

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.

Petitioner,

v.

INTELLECTUAL VENTURES II LLC

Patent Owner.

Case No. IPR2025-00342
U.S. Patent No. 7,336,805

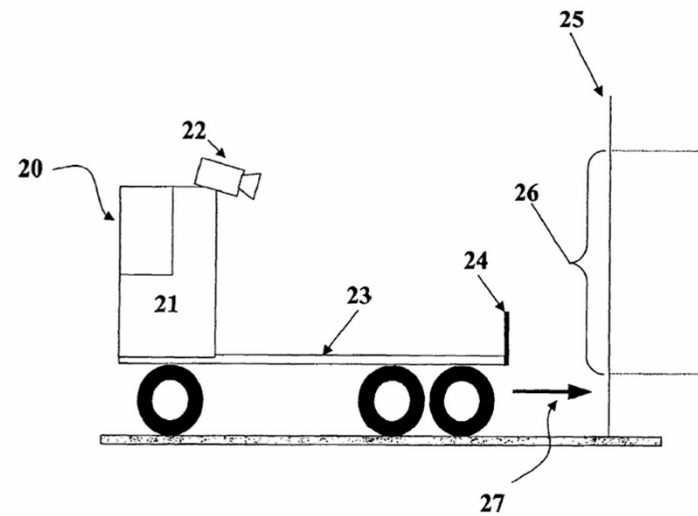


Figure 2

Patent Owner Demonstratives

"DEMONSTRATIVE EXHIBIT - NOT EVIDENCE"

Independent Claim

[1.0] A method for assisting guidance of a motor vehicle on the basis of image data, the method comprising:

[1.1] acquired1 image data using an imaging sensor from a surrounding field of the motor vehicle;

[1.2] extracting from the acquired image data positional parameters of at least one potential destination relative to the motor vehicle; and

[1.3] calculating at least one trajectory describing an optimized travel path using the positional parameters so as to assist a subsequent vehicle guidance for at least one of the potential destinations,

[1.4] wherein the extracting includes:

[1.4.0] performing an edge detection and edge segmentation on the image data so as to break down the image data into a plurality of edge segments and storing interrelationships of the plurality of edge segments in a mathematical tree structure;

[1.4.1] analyzing the plurality of edge segments for the presence of a geometric object associated with a geometrical form that may at least partially describe a potential destination so as to identify one or more potential geometric objects;

[1.4.2] analyzing the one or more potential geometric objects for plausibility using a matching algorithm so as to identify one or more plausible objects;

[1.4.3] performing an additional acceptance analysis so as to identify at least one accepted object, the additional acceptance analysis including analyzing a shape of the image formation of each object in the image data based on knowledge of at least one imaging property of the imaging sensor relative to the surrounding field; and

[1.4.4] storing at least one accepted object that corresponds to a most proximate destination together with corresponding relative positional data in an object list.

Dependent Claim in Dispute

2. The method as recited in claim 1, further comprising processing the mathematical tree structure using a tree traversal algorithm.

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The Issues Before the Board Today

- Does Petitioner actually prove claim 1's staged workflow, or does it just subdivide Broggi's single vehicle-box routine into multiple supposed claim steps?
- Does Petitioner identify a true additional acceptance analysis after the earlier analyzing steps, or only Broggi's top-of-box search and distance refinement within the same detection process?
- Does Petitioner's reading of the "extracting" limitation render the earlier steps of edge detection, tree storage, geometric-object analysis, and plausibility analysis effectively irrelevant to the claimed output?
- Has Petitioner shown the claimed mathematical tree structure actually being stored, traversed, and then used in the required downstream workflow, including claim 2's traversal requirement?
- Has Petitioner shown optimized path computation to an accepted destination object, or only reactive steering updates to follow Broggi's moving lead vehicle?
- Should the IPR have been instituted in light of *Revvo & Tesla*?

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Claim Construction

"DEMONSTRATIVE EXHIBIT - NOT EVIDENCE"

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“performing an additional acceptance analysis”

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“Additional Acceptance Analysis” was Critical to Allowance

Allowable Subject Matter

Reasons of Allowance:

1. Claims 1-19 are allowed.

The following is an examiner's statement of reasons of allowance:

Both the instant invention and the closest prior art Ninomiya et al., U.S. Patent No. 5,220,508 are directed to vehicle guidance using image analysis and image processing which further includes extracting from the acquired image data positional parameters of at least one potential destination relative to the motor vehicle. However, in the instant invention the extracting of the parameters further includes edge detection and segmentation on the image data along with performing an additional acceptance analysis so as to identify at least one accepted object, the additional acceptance analysis including analyzing a shape of the image formation of each object in the image data based on the knowledge of at least one imaging property of the imaging sensor relative to the surrounding field and storing at least one accepted object that corresponds to a most proximate destination together with corresponding relative positional data in an object list in combination with other limitations in claims 1 and 13, which is not taught by the prior art of record. Therefore claims 1 and 13 are allowed. All other claims depending on claims 1 and 13 are allowable at least by dependency on claims 1 and 13.

