

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSARA, INC.

Petitioner

v.

MOTIVE TECHNOLOGIES, INC.,

Patent Owner.

Case IPR2025-00574

U.S. Patent No. 11,875,580

PATENT OWNER'S PRELIMINARY RESPONSE

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2001	U.S. Patent No. 11,798,187, “Lane detection and distance estimation using single-view geometry” (Oct. 24, 2023)
2002	Provisional Application No. 62/975,360, filed on Feb. 12, 2020
2003	Declaration of Scott Andrews
2004	Declaration of Hector Ribera

Patent Owner Motive Technologies, Inc. (“Patent Owner”) respectfully submits the following Preliminary Response to the petition for *inter partes* review (“Petition”) of claims 1-7 (“Challenged Claims”) of U.S. Patent No. 11,875,580 (“the ‘580 Patent”) filed by Samsara, Inc. (“Samsara” or “Petitioner”). This Preliminary Response is accompanied by the declaration of Mr. Scott Andrews, an expert in Vehicle Information Systems and Vehicle Electrical/Electronics Systems, who testifies regarding technical facts and opinions relied upon in this Preliminary Response. *See* Ex. 2003, ¶¶ 2-10.

I. INTRODUCTION

Institution of Samsara’s Petition should be denied because none of the grounds asserted in the Petition presents a viable combination of references that render claim 1 of the ‘580 Patent obvious. All the grounds rely on an incorrect interpretation of the same primary reference, Choe et al. (Ex. 1005), incorrectly alleging that it teaches the use of “predictive models” to “predict the initial horizon line.” *See e.g.*, Pet. at 27. As shown in this Preliminary Response, Choe does not teach or suggest the use of “predictive models” in “identifying one or more lines in the video ..., the one or more lines including a horizon line” as required by the Challenged Claims. Because Petitioner relies on its incorrect interpretation of Choe as the basis for combining Choe with the other references for all the asserted grounds, the Petition fails to present “a reasonable likelihood that the petitioner

would prevail with respect to at least 1 of the claims challenged in the petition” and it must therefore be denied. *See* 35 U.S.C. § 314 (a).

II. BACKGROUND

A. The '580 Patent

The inventors of the '580 Patent found a problem with prior art automotive systems for detection of objects on the road, which required use of “[m]ultiple cameras or sensors [that] may be installed in a vehicle to detect objects.” Ex. 1001 at 1:10-11.¹ The problem was that “use of multiple cameras” or proximity sensors “such as Radar and Lidar” was too expensive. *Id.* at 1:11-14. They realized that monocular cameras could provide a more cost-effective approach, but their use “require[d] the location of the camera to be predefined or preset.” *Id.* at 14-16.

To address these deficiencies of the prior art, the '580 Patent describes various example embodiments for “using a monocular camera (e.g., an image sensor) that may be retrofitted and adjustable within the vehicle such as, the

¹ Because Petitioner has largely failed to comply with the pagination numbering requirement of 37 CFR 42.63(d)(2), Patent Owner in this Preliminary Response, when citing to Petitioner’s exhibits has used references to column and line numbers for patents, paragraph numbers for patent applications, and original page numbers of publications when possible.

vehicle's dashboard.” *Id.* at 1:21-23. To increase ease of use and avoid the need to have a predefined or preset location for the camera, the invention provides approaches for “initializing such a camera onboard a vehicle.” *Id.* at 1:28-29. “Upon driving, the camera initializes itself to determine its height with respect to the ground as well as a road plane normal. Thus, the camera may be installed in various positions and later re-initialized or recalibrated as needed.” *Id.* at 1:24-27.

The Challenged Claims are directed to such a method, which includes receiving video from a camera device “over a network” and transmitting camera parameter data back to the camera device. *Id.* claim 1. This method may, for example, be used to provide “a network-based initialization system.” *See e.g., id.* at 1:36-52. One embodiment of such a network-based initialization system is summarized in the specification as follows:

[A] server-side system receives a video comprising a set of image frames and identifies one or more lines in the video using a predictive model (e.g., a convolutional neural network). In one embodiment, the lines can include a horizon line. After identifying the horizon line, the system computes some camera parameters (e.g., height, viewing angle, road plane normal, etc.) based on the horizon line. The system then overlays the computed horizon line on the video and transmits it to an annotator device for manual review. In response, the annotator device can transmit a confirmation indicating the horizon line was accurate. In some embodiments, the annotator device can reject the horizon line and manually add the horizon line. Once the horizon line is confirmed, the

system returns the camera parameters to the calling party (e.g., a camera onboard a vehicle).

Id. The inventors realized that a network-based camera initialization service could be implemented to provide a robust approach to initializing dash-cams in a reliable way using “a remote computing device executing the camera initialization service 232,” for example, “an application running on a remote server.” *See e.g., id.* at 5:13-20.

The specification explains that the disclosed “[s]ystems can use the illustrated neural network in some embodiments **instead of a geometric process** to determine lane and horizon lines.” *Id.* at 7:14-16 (emphasis added). “Specifically, given an input image 302 (e.g., a video frame), a backbone network 304 can convolve the input image 302 to generate a set of intermediate features (not illustrated).” *Id.* at 7:16-19. The specification provides a lane-horizon marking head 306 that can comprise “a CNN configured to process images and output a sequence of points representing the horizon and/or lane lines.” *Id.* at 7:24-27. The specification provides many examples of CNN technologies that may be used with the invention, such as, “a fully convolutional network (FCN) that includes a plurality of convolutional blocks where each block can include one or more convolution, batch normalization, activation and up-sampling layers ... FCN can also be a network comprising, or based on, Unet, DeepLab, PSPNet, SCNN or

EnetSAD architectures ... [and] can include a neck module that further processes backbone features to detect markers on fine-grain scale.” *Id.* at 7:27-36. Notably, “the neural network is trained to predict lane **and horizon** key points 308.” *Id.* at 8:7-8 (emphasis added). The neural network training is based on the processing of images with ground truth image labels to “compute a prediction loss.” *See e.g., id.* at 9:60-10:58 ; see also, FIG. 4A-4B.

Using “predictive models” in “identifying one or more lines in the video ... including a horizon line” is a key aspect of the Challenged Claims. The specification explains that “the model of FIG. 3A can provide advantages over the offline process of FIG. 2.” *Id.* at 8:37-39. “For example, the use of the neural network can relax constraints that the vehicle needs to be driving on a highway having three or more lane lines. Indeed, just two lane-lines with a known lane-width would be sufficient for camera initialization. That is, since the model is **capable of predicting the horizon line directly**, previous requirements of having three lane lines in frame (e.g., to **geometrically** calculate a horizon line) can be relaxed.” *Id.* at 8:39-46 (emphasis added).

