as well as other cost functions (e.g., based on speed limits, traffic lights, etc.), if any, to determine optimized variables that make up the motion plan **128**. By way of example, the model **126** can also determine that the vehicle **102** can pass the object **202** without increasing the potential risk to the vehicle **102** and/or violating any traffic laws (e.g., speed limits, lane boundaries, signage). For example, the model ... example, the motion plan **128** can include a trajectory by which the vehicle **102** is to pass the object **202** with at least a passing distance margin **430** between the vehicle **102** and the object **202**. Moreover, the motion plan **128** can modulate the speed of the vehicle **102** such that the vehicle **102** stops ... object relative to a travel route associated with the vehicle. At (**510**), the method **500** can include determining a vehicle action using a machine-learned model. The computing device(s) **106** can determine a vehicle action for the vehicle **102** based at least in part on the model **126** (e.g., a machine-learned model) and the one or more features **124** associated with the object **202**. For instance, the computing device(s) **106** can obtain data descriptive of ... the vehicle heading by a steering component, application of a braking force by a braking component) can cause the vehicle **102** to move past the object **202** with a passing distance margin **430** between the vehicle **102** and the object **202** (and/or at a passing speed **432**). FIG. 6 depicts an example computing system **600** according to example embodiments of ... the communication interface **610** can include, for example, one or more of a communications controller, receiver, transceiver, transmitter, port, conductors, software and/or hardware for communicating data. In some implementations, vehicle computing system **100** can further include a positioning system **612**. The positioning system **612** can determine a current position of the vehicle **102**. The ...

Systems and methods for prioritizing object prediction for autonomous vehicles

Inventor: Haynes, Galen ClarkPittsburgh, PA, USPatent rights: US Only
Assignee: Uber Technologies, Inc.San Francisco, CA, USUS (Residence)Patent rights: US Only
Publication info: Haynes, Galen Clark (Inventor). Uber Technologies, Inc. (Assignee). US 10216189 B1 . (Published 26 Feb 2019).
Abstract (summary): Systems and methods for determining object prioritization and predicting future object locations for an autonomous vehicle are provided. A method can include obtaining, by a computing system comprising one or more processors, state data descriptive of at least a

current or past state of a plurality of objects that are perceived by an autonomous vehicle. The method can further include determining, by the computing system, a priority classification for each object in the plurality of objects based at least in part on the respective state data for each object. The method can further include determining, by the computing system, an order at which the computing system determines a predicted future state for each object based at least in part on the priority classification for each object and determining, by the computing system, the predicted future state for each object based at least in part on the determined order.

Front page drawing:



Publication number: US 10216189 B1 (26 February 2019)
Application number: US 2017811865 (14 November 2017)
Keywords in context:
Specification: ... objects classified as low-priority. According to another aspect of the present disclosure, the priority classification system described herein can include or leverage one or more machine-learned models that assist in classifying each object perceived by the autonomous vehicle. As an example, in some implementations, the priority classification system can include a machine-learned object classifier configured to classify each perceived object, such as by classifying each object as high-priority or low-priority. The use of machine-learned models can improve the speed, quality, and/or accuracy of object priority classification. The improved ability to classify objects according to priority can allow for more efficient ... the computing system can include a perception system, a prediction system, and a motion planning system that cooperate to perceive the surrounding environment of the autonomous vehicle and determine a motion plan for controlling the motion of the autonomous vehicle accordingly. For example, the perception system can perceive one or more objects that are proximate to ... concurrently determine a motion plan for the autonomous vehicle using predicted future states for a time frame N−3. Thus, a motion plan for the autonomous vehicle can be iteratively determined using data from each of a plurality of consecutive time frames. However, in such an implementation, each of the perception, prediction, and motion planning systems may require ... as the object. In contrast, the systems and methods according to example aspects of the present disclosure can allow for determining a priority classification for objects perceived by an autonomous vehicle and

determining a predicted future state for each object based at least in part on the priority classification for each object, thereby enabling higher priority objects to ... low-priority objects. According to another aspect of the present disclosure, the priority classification systems and methods described herein can include or leverage one or more machine-learned models that assist in classifying the objects. As an example, in some implementations, the priority classification system can include a machine-learned object priority classifier to classify ... implementations, the machine-learned object priority classifier can classify each object as either high-priority or low-priority. According to yet another aspect of the present disclosure, the machine-learned models included in or employed by the priority classification systems described herein can be trained using log data collected during actual operation of autonomous vehicles on ... perception, such as whether the object became more or less likely to interact with the autonomous vehicle in the resulting future state of the object. Training the machine-learned models on such real-world log data can enable the machine-learned models to determine object classifications which better mirror or mimic real-world object behavior. According to additional aspects of the present disclosure, the prediction system can determine ... as high-priority can then be provided to the motion planning system. Thus, as soon as a predicted future state has been determined for each high-priority object, a motion plan can be determined for the autonomous vehicle. Further, in some implementations, after the prediction system has provided the predicted future state for each object classified as high-priority to the motion planning ... or algorithms used by the respective prediction system. For example, in some implementations, a high-fidelity prediction system can include or otherwise leverage one or more machine-learned models in order to predict a future location for each object. For example, in some implementations, the prediction system can be a goal-oriented prediction system that ... system that determines the one or more trajectories by which the object can achieve the goals. In some implementations, the prediction system can include a machine-learned goal-scoring model, a machine-learned trajectory development model, and/or other machine-learned models. In some implementations, a high-fidelity prediction system can be used to determine a predicted future state for objects classified as high-priority. In some implementations, ... of the present disclosure can allow for determining a priority classification for objects perceived by an autonomous vehicle. In particular, by applying one or more heuristic processes and/or using machine-learned models, the systems and methods of the present disclosure can determine a respective priority classification for each object perceived by an autonomous vehicle. The order ... and one or more vehicle controls **107**. The vehicle computing system **102** can assist in controlling the autonomous vehicle **10**. In particular, the vehicle computing system **102** can receive sensor data from the one or more sensors **101**, attempt to comprehend the surrounding environment by performing various processing techniques on data collected by the sensors ... travelway); traffic control data (e.g., the location and instructions of signage, traffic lights, or other traffic control devices); and/or any other map data that provides information that assists the vehicle computing system **102** in comprehending and perceiving its surrounding environment and its relationship thereto. The perception system **103** can identify one or more objects that are ... to the pre-determined ratio (i.e., the ratio of high-priority to low-priority objects is within a threshold variance of the pre-determined ratio). In some implementations, a machine-learned model can be used to determine the priority classification for each object based on the respective state data for each object. For example, in some implementations, the machine-learned model can be configured to classify each object as either high-priority or low-priority and provide the priority classification for each object to the prediction system **104**. In some implementations, the respective state data for each

object can be input into the machine-learned model, and data indicative of a respective priority classification for the object can be received as an output of the machine-learned model. In some implementations, the machine-learned model can be trained based at least in part on training data that comprises annotated vehicle data logs that were previously collected during previous autonomous vehicle driving sessions. For ...

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Search Strategy

Databases: ABI/INFORM® Professional Advanced, Abstracts in New Technology & Engineering, Business & Industry, Ecology Abstracts, Ei Compendex®, Environment Abstracts, Environmental Engineering Abstracts, Gale Group Computer Database™, Gale Group New Product Announcements / Plus®, Gale Group Newsletter Database™, Gale Group PROMT®, Gale Group Trade & Industry Database™, Inspec®, Jane's Defense & Aerospace News, Mechanical & Transportation Engineering Abstracts, NTIS: National Technical Information Service, Pollution Abstracts, ProQuest Advanced Tech & Aerospace Professional, ProQuest Dissertations and Theses Professional, ProQuest Materials Research Professional, ProQuest Newsstand Professional, Risk Abstracts, SciSearch®: a Cited Reference Science Database, Transport Research International Documentation, UBM Computer Full Text

Set#	Searched for	Results
S1	(autonom* or autono* or automa* or automat* or intelligent*)	40214535*
S2	(vehicle$1 or car$1 or motorcar$1 or (motor* p/1 car$1) or motorvehicle$1 or (motor* p/1 vehicle$1) or automobile$1 or (auto* p/1 mobile$1) or EV$1 or (electric* p/1 vehicle$1) or HEV$1 or PHEV$1 or PSHEV$1 or SHEV$1)	131111087*
S3	(predict* or determin* or probab* or likelihood or theoretic* or stochastic* or assum* or estimat*)	174013076*
S4	(motion or trave* or commut* or trip$1 or journey* or moving or moves or movement$1)	128335607*
S5	(object$1 or pedestrian or bicyclist or vehicle or material$1 or element$1 or suppl* or component$1 or member$1 or substance$1 or item$1 or thing$1 or composite$1 or wood* or metal* or plywood$1 or resource$1 or commodit*)	373442134*
S6	(order or mean$1 or suppos* or toward$1 or conducive or pursuance)	160659427*
S7	(maintain* or stay or sustain* or preserv* or retain* or keep* or hold* or conserv* or retent* or kept or upkeep*)	222019160*
S8	(threshold* or margin* or boundar* or capacity or limit$1 or maximum or border$1 or perimeter* or toleran* or deviat* or (set p/1 point) or setpoint or range$1)	146832150*
S9	(distanc* or range$1 or spac* or gap or interval or separat* or interspac* or plenum or proxim* or length or displac*)	155973229*

S10	((Machine p/1 Learning$1) or ML$1 or (artificial p/1 intelligence$1) or machine$1 or AI$1 or (Machine p/1 intelligence$1) or MI$1 or (Virtual p/1 intelligence$1) or VI$1 or (Computer p/1 intelligence$1) or CI$1 or Siri or Alexa)	206154705*
S11	(model$1 or framework$1 or template$1 or blueprint$1 or parameter$1 or guide$1 or guidelin* or (guide p/1 line$1) or outline$1 or format$1 or standard$1 or profile$1 or figure$1 or foundation* or outline$1 or structur* or composit* or configurat*)	240309010*
S12	(train* or learn* or ascertain* or stud* or educat* or explor* or understand* or assimilat* or acquir* or memoriz* or lucubrat* or attain* or heuristic* or teach*)	324216465*
S13	(based or dependen* or relianc* or bases or base or basing or conditional or relian* or rely or relied or relies or relying)	189178083*
S14	(reaction$1 or feedback or respons* or repl* or acknowledg* or answer* or respond*)	185419033*
S15	(observ* or visible or seeable or percept* or preceiv* or notice* or detect* or discern* or recogniz*)	128456161*
S16	(evaluat* or determin* or analy* or test* or calcula* or estimat* or judg* or deduc* or comput* or assess* or pars* or check* or extrapolat* or diagnos* or analiz*)	311922489*
S17	(information$1 or data$1 or info$1 or file$1 or object$1 or record$1 or content$1)	578571427*
S18	((s1 n/3 s2) n/3 s3)	32937*
S19	(s4 n/3 s5)	3927904*
S20	s18 n/5 s19	647°
S21	(s6 n/3 s7)	5162515*
S22	((s8 n/3 s9) n/5 s5)	2982604*
S23	s21 n/5 s22	618°
S24	((s10 n/3 s11) n/5 s12)	656795*
S25	((s13 n/3 s14) n/5 s15)	132922*
S26	s24 n/5 s25	11°
S27	((s2 n/3 s16) n/5 s17)	383616*

S28	(s13 n/5 (s10 n/3 s11))	382579*
S29	s27 n/5 s28	20°
S30	s20 and s23 and s26 and s29	0°
S31	s20 and s23 and s24 and s27	0°
S32	s20 and s22 and s24 and s27	3°
S33	s32 and pd(<=20190129)	3°
S34	s20 and s22 and s24	6°
S35	s34 and pd(<=20190129)	6°
S36	s20 and s22	60°
S37	s36 and pd(<=20190129)	44°
S38	au("Anthony, Samuel English")	1°

* Duplicates are removed from the search, but included in the result count.
° Duplicates are removed from the search and from the result count.

