

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners,

v.

SNAPAID, LTD.
Patent Owner

U.S. PATENT NO. 10,944,901

Case IPR2025-TBD

**PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 10,944,901**

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LIST OF EXHIBITS¹

Exhibit No.	Description
1001	U.S. Patent No. 10,944,901
1002	<i>Curriculum Vitae</i> of Dan Schonfeld
1003	Declaration of Dan Schonfeld in Support of <i>Inter Partes</i> Review
1004	U.S. Patent No. 8,508,622 (“Anon”)
1005	AN-1057 Using an Accelerometer for Inclination Sensing
1006	U.S. Patent No. 5,831,670 (“Suzuki”)
1007	U.S. Pat. App. Pub. No. 2010/0149361 (“Takeuchi”)
1008	U.S. Pat. App. Pub. No. 2004/0012682 (“Kosaka”)
1009	U.S. Pat. App. Pub. 2009/0296989 (“Ramesh”)
1010	U.S. Pat. App. Pub. 2012/0201427A1 (“Jasinski”)
1011	U.S. Patent No. 8,009,198 (“Alhadeef”)
1012	Liu et al., “Image Quality Assessment Using Multi-Method Fusion” IEEE 2012 (“Liu”)
1013	U.S. Pat. App. Pub. No. 2010/0246939 (“Aisaka”)
1014	U.S. Pat. App. Pub. No. 2008/0192129 (“Walker”)
1015	U.S. Pat. App. Pub. No. 2005/0270381 (“Owens”)
1016	Excerpts from Hector Garcia-Molina et al., “DATABASE SYSTEMS The Complete Book,” 2009 (“Garcia-Molina”)
1017	Che-Hua Yeh et al., “Personalized Photograph Ranking and Selection System,” 2010 (“Yeh”)
1018	Cavalcanti, et al., “A Survey on Automatic Techniques for Enhancement and Analysis of Digital Photography,” 2013 (“Cavalcanti”)

¹ Unless otherwise specified, citations are to the original page, column, and line numbers in exhibits, and all emphasis is added unless otherwise noted.

I. INTRODUCTION

Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner” or “Samsung”) respectfully request *inter partes* review of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 10,944,901 (“the ’901 Patent”).

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioner requests cancellation of the Challenged Claims as unpatentable under 35 U.S.C. §103.

A. Prior Art Patents and Printed Publications

Petitioner’s challenge is based on the following references, which predate the earliest priority date to which the ’901 Patent is entitled:

1. U.S. Patent No. 8,508,622 (“Anon”) (EX1004) was filed on January 18, 2011, issued on August 13, 2013, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(e).

2. U.S. Patent No. 5,831,670 (“Suzuki”) (EX1006) was filed June 18, 1996, issued on November 3, 1998, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

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3. U.S. Pat. App. Pub. No. 2010/0149361 (“Takeuchi”) (EX1007) was filed October 14, 2009, published June 17, 2010, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

4. U.S. Pat. App. Pub. No. 2004/0012682 (“Kosaka”) (EX1008) was filed July 2, 2003, published January 22, 2004, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

5. U.S. Pat. App. Pub. No. 2009/0296989 (“Ramesh”) (EX1009) was filed May 28, 2009, published December 3, 2009, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

6. U.S. Pat. App. Pub. No. 2012/0201427 (“Jasinski”) (EX1010) was filed February 4, 2011, published August 9, 2012, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, at least pre-AIA 35 U.S.C. §102(a) and (e).

7. Liu et al., “Image Quality Assessment Using Multi-Method Fusion” IEEE 2012 (EX1012) (“Liu”) was published on March 11, 2013. As discussed in Section III.B, below, the ’901 Patent is not entitled to the priority date of either of its

provisional applications, and therefore, Liu is prior art under at least 35 U.S.C §102(a)(1).

8. U.S. Patent No. 8,009,198 (“Alhadeff”) (EX1011) was filed on April 22, 2004 as a PCT application, issued on August 30, 2011, and is prior art under at least 35 U.S.C §§102(a)(1) and 102(a)(2), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

9. Hector Garcia-Molina *et al.*, “DATABASE SYSTEMS The Complete Book,” 2009 (“Garcia-Molina”) (EX1016), is a textbook published in 2009 on database design and is prior art under at least 35 U.S.C §102(a)(1), and to the extent the ’901 Patent is entitled to its earliest claimed priority date, pre-AIA 35 U.S.C. §102(b).

B. Relief Requested

The grounds are set forth below and supported by the declaration of Dr. Dan Schonfeld. (EX1003).

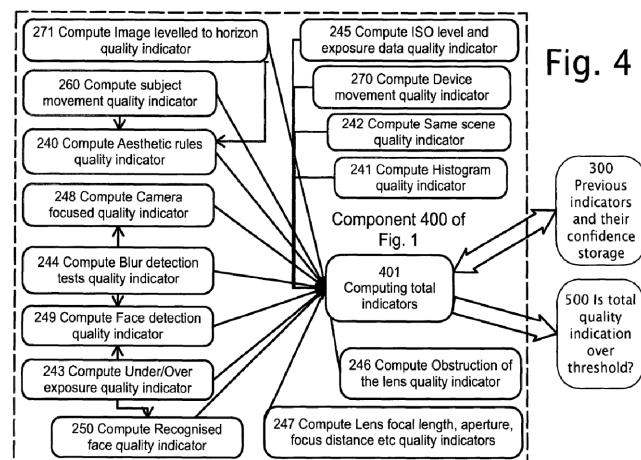
Ground	Claims	Proposed Statutory Rejection
IA	1-4, 6, 8	Anon, Suzuki, Jasinski and Garcia-Molina
IB	10, 13-14, 17-20	Anon, Takeuchi, Jasinski, Kosaka, and Garcia-Molina
IC	5, 7	Anon, Suzuki, Jasinski, Garcia-Molina and Ramesh

ID	16	Anon, Takeuchi, Jasinski, Kosaka, Garcia-Molina and Ramesh
1E	9	Anon, Suzuki, Jasinski, Grace-Molina and Liu
1F	11, 12	Anon, Takeuchi, Jasinski, Kosaka, Garcia-Molina and Liu
1G	15	Anon, Takeuchi, Jasinski, Kosaka, Garcia-Molina and Alhadeff

III. THE '901 PATENT

A. Specification

The '901 Patent, titled “Real Time Assessment of Picture Quality,” was filed as U.S. Patent Application No. 16/867,919 on May 6, 2020. The '901 Patent describes a method and system for real-time assessment of image quality in camera devices. EX1001, Abstract. Multiple sensors (*e.g.*, accelerometers, lens modules) are used to determine a plurality of quality indicators (QIs) for each image. *Id.*, 2:24-41. The “total” image quality is evaluated by combining various quality indicators (QIs), as shown below in Figure 4.



The system provides real-time suggestions to users for improving photo quality based on the quality indicators. *Id.*, 3:22-27.

The '901 Patent admits the “[p]rior art has used certain independent quality indicators” and “quantif[ied] the quality by means of a total quality indicator.” *Id.*, 2:42-62. The '901 Patent purports to distinguish the prior art by asserting that, in its invention, “the weight of one indicator will take into account data from other quality indicators.” *Id.*, 2:63-67. But that feature is not found in most Challenged Claims, and regardless, it was known in the prior art. *See infra* Section VI.A.2.

B. Priority Date

The '901 Patent claims priority to Provisional Application No. 61/717,216, filed on October 23, 2012, and Provisional Application No. 61/759,643, filed on February 1, 2013. Neither provisional supports all limitations of any Challenged Claim. *Studiengesellschaft Kohle, M.B.H. v. Shell Oil Co.*, 112 F.3d 1561, 1564 (Fed. Cir. 1997) (“35 U.S.C. § 120 requires an applicant to meet the disclosure requirement of § 112, ¶1 in a single parent application in order to obtain an earlier filing date for individual claims.”). For example, neither provisional discloses “at least one appropriate suggestion from a pre-stored table of suggestions” required by all Challenged Claims. Therefore, the '901 Patent is not entitled to either provisional filing date. *See* 35 U.S.C. § 119(e), 37 CFR § 1.78(a)(3)-(4); *see also Droplets, Inc. v. E*TRADE Bank*, 887 F.3d 1309, 1316 (Fed. Cir. 2018). As another example,

neither provisional discloses “an artificial neural network employing deep learning algorithm” or a “Peak Signal-to-Noise Ratio (PSNR) calculation” as required by claims 9 and 11, and therefore, these claims are not entitled to either provisional filing date without regard to the other claims.

C. Prosecution History

Prosecution of the '901 Patent was cursory. There was no substantive discussion of any prior art reference, and no claims were rejected over prior art.