EX1002, 341

53. Technically, Ninomiya's pipeline proceeds as follows. A camera image is acquired; an edge-segment extracting block computes edge primitives and outputs a list of short edge segments; a clustering circuit groups colinear segments to form longer edge segments; a selecting circuit chooses which longer edge segments correspond to stored guide signs using an evaluation function based on distance to the forecast guide-sign position, total segment length, and multi-sign matching consistency; a position/heading calculating block transforms the selected edge(s) into the appropriate coordinate frames and computes vehicle pose; and an integrating block fuses pose with wheel-odometry for travel control (EX2009, 10:55–68; 11:1–16; 13:41–67; 14:1–13; 14:60–67; 15:1–18; 16:1–13).

13. As Dr. Majumder explains,

EX12010, 23

this architecture proceeds from matching/selection directly to pose computation and optional, global calibration; it does not disclose a distinct, downstream additional acceptance analysis that analyzes “the shape of the image formation” of each already-plausible object using knowledge of the imaging sensor relative to the surrounding field (e.g., camera height/tilt, horizon/vanishing-line geometry, perspective distortion). EX2010, ¶59

These points align with the examiner's allowance rationale distinguishing the

'805 patent's pipeline from prior art approaches like Ninomiya: Ninomiya performs image analysis to support guidance, but it does not teach the claimed additional acceptance analysis based on imaging-sensor properties nor a subsequent computation of an optimized trajectory to an accepted destination object.

POR, 7

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The Specification Confirms the importance of “additional acceptance analysis”

SUMMARY OF THE INVENTION

15 An object of the present invention is to provide a method for assisting vehicle guidance on the basis of image data, particularly when maneuvering trucks toward docking stations, as well as to provide a device suited for implementing the method, which functions without the need for affixing
20 specific visual signatures at the destination.

The present invention provides a method for assisting guidance of a motor vehicle on the basis of image data, particularly when maneuvering trucks toward docking stations, in which image data are acquired by an imaging sensor from the surrounding field of the motor vehicle; from the acquired image data, the positional parameters of at least one potential destination relative to the motor vehicle being extracted, and, as a consequence thereof, a trajectory describing an optimized travel path being calculated in order to assist a subsequent vehicle guidance for at least one of the potential destinations. According to the method, to extract the relative positional parameters of the at least one potential destination, the image data undergo an edge detection and edge segmentation, in order to break down the image data into individual edge segments, whose interrelationships are stored in a mathematical tree structure. Subsequently, these edge segments are then analyzed to check for the presence of a geometric object that is similar to a geometric form which, typically, at least partially describes a potential destination. The detected geometric objects that correspond to the typical geometric form are analyzed for plausibility using a matching algorithm. These plausible objects undergo an additional acceptance analysis to the effect that, based on the knowledge of the imaging properties of the imaging sensor in relation to its surrounding field, the shape of the image formation of the objects in the image data is analyzed. In addition, at least that object which is accepted in this manner and which corresponds to the most proximate destination is stored, along with the corresponding relative positional data, in an object list, and, to this end, at least one trajectory describing an optimized travel path is computed.

EX1001, 2:15-52

In the system according to the present invention for assisting a motor vehicle guidance on the basis of image data, in particular for maneuvering trucks toward docking stations, including a method and a device suited for implementing this method, image data are acquired by an imaging sensor from the surrounding field of a vehicle and, from these data, the positional parameters of at least one potential destination relative to the motor vehicle are extracted. This results in the calculation of a trajectory describing an optimized travel path in order to assist a subsequent vehicle guidance for at least one of the potential destinations. In this connection, along the lines of the present invention, to extract the relative positional parameters of the at least one potential destination, the image data undergo an edge detection and edge segmentation. To that end, the image data are broken down into individual edge segments, and their interrelationships are stored in a mathematical tree structure. In a subsequent step, these edge segments are then analyzed to check for the presence of a geometric object that is similar to a geometric form which, typically, at least partially describes a potential destination. If the typical destination is a docking station for trucks at a warehouse, for example, then the typical geometric form substantially corresponds to a rectangle having roughly identical side lengths of approximately 2.5 m. Within the framework of the inventive method, the detected geometric objects that correspond to the typical geometric form are then analyzed for plausibility using a matching algorithm, these objects, which are classified as plausible, undergoing an additional acceptance analysis to the effect that, based on the knowledge of the imaging properties of the imaging sensor in relation to its surrounding field, the shape of the image formation of the objects in the image data is analyzed (thus, an image of a typical rectangular geometric form viewed from an elevated location is formed in the image data as a trapezoid that tapers toward the top). In a final method step, at least that object which is determined within the scope of the acceptance analysis and which corresponds to the most proximate destination is stored, along with the corresponding relative positional data, in an object list, and, to this end, at least one trajectory describing an optimized travel path is computed.