Dialog – NPL Search Results

Active Sensing and Estimation for Nonlinear Systems with Applications to Car-Bicycle Collision Prevention

Author: Jeon, Woongsun
Publication info: University of Minnesota. ProQuest Dissertations Publishing, 2019. 13813310.
Abstract (summary): This dissertation develops a smart bicycle with novel sensors, active sensing control systems and nonlinear estimation algorithms for prevention of car-bicycle collisions. The smart bicycle tracks nearby cars, predicts their trajectories, and in the case of an anticipated collision with the bicycle sounds an audio alarm to alert the motorist to the presence of the bicycle. The challenges in developing the proposed system come from the inability to utilize the expensive radar and high-density LIDAR sensors typically used on prototype autonomous cars. Alternate sensor systems that are more than one order of magnitude cheaper must be used for the bicycle application. Active control of real-time sensor orientation and sophisticated estimation algorithms based on hybrid nonlinear observers are needed to enable the bicycle to reliably track nearby vehicles using the new inexpensive sensors. While the new active sensing controllers and nonlinear estimation algorithms were primarily developed and demonstrated on a bicycle in this project, they also have a large number of future applications on other vehicle platforms.

First, the dissertation develops an active sensing system for a bicycle to accurately detect and track vehicles behind the bicycle in order to prevent rear-end collisions. A single beam laser sensor that is inexpensive, small and lightweight is adapted for this sensing mission. The rotational orientation of the laser sensor needs to be actively controlled in real-time in order to continue to focus on a rear vehicle, as the vehicle's lateral and longitudinal distances from the bicycle change. This tracking problem requires controlling the real-time angular position of the laser sensor without knowing the future trajectory of the vehicle. The challenge is addressed by mounting the sensor on a rotationally controlled platform, using a novel receding horizon framework for active sensor orientation control, and an interacting multiple model framework for estimation. The features and benefits of this active sensing system are analyzed using simulation results. Then, extensive experimental results are presented using a prototype instrumented bicycle to show the performance of the system in detecting and tracking rear vehicles during both straight and turning maneuvers.

Next, the topic of simultaneously searching for and tracking of multiple vehicles behind the bicycle using the same single beam laser sensor is addressed. Vehicles in the bicycle's lane and in the adjacent left lane are both considered. The tasks involved are searching both lanes to detect presence of vehicles, tracking a vehicle's trajectory once it has been detected, and switching between searching and tracking as needed. A rigorous search algorithm that minimizes the number of sensor rotational angles needed to search the entire region of interest is developed. An error covariance matrix approach is utilized to switch between tracking vehicles and searching a region of interest. Detailed simulation results are presented to show how the developed system handles the absence and presence of vehicles in the two lanes and handles different types of lane change maneuvers while tracking multiple vehicles.

For tracking vehicles in front of the bicycle, including vehicles at traffic intersections, low-density LIDAR or radar sensors with a capability to make multiple distance measurements need to be utilized. The vehicle tracking task is challenging, especially due to the complex maneuvers

and large orientation changes that occur with traffic at an intersection. A nonlinear observer is developed and utilized for the vehicle tracking task. Previous results in the literature on vehicle tracking have typically used an interacting multiple model estimator that needs different models for different modes of vehicle motion. This work uses a single nonlinear vehicle model that can be used for all modes of vehicle motion. Previous nonlinear observer design results from literature do not work for the nonlinear system under consideration due to the wide range of operating conditions that need to be accommodated. Hence, a new hybrid nonlinear observer design technique that utilizes switched gains and better bounds on the coupled nonlinear functions in the dynamics is developed. The asymptotic stability of the observer is established using Lyapunov techniques. The observer design with the developed technique is then implemented in both simulations and experiments. Experimental results show that the observer can simultaneously and accurately estimate longitudinal position, lateral position, velocity and orientation variables for the vehicle from radar measurements. Results are presented both for tracking of vehicle maneuvers on highways and of maneuvers on urban roads at traffic intersections where turns and significant changes in vehicle orientation can occur.
The hybrid nonlinear observer developed for vehicle tracking also leads to a new conclusion on the importance of switched gains for observers in the case of non-monotonic nonlinear systems. A theoretical result which shows the non-existence of a stabilizing observer gain for non-monotonic systems, no matter how small the Lipschitz constant or Jacobian bounds of the nonlinearity, is developed. This is followed by development of a theoretical observer design technique based on switched observer gains for observer stabilization in non-monotonic nonlinear systems.
Finally, a robust prototype bicycle with hardware for tracking of rear and side vehicles is developed in order to conduct a field operational test (FOT) in collaboration with a Minnesota bicycle company called Quality Bicycle Products (QBP). Ten employees of QBP will ride 10 instrumented bicycles for 6 months in two stages of the FOT. Data collected from the FOT will help refine the developed smart bicycle and evaluate its effectiveness in real world riding.
The contributions of this dissertation include development of a smart vehicle tracking system suitable for on-bicycle implementation based on a new paradigm of active sensing and hybrid nonlinear estimation algorithms, development of a fundamental new observer design method for nonlinear non-monotonic systems and potential future commercialization of a new bicycle safety technology based on the outcomes of a proposed field operational test.

Keywords in context:
Full text: ... for a 1 second reaction time of the driver (the driver starts braking 1 second after the alert is sounded) and requiring a 3m safety distance margin (the vehicle stops 3m before the bicycle). The alert is provided to both the driver and bicyclist when the time to collision between the vehicle and bicycle ... such that both of the design equations (5.23) and (5.24) are satisfied. 5.5 Application to Vehicle Tracking This section develops a nonlinear observer for an autonomous vehicle to estimate motion variables of other vehicles on a road, based on measurements from an on-board radar sensor [60]. The developed observer is used to track the lateral ...

Autonomous Vehicle Motion Planning with Ethical Considerations

Author: Thornton, Sarah Marie
Publication info: Stanford University. ProQuest Dissertations Publishing, 2018. 28114619.
Abstract (summary): Human drivers navigate the roadways by balancing values such as safety, legality, and mobility. An autonomous vehicle driving on the same roadways as humans likely needs to navigate based on similar values. For engineers of autonomous vehicle technology, the challenge is then to connect these human values to the algorithm design. To address this challenge, a mapping of philosophical frameworks to mathematical frameworks is used in order to motivate various design choices in a motion planning algorithm. Deontological ethics parallels rule-based mathematical concepts while consequentialism parallels cost-based mathematical concepts. The philosophical theory of virtue ethics is also used to help motivate the relative weightings between the design objectives of path tracking, obstacle avoidance, and adherence to traffic laws. Experimental results of an autonomous vehicle navigating an obstructed two-lane roadway with a double yellow line demonstrate the implications of the various design choices in a model predictive steering controller. In order to determine the success of the human values captured in an algorithm, the iterative methodology of value sensitive design (VSD) is used to formalize the connection of human values to engineering specifications. A modified VSD methodology is used to develop an autonomous vehicle speed control algorithm to safely navigate a pedestrian crosswalk. Two VSD iterations are presented that model the problem as a partially observable Markov decision process and use dynamic programming to compute an optimal policy to control the longitudinal acceleration of the vehicle based on the belief of a pedestrian crossing. The speed control algorithms are also tested in real-time on an experimental vehicle on a closed-road course.

Keywords in context:
Full text: ... pedestrian crosswalks are embedded in a partially observable Markov decision process (POMDP) for speed control. The speed limit is implicitly accounted for by limiting the vehicle state space to the speed limit. The unsignalized pedestrian crosswalk is assumed to be a marked crosswalk or an unmarked crosswalk at an intersection as described by California Vehicle Code §21950. The vehicle distance ... choice of sensors, the perception layer, or even how the vehicles are tested and deployed. Chapter 2 Comparative Analysis of Steering System Modeling in Model Predictive Control Autonomous vehicle motion planning requires ethical considerations in situations where value conflicts arise. Some engineering problems within motion planning, how- ever, do not deal with value conflicts ... vehicle's distance to the crosswalk Pr(ct | ¬ct; pt = STOPPED) = (pxing/dmax)dt, (4.11) where pxing is 52.3 % [99] likelihood and dmax is the maximum distance the vehicle is defined to be away from the crosswalk. (The probability of 52.3 % is calculated from Schroeder and Rouphail's [99] statistics on yield and non-yield ...

Predictive Maneuver Planning and Control of an Autonomous Vehicle in Multi-Vehicle Traffic with Observation Uncertainty

Author: Wang, Qian
Publication info: Clemson University. ProQuest Dissertations Publishing, 2017. 10621800.
Abstract (summary): Autonomous vehicle technology is a promising development for improving the safety, efficiency and environmental impact of on-road transportation systems.

However, the task of guiding an autonomous vehicle by rapidly and systematically accommodating the plethora of changing constraints, e.g. of avoiding multiple stationary and moving obstacles, obeying traffic rules, signals and so on as well as the uncertain state observation due to sensor imperfections, remains a major challenge.