D. Person of Ordinary Skill in the Art

As Dr. Schonfeld explains in his declaration (EX1003), a POSA at the time of the '901 Patent would have had at least a bachelor's degree in electrical engineering, computer science, or a related field, and at least two years of experience with image processing and analysis. Individuals with different education and additional experience could still be of ordinary skill in the art if that additional experience compensates for a deficit in their education and experience. (EX1003, ¶¶49-51).

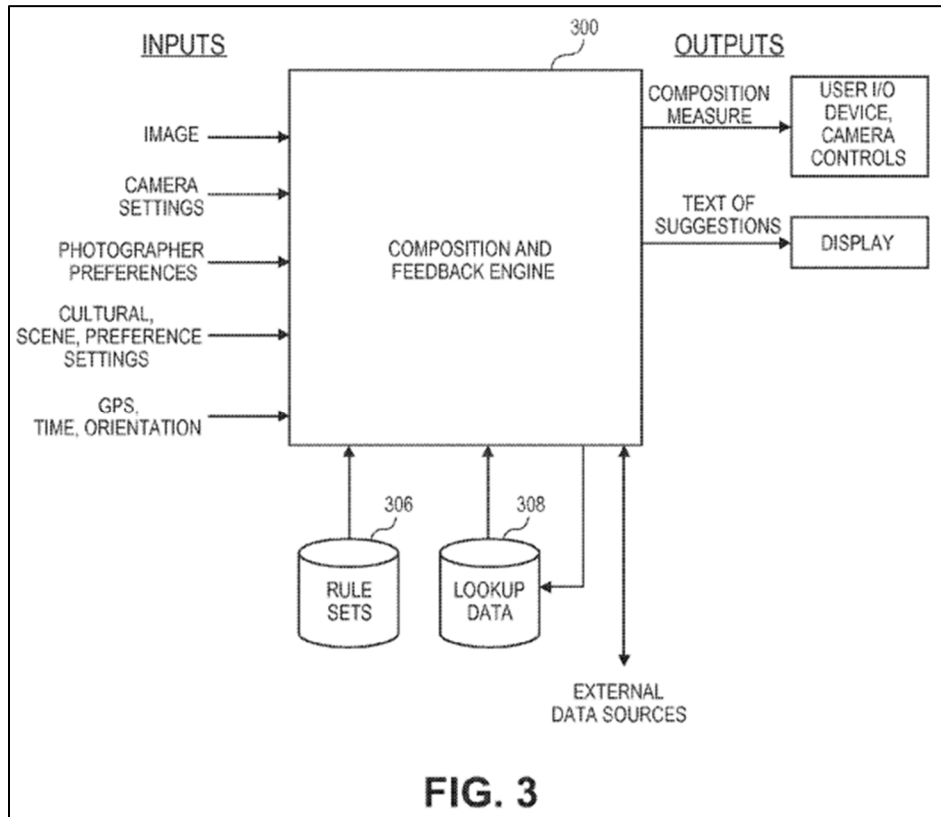
IV. CLAIM CONSTRUCTION

Claims in IPR are construed under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). For purposes of this proceeding only, terms in the Challenged Claims need not be construed. If PO raises claim construction arguments, Petitioner reserves the right to respond.

V. OVERVIEW OF THE PRIOR ART

A. Anon

Anon discloses “[a]n image capturing device” that “determine[s] a plurality of image-based characteristics for a proposed image,” including “a likely quality of a composition and/or recommendations for improvement usable while the image or video is being taken.” EX1004, Abstract, 2:64-3:1. Anon “compute[s] a composition measure for the proposed image” from the plurality of image-based characteristics, which is used to “provide suggestions for altering at least one characteristic of the proposed image.” *Id.*, 1:59-2:8. Anon explains that “the photographer is provided with real-time feedback as to composition and recommendations, or can be provided with such feedback after the fact.” *Id.*, 3:22-26. Anon’s system, which incorporates a “composition and feedback engine” 300, is illustrated in Figure 3 below:



Id., 6:32-41, Fig. 3. The composition and feedback engine (“CFE”) performs its evaluation and computation of a composition measure using a “weighted, combination of parameters.” *Id.*, 8:32-35; *see also id.*, 6:42-45. Anon’s CFE makes use of inputs from the image capturing device, such as the image itself, device settings, and metadata, combines it with rule sets 306 and lookup data 308, and outputs recommendations to improve image quality. *Id.*, 7:4-21.

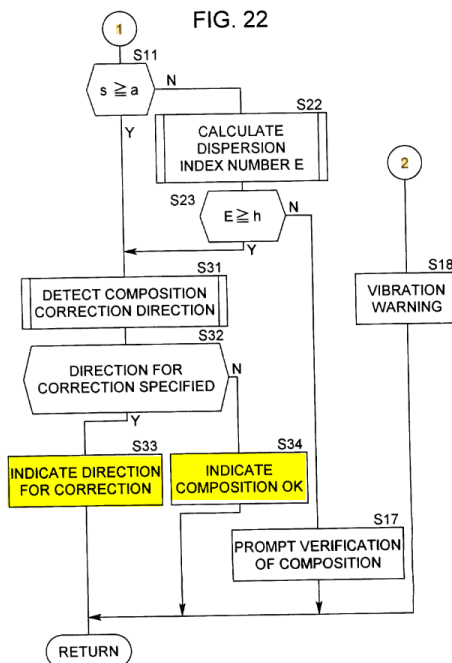
B. Takeuchi

Takeuchi relates to an “image evaluation apparatus and camera which are capable of evaluating an image which is comprehensively good.” EX1007, Abstract, ¶[0006]. Like Anon, Takeuchi’s system provides a comprehensive evaluation of

image quality, including, for example, explicit detection and quantification of overexposure and underexposure, and offers feedback or correction suggestions to the user. *See e.g., id.*, ¶¶[0147], [0290]. Takeuchi also teaches using a “total evaluation result” for an image using a weighted combination of different quality evaluation methods. *Id.*, ¶[0269].

C. Suzuki

Suzuki discloses a camera that evaluates composition quality based on various factors, including camera leveling, subject position, and presence of distracting elements (*e.g.*, tilted horizons, objects behind heads). EX1006, Abstract, 1:24-32, 1:49-57. For example, if the deviation of a horizontal edge (such as the horizon) from the true horizontal (*e.g.*, ΔY) is greater than a threshold, the system recognizes the horizon as tilted and triggers a recommendation for the user. *See id.*, 22:1-11. Suzuki further teaches using thresholds to evaluate image-quality-related values and to provide user recommendations when those factors are suboptimal. *See, e.g., id.*, 7:34-43, Fig. 22.



VI. SPECIFIC GROUNDS FOR PETITION UNDER 37 C.F.R. § 42.104(B)

A. Ground IA: Claims 1-4, 6 and 8 Are Obvious in View of Anon, Suzuki, Jasinski, and Garcia-Molina

1. Independent Claim 1

- i. [1.pre.] “A method for estimating quality of at least one image from a plurality of images, for use with a device that comprises in a single enclosure a digital camera module or functionality that comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to the optical lens for capturing an image of the scene; a motion sensor for sensing the device motion; wherein the motion sensor consists of, or comprises, an accelerometer, a gyroscope or both, and a processor coupled to at least one image sensor and to the digital camera for receiving data therefrom, the method by the processor comprising use of at

least one value and weight.”

To the extent the preamble is limiting, Anon discloses a method for estimating image quality of at least one image from a plurality of images by analyzing multiple image-based characteristics, computing a composition measure—quality measure—and providing real-time suggestions to the user. *See* EX1004, 2:9-15, 2:16-28, 2:32-38, 3:14-26.

Anon describes “[a]n image capturing device includ[ing] an image sensing device, a processor, and a memory.” *Id.*, Abstract, 1:59-2:8. Anon explains that “light passing through lens 102 impinges on CCD 104 to form a digital, electronically readable image” (*id.*, 5:54-56) and that “Camera 100 is equipped with a processor 106 ... and a composition and feedback engine (‘engine’) 108” (*id.*, 5:56-59). A POSA would have understood this to mean that Anon’s device comprises at least one optical lens for focusing received light from a scene and an image sensor (*i.e.*, CCD) coupled to the lens for capturing an image of the scene. EX1003, ¶56.

Anon discloses that the device is an integrated unit, explaining that, “[i]n a typical operation, the photographer uses a device that is either a camera (e.g., point-and-shoot, DSLR, SLR) or a multi-purpose device that includes a camera (such as a mobile telephone with a camera)” and that “[t]he photographer uses a device ... to stage a shot ... and then captur[es] the image.” EX1004, 3:14-20. A POSA would have understood that Anon’s camera components are housed within a single

enclosure, as is standard for digital cameras and camera-equipped mobile devices.