The inventors described other aspects of the system with reference to “commonly-owned application Ser. No. 17/173,950, filed Feb. 11, 2021” and incorporated this application by “reference in its entirety.” *See e.g., id.* at 5:38-47 (“detail on computing camera properties based on detected lane lines”); 14:34-36

(“detail on computing an IPM”); 15:20-27 (“a geometric algorithm to determine a lane width”) and 49-52)”[d]etails of applying an IPM to a set of image frames to detect lane lines”), and 16:1-11 (“[d]etails of detecting object distances”).

Application No. 17/173,950 has since issued as U.S. Patent No. 11,798,187 (“the ’187 patent”). *See* Ex. 2001. The incorporated ’187 patent “claims the benefit of priority of Provisional Pat. Appl. No. 62/975,360 filed on Feb. 12, 2020” and which was itself “incorporated by reference in its entirety” into the ’187 patent disclosure. *See* Ex. 2001 at 1:8-10; *see also*, Ex. 2003, ¶ 23-24. Accordingly, the disclosure of Provisional Pat. Appl. No. 62/975,360 is incorporated by reference and therefore part of the disclosure of ’580 Patent. As will be further discussed below, this provisional application includes the Khan (Ex. 1007) and Ali (Ex. 1008) references relied upon in the Petition, but as explained in the Specification, these references do not disclose the claimed invention.

B. Prosecution History

The prosecution of the application leading to the ’580 Patent required only a single office action. *See* Ex. 1002 at 0128. Prior to the Office Action, the applicants submitted an IDS that disclosed, among other references, Pub. No. 20210049780 to Westmacot et al. *Id.* at 0094-95. Petitioner relies on this reference (Ex. 1010) for two of the asserted grounds even though the Examiner considered it and did not find it relevant enough to rely on it for any claim

rejection. *Id.* at 0019-0020 and 0129-0137. Given the novelty of the invention, the Examiner's prior art search did not turn up any references applicable to claims 4 and 6-7; the Office Action noted that claims 4 and 6-7, among others, "would be allowable if rewritten in independent form." *Id.* at 0136. The Examiner rejected claims 1-3 and 5 (among others) under Section 103 based on KWANT1 et al. (U.S. Pub. No. 2019/0034740 A1) and KWANT2 et al. (U.S. Pub. No. 2019/0102674 A1). *Id.* at 0131; *see also*, Ex. 1057 and Ex. 1058.

With respect to the "identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line" element of claim 1 that is at issue in this Preliminary Response, the Examiner identified paragraph 46 and the Abstract of KWANT1. *Id.* The Examiner quoted from KWANT1's paragraph 46: "the output of a lane feature detection process include lane models representing the detected lanes or features, and associated prediction confidence values indicating a probability that the processed features of the input image are predictive of the detected lane features." *Id.* Specifically, as to the lines "including a horizon line," the Examiner quoted from the Abstract of KWANT1: "determining a horizontal line in the image at which a maximum number of the one or more extended road lanes crosses over a minimum horizontal extent of the horizontal line." *Id.*

The applicants filed a Response that did not amend any claims. *Id.* at 0138-0149. Instead, with respect to claim 1, the applicants traversed the rejection and explained why KWANT1 failed to teach or suggest, among other elements, the “predicting a horizon line” step required by claim 1. *Id.* at 0145. Specifically, the applicants explained:

KWANT1 does not disclose using a predictive model to detect a horizon line. Instead, KWANT1 describes predicting lane lines. KWANT1 then describes extending these lane lines and, using a geometric approach, identifying the horizon line. KWANT1 only describes using predictive modeling to predict lane lines. Thus, KWANT1 does not describe predicting a horizon line as claimed.

Id. at 0145-0146. In response to applicants’ arguments, the Examiner issued a Notice of Allowance, stating that applicant’s arguments “have been fully considered and are persuasive.” *Id.* at 0169. Notably, in the Notice of Allowance the Examiner did not highlight the Westmacot reference as being one of the closest prior art.

The Petitioner asserts that the references it relies upon in the Petition (Choe, Khan, Ali, Workman, and Westmacot) “were applied during prosecution, and only Westmacot was considered as being cited in an Information Disclosure Statement.” *See* Pet. at 7. What Petitioner fails to mention is that not only was Westmacot (Ex. 1010) considered by the Examiner, but as noted above, Khan (Ex. 1007) and Ali

(Ex. 1008) were also in front of the Examiner because they are part of the '580 Patent's disclosure.

The '580 Patent incorporates by reference the '187 patent, which itself incorporates the '360 provisional application. The '187 patent's description discloses the same subject matter in Khan and Ali. In fact, the '360 provisional that is incorporated by reference is composed of both Khan and Ali:

Lane detection using lane boundary marker network with road geometry constraints Hussam Ullah Khan, Afshen Rafiqat Ali, Ali Hassan, Ahmed Ali, Wajahat Karmi, Aamer Zaheer KeepTruckin Inc. (RnD) Lahore, Pakistan (hussam.khan, afshen, ali.hassan, ahmed.ali, wajahat.karmi, aaz)@keeptruckin.com Abstract Lane detection is of critical importance to both the self-driving cars as well as advanced driver assistance systems. While current methods use a range of features from low-level to deep features extracted from convolutional neural networks, they all suffer from the problem of occlusion and struggle to detect lanes with line or no evidence on the road. In this paper, we use a lane boundary marker network to detect keypoints along the lane boundaries. An inverse perspective mapping is estimated using road geometry which is then applied to the detected markers and line/curves are fitted jointly on the rectified points. Finally, missing lane boundaries are predicted using lane geometry constraints i.e., equidistant and parallelism. Reciprocal weighted averaging ensures lane boundaries with strong evidence dominate their predicted alternatives. The results show a significant improvement of +7.8%, +5.9% and +1.2% of F1 scores over the state-of-the-art on CULane, Lane, CCheck and TeMple datasets, respectively. This proves our algorithm's robustness against both occluded and missing lanes cases. Furthermore, we also show that our algorithm can be combined with other lane detectors to improve their lane retrieval potential. 1. Introduction Fully autonomous vehicles in the form of self-driving cars are gradually appearing on the scene and we have Google Waymo [17], Tesla's Auto-pilot [19], Comma.ai's OpenPilot [10] and Intel's Mobileye solutions [18] just to name a few. Along with self-driving cars, Advanced Driver Assistance Systems (ADAS) have also captured a surge in the interest. Both self-driving cars and the ADAS require different levels of autonomy but some aspects of automation are still common. One of them is road lane detection and segmentation. Lane detection is critical in identifying and ensuring safe driving practices and an on-board system with this capability can alert the driver in case of an unsafe lane change and avoid it in the first place if it is a self-driving vehicle. Besides, it is also necessary in understanding the road layout and surrounding scene geometry for proper route planning for autonomous or semi-autonomous vehicles. Lane detection has classically been done using either low-level edge features, histogram analysis, lane boundary detection algorithms such as Linear Hough Transform [15] or a combination. Although such methods are intuitive and efficient, they are however easily fooled by non-lane edges or lines appearing in the images such as road curbs, shadows as well as false negatives due to erased or inconsistent lane boundary markings. Recently, deep learning based solutions have also been proposed that produce more robust MOTIVE TECHS - EX2002 P. 0018 IPR2025-02574	Real-time vehicle distance estimation using single view geometry Ahmed Ali, Ali Hassan, Afshen Rafiqat Ali, Hussam Ullah Khan, Wajahat Karmi, Aamer Zaheer KeepTruckin Inc. Lahore, Pakistan (ahmed.ali, ali.hassan, afshen, hussam.khan, wajahat.karmi, aaz)@keeptruckin.com Abstract Distance estimation is required for advanced driver assistance systems (ADAS) as well as self-driving cars. It is crucial for obstacle avoidance, tailgating detection and accident prevention. Currently, radars and lidars are primarily used for this purpose which are either expensive or offer poor resolution. Deep learning based depth or distance estimation techniques require huge amount of data and ensuring domain invariance is a challenge. Therefore, in this paper, we propose a single view geometric approach which is lightweight and uses geometric features of the road lane markings for distance estimation that integrates well with the lane and vehicle detection modules of an existing ADAS. Our system introduces novelty on two fronts: (1) It uses cross-ratios of lane boundaries to estimate horizon (2) it determines an Inverse Perspective Mapping (IPM) and camera height from a known lane width and the detected horizon. Distances of the vehicles on the road are then calculated by back-projecting image point to a ray intersecting the reconstructed road plane. For evaluation, we used lidar data as ground truth and compare the performance of our algorithm with radar as well as the state-of-the-art deep learning based monocular depth prediction algorithms. The results on three public datasets (KITTI, nuScenes and Lyft level 5) showed that the proposed system maintains a consistent RMSE between 6.10 to 7.51. It outperforms other algorithms on two of the datasets while on KITTI it falls behind one important deep learning method. Furthermore, it is computationally inexpensive and is data-domain invariant. 1. Introduction Human error is one of the major causes of driving accidents. At the heart of safe driving practices lies the driver's judgment to estimate their vehicle's braking distance w.r.t other road users. For this reason, Advanced Driver Assistance Systems (ADAS) have evolved substantially over the last few years and features such as pedestrian and tailgating MOTIVE TECHS - EX2002 P. 0018 IPR2025-02574
Ex. 2002 at 0008-0017 (Khan)	Ex. 2002 at 0018-0027 (Ali)

See Ex. 2002 at 0008 and 0018. Thus, Khan and Ali are part of the disclosure of the '580 Patent.

The '580 Patent refers to the Khan/Ali/'187 patent disclosure as providing additional “detail on computing camera properties based on detected lane lines,”

“detail on computing an IPM,” “a geometric algorithm to determine a lane width,” “[d]etails of applying an IPM to a set of image frames to detect lane lines,” and “[d]etails of detecting object distances.” Ex. 1001 at 5:38-47, 14:34-36, 15:20-27 and 49-52, and 16:1-11. But Khan and Ali do not disclose the “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” element of the claims.

In sum, contrary to Petitioner’s implication the art relied upon in the Petition was not in front of the Examiner, the fact is that, of the 5 references relied upon in the Petition, 3 of them—Khan, Ali, and Westmacot—were before the Examiner during prosecution. There is nothing in these or the remaining two references that discloses or renders obvious the invention of claims 1-7.

C. Relevant Person of Ordinary Skill In The Art

Patent Owner disagrees with Petitioner’s proposed education and training of the relevant Person of Ordinary Skill in the Art (“POSITA”) for the ’580 Patent. The factors that may be considered to determine the level of ordinary skill in the art include the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted). The level of ordinary skill

in the art also may be reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

The '580 Patent “relate[s] to **automotive systems** and to machine learning systems for analyzing sensor data in such systems.” Ex. 1001 at 1:7-10 (emphasis added). Petitioner’s proposed POSITA appears to be some sort of expert in computer/machine vision but lacks any training or experience in “automotive systems,” precisely what the '580 Patent relates to. *See* Ex. 2003 at ¶ 37. The type of problem being addressed by the '580 Patent deals with the initialization of cameras in automotive systems. *See* Ex. 2003 at ¶ 34. This is different than the type of problems that computer vision generally may encounter. *Id.* at ¶ 37. The typical educational level of active workers in the automotive systems design field was a bachelor’s degree in engineering, typically Electrical, or Computer Science. *Id.* at ¶ 35. A typical designer of a system such as those described in the '580 Patent would have at least two years working experience in the field, perhaps less with a more advanced degree. *Id.*

Moreover, the references relied upon in the Petition are also related to the automotive field. *Id.* at ¶ 34; *see also, e.g.*, Ex. 1005 at [0001] (“disclosure relate generally to operating autonomous vehicles”); Ex. 1007 at 1823 (“[l]ane detection is of critical importance to both self-driving cars as well as advanced driver assistance systems”); Ex. 1008 (“[d]istance estimation is required for advanced

driver assistance systems (ADAS) as well as self-driving cars”); Ex. 1010 at 1:13-14 (“[a] rapidly emerging technology is autonomous vehicles (Avs) that can navigate by themselves ...”). Thus, some experience or training with automotive systems is needed for the appropriate level of ordinary skill in the relevant art. *See Okajima*, 261 F.3d at 1355.

Accordingly, Patent Owner disagrees with Petitioner’s proposed POSITA and submits that a POSITA for the ’580 Patent as of 2021 would have a bachelor’s degree in engineering or computer science with one- or two-years training and/or experience in design of software for camera/sensor systems in the automotive industry. *See* Ex. 2003 at ¶ 35.