This dissertation attempts to address this challenge via designing a robust and efficient predictive motion planning framework that can generate the appropriate vehicle maneuvers (selecting and tracking specific lanes, and related speed references) as well as the constituent motion trajectories while considering the differential vehicle kinematics of the controlled vehicle and other constraints of operating in public traffic. The main framework combines a finite state machine (FSM)-based maneuver decision module with a model predictive control (MPC)-based trajectory planner. Based on the prediction of the traffic environment, reference speeds are assigned to each lane in accordance with the detection of objects during measurement update. The lane selection decisions themselves are then incorporated within the MPC optimization.

The on-line maneuver/motion planning effort for autonomous vehicles in public traffic is a non-convex problem due to the multiple collision avoidance constraints with overlapping areas, lane boundaries, and nonlinear vehicle-road dynamics constraints. This dissertation proposes and derives some remedies for these challenges within the planning framework to improve the feasibility and optimality of the solution. Specifically, it introduces vehicle grouping notions and derives conservative and smooth algebraic models to describe the overlapped space of several individual infeasible spaces and help prevent the optimization from falling into undesired local minima. Furthermore, in certain situations, a forced objective selection strategy is needed and adopted to help the optimization jump out of local minima.

Furthermore, the dissertation considers stochastic uncertainties prevalent in dynamic and complex traffic and incorporate them with in the predictive planning and control framework. To this end, Bayesian filters are implemented to estimate the uncertainties in object motions and then propagate them into the prediction horizon. Then, a pair-wise probabilistic collision condition is defined for objects with non-negligible geometrical shape/sizes and computationally efficient and conservative forms are derived to efficiently and analytically approximate the involved multi-variate integrals. The probabilistic collision evaluation is then applied within a vehicle grouping algorithms to cluster the object vehicles with closeness in positions and speeds and eventually within the stochastic predictive maneuver planner framework to tighten the chanced-constraints given a deterministic confidence margin. It is argued that these steps make the planning problem tractable for real-time implementation on autonomously controlled vehicles.

Keywords in context:

Full text: ... Within the prediction horizon, a rule-based assignment of reference speeds for each reference lane is applied in each interval of the horizon based on the predicted motion of the autonomous vehicle and other object vehicles. Then, the sequence of maneuvers is incorporated in a relaxed stochastic MPC formulated to simultaneously generate the optimized reference selections and ... are then used for redefining the obstacle collision constraints for model predictive control (MPC) and guidance of an ACV. Therein, we formed groups between detected object vehicles based on a distance threshold defined by the overlap of their elliptical collision fields. The identified vehicle groups are then represented with the tightest/optimal hyper-elliptical boundaries. The results of our ...

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/777,673	Filing Date 01/30/2020	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	03/30/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	HSLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/TRACIE V HARGROVE/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FIRST INVENTOR	Samuel English Anthony
APPLICATION NO.:	16/777,673
TITLE:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
FILING DATE:	January 30, 2020
EXAMINER:	Weber, Tamara L
GROUP ART UNIT:	3667
CONFIRMATION NO.	9420
ATTY. DKT. NO.:	35447-45618/US

CERTIFICATE OF TRANSMISSION			
I hereby certify under 37 C.F.R. § 1.8(a)(ii) that this correspondence is being deposited or transmitted in accordance with 37 C.F.R. § 1.8(a)(i) on or before the local date shown below.			
Signature:	/ Rajendra B. Panwar/		
Typed or Printed Name:	Rajendra B. Panwar, Reg No 63,165	Dated:	2022-03-30

RESPONSE AND AMENDMENT A

The following is in response to the Office Action mailed September 30, 2021.

AMENDMENTS TO THE CLAIMS

All pending claims, along with a current status of each, are reproduced below. If indicated, please amend the claims accordingly.

1. (Currently Amended) A method comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image;

determining [[a]] the hidden context of the traffic entity based on [[a]] the output of the machine learning based model~~, wherein the machine learning based model is trained based on feedback received from users~~

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~~responsive to presenting images or videos showing traffic scenarios to the users~~;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context of the traffic entity;

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

2. (Currently Amended) The method of claim 1, wherein the region is in [[the]] a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

3. (Currently Amended) The method of claim 1, wherein the region is in [[the]] a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing [[the]] a size of the region along the direction of the motion vector.

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4. (Original) The method of claim 1, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

5. (Original) The method of claim 1, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

6. (Original) The method of claim 1, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

7. (Original) The method of claim 1, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

8. (Original) The method of claim 1, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

9. (Original) The method of claim 1, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

10. (Currently Amended) A non-transitory computer readable storage medium storing instructions, that when executed by a processor, cause the processor to perform steps comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image;

determining [[a]] the hidden context of the traffic entity based on [[a]] the output of the machine learning based model~~, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users~~;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context of the traffic entity;

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navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

11. (Currently Amended) The non-transitory computer readable storage medium of claim 10, wherein the region is in [[the]] a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

12. (Currently Amended) The non-transitory computer readable storage medium of claim 10, wherein the region is in [[the]] a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing [[the]] a size of the region along the direction of the motion vector.

13. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

14. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

15. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

16. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

17. (Original) The non-transitory computer readable storage medium of claim 10, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

18. (Original) The non-transitory computer readable storage medium of claim 10, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

19. (Currently Amended) A computer system comprising:

a processor; and

a non-transitory computer readable storage medium storing instructions that when executed by a processor, cause the processor to perform steps comprising:

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receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image;

determining [[a]] the hidden context of the traffic entity based on [[a]] the output of the machine learning based model~~, wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users~~;

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determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context of the traffic entity;

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

20. (Currently Amended) The computer system of claim 19, wherein the region is in [[the]] a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

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REMARKS

Claims 1–20 were pending in this application, and claims 1, 10, and 19 were the independent claims. Claims 1-3, 10-12, and 19-20 are amended herein. No claims are added. No claims are canceled. Support for the claim amendments is found throughout the specification as filed, for example, at paragraphs [0064-0070].

REJECTIONS UNDER 35 U.S.C. § 102 and/or 35 U.S.C. § 103

Claims 1–3, 8–12, and 17–20 were rejected under 35 U.S.C. § 103 as unpatentable over Cheng et al. (US-2020/0193829-A1, hereinafter Cheng) in view of Tran et al. (US-2017/0318360-A1, hereinafter Tran).

Claim 1 as amended recites:

…

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image;

determining the hidden context of the traffic entity based on the output of the machine learning based model;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval;

modifying the region based on the hidden context of the traffic entity;

…

Accordingly, the claimed invention concerns receiving sensor data from sensors mounted on the autonomous vehicle. The sensor data includes images. One or more traffic entities are identified based on the sensor data. For each traffic entity identified, an image showing the traffic entity is provided as input to a machine learning model. The machine learning model is configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image. A region of the point cloud where the traffic entity is expected to reach within a threshold time interval is determined and the region is modified based on the hidden context of the traffic entity.

Claim1 was rejected in view of Cheng and Tran. The office action states that "Cheng does not disclose a machine learning model trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users" and cites Tran, [00298] as disclosing "wherein the machine learning based model is trained based on feedback received from users responsive to presenting images or videos showing traffic scenarios to the users." The cited portion of Tran state that a "library may be built manually, or by the vehicle " s observation of other vehicles (autonomous or not) on the roadway" and "observation and learning may be accomplished by, for example, tools and techniques of machine learning." The cited portions do not disclose at least the claim limitation "providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of the traffic entity shown in the input image."

Therefore, independent claim 1 is patentable over the cited references. Independent claims 10 and 19 are also patentable at least for the same reasons. The dependent claims

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incorporate the limitations of their respective independent claims and are also patentable for the above reasons.

DOUBLE PATENTING REJECTION

Claims 1, 4-10, and 13-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777386. Applicant requests this rejection be held in abeyance pending allowance of the application. If the rejection is maintained and the claims are deemed otherwise allowable, Applicant will consider filing a terminal disclaimer.

CONCLUSION

Based on the foregoing, the application is in condition for allowance of all claims, and a Notice of Allowance is respectfully requested. If the examiner believes for any reason direct contact would help advance the prosecution of this case to allowance, the examiner is encouraged to telephone the undersigned at the number given below.

If extensions of time are necessary to prevent abandonment of this application, then such extension of time are hereby petitioned under 37 CFR 1.136(a), and any fees required therefore are hereby authorized to be charged to our Deposit Account 19-2555.

Respectfully submitted,

Dated: March 30, 2022

/ Rajendra B. Panwar /

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Electronic Patent Application Fee Transmittal

Application Number:	16777673
Filing Date:	30-Jan-2020
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar/Natasha Pasciucco
Attorney Docket Number:	35447-45618/US

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	2253	1	740	740
Miscellaneous:				
			Total in USD ($)	**740**

Electronic Acknowledgement Receipt

EFS ID:	45356403
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar
Filer Authorized By:	
Attorney Docket Number:	35447-45618/US
Receipt Date:	30-MAR-2022
Filing Date:	30-JAN-2020
Time Stamp:	16:14:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$740
RAM confirmation Number	E20223TG14482483
Deposit Account	192555
Authorized User	Rajendra Panwar

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		45618_OAR.pdf	48712 7b750176f4cef0600cfce19e2cd9bb36a620e77e	yes	12
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Request for Reconsideration-After Non-Final Rejection		1	1	
	Claims		2	9	
	Applicant Arguments/Remarks Made in an Amendment		10	12	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38642 4bcce146fa487b4ee67d2c52a0da37581d9e0acd	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	87354		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
				Application Number	16/777,673
				Filing Date	January 30, 2020
				First Named Inventor	Samuel English Anthony
				Applicant	Perceptive Automata, Inc.
				Art Unit	3667
				Confirmation Number	9420
				Examiner Name	WEBER, TAMARA L
Sheet	1	of	2	Attorney Docket Number	35447-45618/US

U.S. PATENT DOCUMENTS				
		Document No.		
Examiner Initials*	Cite No.[1]	Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-7,269,516 B2	09-11-2007	Brunner et al.
	A2	US-8,175,333 B2	05-08-2012	Eaton e tal.
	A3	US-2011/0210866 A1	09-01-2011	David et al.
	A4	US-2015/0210280 A1	07-30-2015	Agnew et al.
	A5	US-2016/0355181 A1	12-08-2016	MORALES TERAOKA et al.
	A6	US-2017/0131719 A1	05-11-2017	Micks et al.
	A7	US-2017/0153639 A1	06-01-2017	Stein
	A8	US-2017/0329332 A1	11-16-2017	Pilarski et al.
	A9	US-2018/0374359 A1	12-27-2018	Li et al.
	A10	US-2019/0107840 A1	04-11-2019	Green et al.
	A11	US-2019/0122037 A1	04-25-2019	Russell et al.
	A12	US-2019/0187720 A1	06-20-2019	Fowe
	A13	US-2019/0359205 A1	11-28-2019	Xu et al.
	A14	US-2020/0167954 A1	05-28-2020	Wallin et al.