EX1003, ¶57. As shown in Figure 1 below, Anon’s exemplary camera is a digital camera. *See e.g.*, EX1004, Fig. 1, 3:11-14.

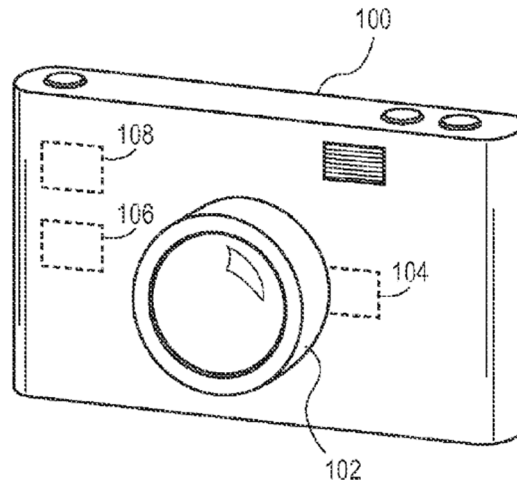


FIG. 1

Anon explains that “[c]amera-specific external inputs might include the camera’s current geographic location, time of day, orientation and the like,” *id.*, 4:24-33, and expressly discloses the use of motion sensors such as an “accelerometer for orientation.” *Id.*, 4:28-31; *see also id.*, 7:4-7.

Anon describes an “engine” that is coupled to the image sensor, CCD 104, and other camera components. *Id.*, 5:62-64. Anon further explains that the engine “could be implemented as ... software elements executed on a **processor**” *Id.*, 6:34-41. Figure 3, below, shows that the engine has various inputs including an image, camera settings, and GPS, time, and orientation inputs, illustrating that as

implemented on a processor, e.g., processor 106, that processor is coupled to at least one image sensor and to the digital camera for receiving data therefrom. *Id.*, 3:53-60, cl. 9 (“a processor, coupled to the image sensor”). A POSA would have understood that, to receive an image as an input, the engine comprises a processor coupled to the image sensor and the camera itself and that it performs a method comprising use of at least one value and weight as outlined below. EX1003, § VIII.A.1.i.

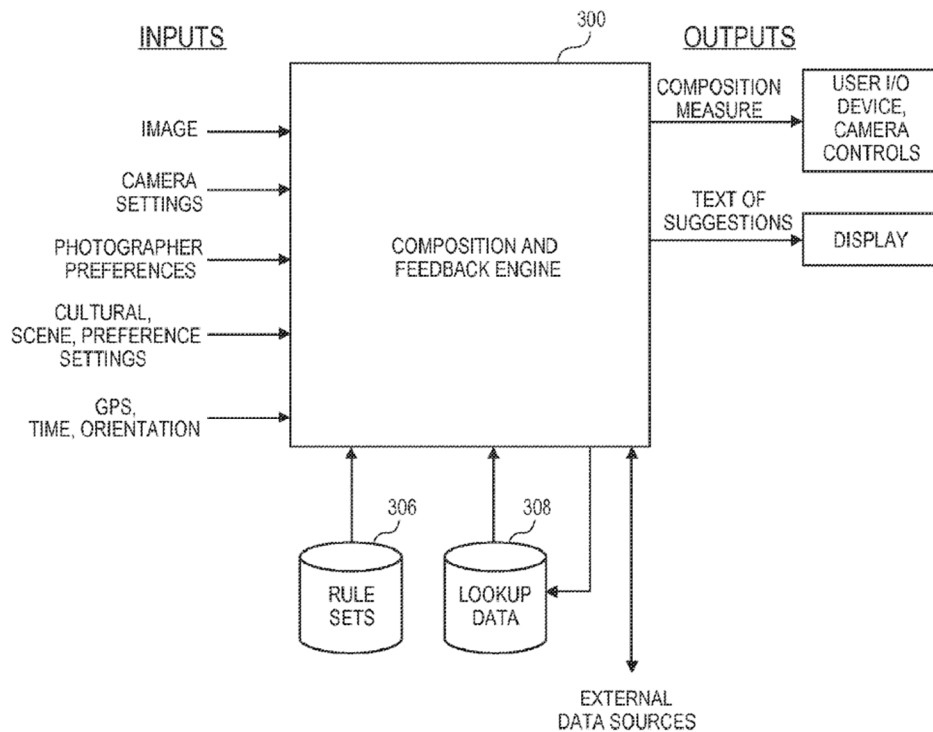


FIG. 3

Anon teaches performing its analysis on at least one image from a “plurality of images” including judging the quality of images from a body of images or from a video sequence. *See, e.g.*, EX1004, 10:8-26, 3:2-10, cl. 10 (“determining a respective

plurality of image-based characteristics using the processor in response to the plurality of images”).

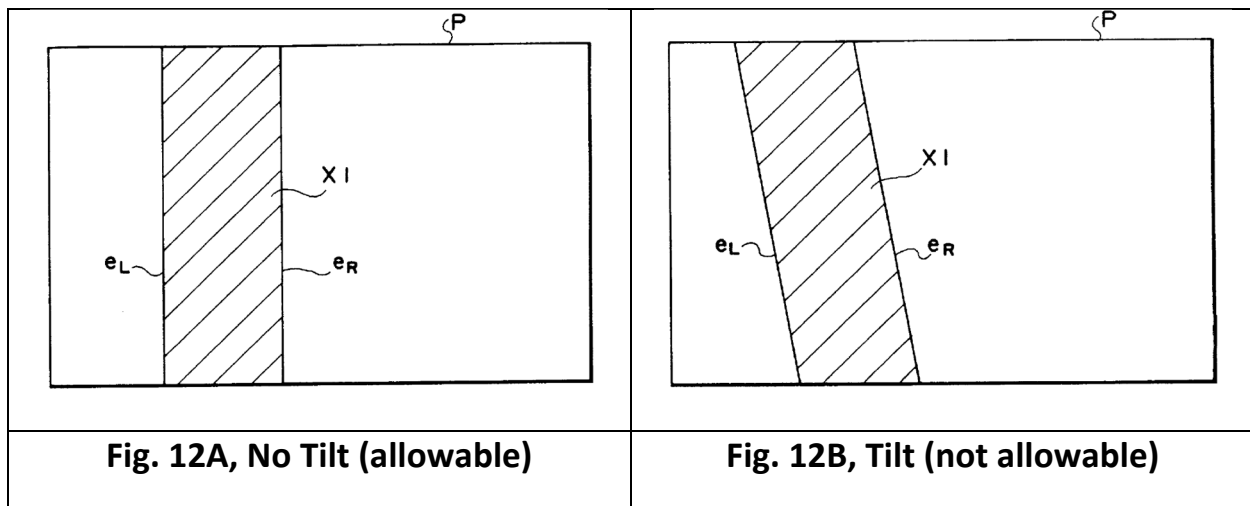
- ii. [1.a] “obtaining a first value (QII) responsive to the device angle to the horizon”

Anon discloses that inputs to engine 300 include the image itself, camera settings, photographer preferences, cultural preferences, scene preferences, as well as location, time, and **orientation inputs**. EX1004, 4:24-33, 7:4-7 (“orientation inputs”), 8:27-44, 9:40-46 (“orientation of the camera”). Anon explains that “parameters from the camera may be used to make the judgment, such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like” (*id.*, 8:28-31) and that “[c]amera-specific external inputs might include the camera's current geographic location, time of day, orientation and the like.” *See id.*, 4:24-26. Anon also teaches to “check the sky-to-land ratio and if the sky takes up too much of the frame, suggest aiming the camera lower.” *Id.*, 9:35-50. A POSA would understand that the “orientation inputs” would include “a first value (QII)” responsive to the “horizon line”: “the engine might consider that the mode is set to ‘landscape image’ mode, the focal-length of the lens, and **the horizon line** of in the image.” *Id.*, 7:50-54.