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The objects, which are scaled and oriented (rotated) in comparator unit (13) by the matching algorithm, subsequently undergo a further acceptance analysis in unit (15). In one especially advantageous type of acceptance analysis, in those cases in which the surrounding field is recorded by the sensor from an elevated position, those objects which do not exhibit any distorted images, as compared to their usual geometric shapes, are rejected as potential destinations. For example, the distortion of rectangular or square geometric shapes of potential destinations is manifested as a trapezoid in an image formation. In another effective type of acceptance analysis, based on knowledge of the customary position of destinations, objects not corresponding to these specifications in the image data are rejected. For example, if an object is included in the image data whose position relative to the imaging sensor is known, then, on the basis of its image formation in the image data, an artificial horizon may be generated, on whose basis the relative position of the recognized objects is ascertained. In this manner, objects, whose position deviates from the usual position of the destination, are excluded from the further processing.

EX1001, 5:62-615

EX1001, 3:23:63

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Dr. Majumder Confirms That Additional Is Linked To The '805's Pipeline

It's a matching, Mr. Webb. At the end of the day you are trying to match from image whether this image is -- really, see the intent of the whole metric is to match whatever I'm seeing in the image, is it actually the destination I should go for.

And, of course, in this intent there has to be some accuracy. If I'm going and ultimately choosing arbitrary destination, then this method is not a good right one.

So the intent tells you that each step I am kind of taking a bunch of objects, applying a criteria, seeing whether it matches and then throwing it away some of which didn't match. Go to the next step. Now I have a second criteria. Let me see which one of these match the second criteria. Throw something out. Go to the third. See what is if you have more criteria.

So if you are going through this pipeline like a sieve, filtering so you get to the right answer, that additional tells you everything, that it really doesn't make any sense to go back to the original set of objects you have identified. Because some of them are already not conforming to some of the criteria, all of which should match for your designation.

EX1073, 91:1-92:8

"DEMONSTRATIVE EXHIBIT - NOT EVIDENCE"

Q. Great. So we were talking about additional acceptance analysis in limitation 1.4.3 and if that limitation does not explicitly refer to one or more plausible objects, but cites each object in the image data, what conveys to a person of ordinary skill? The part that the additional acceptance analysis is performed on only one or more plausible objects?

A. I think additional acceptance only talks about the ones which have already been accepted as plausible objects. Otherwise, there would not be the term "additional". Because all of these are kind of going through the process and you can see that the whole purpose of this pipeline is to elimination.

You can start with 10 objects which are matching the destination, and as you are going down the pipeline, you are sieving. So if my way is to compute the most efficient way of doing this, then why would I go back to something which I've already excluded in the previous pipeline higher up in the pipeline?

So the "additional" basically tells that whatever I have got now, which is the set of candidate destinations, now I have to perform some additional analysis to see if something else can be sieved out.

So that "additional" kind of very clearly states that I'm not going to go back to the beginning where I had ten objects because that's completely -- I have already got other parameters which I have rejected those objects. So whatever has come to be a plausible object, I'm now trying to see even for the restricted based on other things so that I can come to one object, right?

So that "additional" term tells that it cannot be going back to the original list I'm doing.

EX1073, 79:10-81-8 9

“potential destination”

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“Potential Destination” is Fixed Location

SUMMARY OF THE INVENTION

An object of the present invention is to provide a method for assisting vehicle guidance on the basis of image data, particularly when maneuvering trucks toward docking stations, as well as to provide a device suited for implementing the method, which functions without the need for affixing specific visual signatures at the destination.

EX1001 2:15-20

check for the presence of a geometric object that is similar to a geometric form which, typically, at least partially describes a potential destination. If the typical destination is a docking station for trucks at a warehouse, for example, then the typical geometric form substantially corresponds to a rectangle having roughly identical side lengths of approximately 2.5 m. Within the framework of the inventive

EX1001 3:40-47

In this manner, a driver assistance is able to be devised by using the device according to the present invention and on the basis of the method according to the present invention, which computes a trajectory describing an optimized travel path to at least the most proximate destination, based solely on the knowledge of the geometric appearance of the destination, without having to affix specific symbols or markings.

EX1001 3:6-4:4

Thus, the claim language reciting “Potential destination,” refers to a physically fixed and contextually relevant location in the vehicle’s surrounding environment—such as a docking station, cargo bay, or parking spot—that is automatically identified from image data based on geometric features and spatial parameters. As Dr. Majumder explains, the system described in the ‘805 Patent “is able to locate a specific physical location in the vehicle’s environment that the system identifies as a suitable endpoint for the vehicle to approach and stop at, such as a docking station, loading platform, or parking bay.” EX2010, ¶33.