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[6]
	C1	First Examination Report, Indian Patent Application No. 202147039120, 13 April 2022, 6 pages.	
	C2	United States Office Action, U.S. Patent Application No. 16/777,386, December 23, 2021, 49 pages.	

EXAMINER SIGNATURE	
Examiner Signature	
Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (option). [2] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [3] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

[5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
				Application Number	16/777,673
				Filing Date	January 30, 2020
				First Named Inventor	Samuel English Anthony
				Applicant	Perceptive Automata, Inc.
				Art Unit	3667
				Confirmation Number	9420
				Examiner Name	WEBER, TAMARA L
Sheet	2	of	2	Attorney Docket Number	35447-45618/US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/ Rajendra B. Panwar/	Date (YYYY-MM-DD)	2022-05-02
Name/Print	Rajendra B. Panwar	Registration Number	63,165

Electronic Patent Application Fee Transmittal

Application Number:	16777673
Filing Date:	30-Jan-2020
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar/Julie Eng
Attorney Docket Number:	35447-45618/US

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	130	130
		Total in USD ($)		**130**

Electronic Acknowledgement Receipt

EFS ID:	45616704
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar/Julie Eng
Filer Authorized By:	Rajendra Bhagwatisingh Panwar
Attorney Docket Number:	35447-45618/US
Receipt Date:	02-MAY-2022
Filing Date:	30-JAN-2020
Time Stamp:	20:19:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$130
RAM confirmation Number	E202252K20292848
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	45618_US_Information_Disclosure_Statement.pdf	224604 5959d691130872c5d2f8c50cd7b39de218c187e7	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Other reference-Patent/Application/ Search Documents	First_Examination_Report_IN202147039120_13April2022.pdf	5006689 7b1443bb7777f73c166f500b013a48b3d4e1280b	no	6
Warnings:					
Information:					
3	Other reference-Patent/Application/ Search Documents	45617_NFOA_2021-12-23_US16777386.pdf	1987831 d027a42984e080094bfd1ea97da0ad628e2e9679	no	49
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	38096 f4bd904bf85492e3325142b0eb874dcc7ac7833c	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7257220		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

758 7590 07/05/2022

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER	
WEBER, TAMARA L	

ART UNIT	PAPER NUMBER
3667	

NOTIFICATION DATE	DELIVERY MODE
07/05/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTOC@Fenwick.com

Office Action Summary	Application No. 16/777,673	Applicant(s) Anthony, Samuel English	
	Examiner TAMARA L WEBER	Art Unit 3667	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 3/30/2022.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1,4-10 and 13-19 is/are rejected.

8) ☑ Claim(s) 2-3,11-12 and 20 is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 5/2/2022.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

Claim Status

This action is in response to applicant's response and claim amendment filed 3/30/2022. Claims 1-20 are pending and considered below.

Response to Arguments

Claims 1, 4-10 and 13-19 were provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777386. Applicant has not yet filed a Terminal Disclaimer. Therefore, claims 1, 4-10 and 13-19 remain provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777386.

Claims 1-3, 8-12 and 17-20 were rejected under 35 U.S.C. 103 as being unpatentable over Cheng et al. (US-2020/0193829-A1) in view of Tran et al. (US-2017/0318360-A1). Independent claim 1 has been amended to include the limitation "providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing a traffic entity and output summary statistics of expected human responses describing a hidden context of

the traffic entity shown in the input image; determining the hidden context of the traffic entity based on the output of the machine learning based model". Independent claims 10 and 19 were amended in a similar manner. Applicant argued that Tran does not disclose a machine learning model configured to output summary statistics of expected human responses describing a hidden context of a traffic entity shown in an input image. Examiner agrees. Therefore, the 35 U.S.C. 103 rejection of claims 1-3, 8-12 and 17-20 is withdrawn.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject

to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1, 4-10 and 13-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777386. Although the claims at issue are not identical, they are not patentably distinct from each other because navigating the autonomous vehicle based on the motion parameters and the hidden context of each of the traffic entities of Application No. 16/777386 is equivalent to navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities of the instant application. This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Allowable Subject Matter

Claims 2-3, 11-12 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TAMARA L WEBER whose telephone number is (303)297-4249. The examiner can normally be reached on 8:30-5:00 MTN.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Faris Almatrahi can be reached on 3134464821. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available

through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TAMARA L. WEBER
Examiner
Art Unit 3667

/TAMARA L WEBER/
Examiner, Art Unit 3667

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

CPC - Searched*		
Symbol	**Date**	**Examiner**
B60W30/09;095 text limited	09/24/2021	TLW
B60W40/09 text limited	09/24/2021	TLW
B60W60/0015;0027;00274;00276 text limited	09/24/2021	TLW
B60W2420/42;52 text limited	09/24/2021	TLW
B60W2554/40;402;4045;4047 text limited	09/24/2021	TLW
G05D1/0088;0214;0221;0231 text limited	09/24/2021	TLW
G05D2201/0213 text limited	09/24/2021	TLW
G06N7/005 text limited	09/24/2021	TLW
G06N20/00 text limited	09/24/2021	TLW
B60W30/09;095;0956 text limited	06/28/2022	TLW
B60W40/02;09 text limited	06/28/2022	TLW
B60W60/0015;0027;00274;00276 text limited	06/28/2022	TLW
B60W2300/36 text limited	06/28/2022	TLW
B60W2420/42;52 text limited	06/28/2022	TLW
B60W2554/40;402;4029;4045;4047 text limited	06/28/2022	TLW
B60Y2400/81 text limited	06/28/2022	TLW
G05D1/0088;0214;0221;0231 text limited	06/28/2022	TLW
G05D2201/0213 text limited	06/28/2022	TLW
G06N7/005 text limited	06/28/2022	TLW
G06N20/00 text limited	06/28/2022	TLW

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
inventor search	09/15/2021	TLW
STIC/NPL	09/22/2021	TLW
see attached search history report	09/24/2021	TLW
IEEE Xplore/NPL	09/24/2021	TLW
Global Dossier	06/28/2022	TLW
Applicant/Assignee text limited	06/28/2022	TLW
Inventor text limited	06/28/2022	TLW
See attached search history report	06/28/2022	TLW

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
EAST		09/24/2021	TLW
PE2E		06/28/2022	TLW

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/24/2021	06/28/2022							
	1	✓	✓							
	2	✓	O							
	3	✓	O							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	O							
	12	✓	O							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							
	20	✓	O							

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
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				Art Unit	3667
				Confirmation Number	9420
				Examiner Name	WEBER, TAMARA L
Sheet	1	of	2	Attorney Docket Number	35447-45618/US

U.S. PATENT DOCUMENTS				
		Document No.		
Examiner Initials*	Cite No.[1]	Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-7,269,516 B2	09-11-2007	Brunner et al.
	A2	US-8,175,333 B2	05-08-2012	Eaton e tal.
	A3	US-2011/0210866 A1	09-01-2011	David et al.
	A4	US-2015/0210280 A1	07-30-2015	Agnew et al.
	A5	US-2016/0355181 A1	12-08-2016	MORALES TERAOKA et al.
	A6	US-2017/0131719 A1	05-11-2017	Micks et al.
	A7	US-2017/0153639 A1	06-01-2017	Stein
	A8	US-2017/0329332 A1	11-16-2017	Pilarski et al.
	A9	US-2018/0374359 A1	12-27-2018	Li et al.
	A10	US-2019/0107840 A1	04-11-2019	Green et al.
	A11	US-2019/0122037 A1	04-25-2019	Russell et al.
	A12	US-2019/0187720 A1	06-20-2019	Fowe
	A13	US-2019/0359205 A1	11-28-2019	Xu et al.
	A14	US-2020/0167954 A1	05-28-2020	Wallin et al.

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[6]
	C1	First Examination Report, Indian Patent Application No. 202147039120, 13 April 2022, 6 pages.	
	C2	United States Office Action, U.S. Patent Application No. 16/777,386, December 23, 2021, 49 pages.	

EXAMINER SIGNATURE	
Examiner Signature	/TAMARA L WEBER/
Date Considered	06/28/2022

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[1] Applicant's unique citation designation number (option). [2] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [3] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

[5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.L.W/

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				Confirmation Number	9420
				Examiner Name	WEBER, TAMARA L
Sheet	2	of	2	Attorney Docket Number	35447-45618/US

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/ Rajendra B. Panwar/	Date (YYYY-MM-DD)	2022-05-02
Name/Print	Rajendra B. Panwar	Registration Number	63,165

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.L.W/

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:25 PM
L2	122	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:29 PM
L3	12346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:34 PM
L4	5821	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:35 PM
L5	1852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:38 PM
L6	10454	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:40 PM
L7	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:43 PM
L8	27220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:47 PM
L9	16581	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:49 PM
L10	22924	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:50 PM
L11	70746	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:51 PM
L12	72	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:36 PM
L13	53	(autonomous driverless	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/15

		self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle)	EPO; JPO; DERWENT)				04:38 PM
L14	122	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:39 PM
L15	0	L13 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:39 PM
L16	12346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L17	5821	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L18	1852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L19	10454	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L20	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L21	27220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L22	16581	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L23	22924	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L24	70746	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L25	46	L13 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L26	0	("10841563").URPN.	(USPAT)	OR	ON	ON	2021/09/15

							05:30 PM
L27	1	("20140152839").PN. OR ("10841563").URPN.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/09/15 05:31 PM
L28	0	L12 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:32 PM
L29	510	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:33 PM
L30	2	L29 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:34 PM
L31	233	L29 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:38 PM
L32	96	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:39 PM
L33	1426	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:19 PM
L34	698	L33 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:20 PM
L35	588	(autonomous driverless self-driving) NEAR9 (vehicle car automobile)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:20 PM