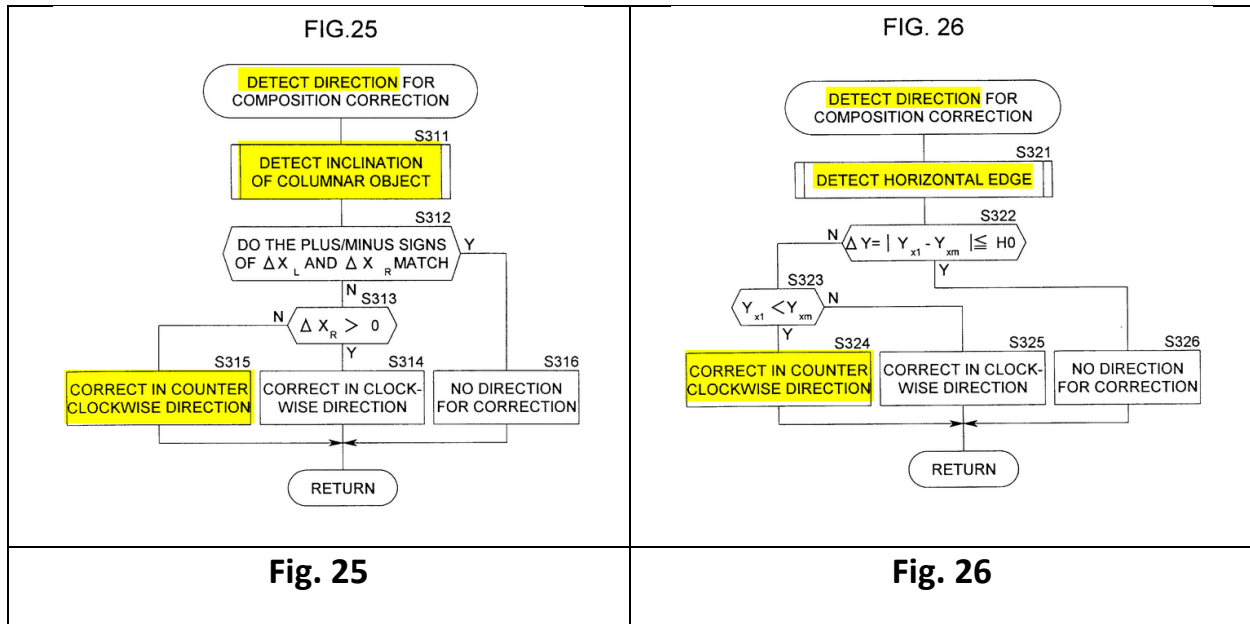
A POSA would have understood that, while Anon does not use the term “angle to the horizon,” “orientation” as determined by an “accelerometer” is, in the context of camera technology, a standard way to obtain a value representing the device's

angle relative to gravity (*i.e.*, the horizon). EX1005 at 1; EX1003, ¶61. As an application note for an Analog Devices accelerometer explains, “an accelerometer can be used to measure the static angle of tilt or inclination” where “the net acceleration or force on a system over time is gravity” in applications such as “horizon detection in digital cameras.” EX1005 at 1; EX1003, ¶61.

To the extent that PO argues that Anon does not obtain a value responsive to the device angle to the horizon, Suzuki remedies any deficiency. Suzuki detects orientation and evaluates whether the camera is tilted relative to the expected horizontal or vertical axes. *See* EX1006, Figs. 12A-12B.



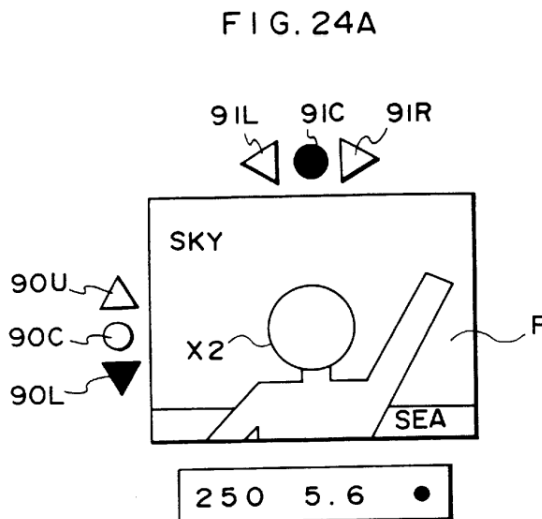
This is accomplished by calculating deviation values (e.g., ΔX_L , ΔX_R , ΔY) to determine if the camera is tilted; and providing feedback to the user to correct the tilt and achieve a leveled position: “If the amount of deviation ΔX_R is a negative value [less than 0], the direction for correction is set to the counter clockwise direction.” *See* EX1006, 21:40-56, Figs. 25-26.



A POSA would have been motivated to modify Anon’s system to use orientation input data for leveling relative to the horizon, as taught by Suzuki, for several reasons. A POSA would have known that unintentional tilt or mis-leveling of a camera is a common cause of poor composition. Suzuki explicitly identifies the problem of camera tilt—whether in landscape or portrait orientation—and its negative impact on image aesthetics, such as slanted horizons or vertical objects appearing askew. *See* EX1006, 1:33-39; EX1003, ¶64.

Anon contemplates the use of external characteristics, including “orientation,” “location,” and “horizon” as part of the data available for composition feedback, and Suzuki demonstrates a practical application of such sensors: detecting whether the camera is level relative to the horizon and providing user feedback to correct tilt. EX1003, ¶65.

Furthermore, Anon's system provides feedback to the user to improve image composition, including suggestions for camera movement, subject placement, and other compositional elements. *See* EX1004, 1:14-17, 7:42-8:13. Integrating orientation inputs to detect and correct camera leveling would have been a natural extension of this paradigm. EX1003, ¶66. As Suzuki teaches, providing feedback to the user when the camera is not level helps the user achieve a more aesthetically pleasing and professional-looking photograph. EX1006, Fig. 24A (indicator 90L), Abstract ("warning device that issues a warning when the signal indicating poor composition has been issued"), 1:12-46, 1:49-58, 4:27-33, 6:19-56, 7:34-43, 9:27-47, 19:7-42.



This aligns directly with Anon's goal of assisting users in capturing better-composed images. EX1003, ¶66.

Suzuki provides methods for detecting tilt and issuing corrective feedback, which could be readily implemented in Anon's engine. The combination would not require undue experimentation or inventive skill, as both systems are designed to process sensor data and provide user guidance. Anon's system is already structured to process a variety of sensor inputs, including those related to orientation. EX1004, 4:24-33. Suzuki's methods for detecting and correcting tilt are compatible with the architecture of Anon's feedback engine, which is designed to analyze image and sensor data and provide actionable feedback to the user. The modification would have thus been straightforward from an engineering perspective to a POSA. EX1003, ¶68. The proposed combination also represents combining prior art elements (Suzuki's methods for detecting and correcting tilt with Anon's CFE) according to known methods to yield predictable results, and the use of a known technique (Suzuki's detection and correction of tilt) to improve similar devices in the same way. EX1003, ¶68.

- iii. [1.b] *“estimating a first weight (c1) associated with the first value”*

Anon's engine determines a plurality of image-based characteristics for a proposed image, and then “compute[s] a composition measure for the proposed image and the given settings that depends from at least two of the plurality of image-based characteristics of the proposed image.” *See* EX1004, 1:64-67. Anon's engine takes into account both intrinsic image characteristics (such as color, focus,

brightness, and energy) and external characteristics (such as geographic location, time of day, user preferences, and cultural rules), and indicates that “[a] typical composition and feedback engine, according to embodiments of the present invention, will consider more than one independent value for some characteristic of an image and provide recommendations that might not be optimal for one characteristic versus another characteristic.” EX1004, 5:26-30. This would have indicated to a POSA that the system weighs different characteristics, sometimes even trading off optimality in one for a better overall composition measure. EX1003, ¶70.

Anon also expressly discloses assigning a weight to each of the inputs into the CFE: “In various embodiments, these parameters may be input into a fuzzy logic set, or the like, and an evaluation, *e.g. weighted, combination of parameters* may be performed by the composition and feedback engine.” EX1004, 8:32-35. Thus, a POSA would understand that Anon’s engine “estimat[es] a first weight (c1) associated with the first value” as claimed.

To the extent that PO argues that Anon does not expressly disclose estimating a first weight (c1) associated with the obtained device angle to the horizon, a POSA would have found it obvious to use Suzuki’s camera leveling determination as one weighted factor among many in Anon’s system. EX1003, ¶71. A POSA would have been motivated to do so for several reasons.

First, camera leveling was a well-known and important aspect of image quality and composition, as recognized by Suzuki. See, e.g., EX1006, 21:1-8. Second, Anon's system was designed to accept multiple, weighted evaluation factors and to update or add new factors as needed to improve image assessment. See EX1004, Fig. 3, 7:4-29, 10:48-50. Anon's disclosure contemplates the use of orientation data as inputs for composition evaluation and describes the use of weighted combinations of multiple characteristics to compute an overall composition measure. *Id.*, 9:26-34. Incorporating camera leveling into Anon as a weighted factor would have been a predictable use of a known quality metric (leveling) in a system designed to combine multiple such metrics for comprehensive evaluation. EX1003, ¶71.

To the extent PO contends that "estimating" should be narrowly construed to require a real-time, context-dependent determination of the claimed "weight," Anon discloses this. Anon expressly teaches that an input into the CFE (e.g., object detection, location, and characteristics) influences the determination of the *weights* attached to other characteristics.