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“A Mathematical Tree Structure”

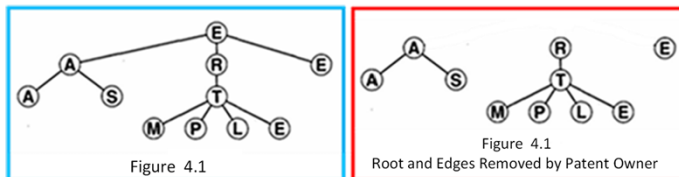
"DEMONSTRATIVE EXHIBIT - NOT EVIDENCE"

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A “Forest” is Not a “Tree”

The patent expressly states the image data are broken into edge segments, “storing interrelationships of the plurality of edge segments in a mathematical tree structure,” and subsequently “these edge segments are then analyzed” to find a geometric object, proceed through a matching stage, and only then perform the additional acceptance analysis, followed by storing the accepted object (EX1001, 3:57–4:22; 4:23–67). The method claims repeat that sequence and even adds claim 2’s directive to process “the mathematical tree structure using a tree traversal algorithm,” which presumes a single connected tree amenable to traversal from a root (EX1001, 8:1–67). The specification’s repeated reference to “a hierarchically organized tree structure” and its pointer to Sedgewick are not casual; they teach the kind of single, connected representation a person of skill would build so that the interrelationships of the plurality can be traversed and tested as a unit in the very next step (EX1001, 3:57–4:22; 4:23–67).

POR, 22



EX2006, 36-37.

Petitioner’s “tree/forest” theory fails on the claim language, the specification’s functional role for the tree, Sedgewick’s definitions, and the record evidence. The claims require “identifying a plurality of edge segments and storing interrelationships of the plurality of edge segments in a mathematical tree structure,” after which “these edge segments are then analyzed” for destination-describing geometric forms, subjected to a plausibility matching stage, and only then sent through an additional acceptance analysis before storage and trajectory computation. EX1001, 6:31–7:22; 8:30–50; 9:3–25. The grammar ties “the plurality” whose interrelationships are stored to “these edge segments” that are later analyzed, indicating a single structure that encodes the interrelationships of that plurality as a set and can be traversed “subsequently” as a unit. EX1001, 6:31–7:22. The specification explains why: the inventors chose a “hierarchically organized tree structure” so that the system can traverse the one hierarchy and evaluate relations such as parallelism and orthogonality to assemble higher-order shapes (e.g., rectangles) that may represent destinations. EX1001, 4:42–64; 5:8–18. Splitting the plurality across disconnected trees would defeat that purpose, because there is no path structure connecting segments in different components and thus no way to encode or traverse their interrelationships in one pass.

POR, 47

“DEMONSTRATIVE EXHIBIT - NOT EVIDENCE”

89. The specification tells the reader why a tree is chosen: to enable hierarchical search by traversal over the interrelationships (parallelism, orthogonality, adjacency) so that higher-order shapes (e.g., rectangles) can be assembled from lower-level edge primitives in a principled way (EX1001, 4:42–51; 4:51–64; 5:8–18). That goal requires connectivity. If relevant edges are split across disconnected trees, there is no single structure encoding their mutual relations, and the very next “analyzing” step cannot traverse paths that do not exist.

EX2010, 89

91. That distinction matters here because the claim speaks to what is stored—“interrelationships of the plurality of edge segments in a mathematical tree structure”—and the very next limitation uses those stored relations to analyze for geometric objects (EX1001, 3:57–63; 4:1–22; 8:1–26). A forest, by definition, contains components between which no paths exist; it cannot encode interrelationships among segments in different trees. Reading “structure” to include a forest would force the next step either to ignore relations across trees (losing information the patent relies on) or to manufacture parent-child pointers that reflect the encoding, not the actual interrelationships among the plurality the patent says are stored and then traversed (EX1001, 4:42–64; 5:8–18).

EX2010, 91

Ground 1: Broggi, Huttenlocher, and Brady

- Claims 1-2, 9-10

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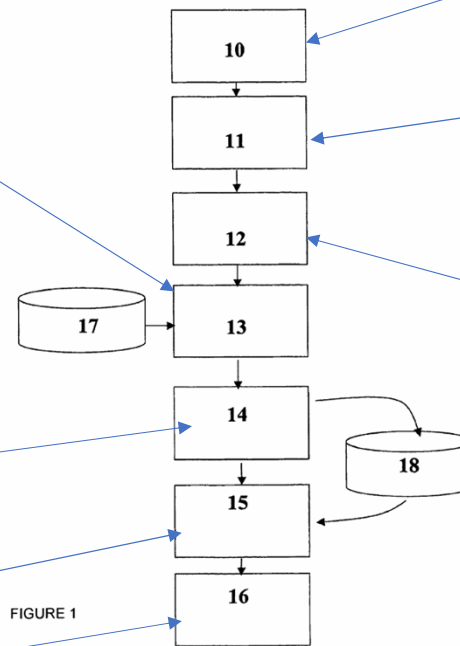
Claim 1 requires a staged workflow, and the intrinsic record shows that workflow

The geometric objects pieced together by the tree traversal algorithm, in connection with the rules derived from the geometric shape of the destination, undergo an additional acceptance analysis. In this connection, the image data are compared in a comparator unit (13), with the aid of a matching algorithm, to object patterns describing the destination stored in a memory (17). As a matching algorithm, the IPC algorithm (Besl, P. J., McKay, N. D., *A Method for Registration of 3-D Shapes*, IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 14, no. 2, 1992, pp. 224-231) is particularly advantageously suited. The iterative IPC algorithm makes it possible for the objects determined with the aid of the tree transversal algorithm to be scaled and rotated in a way that minimizes the quadratic error with respect to the object's deviation from the ideal object pattern of the destination. The distance to the potential destination is also able to be easily estimated from the parameters resulting from the scaling and orientation (in particular rotation). At this point, the iterative sequence of the IPC algorithm is briefly explained by way of example:

EX1001, 5:19-38

detector and segmenter is a unit (12) for locating objects in the image data that have geometric shapes that typically correspond at least partially to the potential destination. In addition, the image-processing unit includes a comparator unit (13) for analyzing the detected geometric objects which correspond to the typical geometric form, to check for plausibility using a matching algorithm for making a comparison with object patterns stored in a memory unit (17). A unit for acceptance analysis (14) is provided, which, based on the comparison of selected geometric objects, analyzes the shape of the image formation of the objects in the image data, based on the knowledge of the imaging properties of the imaging sensor in relation to its surrounding field. The device communicates with a data memory (18) in which at least that geometric object detected in the image data which corresponds to the most proximate destination is stored, along with the corresponding relative positional data, in an object list, and then transfers these data to a processing unit (15) communicating herewith to calculate a trajectory describing an optimized travel path, this processing unit making these data available to a subsequent driver assistance system (16).

EX1001, 3:1-22



EX1001, Fig. 1

The image data generated by image sensor (10) are further processed in an image-processing unit (11), this unit including, in particular, an edge detector and segmenter, with whose assistance the image data are processed in such a way that, at least for one potential destination, the relative positional parameters are able to be extracted from the image data. In this context, based on the knowledge of their position and location, the extracted edges and segments are able to be advantageously stored in a hierarchically organized tree structure in the image data. Many different proven methods for creating and organizing such a hierarchical tree structure are available to one skilled in the art; reference is made here exemplarily to the comprehensive compilation and discussion of widely varying tree structures by Robert Sedgewick (R. Sedgewick, *Algorithms in C*, Chapter 4, Addison-Wesley Pub. Comp. Inc., 1990). Based on the knowledge of the geometric appearance of a destination, this hierarchical tree structure may, at this point, be processed in a unit (12) downstream from the image-processing unit (11), in order to find geometric shapes that typically correspond to the potential destination. This investigation to check for the existence of a geometric object in the image data that typically corresponds to a potential destination is performed on the basis of the hierarchical tree structure, to this end, a tree traversal algorithm known from the related art being able to be effectively used. In the case of a tree traversal algorithm, the individual branches are systematically processed, beginning with the start nodes of the tree (R. Sedgewick, *Algorithms in C*, Chapter 5.6, Addison-Wesley Pub. Comp. Inc., 1998). In this connection, based on the knowledge of the typical geometric shape of a destination, the edges and segments stored in parameters in the branches

EX1001, 4:36-67

Q. What is Figure 1 depicting?

A. They are depicting the pipeline.

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EX1073, 99:6-7

Dr. Majumder Confirms How the '805's Pipeline Works

Q. Okay. Let me stop you there. Can you explain as a person of ordinary skill in the art what that passage means that you just read?

A. So it means that connected downstream of the edge detector and segmenter is a unit. Downstream means it is also expressed in the picture, right, that it is taking its input from 11, number one, right, for locating object's geometric data.

So it will locate in the image data whose shapes are typically similar or at least partially similar to the potential destination.

So, for example, if I'm looking for a rectangular destination, I would look for objects with rectangular shape or at least square shape or partially rectangle shape, but anything that doesn't have corners, like a circle, would be rejected.

EX1073, 100:15-101:12

the destinations. The image-processing unit (11) includes an edge detector and segmenter which extracts the relative positional parameters of the at least one potential destination from the image data. Connected downstream of the edge detector and segmenter is a unit (12) for locating objects in the image data that have geometric shapes that typically correspond at least partially to the potential destination. In addition, the image-processing unit includes a comparator unit (13) for analyzing the detected geometric objects which correspond to the typical geometric form, to check for plausibility using a matching algorithm for making a comparison with object patterns stored in a memory unit (17). A

EX1001, 2:64-3:8

Q. Okay. Same question. Can you explain as a person of ordinary skill in the art what that passage teaches you?

A. So the detected geometric unit which meet the criteria of typical geometric form in 12, again the image shows an output from 12 to 13, it will check that, it will check that, it will check which of these objects stored are actually matching to the, compared to object which is given as a possible destination.

So, for example, suppose I'm looking for rectangle objects and I have both rectangle, squares and anything which has four sides with edges.

Now, if I am looking for an object which is big in size, then I can remove the small object; if I'm looking for object which is square and not rectangle, then I can remove the rectangle. This is the part this one is talking about.

EX1073, 102:1-21

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Dr. Majumder Confirms The Additional Acceptance Is After The Prior Steps

Q. What does that mean to you as a person of ordinary skill in the art?

A. I have identified this object which has four sides. And remember when an object is imaged by an imaging sensor, rectangle may not look rectangle, it may be a trapezoid, or if my object is in such a place where this trapezoid would appear at the top of the image.