		AND "machine learning" SAME (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)					
L36	294	L35 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:21 PM
L37	1	15/833715.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:43 PM
L38	1	16/428810.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:48 PM
L39	2	15/812645.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:51 PM
L40	2	"10730531".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:58 PM
L41	4	"10216189".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:02 PM
L42	251	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:39 PM
L43	12431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L44	5856	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L45	1876	(B60W60/0015	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/23

		B60W60/0027 B60W60/00274 B60W60/00276).cpc.	EPO; JPO; DERWENT)				04:40 PM
L46	10529	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L47	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L48	27389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L49	16691	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L50	23065	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L51	71529	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L52	177	L42 AND (L43 L44 L45 L46 L47 L48 L49 L50 L51)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L53	2	15/624014.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 05:57 PM
L54	1	15/407248.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:03 PM
L55	1	15/144773.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:04 PM
L56	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:50 PM
L57	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:51 PM
L58	2	"20170318360".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:51 PM
L59	2	(mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) AND (L57 L58)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:58 PM
L60	69	(autonomous driverless self-driving) NEAR9	(US-PGPUB; USPAT; FPRS; EPO; JPO;	OR	ON	ON	2021/09/24 03:03 PM

		(vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) WITH context	DERWENT)				
L61	12431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L62	5856	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L63	1876	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L64	10529	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L65	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L66	27389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L67	16691	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L68	23065	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L69	71529	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L70	58	L60 AND (L61 L62 L63	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/24

		L64 L65 L66 L67 L68 L69)	EPO; JPO; DERWENT)				03:05 PM
L71	69	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:19 PM
L72	58	L71 AND (L61 L62 L63 L64 L65 L66 L67 L68 L69)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:20 PM
L73	18	("0000002" OR "0016777" OR "20110210866" OR "20150210280" OR "20160355181" OR "20170131719" OR "20170153639" OR "20170329332" OR "20180374359" OR "20190107840" OR "20190122037" OR "20190187720" OR "20190359205" OR "20200167954" OR "202147039120" OR "7269516" OR "8175333" OR "9415777" OR "9766336").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 11:34 AM
L74	26	"Perceptive Automata".as.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:10 PM
L75	131	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:11 PM
L76	15081	(B60W30/09	(US-PGPUB; USPAT;	OR	ON	ON	2022/06/28

		B60W30/095 B60W30/0956).cpc.	EPO; JPO; DERWENT)				12:15 PM
L77	11220	(B60W40/02 B60W40/09).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:16 PM
L78	3102	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:19 PM
L79	990	B60W2300/36.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:21 PM
L80	13211	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:24 PM
L81	2054	(B60W2554/40 B60W2554/402 B60W2554/4029 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:29 PM
L82	1208	B60Y2400/81.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:31 PM
L83	32014	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:34 PM
L84	19624	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:35 PM
L85	28314	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:35 PM
L86	94838	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:37 PM
L87	184	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:48 PM
L88	1	87 AND 73	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:49 PM
L89	3	87 AND 74	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:51 PM
L90	9	87 AND 75	(US-PGPUB; USPAT; EPO; JPO;	OR	ON	ON	2022/06/28 03:52 PM

			DERWENT)				
L91	113	87 AND (76 77 78 79 80 81 82 83 84 85 86)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:54 PM
L92	10	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if) AND (summary graph chart) WITH (statistic percentage ratio probability) WITH (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:02 PM
L94	41	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:10 PM
L95	17	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:12 PM
L96	32	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:32 PM

		picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)					
L97	22	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck) AND (feedback reaction response) SAME ("hidden context" intention "motion plan" awareness)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:39 PM
L98	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:48 PM
L99	0	("2020/0239026").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/06/28 04:49 PM
L100	35	(Artificial Intelligence) More Like: US-20200239026-A1 Text: (WO-2021231986-A1 OR US-20210356968-A1 OR US-20210357662-A1 OR CN-106030609-A OR US-20210024094-A1 OR US-20200247432-A1 OR WO-2021126062-A1 OR US-20200180647-A1 OR JP-2022523730-A OR US-20210024090-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/28 04:49 PM

		A1 OR EP-3918590-A1 OR WO-2020160276-A1 OR JP-2021506046-A OR EP-3701418-A1 OR WO-2019112912-A1 OR US-10402687-B2 OR US-20190012574-A1 OR US-11126889-B2 OR US-20200293822-A1 OR US-20200249677-A1).did.					
L101	1	16/777386.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:55 PM
L102	1	("2020/0241545").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/06/28 04:56 PM
L103	34	(Artificial Intelligence) More Like: US-11157784-B2 Text: (WO-2021231986-A1 OR KR-102328732-B1 OR JP-6857371-B2 OR EP-3906537-A1 OR JP-2019505034-A OR EP-3863904-A2 OR US-20210370980-A1 OR JP-7072763-B2 OR EP-3906541-A1 OR CN-112888612-A OR US-20210356968-A1 OR JP-2020513617-A OR US-20210357662-A1 OR EP-3957091-A1 OR CN-112868022-A OR US-20200356828-A1 OR JP-6684346-B2 OR JP-2020144853-A OR EP-3837633-A2 OR US-20210339772-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/28 04:56 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N73	2	((autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/24 03:16 PM

		expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context).clm.					
N78	0	((train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 04:32 PM
N79	0	((train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck) AND (feedback reaction response) SAME ("hidden context" intention "motion plan"	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 04:41 PM

		awareness)).clm.					

Global Dossier

Office

US

Type

Application

16777673

0 1

US 16777673 6 Members in Patent Family (6 currently shown) ()

« ()

IP Office Type

- All IP5 Offices
  - EPO
  - SIPO
  - KIPO
  - JPO
  - USPTO
- Non-IP5 Offices

()	Office ()	Application ()	Applicant	Title ()	App. Date ()	Priority #	Pub. # ()	Pub. Date
()	US	16777386 View Dossier ()	1) PERCEPTIVE AUTOMATA INC	AUTOMATIC BRAKING OF AUTONOMOUS VEHICLES USING MACHINE LEARNING BASED PREDICTION OF BEHAVIOR OF A TRAFFIC ENTITY	01/30/2020	US 16777386 US 62822269 US 62800416 US 62798978	US 20200241545 A1 ()	07/30/2020
()	EP	20749742 View Dossier ()	1) PERCEPTIVE AUTOMATA INC	NEURAL NETWORK BASED NAVIGATION OF AUTONOMOUS VEHICLES THROUGH TRAFFIC ENTITIES	01/30/2020	US 62798978 US 62800416 US 62822269 US PCT/US20/15889	EP 3918590 A1 ()	12/08/2021
()	US	PCT/US20/15889 View Dossier ()	1) PERCEPTIVE AUTOMATA INC	NEURAL NETWORK BASED NAVIGATION OF AUTONOMOUS VEHICLES THROUGH TRAFFIC ENTITIES	01/30/2020	US 62800416 US 62822269 US 62798978	WO 2020160276 A1 ()	08/06/2020
()	KR	20217027230 View Dossier ()	1) PERCEPTIVE AUTOMATA INC	교통 개체를 통한 신경망 기반 자율주행자동차 항법	01/30/2020	US 62798978 US 62800416 US 62822269 US PCT/US20/15889	KR 20210118912 A ()	10/01/2021
()	US	16777673 View Dossier ()	1) PERCEPTIVE AUTOMATA INC	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES	01/30/2020	US 16777673 US 62822269 US 62800416 US 62798978	US 20200239026 A1 ()	07/30/2020

	Office	Application	Applicant	Title	App. Date	Priority #	Pub. #	Pub. Date
()	JP	2021544563 View Dossier ()	1) Perceptive Automata Inc., 2) Patent business corporation TANI & ABE, p.c.,	交通エンティティの間を縫っての自律車両のニューラルネットワークベースのナビゲーション	01/30/2020	US 62800416 US 62822269 US 62798978 US PCT/US20/15889	JP 2022523730 A ()	04/26/2022

(http://www.uspto.gov/)

BROWSE BY TOPIC

ABOUT THIS SITE

USPTO BACKGROUND

FEDERAL GOVERNMENT

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/777,673	Filing Date 01/30/2020	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/13/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 23	Minus	** 20	= 3		x $50 =	150
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	150

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/VERNON A TOWLER/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FIRST NAMED INVENTOR:	Samuel English Anthony
APPLICATION NO.:	16/777,673
TITLE:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
FILING DATE:	January 30, 2020
EXAMINER:	Weber, Tamara L
GROUP ART UNIT:	3667
CONFIRMATION NO.:	9420
ATTY. DKT. NO.:	35447-45618/US

CERTIFICATE OF TRANSMISSION			
I hereby certify under 37 C.F.R. § 1.8(a)(ii) that this correspondence is being deposited or transmitted in accordance with 37 C.F.R. § 1.8(a)(i) on or before the local date shown below.			
Signature:	/ Rajendra B. Panwar/		
Typed or Printed Name:	Rajendra B. Panwar, Reg. No. 63,165	Dated:	2022-07-13

RESPONSE AND AMENDMENT

The following is in response to the Office Action mailed July 5, 2022.

AMENDMENTS TO THE SPECFICATION

Please amend the specification to insert the following after paragraph [0001]:

GOVERNMENT SUPPORT STATEMENT

[0002] This invention was made with government support under Award No. 1738479 awarded by National Science Foundation's Division of Industrial Innovation and Partnerships (IIP). The government has certain rights in the invention.

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AMENDMENTS TO THE CLAIMS

All pending claims, along with a current status of each, are reproduced below. If indicated, please amend the claims accordingly.

1. (Currently Amended) A method comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing [[a] an input traffic entity and output summary statistics of expected human responses describing a hidden context of the input traffic entity shown in the input image;

determining the hidden context of the traffic entity based on the output of the machine learning based model;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval; and

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modifying the region based on the hidden context of the traffic entity; and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

2. (Previously presented) The method of claim 1, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

3. (Previously presented) The method of claim 1, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing a size of the region along the direction of the motion vector.

4. (Original) The method of claim 1, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

5. (Original) The method of claim 1, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

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6. (Original) The method of claim 1, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

7. (Original) The method of claim 1, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

8. (Currently Amended) The method of claim 1, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the one or more motion parameters and the hidden context of each of the one or more traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

9. (Original) The method of claim 1, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

10. (Currently Amended) A non-transitory computer readable storage medium storing instructions, that when executed by a processor, cause the processor to perform steps comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

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identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing [[a] an input traffic entity and output summary statistics of expected human responses describing a hidden context of the input traffic entity shown in the input image;

determining the hidden context of the traffic entity based on the output of the machine learning based model;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval; and

modifying the region based on the hidden context of the traffic entity; and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

11. (Previously presented) The non-transitory computer readable storage medium of claim 10, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

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responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

12. (Previously presented) The non-transitory computer readable storage medium of claim 10, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing a size of the region along the direction of the motion vector.

13. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

14. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a task that a user represented by the traffic entity is planning on accomplishing.

15. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

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16. (Original) The non-transitory computer readable storage medium of claim 10, wherein the hidden context represents a goal of a user represented by the traffic entity, wherein the user expects to achieve the goal within a threshold time interval.

17. (Currently Amended) The non-transitory computer readable storage medium of claim 10, wherein navigating the autonomous vehicle comprises:

generating signals for controlling the autonomous vehicle based on the one or more motion parameters and the hidden context of each of the one or more traffic entities; and

sending the generated signals to controls of the autonomous vehicle.

18. (Original) The non-transitory computer readable storage medium of claim 10, wherein the sensor data represents one or more images captured by a camera mounted on the autonomous vehicle or a lidar scan captured by a lidar mounted on the autonomous vehicle.

19. (Currently Amended) A computer system comprising:

a processor; and

a non-transitory computer readable storage medium storing instructions that when executed by [[a]] the processor, cause the processor to perform steps comprising:

receiving, by an autonomous vehicle, sensor data from sensors mounted on the autonomous vehicle, the sensor data comprising one or more images;

generating a point cloud representation of the surroundings of the autonomous vehicle based on the sensor data;

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identifying, one or more traffic entities based on the sensor data, the traffic entities representing non-stationary objects in traffic in which the autonomous vehicle is driving;

for each of the one or more traffic entities:

determining one or more motion parameters describing movement of the traffic entity;

providing an image of the one or more images, the image showing the traffic entity as input to a machine learning model configured to receive an input image showing [[a] an input traffic entity and output summary statistics of expected human responses describing a hidden context of the input traffic entity shown in the input image;

determining the hidden context of the traffic entity based on the output of the machine learning based model;

determining a region of the point cloud where the traffic entity is expected to reach within a threshold time interval; and

modifying the region based on the hidden context of the traffic entity; and

navigating the autonomous vehicle so that the autonomous vehicle stays at least a threshold distance away from the modified region of each of the one or more traffic entities.

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20. (Previously presented) The computer system of claim 19, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in the direction having a component along the motion vector, extending the region along the direction of the motion vector.

21. (New) The computer system of claim 19, wherein the region is in a direction determined based on a motion vector of the traffic entity, wherein the traffic entity represents a user, wherein modifying the region based on the hidden context comprises:

responsive to determining based on the hidden context that the user represented by the traffic entity is likely to move in a direction having a component opposite to direction of the motion vector, decreasing a size of the region along the direction of the motion vector.

22. (New) The computer system of claim 19, wherein the hidden context represents a state of mind of a user represented by the traffic entity.

23. (New) The computer system of claim 19, wherein the hidden context represents a degree of awareness of the autonomous vehicle by a user represented by the traffic entity.

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REMARKS

Claims 1–20 were pending in this application, and claims 1, 10, and 19 were the independent claims. Claims 2–3, 11–12, and 20 were allowable. Claims 1, 10, 17, and 19 are amended herein. Claims 21-23 are added. No claims are canceled.

DOUBLE PATENTING REJECTION

Claims 1, 4-10, and 13-19 were provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 11-18 of copending Application No. 16/777,386. A terminal disclaimer is filed with this response, obviating this rejection. Examiner is requested to withdraw this rejection.

CONCLUSION

Based on the foregoing, the application is in condition for allowance of all claims, and a Notice of Allowance is respectfully requested. If the examiner believes for any reason direct contact would help advance the prosecution of this case to allowance, the examiner is encouraged to telephone the undersigned at the number given below.

If extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 CFR 1.136(a), and any fees required therefore are hereby authorized to be charged to our Deposit Account 19-2555.

Respectfully submitted,

Dated: July 13, 2022

/ Rajendra B. Panwar /

Rajendra B. Panwar, Reg. No. 63,165
FENWICK & WEST LLP
801 California Street
Mountain View, CA 94041
Phone: (650) 335-7107

TESLA EXHIBIT 1002, Page 247

Electronic Patent Application Fee Transmittal

Application Number:	16777673
Filing Date:	30-Jan-2020
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar/LaYonda Prue
Attorney Docket Number:	35447-45618/US

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	3	100	300
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**300**

Electronic Acknowledgement Receipt

EFS ID:	46179562
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar
Filer Authorized By:	
Attorney Docket Number:	35447-45618/US
Receipt Date:	13-JUL-2022
Filing Date:	30-JAN-2020
Time Stamp:	13:59:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$300
RAM confirmation Number	E20227CE00074876
Deposit Account	192555
Authorized User	Rajendra Panwar

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		45618_Response_to_FOA.pdf	92059 40ce09ea2c6e507330aec24b8f573bf92acf3e38	yes	11

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Response After Final Action	1	1
Specification	2	2
Claims	3	10
Applicant Arguments/Remarks Made in an Amendment	11	11

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	38239 c4f629e683dd9fe784218b47ca7b68a26015f19f	no	2

Warnings:

Information:

Total Files Size (in bytes):	130298

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/25 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION**
Application Number	16777673
Filing Date	30-Jan-2020
First Named Inventor	Samuel Anthony
Attorney Docket Number	35447-45618/US
Title of Invention	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Perceptive Automata, Inc.	100%

The owner(s) of percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number(s)

16777386 filed on 01/30/2020

as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that any such patent granted on the pending reference application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○	I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

- ◉ Small Entity
- ○ Micro Entity
- ○ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

- ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

  Registration Number 63165

- ○ A sole inventor
- ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application
- ○ A joint inventor; all of whom are signing this request

Signature	/Rajendra B. Panwar/
Name	Rajendra B. Panwar

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16777673
Filing Date:	30-Jan-2020
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar
Attorney Docket Number:	35447-45618/US

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	2814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**170**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16777673

Filing Date: 30-Jan-2020

Applicant/Patent under Reexamination: Anthony

Electronic Terminal Disclaimer filed on July 13, 2022

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	46179240
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar
Filer Authorized By:	
Attorney Docket Number:	35447-45618/US
Receipt Date:	13-JUL-2022
Filing Date:	30-JAN-2020
Time Stamp:	14:03:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$170
RAM confirmation Number	E20227CE03144940
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	43818 f7f64aaa69ffcbf50e89f5a2e90b7e62841e611a	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38196 7a31d3a71331088d3a76f83d829f1752f600cb96	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	82014		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

758 7590 08/03/2022

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER
WEBER, TAMARA L

ART UNIT	PAPER NUMBER
3667	

DATE MAILED: 08/03/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

TITLE OF INVENTION: NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	11/03/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

758 7590 08/03/2022

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

TITLE OF INVENTION: NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	11/03/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
WEBER, TAMARA L	3667	701-025000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

758 7590 08/03/2022

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER	
WEBER, TAMARA L	
ART UNIT	**PAPER NUMBER**
3667	

DATE MAILED: 08/03/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/777,673	Applicant(s) Anthony, Samuel English	
	Examiner TAMARA L WEBER	Art Unit 3667	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to response filed 7/13/2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-23 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/TAMARA L WEBER/
Examiner, Art Unit 3667

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

CPC - Searched*		
Symbol	**Date**	**Examiner**
B60W30/09;095 text limited	09/24/2021	TLW
B60W40/09 text limited	09/24/2021	TLW
B60W60/0015;0027;00274;00276 text limited	09/24/2021	TLW
B60W2420/42;52 text limited	09/24/2021	TLW
B60W2554/40;402;4045;4047 text limited	09/24/2021	TLW
G05D1/0088;0214;0221;0231 text limited	09/24/2021	TLW
G05D2201/0213 text limited	09/24/2021	TLW
G06N7/005 text limited	09/24/2021	TLW
G06N20/00 text limited	09/24/2021	TLW
B60W30/09;095;0956 text limited	06/28/2022	TLW
B60W40/02;09 text limited	06/28/2022	TLW
B60W60/0015;0027;00274;00276 text limited	06/28/2022	TLW
B60W2300/36 text limited	06/28/2022	TLW
B60W2420/42;52 text limited	06/28/2022	TLW
B60W2554/40;402;4029;4045;4047 text limited	06/28/2022	TLW
B60Y2400/81 text limited	06/28/2022	TLW
G05D1/0088;0214;0221;0231 text limited	06/28/2022	TLW
G05D2201/0213 text limited	06/28/2022	TLW
G06N7/005 text limited	06/28/2022	TLW
G06N20/00 text limited	06/28/2022	TLW
B60W30/09;095;0956 text limited	07/23/2022	TLW
B60W40/02;09 text limited	07/23/2022	TLW
B60W60/0015;0027;00274;00276 text limited	07/23/2022	TLW
B60W2300/36 text limited	07/23/2022	TLW
B60W2420/42;52 text limited	07/23/2022	TLW
B60W2554/40;402;4029;4045;4047 text limited	07/23/2022	TLW

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

B60Y2400/81 text limited	07/23/2022	TLW
G05D1/0088;0214;0221;0231 text limited	07/23/2022	TLW
G05D2201/0213 text limited	07/23/2022	TLW
G06N7/005 text limited	07/23/2022	TLW
G06N20/00 text limited	07/23/2022	TLW

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
inventor search	09/15/2021	TLW
STIC/NPL	09/22/2021	TLW
see attached search history report	09/24/2021	TLW
IEEE Xplore/NPL	09/24/2021	TLW
Global Dossier	06/28/2022	TLW
Applicant/Assignee text limited	06/28/2022	TLW
Inventor text limited	06/28/2022	TLW
See attached search history report	06/28/2022	TLW
Applicant/Assignee text limited	07/23/2022	TLW
Inventor text limited	07/23/2022	TLW
See attached search history report	07/23/2022	TLW

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	Art Unit
	TAMARA L WEBER	3667

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
EAST		09/24/2021	TLW
PE2E		06/28/2022	TLW
additional PE2E search		07/23/2022	TLW

/TAMARA L WEBER/ Examiner, Art Unit 3667	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	**Art Unit**
	TAMARA L WEBER	3667