Other inputs might include an indication of where in the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image, find an object with a defined border that has a color distribution that is wildly different from the histogram of the rest of the image, as might

be the case when photographing a red and yellow bird with a background of green and brown of the surrounding trees). ***This input can be used to influence how various characteristics are weighted.***

EX1004, 3:53-4:3.

To the extent that Anon is argued to not disclose dynamic estimation of weights, Jasinski remedies any deficiency. For each new set of images, Jasinski describes computing weights for each image region dynamically, based on the current image data. See, e.g., EX1010, ¶¶[0120]-[0122]. These weights are recalculated for every image or sequence, enabling the system to adapt instantly to changing scene conditions. *Id.*, ¶¶[0119]-[0122]. As Jasinski explains: “[t]he weighting coefficients w_i can be determined using any method known in the art. In a preferred embodiment, the weighting coefficients w_i are determined to be representative of the estimated relative importance of the image regions to a user.” *Id.*, ¶[0120]. Jasinski discloses attributes that can be considered in the determination of the relative importance, *id.*, ¶[0120], including:

- Image detail: "image regions 365 with high levels of image detail can be weighted more highly," *id.*, ¶[0121].
- Scene brightness: "local scene brightness level can also be an indication of the suitability of an image region... the choice of image regions with a higher local brightness level avoids areas where low signal-to-noise

can interfere with the calculation of accurate motion velocities," *id.*, ¶[0114]

- Region position or presence of important features: "image regions 365 in a face zone or an autofocus zone can be weighted more heavily than other image regions 365 because they are more likely to be a main subject," *id.*, ¶[0120]
- Confidence in the measurement: "the shape of the fitting function 475 can provide an indication of the relative confidence level," *id.*, ¶[0122]

Jasinski's dynamic weighting is not limited to motion estimation, but can be more broadly applied to determining image capture settings. *See id.*, ¶[0031].

A POSA would have understood that using dynamic estimation of weights (as taught by Jasinski) as part of a weighted combination of parameters (as taught by Anon) would allow for accounting of changes in the reliability, relevance, and importance of parameters over different regions of the image or over time. EX1003, ¶73. A POSA would have appreciated that dynamically weighting Anon's composition inputs as taught by Jasinski would have allowed the system to adapt to the most current and relevant scene conditions, thereby providing a more accurate assessment of quality. Jasinski's region-based weighting fits naturally with Anon's teaching that object and region detection influences the weights of other quality characteristics. This combination of Anon-Suzuki and Jasinski is the use of a known

technique (Jasinski’s dynamic weights) to improve similar devices in the same way. For these reasons, a POSA would have been motivated to combine the complementary teachings of Anon-Suzuki and Jasinski with a reasonable expectation of success. EX1003, ¶73.

- iv. [1.c] “obtaining a second value (QI2) associated with an aesthetic quality of image based on the composition”

Anon’s engine receives a proposed image, determines a plurality of image-based characteristics (such as color, focus, brightness, and compositional elements), and then computes a “composition measure” for the proposed image. *See* EX1004, 3:43-4:51, 5:26-30, 6:42-50. This composition measure is a value that depends on, among other inputs, at least two image-based characteristics of the proposed image, including aesthetic quality. *See id.*, 3:43-4:23. For example, Anon explains an “energy” measure as an input, *id.*, 4:7-16, which is a “second value (QI2)” as claimed. Anon notes that energy is an aesthetic indicator. *Id.*, 4:42-51.

Thus, in Anon, the composition measure is intended to reflect the overall aesthetic quality of the image, particularly as it relates to composition. Anon discusses the use of compositional rules such as the “rule of thirds,” balance of luminance, and other aesthetic principles to evaluate the image. *Id.*, 10:41-46. And, as explained in *supra* Section VI.A.1.iii, Anon explains in mathematical terms that

each individual characteristic of an image is assigned a value. *Id.*, 5:40-47. Each of these is also “a second value (QI2)” as claimed.

- v. [1.d] “*estimating a second weight (c2) associated with the second value*”

As discussed in *supra* Section VI.A.1.iii, Anon expressly discloses assigning weights to each of Anon’s quality-indicator inputs. This “weighted, combination of parameters,” EX1004, 8:32-35, would include aesthetic quality indicators such as “energy.” *Id.*, 4:7-16, 4:42-51. To the extent PO contends that “estimating” should be narrowly construed to require a real-time, context-dependent determination of the claimed “weight,” Anon discloses this or, alternatively, it is rendered obvious by the combination of Anon and Jasinski as set forth *supra* Section VI.A.1.iii.

- vi. [1.e] “*wherein at least one of said values is below threshold, to select, at least one appropriate suggestion from a pre-stored table of suggestions of how a user may cause at least one of QI1 or QI2, to be above said threshold and to present said appropriate suggestion to the user.*”

As discussed in *supra* Section VI.A.1.iv, Anon describes a camera system that evaluates a plurality of image-based characteristics (such as focus, color, brightness, energy, subject position, and orientation) to compute a composition measure for a proposed image. Anon uses thresholds to provide feedback, for example: “the camera viewfinder might have three lights (e.g., red, yellow, green) to signal to the photographer a rating of the photograph that would result if a photograph was taken

at that time, with those settings, in that location. The photographer might, seeing a red light, move the camera or make other adjustments to see if a yellow or green light could be obtained.” *See* EX1004, 3:27-33. Anon also teaches using thresholds based on composition measures to trigger suggestions, *see id.*, 5:64-6:8, and expressly discloses making suggestions based on an individual quality indicator, such as an “energy” value, being below a threshold: “there might be an optimal energy measure and certain adjustments might be suggested, such as a suggestion to zoom in to eliminate more low energy background, thereby increasing the energy of the image.” *Id.*, 4:13-16.

Similarly, Suzuki teaches a camera system that evaluates quality based on various factors, including camera leveling, subject position, and presence of distracting elements (*e.g.*, tilted horizons, objects behind heads). *See, e.g.*, EX1006, Fig. 30, 1:24-46, 23:62-24:3, 24:58-67. For example, if the deviation of a horizontal edge (such as the horizon) from the true horizontal (*e.g.*, ΔY) is greater than a threshold, the system recognizes the horizon as tilted and triggers a recommendation for the user. *See id.*, 22:1-11.

Suzuki further teaches the use of thresholds to evaluate quality-related values and to provide user recommendations when those factors are suboptimal. *See id.*, Figs. 20, 22, 19:7-15. A POSA would have been motivated to modify Anon to use Suzuki’s thresholds in such a manner for several reasons (EX1003, ¶¶76-78):

- both systems are designed to help users improve image quality by alerting them to issues and suggesting corrective actions; and
- Anon’s system is designed to be extensible and to incorporate new evaluation factors, including those based on threshold comparisons.

A POSA would have known that using a threshold to trigger a recommendation is a predictable and well-understood method for providing actionable feedback to users and a POSA would have had a reasonable expectation of success in using the thresholds to generate recommendations for a user to improve an image. Both Anon and Suzuki teach threshold-based evaluation and user feedback, and their combination would have been a straightforward, predictable, and technically compatible way to enhance user guidance and image quality in camera systems. EX1003, ¶79.

Further, the combination of Anon and Suzuki would have suggested the use of a pre-stored table (or database) of suggestions or rules for improving image quality. Anon explains that the engine “output[s] an indication of the composition measure to a user, in the form of simple indicators, more complex indicators/displays, and/or *provide suggestions for altering at least one characteristic of the proposed image.*” EX1005, Abstract; *see also id.*, 1:59-2:4. To determine suggestions that should be made, Anon discloses using rule sets 306, which are data structures that contain user suggestions for improving photographs.

As Anon explains, the engine “can also take into account rule sets stored in rule set storage 306 and lookup data stored in lookup data storage 308. Examples of rules are used throughout this disclosure, and it should be understood that engine 300 operates on data structures that represent those rules, possibly in combination with lookup data 308 that may be relevant to a particular rule.” EX1004, 7:15-24. Anon goes on to provide the following example: “a rule in rule set storage 306 might indicate that for landscape images of large bodies of water, adjust the camera settings so that a pleasing amount of light would come from the water relative to the sky, and another rule in *rule set storage 306 might indicate that when standing close to a famous monument, suggest to the photographer where good viewing locations are*, and the lookup data 308 might include data for some commonly widely photographed monuments.” *Id.*, 7:21-29. Anon provides other examples as well: “a camera image type setting might be set to a ‘portrait image’ mode, an image capture device (or the engine itself) might identify the head and/or eyes of the subject to be photographed, the engine would then consider the image type setting, the current lens aperture, etc. and *suggest movement or recomposition based on one or more rules from the rule set.*” *Id.*, 7:44-50. In another example, “the engine might consider that the mode is set to ‘landscape image’ mode, the focal-length of the lens, and the horizon line of in the image itself *and, based on one or more rules, suggest changes.*” *Id.*, 7:50-54.