D. Horizon Line Detection in the Alleged Prior Art

1. Choe (Ex. 1005) Describes Determining Horizon Lines Based on Camera Hardware Settings

Choe discloses a manual camera calibration system that uses camera hardware to determine the horizon line. Ex. 2003 at ¶ 41. As the specification describes, “a calibration system with a visualizer is utilized to calibrate sensors (e.g., cameras, LIDAR, RADAR) of an autonomous driving vehicle (ADV).” Ex. 1005 at [0014]. “The visualizer includes a user interface to visually display a two-dimensional (2D) image captured by a camera and a three-dimensional (3D) image to allow a user visually calibrate the camera, a LIDAR device, and/or a RADAR device.” *Id.* “A user can calibrate any of the sensors such as a pitch angle, a yaw

angle, and/or a roll angle using an input device such as a keyboard or joystick to provide incremental calibration feedback, while displaying the calibration result on a display device concurrently.” *Id.*

In the calibration system of Choe “in response to a first image captured by a camera of an ADV, **a horizon line is determined based on the camera's hardware settings.**” *Id.* at [0015] (emphasis added). “The horizon line represents a vanishing point from a view point of the ADV **based on an initial or default pitch angle of the camera.**” *Id.* “One or more lane lines are determined based on the first image via a perception process performed on the first image.” *Id.* “In response to a first input signal (e.g., an up or down arrow key) received from an input device (e.g., keyboard, joystick, voice interactive command), a position of the horizon line is updated based on the first input signal and a position of at least one of the lane lines is updated based on the updated horizon line.” *Id.*

“Choe consistently describes throughout the specification that the horizon line is determined based on the hardware parameters of the camera.” Ex. 2003 at ¶ 43; *see also, e.g.*, Ex. 1005 at [0046] (“2D rendering module 401 is configured to render a 2D view including superimposing a horizon line onto the image according to the camera setting (e.g., hardware preset pitch angle).”); at [0048] (“perception module 302 determines a horizon line based on the camera’s hardware settings.”); at [0055] (“horizon line 610 is determined and placed on a location within image

601 based on the hardware setting of the targeted camera.”); at [0059] (“processing logic determines a horizon line ... based on a pitch angle of a camera that captured a first image”). Even the claims of Choe limit its invention to “determining a horizon line representing a vanishing point from a view point of the ADV **based on a pitch angle of a camera** that captured a first image representing a two-dimensional (2D) view from the viewpoint of the ADV.” *Id.* at claim 1 (emphasis added).

Choe refers to a “machine learning engine 122,” that “[b]ased on driving statistics 123, ... generates or trains a set of rules, algorithms, and/or predictive models 124 for a variety of purposes.” *Id.* at [0030]. Choe states that “[a]lgorithms 124 may further include sensor calibration algorithms, which will be described further below.” *Id.* Below in the specification, Choe goes on to describe this use of “sensor calibration algorithms” as follows:

[S]ensor calibration module or system 308 is configured to calibrate, **using sensor calibration algorithms** 313, a sensor based on an image or point cloud captured by the sensor **to determine a set of calibration parameters**. The calibration parameters can be utilized by the software to compensate the hardware settings of the sensors during a perception process. Sensor calibration module 308 may be implemented as a part of perception module 302 or communicatively coupled to perception module 302. The functionalities of sensor calibration module 308 may be maintained in a data analytics system such as server 103 to perform

a sensor calibration of a sensor offline based on the images captured by the corresponding sensor. The calibration result can then be uploaded onto the vehicle to be utilized online during the image processing as a part of the perception process.

Id. at [0044] (emphasis added).

Importantly, the predictive models 124 of Choe are generated by a machine learning engine 122 “based on **driving statistics** 123.” *Id.* at [0044]; Ex. 2003 at ¶¶ 45-46. Choe explains that “a data analytics system to perform data analytics services for a variety of clients ... and includes data collector 121 and machine learning engine 122.” Ex. 1005 at [0029]. “Data collector 121 collects driving statistics 123 from a variety of vehicles, either autonomous vehicles or regular vehicles driven by human drivers.” *Id.* “Driving statistics 123 include information indicating the driving commands (e.g., throttle, brake, steering commands) issued and responses of the vehicles (e.g., speeds, accelerations, decelerations, directions) captured by sensors of the vehicles at different points in time.” *Id.* “Driving statistics 123 may further include information describing the driving environments at different points in time, such as, for example, routes (including starting and destination locations), MPOis, road conditions, weather conditions, etc.” *Id.*

Thus, the “predictive models 124” described by Choe are based on “driving statistics 123” and are used for sensor calibration “to determine a set of calibration parameters.” *See* Ex. 2003 at ¶ 46. “Nothing in Choe teaches or suggests

‘identifying one or more lines in the video *using a predictive model*, the one or more lines including a horizon line.’” *Id.* (emphasis added).

2. Kahn (Ex. 1007) Refers to Ali (Ex. 1008) For Estimating Horizon Lines

As noted above, Kahn is part of the disclosure of the ’580 Patent. *See* Ex. 2003 at ¶ 24. Kahn relates to lane detection for self-driving and advanced driver assistance systems. Ex. 1007 at Abstract; *see also*, Ex. 2003 at ¶ 56. The system of Khan “use[s] a lane boundary marker network to detect keypoints along the lane boundaries.” Ex. 1007 at Abstract. Instead of using “deep learning methods for lane detection that output lane boundary maps which are sampled to produce boundary markers,” the authors take “motivation from keypoint detection in Mask-RCNN [12] and predict these lane markers directly instead of sampling them from segmentation maps.” *Id.* at 1825.

Kahn includes a section on “3.2.1 Horizon Estimation.” *Id.* at 1826. Kahn notes that “[t]he estimation of IPM assumes a planar road scene having no elevation and more than one lanes (3 or more lane boundaries), such as a typical highway scenario.” *Id.* Notably, Kahn points out that a “[c]ritical part of initialization is the estimation of a vanishing line (horizon) from these lines.” *Id.* at 1826. Kahn’s methodology for estimating the horizon “requires two sets of vanishing points (VPs), forward and lateral VPs.” *Id.* “Forward VPs can be found from the cross product of the world parallel lines whereas the process of finding

lateral vanishing point is a bit involved.” *Id.* at 1827. “For that we use cross-ratios of three real-world parallel lines which are the lane lines as used by Ali et al. [2].” *Id.* (citing the Ali paper of Ex. 1008). “Once a set of forward and lateral VPs is found, we use their horizon estimation algorithm to find the best fitting horizon l_h .” *Id.* In short, Khan uses the approach disclosed in Ali (Ex. 1008) to estimate the horizon. *See* Ex. 2003 at ¶¶ 57-58 and 66-68.