CPC						
Symbol					**Type**	**Version**
G05D	/	1	/	0221	F	2013-01-01
G05D	/	1	/	0214	I	2013-01-01
B60W	/	30	/	095	I	2013-01-01
G05D	/	1	/	0088	I	2013-01-01
B60W	/	40	/	09	I	2013-01-01
G06N	/	20	/	00	I	2019-01-01
B60W	/	30	/	09	I	2013-01-01
B60W	/	60	/	0015	I	2020-02-01
B60W	/	60	/	0027	I	2020-02-01
G05D	/	1	/	0231	I	2013-01-01
G05D	/	2201	/	0213	A	2013-01-01
B60W	/	2554	/	40	A	2020-02-01
B60W	/	2420	/	42	A	2013-01-01
B60W	/	2420	/	52	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	23	
/TAMARA L WEBER/ Examiner, Art Unit 3667	23 July 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

U.S. Patent and Trademark Office — Part of Paper No.: 20220723

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	**Art Unit**
	TAMARA L WEBER	3667

INTERNATIONAL CLASSIFICATION				
CLAIMED				
G05D	/	1	/	02

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 23	
/TAMARA L WEBER/ Examiner, Art Unit 3667 (Primary Examiner)	23 July 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

U.S. Patent and Trademark Office

Part of Paper No.: 20220723

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/777,673	Anthony, Samuel English
	Examiner	**Art Unit**
	TAMARA L WEBER	3667

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 23	
/TAMARA L WEBER/ Examiner, Art Unit 3667 (Primary Examiner)	23 July 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

U.S. Patent and Trademark Office

Part of Paper No.: 20220723

Bibliographic Data

Application No: 16/777,673

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /TAMARA L WEBER/ Examiner's Signature | Initials

Title: NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
01/30/2020	701	3667	35447-45618/US
RULE			

APPLICANTS

Perceptive Automata, Inc., Boston, MA,

INVENTORS

Samuel English Anthony, Somerville, MA, UNITED STATES

CONTINUING DATA

This application has PRO of 62822269 03/22/2019

This application has PRO of 62800416 02/01/2019

This application has PRO of 62798978 01/30/2019

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

02/18/2020

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

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FILING FEE RECEIVED

$865

OK TO ENTER: /T.L.W/

07/23/2022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FIRST NAMED INVENTOR:	Samuel English Anthony
APPLICATION NO.:	16/777,673
TITLE:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
FILING DATE:	January 30, 2020
EXAMINER:	Weber, Tamara L
GROUP ART UNIT:	3667
CONFIRMATION NO.:	9420
ATTY. DKT. NO.:	35447-45618/US

CERTIFICATE OF TRANSMISSION			
I hereby certify under 37 C.F.R. § 1.8(a)(ii) that this correspondence is being deposited or transmitted in accordance with 37 C.F.R. § 1.8(a)(i) on or before the local date shown below.			
Signature:	/ Rajendra B. Panwar/		
Typed or Printed Name:	Rajendra B. Panwar, Reg. No. 63,165	Dated:	2022-07-13

RESPONSE AND AMENDMENT

The following is in response to the Office Action mailed July 5, 2022.

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:25 PM
L2	122	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:29 PM
L3	12346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:34 PM
L4	5821	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:35 PM
L5	1852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:38 PM
L6	10454	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:40 PM
L7	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:43 PM
L8	27220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:47 PM
L9	16581	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:49 PM
L10	22924	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:50 PM
L11	70746	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 12:51 PM
L12	72	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:36 PM
L13	53	(autonomous driverless	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/15

		self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle)	EPO; JPO; DERWENT)				04:38 PM
L14	122	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:39 PM
L15	0	L13 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:39 PM
L16	12346	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L17	5821	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L18	1852	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L19	10454	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L20	904	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L21	27220	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L22	16581	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L23	22924	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L24	70746	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L25	46	L13 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 04:40 PM
L26	0	("10841563").URPN.	(USPAT)	OR	ON	ON	2021/09/15

							05:30 PM
L27	1	("20140152839").PN. OR ("10841563").URPN.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/09/15 05:31 PM
L28	0	L12 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:32 PM
L29	510	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:33 PM
L30	2	L29 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:34 PM
L31	233	L29 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:38 PM
L32	96	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 05:39 PM
L33	1426	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:19 PM
L34	698	L33 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:20 PM
L35	588	(autonomous driverless self-driving) NEAR9 (vehicle car automobile)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:20 PM

		AND "machine learning" SAME (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)					
L36	294	L35 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/15 06:21 PM
L37	1	15/833715.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:43 PM
L38	1	16/428810.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:48 PM
L39	2	15/812645.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:51 PM
L40	2	"10730531".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 03:58 PM
L41	4	"10216189".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:02 PM
L42	251	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:39 PM
L43	12431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L44	5856	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L45	1876	(B60W60/0015	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/23

		B60W60/0027 B60W60/00274 B60W60/00276).cpc.	EPO; JPO; DERWENT)				04:40 PM
L46	10529	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L47	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L48	27389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L49	16691	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L50	23065	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L51	71529	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L52	177	L42 AND (L43 L44 L45 L46 L47 L48 L49 L50 L51)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 04:40 PM
L53	2	15/624014.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 05:57 PM
L54	1	15/407248.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:03 PM
L55	1	15/144773.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:04 PM
L56	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/23 06:50 PM
L57	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:51 PM
L58	2	"20170318360".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:51 PM
L59	2	(mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) AND (L57 L58)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 02:58 PM
L60	69	(autonomous driverless self-driving) NEAR9	(US-PGPUB; USPAT; FPRS; EPO; JPO;	OR	ON	ON	2021/09/24 03:03 PM

		(vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) WITH context	DERWENT)				
L61	12431	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L62	5856	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L63	1876	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L64	10529	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L65	918	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L66	27389	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L67	16691	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L68	23065	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L69	71529	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:05 PM
L70	58	L60 AND (L61 L62 L63	(US-PGPUB; USPAT;	OR	ON	ON	2021/09/24

		L64 L65 L66 L67 L68 L69)	EPO; JPO; DERWENT)				03:05 PM
L71	69	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:19 PM
L72	58	L71 AND (L61 L62 L63 L64 L65 L66 L67 L68 L69)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2021/09/24 03:20 PM
L73	18	("0000002" OR "0016777" OR "20110210866" OR "20150210280" OR "20160355181" OR "20170131719" OR "20170153639" OR "20170329332" OR "20180374359" OR "20190107840" OR "20190122037" OR "20190187720" OR "20190359205" OR "20200167954" OR "202147039120" OR "7269516" OR "8175333" OR "9415777" OR "9766336").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 11:34 AM
L74	26	"Perceptive Automata".as.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:10 PM
L75	131	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:11 PM
L76	15081	(B60W30/09	(US-PGPUB; USPAT;	OR	ON	ON	2022/06/28

		B60W30/095 B60W30/0956).cpc.	EPO; JPO; DERWENT)				12:15 PM
L77	11220	(B60W40/02 B60W40/09).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:16 PM
L78	3102	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:19 PM
L79	990	B60W2300/36.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:21 PM
L80	13211	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:24 PM
L81	2054	(B60W2554/40 B60W2554/402 B60W2554/4029 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:29 PM
L82	1208	B60Y2400/81.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:31 PM
L83	32014	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:34 PM
L84	19624	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:35 PM
L85	28314	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:35 PM
L86	94838	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 12:37 PM
L87	184	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:48 PM
L88	1	87 AND 73	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:49 PM
L89	3	87 AND 74	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:51 PM
L90	9	87 AND 75	(US-PGPUB; USPAT; EPO; JPO;	OR	ON	ON	2022/06/28 03:52 PM

			DERWENT)				
L91	113	87 AND (76 77 78 79 80 81 82 83 84 85 86)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 03:54 PM
L92	10	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if) AND (summary graph chart) WITH (statistic percentage ratio probability) WITH (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:02 PM
L94	41	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:10 PM
L95	17	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:12 PM
L96	32	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:32 PM

		picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)					
L97	22	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck) AND (feedback reaction response) SAME ("hidden context" intention "motion plan" awareness)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:39 PM
L98	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:48 PM
L99	0	("2020/0239026").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/06/28 04:49 PM
L100	35	(Artificial Intelligence) More Like: US-20200239026-A1 Text: (WO-2021231986-A1 OR US-20210356968-A1 OR US-20210357662-A1 OR CN-106030609-A OR US-20210024094-A1 OR US-20200247432-A1 OR WO-2021126062-A1 OR US-20200180647-A1 OR JP-2022523730-A OR US-20210024090-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/28 04:49 PM

		A1 OR EP-3918590-A1 OR WO-2020160276-A1 OR JP-2021506046-A OR EP-3701418-A1 OR WO-2019112912-A1 OR US-10402687-B2 OR US-20190012574-A1 OR US-11126889-B2 OR US-20200293822-A1 OR US-20200249677-A1).did.					
L101	1	16/777386.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/06/28 04:55 PM
L102	1	("2020/0241545").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/06/28 04:56 PM
L103	34	(Artificial Intelligence) More Like: US-11157784-B2 Text: (WO-2021231986-A1 OR KR-102328732-B1 OR JP-6857371-B2 OR EP-3906537-A1 OR JP-2019505034-A OR EP-3863904-A2 OR US-20210370980-A1 OR JP-7072763-B2 OR EP-3906541-A1 OR CN-112888612-A OR US-20210356968-A1 OR JP-2020513617-A OR US-20210357662-A1 OR EP-3957091-A1 OR CN-112868022-A OR US-20200356828-A1 OR JP-6684346-B2 OR JP-2020144853-A OR EP-3837633-A2 OR US-20210339772-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/28 04:56 PM
L104	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L105	131	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L106	15257	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L107	7065	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

L108	3217	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L109	13482	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L110	1502	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L111	32376	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L112	19828	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L113	28593	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L114	96609	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L115	87	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L116	64	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L117	131	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L118	0	L13 AND L14	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/23

			EPO; JPO; DERWENT)				04:40 PM
L119	15257	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L120	7065	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L121	3217	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L122	13482	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L123	1502	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L124	32376	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L125	19828	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L126	28593	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L127	96609	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L128	56	L13 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L129	1	("10841563").URPN.	(USPAT)	OR	ON	ON	2022/07/23 04:40 PM
L130	2	("20140152839").PN. OR ("10841563").URPN.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/07/23 04:40 PM
L131	0	L12 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L132	811	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