Anon does not specifically disclose that its rules are organized as “tables,” but does disclose that its rules are organized in “data structures.” *Id.*, 7:15-21. A POSA would have understood and found obvious that a table, which is comprised of rows and columns, was the most common and easily implemented data structure that facilitated efficient storage, retrieval, and manipulation of data. Indeed, Garcia-Molina, a leading textbook on database design from 2009, confirms that the two-dimensional table is “the most important model of data.” EX1016, 17; *see generally* EX1016, Chapter 2. Thus, it would have at least been obvious to store Anon’s rule sets in table form, as it would have been use of a known technique to improve similar devices in the same way and applying a known technique to a known device ready for improvement to yield predictable results. EX1003, ¶80.

2. Claim 2

Claim 2 depends from claim 1 and further recites “wherein the estimating of the first weight (c1) is responsive to the values of the second value (QI2) or wherein the estimating of the second weight (c2) is responsive to the values of the first value (QI1).” Both Anon and Suzuki describe camera systems in which the determination of device tilt (orientation) is linked to the aesthetic quality of an image. As discussed *supra* Section VI.A.1.iii, Anon also expressly teaches that the estimation of one value (e.g., object detection, location, and characteristics) “***can be used to influence how various characteristics are weighted.***” EX1004, 3:53-4:3.

A POSA would understand that object location and characteristics within an image is a value “associated with an aesthetic quality of image based on composition”—QI2. EX1003, ¶83. For example, Anon expressly discloses measuring “energy” of a detected subject within an image. EX1004, 8:19-27. As shown above, Anon teaches that object/subject location and characteristics can be used to influence the weights of other characteristics. EX1004, 3:53-4:3. In Anon, the system also uses orientation data (*e.g.*, tilt, roll, pitch) as one of several image-based and external characteristics to compute a “composition measure”—a quantitative or qualitative assessment of the image’s aesthetic quality. *Id.*, 4:24-33 (“Camera-specific external inputs might include the camera's current . . . orientation . . . [to] allow the engine to make recommendations for composition”), 7:4-7, 8:27-44, 8:65-9:3, 9:35-55, 8:32-35 (“weighted, combination of parameters”). For example, a tilted horizon or slanted verticals may lower the composition measure, prompting feedback to the user. *Id.*, 9:35-50. Similarly, in Suzuki, attitude detection is used to judge whether the composition is “good” or “poor” based on established aesthetic rules (*e.g.*, level horizons, upright verticals, proper subject placement). EX1006, Figs. 1, 6, and 30, Abstract, 3:25-36, 4:16-33, 4:49-57, 9:9-27, 20:56-67. A POSA would have understood that the interdependence of orientation of the camera and aesthetic factors is fundamental to operation of both systems, and therefore would have readily understood that weight associated with “device angle

to the horizon”—c1—would be among the weights influenced by Anon’s detection and characterization, e.g., energy, of object/subject location—QI2—in the combined Anon-Suzuki system. EX1003, ¶83.

3. **Claim 3**

Claim 3 depends from claim 1 and further recites “wherein said suggestion may suggest to the user to move to another location.” Anon explicitly discloses a suggestion that the user move to another location to improve the composition and overall aesthetic quality of an image. *See, e.g.*, EX1004, 9:29-32 (“For example, the engine might optimize a suggestion *for changing a camera location* to one where the color mix is less desirable, but where the composition is better.”). For example, Anon’s engine analyzes not only the current image and camera settings but also external context such as geographic location, orientation, and scene type. *Id.*, 2:16-27, 4:24-33, 4:56-5:25, 7:4-14, Fig. 3. Anon’s system provides real-time suggestions to the user, which can include recommendations to change the camera’s position or location. *See id.*, 7:55-63 (“the feedback can be a simple visual, audio or vibratory indication ... but might also include suggestions for improvement, in the form of arrows, icons, text, etc.”), 9:29-32.

4. **Claim 4**

Claim 4 depends from claim 1 and further requires “calculating a total image quality according to, or based on, a total value, and wherein the total value is

calculated as a weighted average value according to, or based on, $c1*QI1+c2*QI2$, where $c1>0$ and $c2>0$, and when said total quality is above or below threshold, giving the user a feedback or saving the image to a user storage.” Anon discloses using a conventional weighted average value as recited by this claim: Anon teaches that input parameters can be weighted and combined, explaining that “these parameters may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:32-35.

Anon further teaches that the calculated composition measure (*i.e.*, combined value) can be compared to a threshold to determine subsequent actions such as user feedback. Anon explains that “[t]he camera might provide more detailed feedback” such as “suggestions for changes to settings ... to improve the composition measure, or an overriding of camera controls based on composition measure (*e.g.*, if the composition measure is **below a threshold**, the camera might lock the shutter button to prevent a photograph from being taken[)].” *Id.*, 3:33-42, 5:64-6:8.

5. Claim 6

Claim 6 depends from claim 1 and further recites “wherein at least one of said weights are defined at least partially over a time-dependent confidence level defined over at least one of said values $QI1$, $QI2$.” Anon does not expressly teach this limitation. Jasinski, however, teaches that the reliability of motion estimates can

fluctuate due to changes in scene content, lighting, camera movement, or subject motion. By capturing a sequence of images at different times and computing motion estimates for each, the system can observe how confidence in those estimates evolves. *See* EX1010, ¶¶[0030], [0088], [0122]. Jasinski teaches weighting coefficients relative to their confidence level. *Id.*, ¶[0122]. A POSA would have understood that using a time-dependent confidence level (as taught by Jasinski) as part of a weighted combination of parameters (as taught by Anon) would allow for accounting of changes in the reliability, relevance, or certainty of the parameters over time. EX1003, ¶89. A POSA would have appreciated that weighting Anon’s estimates according to time-dependent confidence would have allowed the system to adapt to the most current scene conditions, rather than relying on outdated, less reliable data. The result is a more accurate assessment of image quality. The combination of Anon and Jasinski is the use of a known technique (Jasinski’s time-dependent confidence level) to improve similar devices in the same way. For these reasons, a POSA would have been motivated to combine the complementary teachings of Anon and Jasinski with a reasonable expectation of success. EX1003, ¶89.

6. Claim 8

Claim 8 depends from claim 1 and further requires “analyzing the captured image for detecting or recognizing one or more objects in the image, wherein the

second value (QI2) associated with the aesthetic quality is partially based on detected objects.” Anon’s system analyzes images in real-time to detect or recognize one or more objects (such as faces, people, or other subjects), and the value associated with aesthetic quality is at least partially based on the detected objects and their properties within the image. EX1004, 3:53-60, 8:15-31, 8:65-9:25, cl. 6 (“classification of the subject is one of a person's face, an animal, a landscape object, a primary object of interest, a building or a landmark”). For example, Anon explains that the system may judge a “good” image as one where the subject (*e.g.*, a person) is in focus, the subject’s eyes are open, and the subject is not obscured by background objects. *See id.*, 8:19-23 (“if a photographer is taking a picture of a person in front of an object, such as the Eiffel Tower, a ‘good’ shot is typically judged when the Eiffel Tower is positioned to not be directly behind the subject’s head”); 8:25-26 (“energy” of subject); 8:15-31.

B. Ground IB: Claims 10, 13-14, and 17-20 Are Obvious in View of Anon, Takeuchi, Jasinski, Kosaka, and Garcia-Molina

1. Independent Claim 10

- i. *[10.pre.] “A method for estimating a quality of at least one image from a stream of images from a video, for use with a device that comprises in a single enclosure a digital camera module or functionality that comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to at least one optical lens for capturing an image of the scene; a motion or*

location sensor for sensing the device motion; and a processor coupled to the image sensor and to the digital camera for receiving data therefrom, the method by the processor comprising use of at least one value and weight”

To the extent that the preamble is limiting, Anon discloses a method for estimating image quality of at least one image from a stream of images from a video. Anon explains that, “unless otherwise indicated, what is explained about a photographer using a camera to capture a photograph can equally apply, unless otherwise indicated, to a videographer using a video camera to capture a video sequence...” EX1004, 3:2-10. Anon analyzes multiple image-based characteristics, computing a composition measure, and providing real-time suggestions to the user. *See id.*, 2:9-14, 2:16-28, 2:33-38, 3:14-26.