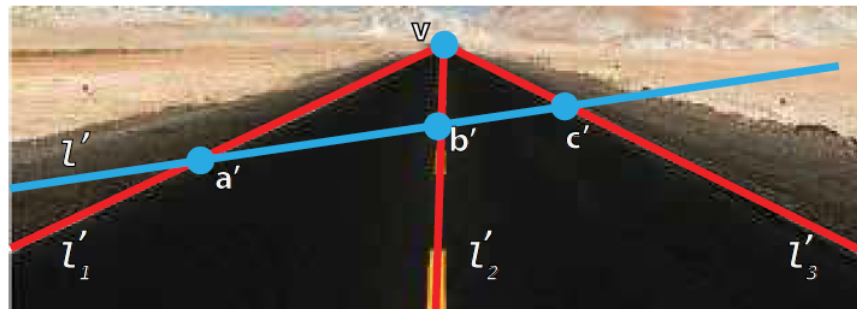
3. Ali (Ex. 1008) Describes a Purely Geometrical Approach to Detecting the Horizon

Like Kahn, Ali is also part of the disclosure of the ’580 Patent. Ali deals with distance estimation for advanced driver assistance systems (ADAS) and for self-driving cars. Ex. 1008 at Abstract; Ex. 2003 at ¶ 59. The Ali “system introduces novelty on two fronts: (1) it uses cross-ratios of lane boundaries to estimate horizon [and] (2) it determines an Inverse Perspective Mapping (IPM) and camera height from a known lane width and the detected horizon.” Ex. 1008 at Abstract.

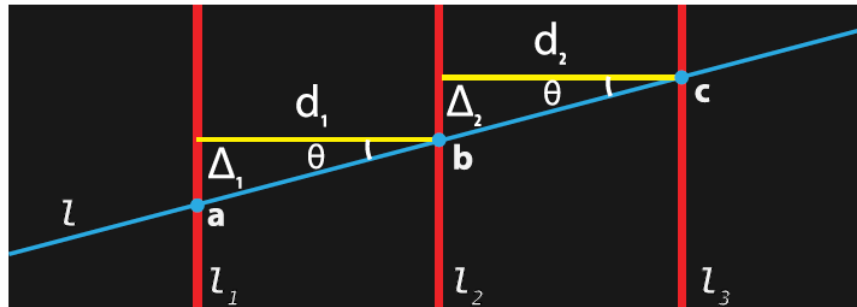
Ali provides a section describing its “Horizon estimation” approach. *Id.* at 1103 (Section 3.2.2). It explains that “[t]he horizon must be known to estimate the required camera rotation for an IPM.” *Id.* For the Ali system, “[a] horizon is a vanishing line of a plane which, in our case, is the road.” *Id.* Specifically, Ali explains:

In order to find vanishing line, we need two vanishing points. The first one can be simply calculated through the cross product of the vectors of any two lane lines expressed in homogeneous coordinates (see Figure 5 (a)). We call it the forward vanishing point (V). Finding a second vanishing point, however, is a bit involved. ... For this, we will need three co-linear points existing on the road plane having known real world length ratios. Since we already have detected lane lines in the image which lie on the road plane, we can find three co-linear points by drawing any line l' which intersects all three lane lines at points a' , b' and c' respectively.

Id. at 1103-1104. The process of getting the vanishing points is illustrated in Figure 5, which is reproduced below:



(a)



(b)

Figure 5. (a) Perspective view of road plane. Lane lines (l'_1 , l'_2 , and l'_3) are shown in red and an arbitrary line l' (blue) cuts all lane lines at points a' , b' , and c' . Forward vanishing point (V) is obtained by the cross product of any two lane lines (b) Real world top-down view of the road plane. d_1 and d_2 are the distances between lane lines l_1 , l_2 and l_2 , l_3 respectively. Since all lane lines are parallel Δ_1 and Δ_2 are similar triangles which implies

$$\frac{ab}{bc} = \frac{d_1}{d_2}$$

Id. at 1104. Because the three vanishing points “lie on three (parallel) lane lines (l_1 , l_2 and l_3), it can be established **through trigonometry** that the ratio of the line segments ab/bc is equal to d_1/d_2 where d_1 and d_2 are the distances between lines l_1 , l_2 and l_3 respectively.” *Id.* (emphasis added).

Ali explains that “[s]ince the initialization is required only once for a camera, it can be done on a highway or a section of the highway where lanes are consistent/equidistant (using gps);” this is helpful because it allows to assume that the ratio of the distances between the lines to be 1. *Id.* at 1104; Ex. 2003 at ¶ 61. “After getting two vanishing points (VPs) per frame,” Ali describes that the “horizon” can be found using “all the sets of the vanishing points across all the frames of a video clip” by finding “the best fitted line to the VPs as described in Algorithm 1.” Ex. 1008 at 1104. “This is the ‘[b]est fitting Horizon (l_h) estimation’ algorithm referred to in the Kahn paper.” Ex. 2003 at ¶ 61 (citing Ex.

1007 at 1827). In short, the horizon line estimation approach that Ali describes is “a purely geometrical approach.” Ex. 2003 at ¶ 62.

4. Westmacot (Ex. 1010) is not Alleged to Disclose Horizon Line Detection

Westmacot was considered by the Examiner during prosecution and not found to be relevant to the claims of the ’580 Patent. *See* Ex. 1002 at 0119, 0131, and 0150. Westmacot “relates to image annotation, such as the creation of annotated street road images which can be used (among other things) for training a machine learning road detection component.” Ex. 1010 at 1:5-7; Ex. 2003 at ¶ 81.

The Petition does not allege that Westmacot discloses “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line.” Instead, for this element, the Petition relies on combining Westmacot with Choe and Kahn and Ali (Ground 5) or Workman (Ground 6).

5. Workman (Ex. 1011) Describes Computer Vision Research But Not Specific to Automotive Systems

The Petition relies on Workman and impermissible hindsight to allege that the claimed “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” was obvious.

Workman describes an experimental work in computer vision “investigat[ing] methods for directly estimating the horizon line using convolutional neural networks.” Ex. 1011 at 10; Ex. 2003 at ¶ 71. The authors

found that existing datasets were insufficient and in this paper they “introduce a new benchmark dataset.” Ex. 1011 at 1. Workman notes that “[d]espite [the] demonstrated importance [of horizon line estimation in computer vision], progress on this task has stagnated and nearly all recent methods that focus on this problem make assumptions about the presence of particular geometric objects in the scene, such as vanishing points, repeated textures, and coplanar circles.” *Id.* (citations omitted). In fact, Workman notes that “[r]ecent work using learning-based methods for horizon line estimation has been limited.” Ex. 1011 at 2.

Workman does not mention any automotive systems or initialization of dash-cam or automotive sensor systems as a relevant field or application of its experimental approach. Ex. 2003 at ¶ 71.

III. SAMSARA’S GROUNDS FAIL TO SHOW A REASONABLE LIKELIHOOD THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE

The Petition fails to show a reasonable likelihood that the Challenged Claims are unpatentable at least because none of the grounds show that the prior art suggests all the limitations of the sole independent claim, claim 1. Specifically, none of the alleged prior art combinations show the method of claim 1, including “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line,” to be obvious under 35 U.S.C. § 103.