L133	5	L29 AND L14	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L134	330	L29 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L135	130	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L136	2087	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" AND (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L137	918	L33 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L138	894	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND "machine learning" SAME (predict$5 probabilit$5) SAME (pedestrian bicyclist vehicle) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L139	390	L35 AND (L16 L17 L18 L19 L20 L21 L22 L23 L24)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L140	1	15/833715.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

L141	2	16/428810.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L142	2	15/812645.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L143	2	"10730531".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L144	4	"10216189".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L145	331	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5)	(US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L146	15257	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L147	7065	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L148	3217	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L149	13482	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L150	1502	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L151	32376	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L152	19828	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO;	OR	ON	ON	2022/07/23 04:40 PM

			DERWENT)				
L153	28593	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L154	96609	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L155	243	L42 AND (L43 L44 L45 L46 L47 L48 L49 L50 L51)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L156	2	15/624014.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L157	1	15/407248.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L158	1	15/144773.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L159	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L160	2	"20200193829".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L161	2	"20170318360".pn.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L162	2	(mind mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) AND (L57 L58)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L163	112	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind	(US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

		mental task objective errand purpose business reason$3 shopping accomplish$5 aware$5 awake notice attention goal) WITH context					
L164	15257	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L165	7065	B60W40/09.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L166	3217	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L167	13482	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L168	1502	(B60W2554/40 B60W2554/402 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L169	32376	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L170	19828	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L171	28593	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L172	96609	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L173	93	L60 AND (L61 L62 L63 L64 L65 L66 L67 L68 L69)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L174	112	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

		people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context					
L175	93	L71 AND (L61 L62 L63 L64 L65 L66 L67 L68 L69)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L176	18	("0000002" OR "0016777" OR "20110210866" OR "20150210280" OR "20160355181" OR "20170131719" OR "20170153639" OR "20170329332" OR "20180374359" OR "20190107840" OR "20190122037" OR "20190187720" OR "20190359205" OR "20200167954" OR "202147039120" OR "7269516" OR "8175333" OR "9415777" OR "9766336").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/07/23 04:40 PM
L177	26	"Perceptive Automata".as.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L178	131	Samuel NEAR3 Anthony.inv.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L179	15257	(B60W30/09 B60W30/095 B60W30/0956).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L180	11376	(B60W40/02 B60W40/09).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L181	3217	(B60W60/0015 B60W60/0027 B60W60/00274 B60W60/00276).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L182	1012	B60W2300/36.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L183	13482	(B60W2420/42 B60W2420/52).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

L184	2125	(B60W2554/40 B60W2554/402 B60W2554/4029 B60W2554/4045 B60W2554/4047).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L185	1231	B60Y2400/81.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L186	32376	(G05D1/0088 G05D1/0214 G05D1/0221 G05D1/0231).cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L187	19828	G05D2201/0213.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L188	28593	G06N7/005.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L189	96609	G06N20/00.cpc.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L190	191	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L191	1	87 AND 73	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L192	3	87 AND 74	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L193	9	87 AND 75	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L194	118	87 AND (76 77 78 79 80 81 82 83 84 85 86)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L195	10	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) WITH (imag$3 video$9 picture) WITH (scene scenario situation what-if) AND (summary graph chart) WITH (statistic percentage ratio probability) WITH	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

		(feedback reaction response)					
L196	41	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L197	17	train$3 SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L198	32	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L199	22	(train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM

		SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck) AND (feedback reaction response) SAME ("hidden context" intention "motion plan" awareness)					
L200	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L201	0	("2020/0239026").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/07/23 04:40 PM
L202	39	(Artificial Intelligence) More Like: US-20200239026-A1 Text: (WO-2020160276-A1 OR EP-3918590-A1 OR US-20200241545-A1 OR KR-20210118912-A OR JP-2022523730-A OR WO-2021231985-A1 OR US-20210354730-A1 OR US-20200247432-A1 OR US-20200180647-A1 OR US-20200249677-A1 OR US-20210024090-A1 OR US-20210024094-A1 OR WO-2021231986-A1 OR US-20210356968-A1 OR US-20210357662-A1 OR US-20210110203-A1 OR US-20190340465-A1 OR US-10614344-B2 OR US-10627818-B2 OR WO-2018162521-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/23 04:40 PM
L203	1	16/777386.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:40 PM
L204	2	("2020/0241545").urpn.	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/23

		AND (PGPB | USPT | USOC).dbnm.	USOCR)				04:40 PM
L205	40	(Artificial Intelligence) More Like: US-11157784-B2 Text: (US-20200356828-A1 OR CN-111907527-A OR CN-112868022-A OR WO-2021133832-A1 OR US-20200247432-A1 OR US-20210024094-A1 OR US-20200180647-A1 OR US-11023749-B2 OR US-20210004611-A1 OR US-20210070286-A1 OR US-11077850-B2 OR JP-2022523730-A OR US-11320827-B2 OR US-20200241545-A1 OR CN-108974009-B OR US-20220026913-A1 OR US-20200363800-A1 OR EP-3918590-A1 OR CN-110244701-A OR WO-2020160276-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/23 04:40 PM
L206	1	16/777673.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 04:59 PM
L207	1	206 AND direction NEAR9 "motion vector"	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 05:00 PM
L208	1	206 AND state NEAR3 mind	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 05:02 PM
L209	1	206 AND degree NEAR3 awareness	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 05:02 PM
L213	752	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND (imag$3 video$9) WITH ("traffic entities" pedestrian vehicle bicycl$5) SAME machine NEAR3 (learning learned) AND (human person people) WITH (response expect$9 intuition experience feedback)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 05:58 PM

L214	683	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND (imag$3 "point cloud") WITH ("traffic entities" pedestrian vehicle bicycl$5) SAME machine NEAR3 (learning learned) AND (human person people) WITH (response expect$9 intuition experience feedback)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:22 PM
L215	0	214 AND 177	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:23 PM
L216	8	214 AND 178	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:23 PM
L217	427	214 AND (179 180 181 182 183 184 185 186 187 188 189)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:25 PM
L218	27	198 AND (179 180 181 182 183 184 185 186 187 188 189)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:31 PM
L219	21	199 AND (179 180 181 182 183 184 185 186 187 188 189)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:35 PM
L220	85	(autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND (imag$3 "point cloud") AND ("traffic entities" pedestrian vehicle bicycl$5) WITH machine NEAR3 (learning learned) WITH (human person people) WITH (response expect$9 intuition experience feedback)	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:40 PM
L221	1	16/777386.app.	(US-PGPUB; USPAT; EPO; JPO; DERWENT)	OR	ON	ON	2022/07/23 06:45 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N73	2	((autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND ("machine learning" "neural network" "artificial	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/24 03:16 PM

		intelligence") SAME (predict$5 probabilit$5 expect$5) SAME (pedestrian bicyclist vehicle "traffic entity") SAME (reach$3 move motion vector trajectory) AND (human person people user) SAME (intuition experience feedback) SAME (scenario environment situation$5) AND (mind mental task objective errand purpose business reason$3 accomplish$5 aware$5 awake notice attention goal) WITH context).clm.					
N78	0	((train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 04:32 PM
N79	0	((train$3 model) SAME ("machine learning" "machine learned") SAME (feedback reaction response) SAME (imag$3 video$9 picture) SAME (scene scenario situation what-if traffic) AND (summary graph chart) SAME (statistic percentage ratio probability) SAME (feedback reaction response) AND (autonomous driverless self-driving) NEAR9 (vehicle automobile truck) AND (feedback reaction response)	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/28 04:41 PM

		SAME ("hidden context" intention "motion plan" awareness)).clm.					
N83	4	((autonomous driverless self-driving) NEAR9 (vehicle car automobile) AND (imag$3 "point cloud") AND ("traffic entities" pedestrian vehicle bicycl$5) WITH machine NEAR3 (learning learned) WITH (human person people user) WITH (response expect$9 intuition experience feedback)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/07/23 06:46 PM

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Courtesy Reminder for
Application Serial No: 16/777,673

Attorney Docket No: 35447-45618/US
Customer Number: 758
Date of Electronic Notification: 08/03/2022

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
PTOC@Fenwick.com

To view your correspondence online or update your email addresses, please visit us anytime at **https://ppair-my.uspto.gov/pair/PrivatePair.**
If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

758 7590 08/03/2022

FENWICK & WEST LLP
SILICON VALLEY CENTER
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MOUNTAIN VIEW, CA 94041

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Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	01/30/2020	Samuel English Anthony	35447-45618/US	9420

TITLE OF INVENTION: NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	11/03/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
WEBER, TAMARA L	3667	701-025000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Fenwick & West LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE OR COUNTRY)
Perceptive Automata, Inc.	Boston, MA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

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☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 192555

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Rajendra Panwar/ Date 11/2/2022

Typed or printed name Rajendra B. Panwar Registration No. 63,165

TESLA EXHIBIT 1002, Page 299

Electronic Patent Application Fee Transmittal

Application Number:	16777673
Filing Date:	30-Jan-2020
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Filer:	Rajendra Bhagwatisingh Panwar/Kristi Brown
Attorney Docket Number:	35447-45618/US

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	600	600

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**600**

Electronic Acknowledgement Receipt

EFS ID:	46941751
Application Number:	16777673
International Application Number:	
Confirmation Number:	9420
Title of Invention:	NAVIGATING AUTONOMOUS VEHICLES BASED ON MODULATION OF A WORLD MODEL REPRESENTING TRAFFIC ENTITIES
First Named Inventor/Applicant Name:	Samuel English Anthony
Customer Number:	758
Filer:	Rajendra Bhagwatisingh Panwar
Filer Authorized By:	
Attorney Docket Number:	35447-45618/US
Receipt Date:	02-NOV-2022
Filing Date:	30-JAN-2020
Time Stamp:	12:14:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$600
RAM confirmation Number	E2022A2C15094143
Deposit Account	192555
Authorized User	Rajendra Panwar

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	45618_US_Issue_Fee_Transmittal.pdf	175556 569cc2f11bd3b17dccf5be32bb87d2f2a646582b	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38312 195ded26c720c7e526b7025165d516374ee8d2b2	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	213868		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/777,673	12/06/2022	11520346	35447-45618/US	9420

758 7590 11/16/2022

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MOUNTAIN VIEW, CA 94041

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 61 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Samuel English Anthony, Somerville, MA;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Perceptive Automata, Inc., Boston, MA

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