As set forth in *supra* Section VI.A.1.i, Anon’s camera device comprises at least one optical lens for focusing received light from a scene and an image sensor (e.g., CCD) coupled to the lens for capturing an image of the scene, housed within a single enclosure. As further explained in *supra* Section VI.A.1.i, Anon also teaches a “motion sensor that can provide the engine with inputs as to how the camera is moving.” *Id.*, 10:27-46, 2:64-3:10. And as also explained in *supra* Section VI.A.1.i, Anon describes an “engine” executed on a processor where the processor is coupled to the image sensor and the digital camera itself for performing a method comprising use of at least one value and weight as outlined below. EX1003, ¶93.

- ii. [10.a] “obtaining a first value (QI1) responsive to the device motion from the motion or location sensor”

Anon discloses that inputs to engine 300 include the image itself, camera settings, photographer preferences, cultural preferences, scene preferences, as well as **location**, time, and orientation inputs. EX1004, Fig. 3, 4:24-33, 7:4-29. Anon explains that “parameters from the camera may be used to make the judgment, such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like,” (*id.*, 8:27-31) and that “[c]amera-specific external inputs might include the camera’s current geographic location, time of day, orientation and the like.” *See id.*, 4:24-26. For example, Anon explains that, “if the engine is aware of the camera location and has access to a data set of rules (e.g., ‘when located at the GPS coordinates of the front of Cinderella’s Castle™ in Disneyland, suggest centering on the castle rather than rule of thirds’).” *Id.*, 5:3-7. A POSA would have understood that GPS coordinates constitute a value—e.g., longitude and latitude coordinates—which is the claimed “first value (QI1).” EX1003, ¶94.

Anon also discusses the use of motion sensors “that can provide the engine with inputs as to how the camera is moving.” EX1004, 10:26-35. Anon explains, for example, that “it might be a preference when a subject is moving quickly in a scene

to frame more of the scene in front of the subject than in back of the subject and this could be suggested by the engine to a videographer.” *Id.*, 10:31-35.

- iii. [10.b] “*estimating a first weight (c1) associated with the first value*”

As discussed above in *supra* Section VI.A.1.iii, Anon expressly discloses assigning weights to each of Anon’s quality-indicator inputs. This “weighted, combination of parameters,” EX1004, 8:32-35, would include orientation, location, and motion inputs that constitute the claimed “first value (QI1).” *Id.*, Fig. 3, 4:24-33, 7:4-29. To the extent PO contends that “estimating” should be narrowly construed to require a real-time, context-dependent determination of the claimed “weight,” Anon discloses this or, alternatively, it is rendered obvious by the combination of Anon and Jasinski as set forth *supra* Section VI.A.1.iii.

- iv. [10.c] “*obtaining a second value (QI2) where the second value is a measurement of under or over exposure of the image*”

Anon does not expressly disclose obtaining a measurement value indicating whether an image is under or over exposed. Takeuchi, however, explicitly uses exposure information in its image quality evaluation. The system computes luminance information and exposure values. *See* EX1007, ¶¶[0084], [0090], [0137]. Takeuchi explains that the evaluation includes checks for underexposure (blackout) and overexposure (whiteout), both for the main subject and the overall image. Points are added or subtracted from the image quality score based on whether the exposure

is within a preferred range. *See id.*, ¶[0147] (“[T]he body side microcomputer 21 seeks regions where there is underexposure (blackout) or overexposure (whiteout) with respect to the overall picture, and judges whether their proportion is below a predetermined value.”). A POSA would understand that Takeuchi’s exposure measure is “a second value (QI2)” as claimed.

Both Anon and Takeuchi are directed to the problem of evaluating and improving the quality of images. Takeuchi’s system provides a comprehensive evaluation of image quality, including explicit detection and quantification of overexposure and underexposure, and offers feedback or correction suggestions to the user. *See e.g.*, EX1007, ¶¶[0147], [0290]. Anon’s system is focused on real-time feedback regarding image composition and overall quality, using a variety of image-based characteristics (such as color, focus, brightness, and energy) to compute a “composition measure.” *See* EX1004, 1:59-2:8.

A POSA would have recognized that exposure—specifically, the presence of overexposed or underexposed regions—is a fundamental aspect of overall image quality. Poor exposure can result in loss of detail, which directly impacts the aesthetic and technical value of a photograph. EX1003, ¶97. Anon’s system provides suggestions to improve image quality, and explicitly contemplates using multiple image-based characteristics, including brightness, as part of its composition measure. EX1004, 2:9-15. A POSA would have been motivated to combine

Takeuchi's exposure determination with Anon's system for several reasons (EX1003, ¶98):

- Anon's system seeks to provide a holistic evaluation of image quality, and Takeuchi's exposure analysis offers a robust, quantitative method for detecting and scoring exposure problems. Integrating this would have filled a clear need in Anon's framework for a reliable exposure input.

- Anon's teaches that different types of characteristics can be used to judge an image with its system. EX1004, 8:14-35, 10:48-50.

- Both systems are designed to provide actionable feedback to the user. Takeuchi's system not only detects exposure issues but also suggests corrections (EX1007, ¶[0290]), which aligns with Anon's goal of providing real-time suggestions to improve image quality. *See* EX1004, 3:22-26.

- It was well-established in the field that exposure is a key determinant of image quality. A POSA would have been aware of many prior art systems which analyze exposure as part of their quality assessment. *See, e.g.*, EX1013, U.S. Pat. App. Pub. No. 2010/0246939 to Aisaka, EX1014, U.S. Pat. App. Pub. No. 2008/0192129 to Walker, and EX1015, U.S. Pat. App. Pub. No. 2005/0270381 to Owens. Thus, a POSA would have naturally considered exposure analysis as a potential input for any comprehensive image quality system.

A POSA would have a reasonable expectation of success in implementing Takeuchi's exposure determination as an input to Anon's system for several reasons (EX1003, ¶99):

- Takeuchi's exposure evaluation produces quantitative results (*e.g.*, scores or flags for overexposure/underexposure) that are readily usable as input features in Anon's composition measure, which is designed to aggregate multiple image-based characteristics. *See* EX1007, ¶[0090]; EX1004, 5:40-47.

- Both references describe modular systems where different evaluation units (*e.g.*, for exposure, focus, color, etc.) contribute to an overall image score or feedback mechanism. *See* EX1007, ¶[0289]; EX1004, 5:26-30. Integrating an additional input such as exposure would have been a straightforward extension of Anon.

v. [10.d] “*estimating a second weight (c2) associated with the second value*”

As discussed above in *supra* Section VI.A.1.iii, Anon expressly discloses assigning weights to each of Anon's quality-indicator inputs. Based on the teachings of Anon and Takeuchi discussed in the previous section—*supra* Section VI.B.1.iv—a POSA would have understood that this “weighted, combination of parameters,” EX1004, 8:32-35, would include assigning a weight to the exposure measure of Takeuchi in combination with Anon. EX1003, ¶100. To the extent PO contends that

“estimating” should be narrowly construed to require a real-time, context-dependent determination of the claimed “weight,” Anon discloses this or, alternatively, it is rendered obvious by the combination of Anon and Jasinski as set forth *supra* Section VI.A.1.iii.

- vi. *[10.e] “analyzing the captured image for detecting or recognizing one or more objects in, or one or more characteristics of the image or at least one of object characteristics to obtain a third value (QI3) associated with the analysis”*

Anon explicitly discloses the detection and recognition of objects within the image:

Other inputs might include an indication of where in the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image, find an object with a defined border that has a color distribution that is wildly different from the histogram of the rest of the image, as might be the case when photographing a red and yellow bird with a background of green and brown of the surrounding trees).

EX1004, 3:62-4:3. A POSA would have understood this passage to mean that Anon detects and recognizes specific objects, such as faces or distinctively colored objects, within the image, and would recognize that Anon’s “indication of where in the image the subject is” generates “a third value (QI3)” as claimed. EX1003, ¶101.

Takeuchi also makes detects and recognizes objects as part of its image quality evaluation process. For example, Takeuchi’s system detects the position of what is

estimated to be a person's face within an image. *See* EX1007, ¶[0115]. This is achieved using a database of pattern images with common facial features and applying pattern matching to the image data. *Id.* When a region matches a face pattern, it is estimated to be a face, and this information is used for main subject estimation. During the main subject estimation, “the body side microcomputer 21 segments the picture of the target image into a plurality of blocks and compares this image with the face detection region information obtained in Step S103 for the image in question. Then, the body side microcomputer 21 adds a predetermined number of points to the region where a face image is detected.” *Id.*, ¶[0134]. According to Takeuchi, in the main subject estimation computation, the contribution of each item “may be adjusted by appropriately setting the size of the number of points to be added for each item.” *Id.*, ¶[0136].

A POSA would have been motivated to use Takeuchi’s object detection and point system as an input to Anon’s quality estimation engine for several reasons (EX1003, ¶103):

- Anon explicitly acknowledges that a “good” image is often defined by the subject being in focus, well-exposed, and well-composed. EX1004, 8:19-26. Takeuchi’s system directly quantifies aspects of the detected subject, providing a granular, subject-aware quality score of an image. *See e.g.*, EX1007, ¶[0142].