A. Ground 1 – Choe Fails to Teach or Suggest Using Predictive Models to Identify a Horizon Line in Video Images.

In Ground 1, the Petition challenges claim 1-7 under Section 103 based on Choe (Ex. 1005). In Grounds 2 and 3, Petitioner tacitly acknowledges that Choe fails to describe the use of “predictive models” to identify a horizon line. *See* Pet. at 41 (“... if PO alleges that Choe fails to explicitly describe its ‘predictive models,’ ...”) and 47 (“... if PO alleges that Choe does not explicitly disclose which predictive models it uses or whether it uses predictive models to identify the horizon line.”). Choe does not teach or suggest using predictive models for “identifying one or more lines in the video ... including a horizon line” as required by claim 1. Ex. 2003 at ¶ 54.

The Petition alleges that in Choe, “[t]he initial horizon and lane lines are identified ‘using a predictive model.’” Pet. at 27. “This is incorrect.” Ex. 2003 at ¶ 47. Instead, Choe describes throughout the specification, for every embodiment, “that the horizon line is determined based on the hardware parameters of the camera.” *Id.*; *see also, e.g.*, Ex. 1005 at [0046], [0048], [0055], [0059].

The Petition points to Choe’s paragraph [0030] stating that “predictive models 124” may be used for “sensor calibration algorithms.” Pet. at 27 (citing Ex. 1005 at [0030]). But Petitioner misinterprets this paragraph to conclude that “the initial horizon line is predicted with a predictive model 124.” *Id.* at 27-28; Ex. 2003 at ¶ 48. What paragraph [0030] in Choe actually states is that “[b]ased on

driving statistics 123, machine learning engine 122 generates or trains a set of rules, algorithms, and/or predictive models 124 for a variety of purposes.” Ex. 1005 at [0030] (emphasis added). Thus, as explained above, the “predictive models” in Choe are based on the use of machine learning to process driving statistics, such as vehicle speeds, accelerations, etc., not based training a predictive model with images to identify lines in the images. *See* Ex. 2003 at ¶48. In this paragraph, Choe goes on to state that “[a]lgorithms 124 may further include **sensor calibration** algorithms, which will be described **further below**.” Ex. 1005 at [0030] (emphasis added). Notably, this statement refers broadly to “sensor” calibration, which could also be referring to LIDAR devices, RADAR devices, or other sensors; it is not specific to “camera” calibration as Petitioner’s expert incorrectly testifies. *See* Ex. 1003 at ¶93; *see also*, Ex. 2003 at ¶49. Even if this disclosure related expressly to camera calibration, “calibration is a broad term and does not necessarily include identifying a horizon line.” *See* Ex. 2003 at ¶49.

Critically, the Choe paragraph relied upon by the Petitioner and Petitioner’s expert states that the use of these algorithms for sensor calibration “will be described further below.” Ex. 1005 at [0030]. Yet, neither the Petition nor the expert declaration discuss what Choe “further describes” about the use of these algorithms for sensor calibration. As noted above, “further below” Choe describes that a “sensor calibration module or system 308 is configured to calibrate, using

sensor calibration algorithms 313, a sensor based on an image or point cloud captured by the sensor **to determine a set of calibration parameters.**” Ex. 1005 at [0044] (emphasis added). Thus, the “predictive models 124” referenced in paragraph [0030], which are based on machine learning processing of **driving statistics** (e.g., driving commands, speeds, accelerations, decelerations, etc.), are used for sensor calibration “to determine a set of calibration parameters.” *See id.* at [0030] and [0044].

Thus, unlike the image-trained predictive models of the ’580 Patent, Choe’s predictive models are based on machine learning processes that use driving statistics for learning. Ex. 2003 at ¶¶51-53. While the predictive models of the ’580 Patent are trained from ground truth images to directly identify horizon lines in images, the sensor calibration predictive models in Choe are trained with driving statistics to determine calibration parameters, not lines in images. *Id.* “Choe does not teach or suggest the use of a predictive model trained with images for any purpose, much less for determining a horizon line in video images.” *Id.* at ¶53. Instead, to determine the horizon line, Choe teaches the use of hardware parameters of the camera, not the use of predictive models. *Id.* at ¶54.

In sum, Choe does not teach or suggest using predictive models to “identify[] one or more lines in the video using a predictive model, the one or more

lines including a horizon line.” Thus, Choe cannot render claim 1 or any of the dependent claims, 2-7, obvious. Accordingly, Ground 1 fails.

B. Ground 2 – Khan and Ali Disclose the Use of a Geometric Algorithm, not a Predictive Model, to Determine the Horizon.

Ground 2 in the Petition relies on the combination of Choe with Khan and Ali. As noted above, Khan and Ali are part of the disclosure of the ’580 Patent. While Khan and Ali provide “additional detail” regarding some other aspects of the described embodiments, neither Khan nor Ali provide the element missing in Choe of “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” required by claim 1. *See* Ex. 2003 at ¶¶55, 63.

The Petition alleges that “[i]n Khan, the predictive model used to identify lane and horizon lines is called a ‘Mask-RCNN.’” *Id.* (citing Ex. 1007, 1825). This is incorrect. *See* Ex. 2003 at ¶64. Khan states that “[a]s generally is the case with deep learning methods for **lane detection** that output lane boundary maps which are sampled to produce boundary markers, we instead take motivation from keypoint detection in Mask-RCNN [12] and predict these lane markers directly instead of sampling them from segmentation maps.” Ex. 1007 at 1825 (emphasis added). Khan does not mention or suggest using Mask-RCNN to identify a **horizon** line in video. *See* Ex. 2003 at ¶64.

The Petition then also states that “Khan uses RANSAC (a predictive model) to predict the horizon line.” *See* Pet. at 41 (citing Ex. 1007, 1826-27). This too is incorrect. Ex. 2003 at ¶65. RANSAC is not a model at all; “provides a process for fitting a model to experimental data.” *Id.* What Khan actually states regarding RANSAC is that the “estimation of IPM assumes a planar road scene having no elevation and more than one lanes (3 or more lane boundaries), such as a typical highway scenario.” Ex. 1007 at 1826. It then explains that their process starts “by fitting lines to the detected markers” but “[a] best fit line must have a minimum number of inlier markers.” *Id.* Khan then defines inlier markers as “those having horizontal distance of under 8 pixels to the best 1st degree line fit through RANSAC [8].” *Id.* Thus, the RANSAC fitting process is mentioned in the context of determining what an “inlier marker” is. *See* Ex. 2003 at ¶65. “Khan does not describe using RANSAC to predict the **horizon** line.” *Id.* (emphasis added).