So now this step what I'm going to do is say my camera properties says if my destination is a rectangle, it would probably appear as a trapezoid and it will probably appear at the top. So if I have trapezoids appearing at the bottom of other places, I can reject them and now I know the top one is the only one I'm looking for.

EX1073, 103:14-104:8

parison with object patterns stored in a memory unit (17). A unit for acceptance analysis (14) is provided, which, based on the comparison of selected geometric objects, analyzes the shape of the image formation of the objects in the image data, based on the knowledge of the imaging properties of the imaging sensor in relation to its surrounding field. The device communicates with a data memory (18) in which at least that geometric object detected in the image data which corresponds to the most proximate destination is stored, along with the corresponding relative positional data, in an object list, and then transfers these data to a processing unit (15) communicating herewith to calculate a trajectory describing an optimized travel path, this processing unit making these data available to a subsequent driver assistance system (16).

EX1001, 3:8-13

The objects, which are scaled and oriented (rotated) in comparator unit (13) by the matching algorithm, subsequently undergo a further acceptance analysis in unit (15). In one especially advantageous type of acceptance analysis, in those cases in which the surrounding field is recorded by the sensor from an elevated position, those objects which do not exhibit any distorted images, as compared to their usual geometric shapes, are rejected as potential destinations. For

EX1001, 5:62-6:2

"DEMONSTRATIVE EXHIBIT - NOT EVIDENCE"

Q. Okay. Can you explain as a person of ordinary skill in the art what that passage means?

A. This means that whenever you are imaging an object, if you take a head-on image, the shape of the object is mostly retained, but if you are imaging it say, for example, from the top or from the side, then you have something what we call perspective projection and other kind of image properties which can lead to a change in the shape.

So here what it is telling, that even though my geometric objects could have conformed to the original geometric shapes, here I'm checking that the image from above, does it conform to how the image of such a destination would appear given that I know the position and orientation of the image sensor.

And if it does not conform to that, I can reject those objects.

EX1073, 106:12-107:11

Broggi Doesn't Teach the Pipeline

The Petition's own citations show it mapping limitation [1.4.1] and [1.4.3] to the same bounding-box detection routine in Broggi, rather than to distinct, sequential stages as the claim and specification require. For [1.4.1] ("analyzing the plurality of edge segments for the presence of a geometric object ... so as to identify one or more potential geometric objects"), the Petition relies on Broggi's two-step box routine—first "determining 'two corners representing the bottom of the bounding box around the vehicle'" and then "detecting 'the top part of the bounding box, which is looked for in a specific region whose location is again determined by perspective and size constraints'"—as the analysis that identifies the candidate object (Petition, 43–44).

It then uses the very same top-of-box search, in the same detection sequence and in the same cited pages of Broggi, to satisfy [1.4.3] ("performing an additional acceptance analysis ... including analyzing a shape of the image formation ... based on knowledge of at least one imaging property ..."), asserting that "detecting the top part of the bounding box" includes the claimed acceptance analysis because that top is "looked for in a specific region whose location is ... determined by perspective and size constraints," and tying it to Broggi's subsequent "distance refinement" step (Petition, 50–51).

POR, 35

Ex.1003, ¶¶110-113. For example, as discussed in [1.2] and [1.4.0], Broggi performs bounding box detection by (1) determining "two corners representing the bottom of the bounding box around the vehicle" and (2) detecting "the top part of the bounding box, which is looked for in a specific region whose location is again determined by perspective and size constraints." Ex.1005, 171. Accordingly, Broggi analyzes the image data for the presence of a geometric object (bottom corners of a preceding vehicle) associated with a geometrical form (shape associated with bottom corners of a preceding vehicle) that may at least partially describe a potential destination (location of the preceding vehicle) so as to identify one or more potential geometric objects (potential bottom of the bounding box), but does not explicitly disclose that a plurality of edge segments are being analyzed for this purpose. Ex.1005, 171. Broggi explains that for vehicle bounding box

Petition, 43

box[.]” Ex.1005, 171. This identification of the “top part of the bounding box” is an additional acceptance analysis because it is an additional analysis step of Broggi’s vehicle detection that confirms the relevant portion of the image includes the top of the preceding vehicle associated with the previously detected bottom corners, which completes the bounding box. See Ex.1005, 170; Ex.1003, ¶119.

Petition, 49

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Dr. Majumder Confirms How Broggi Works

113. The Petition's own mapping shows it collapsing those distinct steps into one detection flow. For [1.4.1], it points to Broggi's two-step vehicle bounding-box detector—first locating the bottom corners, then searching for the top of the box in a constrained region “determined by perspective and size constraints”—and treats that as the analysis that “identifies” the candidate object (Petition, 43–44). For [1.4.3], it reuses the very same “top-of-box” search in the same sequence and pages and relabels it the claimed acceptance analysis, arguing that looking for the top in a perspective/size-defined region is “based on imaging properties,” and then folds in Broggi's distance refinement (Petition, 50–51). In other words, the same top-of-box heuristic is asked to do double duty as both the identification step and the acceptance step.

EX2010, 113

Q. In the last sentence of paragraph 113 it states that the same top-of-box heuristic is asked to do double duty as both the identification step and the acceptance step.

A. Uh-huh.

Q. What do you mean by that?

A. So if you notice that there are kind of four steps which are identifying different things. Like first one is identifying a geometric object. The next one is identifying shape which is consistent with image formation. And then the acceptance analysis is a separate step. Right?

So all of them have been compressed into one. There is in Broggi, there is only the detection of bottom corners and then there is an idea of the search for the target. So as you see, the target will be done.

So they kind of identify a box where I'm going to search for the target that I am tracking. It is not stationary, it is continuously moving. And then I will have some kind of, you know, property distance refinement to say yes, this is the correct target.

So all these steps have been compressed. There is no pipeline where I am sieving through different things and rejecting.

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EX1073, 95:2-96-15

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How Broggi Works

A. Vehicle Detection Processing Steps

1) Symmetry Detection: In order to search for symmetrical features, the analysis of gray level images is not sufficient. Fig. 8 shows that strong reflections cause irregularities in vehicle symmetry, while uniform areas and background patterns may present highly correlated symmetries. In order to cope

with these problems, also symmetries in other domains are computed.

EX1005, 170-171

2) Bounding Box Detection: After the localization of the symmetry, the symmetrical region in the edge image is checked for the presence of two corners representing the bottom of the bounding box around the vehicle. A traditional pattern matching technique is used. Moreover, perspective constraints as well as size constraints are used to speed-up the search. Fig. 13 shows possible and impossible bottom parts of the bounding box, while Fig. 14 presents the results of the lower corners detection.

This process is followed by the detection of the top part of the bounding box, which is looked for in a specific region whose location is again determined by perspective and size constraints. Fig. 15 shows the search area.

EX1005, 171

3) Backtracking: Sometimes it may happen that in correspondence to the symmetry maximum no correct bounding boxes exist. Therefore, a backtracking approach is used: the symmetry map is again scanned for the next local maximum and a new search for a bounding box is performed. Fig. 16 shows a situation in which the first symmetry maximum, generated by a building, does not lead to a correct bounding box; on the other hand, the second maximum leads to the correct detection of the vehicle.

EX1005, 170-171

4) Distance Refinement: The distance to the leading vehicle is computed with the knowledge of the camera calibration. Unfortunately, it may assume wrong values since it may happen that the lower part of the vehicle is not correctly detected. Sometimes, in fact, the luminance gradient of the region between the rear bumper and the chassis is so high to be misinterpreted as the lower part of the vehicle. In order to refine this measurement, which is of importance for the platooning functionality, an adjustment step is mandatory: it is performed taking advantage of stereo techniques. Starting from the distance value estimated from the left image, a portion of the right image is searched for a pattern similar to the one enclosed into the bounding box.

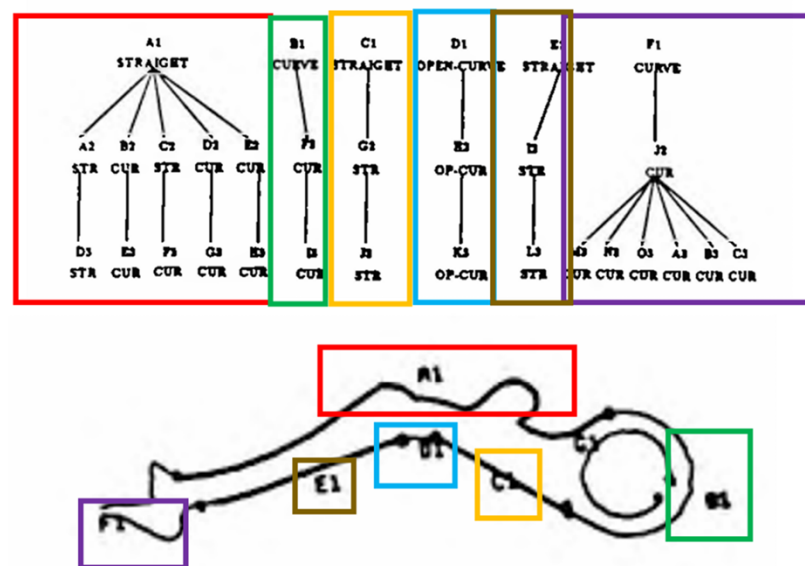
EX1005, 172

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How Huttenlocher Works

Specifically, from Figure 4 it is impossible to extract any information about the relationship between any two nodes. As shown “in Patent Owner’s annotated combined version of Huttenlocher’s Figure 3 (bottom) and Figure 4 (top), Figure 4 does not show the inter-relationships between the edge segments ‘A1 Straight,’ ‘B1 Curve,’ ‘C1 Straight,’ ‘D1 Open Curve,’ ‘E1 Straight,’ and ‘F1 Curve.’” EX2010, ¶167.



POR, 28-29

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Following a Lead Car is Not a Destination

Dr. Majumder provides the following analogy to demonstrate the distinction between the “platooning” taught in Broggi and the Challenged Claims.