The Petition is correct in that Khan cites Ali (Ex. 1008) with respect to the determination of the horizon line: “described more fully in Ali.” *See* Pet. at 41. But, like Khan, Ali does not describe the use of a predictive model to identify the horizon line. Instead, Ali describes a geometric approach expressly distinguished in the ’580 Patent. Ex. 2003 at ¶¶67-69.

Both Khan and Ali “assume[] a planar road scene having no elevation and more than one lanes (**3 or more lane boundaries**), such as a typical highway

scenario.” *See* Ex. 2003 at ¶¶67-68; *see also*, Ex. 1007 at 1826 and Ex. 1008 at 1103-1104. “The ’580 Patent specification expressly noted that the use of predictive models for identifying the horizon line improved over these types of geometric approaches.” Ex. 2003 at ¶69. As the ’580 Patent explains:

the use of the neural network can relax constraints that the vehicle needs to be driving on a highway having three or more lane lines. Indeed, just two lane-lines with a known lane-width would be sufficient for camera initialization. That is, since the model is capable of predicting the horizon line directly, **previous requirements of having three lane lines** in frame (e.g., to **geometrically** calculate a horizon line) can be relaxed.

Ex. 1001 at 8:39-46 (emphasis added). As described above, Ali teaches precisely this prior art type of geometric approach for estimating the horizon that the ’580 Patent recognized and improved upon. *See* Ex. 2003 at ¶69; *see also*, Ex. 1008 at 1104 and Fig. 5. Ali explains that to determine the horizon, it uses the fact that the vanishing points “lie on three (parallel) lane lines (l_1 , l_2 and l_3),” which is the “previous requirements of having three lane lines in frame” that is no longer required in the claimed method. *See* Ex. 1001 at 8:39-46; *see also*, Ex. 2003 at ¶¶67-69. The use of predictive models in the invention of the ’580 Patent allows it to “relax constraints” required by this previous geometric approach. *Id.*

Thus, the Khan/Ali geometric horizon estimation disclosure does not teach or suggest “identifying one or more lines in the video using a predictive model, the

one or more lines including a horizon line” required by claim 1. Ex. 2003 at ¶70. Their combination with Choe, even if it were appropriate and not based on impermissible hindsight (i.e., using the ’580 Patent’s own disclosure from Kahn and Ali), still fails to render the Challenged Claims obvious.

C. Ground 3 – No Reason to Combine Choe with Workman but for Impermissible Hindsight

Ground 3 of the Petition relies on the combination of Choe with Workman (Ex. 1011). As described with reference to Ground 1, Choe uses a camera-hardware-based approach to determine horizon lines. Workman is a generic computer vision reference that has no relation to the type of automotive system of Choe. Ex. 2003 at ¶¶71-73. “Absent the teachings of the ’580 Patent, a POSITA would not be motivated to replace Choe’s hardware-based approach to determine horizon lines with Workman’s image-trained predictive models to identify a horizon line.” Ex. 2003 at ¶73. As the Federal Circuit has noted, “‘the prejudice of hindsight bias’ often overlooks that the ‘genius of invention is often a combination of known elements which in hindsight seems preordained.’” *Polaris Industries, Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1068 (Fed. Cir. 2018).

The Petition asserts that “if PO alleges that Choe does not explicitly disclose which predictive models it uses or whether it uses predictive models to identify the horizon line, a POSA would have searched for references that use predictive models and how such models were used.” Pet. at 47. But the failure of disclosure

in Choe is not that it does not explicitly disclose which predictive models it uses. Choe discloses using predictive models but those models are based on driving statistics, like speeds, accelerations, etc., and are to be used for sensor calibration “to determine a set of calibration parameters.” *See* Ex. 1005 at [0029], [0030], and [0044]; *see also*, Ex. 2003 at ¶¶48-50. Choe also consistently describes that “a horizon line is determined based on the camera’s hardware settings.” Ex. 1005 at [0015]; Ex. 2003 ¶47. Simply disclosing the use of driving-statistics-based predictive models used to calibrate sensors with calibration parameters does not motivate a POSITA to look for image-trained predictive models to identify horizon lines. Ex. 2003 at ¶74. “There is simply nothing in Choe to motivate a POSITA to look for other references discussing the use of image-trained predictive models, much less for the different purpose of identifying a horizon line.” *Id.* “Choe does not identify any shortcomings with its camera-hardware based approach to determining the horizon line, much less the need for using predictive models, which Choe describes being used for other purposes.” *Id.*

To support this improper combination, Petitioner relies on its expert who simply repeats the same conclusory statements, providing no citation to any disclosure in Choe to show any motivation to combine with Workman. *See* Ex. 1003 at ¶146. Petitioner’s expert opinion is basically that the use of image-trained predictive models to identify horizon lines in generic image data sets was disclosed

in Workman and that some of the camera calibration elements of the claims was disclosed by Choe. However, Petitioner’s expert “failed to provide the glue to combine these references.” *See InTouch Techs., Inc. v. VGO Commc’ns, Inc.*, 751 F.3d 1327, 1348-49 (Fed. Cir. 2014).

Petitioner’s expert explains that “to show that predictive models were already used to identify these lines, I relied on Khan and Ali. These publications include the inventors as authors.” Ex. 1003 at ¶145. In fact, as described above, Khan and Ali are part of the ’580 Patent disclosure. Thus, “[i]t appears that [the expert] relied on the . . . patent itself as her roadmap for putting . . . pieces of a ‘jigsaw puzzle’ together.” *See* IPR2023-00656, Paper No. 33 (FWD) at 50, (October 2, 2024) (citing *InTouch Techs.*, 751 F.3d at 1351).

The Petition, after assuming a non-existent motivation in Choe to look at Workman, concludes that a “POSA would have known *how* and *why* to use Workman’s predictive models to identify the horizon lines in Choe with an expectation of success because” (1) “the combination achieved state-of-the-art results, and (2) the combination “identifies the horizon line faster than other models.” *See* Pet. at 47-48; Ex. 1003, ¶¶147-150. However, the statements in Workman relied upon in the Petition do not actually support the proposed combination with Choe. *See* Ex. 2003 ¶75.

a. Alleged “state-of-the-art” results

Workman’s paper does not relate to any results in initialization of camera vehicular systems or in any sort of automotive system. *See* Ex. 2003 at ¶76. Instead, the referenced performance in the Petition (Pet. at 47) relates to how the experimental system was able to “achieve state-of-the-art results on **the challenging HLW dataset** and two existing **benchmark datasets**.” Ex. 1011 at 1 (emphasis added); *see also*, Ex. 2003 at ¶76. The paper explains that the authors “introduce a new benchmark dataset, Horizon Lines in the Wild (HLW), containing real-world images **with labeled horizon lines**.” Ex. 1011 at 1 (emphasis added). This provides no indication of whether a POSITA would know “*how* and *why* to use Workman’s predictive models to identify the horizon lines in Choe” because Choe does not use any sort of predictive model to identify horizon lines; it uses the camera’s hardware settings. *See* Ex. 2003 at ¶¶76-77. Moreover, “[t]he predictive models of Choe, which are not used for identifying lines but to generate ‘calibration parameters,’ are based on the machine learning processing of ‘driving statistics’ and have no relation or ability to work with the HLW dataset of ‘real-world images with labeled horizon lines’ or any other dataset of images.” *Id.* at ¶76.