“Consider the difference between a person using GPS navigation to drive to a known restaurant versus a person blindly following another car without knowing where it’s going.

In the first scenario, the GPS system calculates a destination-driven, optimized path based on road conditions, distance, and travel time. The driver knows exactly where they’re going, and the system computes a trajectory that actively assists the driver in reaching that specific location in the most efficient way possible. This reflects what is required in the challenged claims: the system must calculate at least one trajectory describing an

optimized travel path using positional parameters specifically to assist vehicle guidance to a destination.

In the second scenario—the one described in Broggi—the driver simply follows the taillights of the car in front, regardless of where that car is headed. There is no understanding of the endpoint, no route optimization, and no calculated guidance to an actual destination. The leader car could be heading to the store, to the mountains, or even circling a parking lot—the follower has no idea. It adapts its path in real-time solely to maintain alignment and distance with the vehicle ahead, not to reach a defined endpoint. This is akin to ARGO’s platooning: it calculates steering corrections based on the preceding car’s movements, but it never plans a path to a known or optimized destination.” EX2010, ¶¶139-141.

POR. 43-44

Broggi’s platooning control does not satisfy limitation [1.3] because the claims require computing “at least one trajectory describing an optimized travel path using the positional parameters of an accepted destination object,” and doing so only after the three-gate pipeline has produced that accepted object. The ‘805 patent sets out that order expressly: identify candidate geometric objects from edge segments, test those candidates for plausibility using a matching algorithm, then perform an additional acceptance analysis based on camera–scene imaging properties, store the accepted destination with corresponding positional data in an object list, and then compute the optimized trajectory for guidance. See EX1001, 6:31–7:22; 7:45–8:34; 8:30–50; 9:3–25. The device description likewise makes clear that the accepted object’s positional data are provided to a processing unit “to calculate a trajectory describing an optimized travel path,” i.e., a planner that consumes the stored parameters of the accepted destination, not a mere reactive steering adjustment. See EX1001, 7:45–8:34; 8:30–50.

POR. 41-42

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In the end, Tesla’s theory reduces “potential destination” to anything the vehicle happens to be heading toward at a given moment. Reply, 14-17, 25-27. But the ‘805 patent claims more than that: a destination selected through the patent’s staged analysis and used as the endpoint for path computation. EX1073, 53:15-54:5; 64:22-65:22; 68:2-14. Broggi’s moving lead vehicle is tracked, not selected and used as a destination in that claimed sense.

Sur-Reply, 23- 24

Tesla Never Explained the Different Claim Constructions

Allowing these proceedings to continue if the district court were to reject Petitioner's indefiniteness theory would only further encourage Petitioners to take inconsistent claim constructions before the institution decision, because doing so would be advantageous to the Petitioner regardless of the district court's ruling, i.e., if, after the institution decision, the district court finds the claim indefinite then the Petitioner has won and the IPR is of no consequence; while, if, after the institution decision, the district court finds the claim is not definite, Petitioner can proceed with the IPR based on a construction that was inconsistent at the time of the Petition. Permitting such gamesmanship will not further the policy of "providing greater predictability and certainty in the patent system. *Revvo*, IPR2025-00632, Paper 20, at 4, *citing*, 83 FR 51342-43. The Board should therefore follow *Revvo* and *Tesla* and vacate the Institution Decision in this case for failing to explain at the outset why inconsistent positions were warranted.

Supplemental POR 5

U.S. Patent 7,336,805			
Claim(s)	Claim Term	IV's Proposed Construction	Tesla's Proposed Construction
1	"may at least partially describe a potential destination"	Plain and ordinary meaning. Not indefinite.	Indefinite
1	"potential geometric objects for plausibility using a matching algorithm so as to identify one or more plausible objects"	Plain and ordinary meaning. Not indefinite.	Indefinite

EX1060, 3.

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Conclusion

- Does Petitioner actually prove claim 1's staged workflow, or does it just subdivide Broggi's single vehicle-box routine into multiple supposed claim steps?
 - Broggi creates a box around a vehicle
- Does Petitioner identify a true additional acceptance analysis after the earlier analyzing steps, or only Broggi's top-of-box search and distance refinement within the same detection process?
 - Broggi does not teach the sieving pipeline of the '805
- Does Petitioner's reading of the "extracting" limitation render the earlier steps of edge detection, tree storage, geometric-object analysis, and plausibility analysis effectively irrelevant to the claimed output?
 - Yes. Petitioner's mapping effectively reads limitation [1.4.3] out of the claims
- Has Petitioner shown the claimed mathematical tree structure actually being stored, traversed, and then used in the required downstream workflow, including claim 2's traversal requirement?
 - A forest is not a tree and can not be traversed using a tree traversal algorithm
- Has Petitioner shown optimized path computation to an accepted destination object, or only reactive steering updates to follow Broggi's moving lead vehicle?
 - Blindly following a lead car is not navigating to a destination
- Should the IPR have been instituted in light of *Revvo & Tesla*?
 - It was Tesla's burden to notify the PTAB that it had taken inconsistent claim construction positions

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