In sum, Choe uses camera hardware settings to determine the horizon line and there is no indication that its results are not already “state-of-the-art” without the need for the combination with Workman. *Id.* at ¶77. “A POSITA would not

know how or why the Workman disclosure is relevant to the completely different Choe system.” *Id.*

b. Alleged faster identification than other methods

Once again, the “orders of magnitude faster” from Workman referenced in the Petition (Pet. at 48) is not relevant to the disclosure of Choe. Ex. 2003 at ¶78. The paper compared its experimental approach to “current state of the art methods” but does not mention or compare against any sort of automotive systems or calibration of automotive sensors. Ex. 1011 at 1; *see also*, Ex. 2003 at ¶78. Workman reports that “[r]ecent state-of-the-art methods are quite slow, which is reasonable when you have a small testing dataset.” Ex. 1011 at 3. For example, the authors state that “we find that the approach of Lezama et al. [19] requires approximately 30 seconds per image on YUD and 1 minute per image on ECD (results obtained using code made available by the authors).” *Id.* Thus, “[t]he fact that the experiments in Workman required ‘only milliseconds per image’ and ‘outperform[ed] all existing methods’ does not provide any indication of how it performs compared to the camera-hardware-based approach of Choe.” *See* Ex. 2003 at ¶78.

Choe does not report any performance issues with its approach to horizon line determination. Choe’s calibration process determines the horizon line initially based on the camera hardware settings, which may be faster than Workman’s

approach. Further, this initial “position of the horizon line is updated based on an input signal” from the user, “received from an input device (e.g., keyboard, joystick, voice interactive command.)” *See* Ex. 1005 at [0015]. Thus, “[g]iven this user-based refinement of the horizon line position, the difference between 30 seconds or milliseconds per image may not be that relevant to the Choe system.” Ex. 2003 at ¶79. In any case, nothing in Workman indicates that a POSITA would know “*how* and *why*” to use Workman’s image-trained predictive models to identify the horizon lines in Choe since Choe’s camera-hardware-based approach is completely different. *See id.*

The Petition fails to identify any motivation in Choe for a POSITA to go look for other publications disclosing the use of image-trained predictive models to identify lines, much less horizon lines, in video images. *See id.* at ¶80. “Choe discloses the use of predictive models based on driving statistics for sensor calibration and self-driving assistance but does not suggest their use for line identification in any way.” *Id.* “Workman is in an unrelated field as it does not pertain to automotive systems and provides no motivation to combine its image-trained models with a sensor calibration system like Choe’s.” *Id.* Thus, “[n]either the Petitioner nor its expert provide any rational for why a POSITA would have been motivated to change the ‘camera-hardware-based’ approach for identifying the horizon line in Choe with the type of image-trained algorithms disclosed in

Workman.” *Id.* It is apparent that “Petitioner’s proposed combination of teachings plainly takes into account knowledge gleaned only from applicant’s disclosure, i.e., impermissible hindsight.” *See* IPR2023-00656, Paper No. 33 at 52 (citing *In re McLaughlin*, 443 F.2d 1392, 1313–14 (CCPA 1971)). As such, institution based on Ground 3 should also be denied.

D. Ground 4 – Petitioner does not allege Westmacot discloses any predictive models.

Ground 4 challenges claims 5-7 based on the combination of Choe and Westmacot (Ex. 1010). While not expressly stated, it appears that Petitioner’s Ground 4 relies on Ground 1 with respect to the limitations of independent claim 1. Because Ground 4 relies on the failed allegations in Ground 1 with respect to Choe and claim 1, as already explained above, Ground 4 also fails as to dependent claims 5-7. Specifically, Petitioners do not identify any additional disclosure in Westmacot that would teach or suggest the “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” element required by claim 1.

E. Ground 5 – Neither Choe, Westmacot, Khan, or Ali Teach or Suggest the Claimed Horizon Line Identification.

Ground 5 relies on the combination of Choe with Westmacot, Khan, and Ali. Pet. at 73. Ground 5 relies on Petitioner’s arguments regarding Grounds 1, 2, and 4. Because, as explained above with respect to each of those grounds, neither

Choe, Westmacot, Khan, or Ali teach or suggest the “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” element required by claim 1, Ground 5 also fails.

F. Ground 6 – Petitioner Does Not Identify Any Additional Motivation to Combine Workman or Westmacot with Choe.

Ground 6 relies on the combination of Choe with Westmacot, and Workman. Pet. at 74. Ground 6 relies on Petitioner’s arguments regarding Grounds 1, 2, and 3. Specifically, Petitioner asserts that “[a]s Ground 3 explains, a POSA would have been motivated to use Workman’s predictive models in Choe’s system. *Supra* Section VII.A. The same motivations to combine apply equally to the Choe-Westmacot combination with Workman.” Pet. at 75. Thus, Petitioner does not identify any additional motivation in Westmacot for the combination with Workman. Thus, as explained above with respect to grounds 1-2, neither Choe, nor Westmacot teach or suggest the “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” element required by claim 1. Further, as explained with respect to Ground 3, the combination with Workman is improperly based on impermissible hindsight. Thus, Ground 6 also fails.

IV. CONCLUSION

For the reasons set forth above, Petitioner has failed to demonstrate a reasonably likelihood that it would prevail with respect to at least one of

challenged claims 1-7. This, the *inter partes* review Petition should therefore be denied.

Respectfully submitted,

Date: June 19, 2025

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

The undersigned certifies Pursuant to 37 C.F.R. § 42.24(d), I certify that this preliminary response complies with the type-volume limits of 37 C.F.R. § 42.24(c)(1) because it contains 8278 words, according to the word-processing system used to prepare this petition, excluding the parts of this preliminary response that are exempted by 37 C.F.R. § 42.24(c) (including the table of contents, a table of authorities, an exhibits list, a listing of facts, a certificate of service or this certificate of word count, or appendix of exhibits).

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CERTIFICATE OF SERVICE

The undersigned certifies that on June 19, 2025, a complete and entire copy of this PATENT OWNER PRELIMINARY RESPONSE was provided via electronic mail (by consent) to the Patent Owner by serving the correspondence address identified in the Mandatory Notices:

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