- Anon’s system is designed to automate the process of evaluating images, and it is explicitly open to using a variety of “image-based characteristics” as inputs to its composition measure. *See* EX1004, 3:53-59. Takeuchi’s point system is a high-level input that encapsulates multiple technical quality factors in a single, objective score. *See* EX1007, ¶[0289].

By leveraging Takeuchi’s object-based scoring, Anon’s system would more efficiently and accurately identify images where the main subject is well-captured, reducing the need for manual review and improving the user experience—an explicit goal of both systems. EX1003, ¶104. A POSA would have a reasonable expectation of success in incorporating Takeuchi’s object-based scoring into Anon’s engine. EX1003, ¶104.

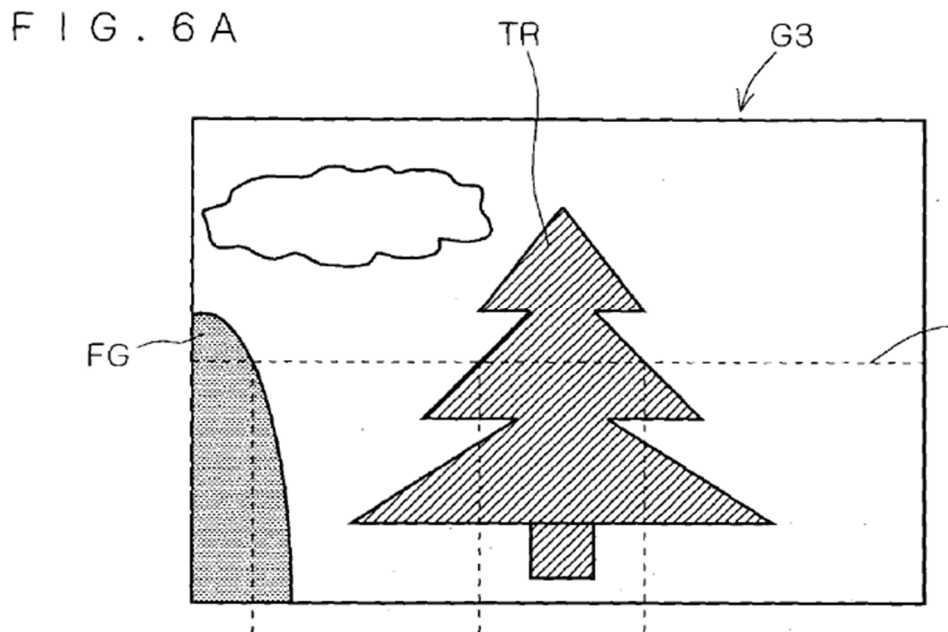
vii. [10.f] “*estimating a third weight (c3) associated with the third value*”

As discussed above in *supra* Section VI.A.1.iii, Anon expressly discloses assigning weights to each of Anon’s quality-indicator inputs. Based on the teachings of Anon and Takeuchi discussed in the previous section—*supra* Section VI.B.1.vi—a POSA would have understood that this “weighted, combination of parameters,” EX1004, 8:32-35, would include assigning a weight to apply to the third value (*e.g.*, the value related to object or face detection analysis). EX1003, ¶105. To the extent PO contends that “estimating” should be narrowly construed to require a real-time, context-dependent determination of the claimed “weight,” Anon discloses this or,

alternatively, it is rendered obvious by the combination of Anon and Jasinski as set forth *supra* Section VI.A.1.iii.

- viii. [10.g] “obtaining a forth value (QI4) responsive to obstruction of at least one optical lens, estimating a forth weight (c4) associated with the forth value”

Anon does not expressly teach obtaining a value responsive to obstruction of at least one optical lens. Kosaka, however, discloses a digital camera system that is designed to detect whether a user's finger is unintentionally obstructing the lens before an image is captured. *See e.g.*, EX1008, Fig. 6A.



The system operates by analyzing a series of live view images (or images for autofocus) in real time, prior to the actual image capture. *Id.*, Abstract, Figs. 9, 24, ¶¶[0047], [0098]. The determination part of the camera examines changes over time in the position of low-brightness areas within these images. *Id.*, Abstract, ¶¶[0089],

[0141]. If a low-brightness area remains stationary while other areas shift due to camera shake or reframing, the system identifies this stationary area—especially if it is located at the periphery of the image—as a potential finger obstruction (*i.e.*, a lens obstruction). *See, e.g., id.*, Figs. 4A-8, ¶¶[0074]–[0075]. A POSA would understand that this analysis generates “a forth value (QI4) responsive to obstruction” of the camera lens as claimed.

Kosaka further explains that the camera can notify the user of such an obstruction before the image is taken, allowing the user to correct the issue and avoid capturing an image with a finger or other object blocking the lens. *Id.*, ¶¶[0089], [0099]. In some embodiments, the system can even generate a corrected image by deleting the obstructed area or prevent the image from being recorded if an obstruction is detected. *See id.*, Figs. 9-10, 23-25, ¶[0089] (“Examples of the notifying operation are, concretely, indication of a note by characters of ‘Note: finger is in’ on the display 7 or a predetermined figure and output of sound of a note from a speaker or voice”).

According to Kosaka, the system analyzes the brightness (luminance) of pixels along a line or within an area of the image. A “low-brightness area” is defined as a region where the pixel value is lower than a predetermined threshold (referred to as “TH1” by Kosaka). For example, in the description of FIG. 4B, the system

identifies areas where the brightness is below threshold TH1 as potential obstructions (such as a finger or a tree). *Id.*, ¶[0069].

Anon, Takeuchi, and Kosaka are each concerned with improving the quality of captured images and automating the process of identifying and selecting “good” photographs. Kosaka’s finger obstruction detection is a well-defined image defect that directly impacts perceived image quality. Anon’s system is designed to accept a wide range of image-based characteristics as inputs to its composition measure, and Takeuchi’s system provides a subject-aware (i.e., object detection) evaluation. These approaches are complementary: Kosaka detects a specific, common image flaw; Takeuchi provides a robust technical and subject-aware score; and Anon offers a flexible, extensible framework for integrating such inputs into a comprehensive quality assessment. EX1003, ¶107.

A POSA would have been motivated to use Kosaka’s finger obstruction determination as an input to Anon’s engine, especially in combination with Takeuchi, for several reasons (EX1003, ¶108):

- Kosaka teaches that finger obstruction is a common cause of poor image quality, especially in small digital cameras. See EX1008, ¶¶[0006]–[0007]. Anon’s system is designed to identify images with technical or compositional flaws. *See, e.g.*, EX1004, 2:64–3:1. Integrating a finger

obstruction detection signal from Kosaka would allow Anon's system to recommend to users to correct this defect, improving the quality of images.

- Anon's system is designed to accept a variety of image-based characteristics as inputs to its composition measure, including "higher-level aspects of the image being sensed" and "image-based characteristics". *See e.g.*, EX1004, 2:9-15, 3:53-57. Kosaka's output—a determination of whether a finger is obstructing the image—fits naturally as an input to Anon's quality scoring engine.

- Takeuchi's system evaluates technical and subject-centric aspects (focus, exposure, etc.), but does not specifically address finger obstruction. By combining Takeuchi's object-based scoring with Kosaka's finger obstruction detection, Anon's system would provide a more comprehensive and robust assessment of image quality, covering both general technical quality and specific, high-impact defects.

A POSA would have had a reasonable expectation of success in implementing this combination for several reasons. First, Anon's system is designed to accept and combine multiple, diverse image-based inputs using weighted combinations. Kosaka's output is simply another input to be weighted alongside other quality factors (focus, exposure, subject detection, etc.). Both Anon and Takeuchi discuss combining multiple evaluation metrics to arrive at a final quality score. The addition

of Kosaka's finger obstruction detection would have been a straightforward extension of this approach, and would have been expected to yield predictable, desirable results (*i.e.*, making recommendations to a user how to improve an image). EX1003, ¶109.

Moreover, as discussed above in *supra* Section VI.A.1.iii, Anon expressly discloses assigning weights to each of Anon's quality-indicator inputs. Based on the above teachings of Anon, Takeuchi, and Kosaka, a POSA would have understood that this "weighted, combination of parameters," EX1004, 8:32-35, would include assigning a weight to apply to the "forth value" (e.g., the value responsive to obstruction of the optical lens). EX1003, ¶110. To the extent PO contends that "estimating" should be narrowly construed to require a real-time, context-dependent determination of the claimed "weight," Anon discloses this or, alternatively, it is rendered obvious by the combination of Anon and Jasinski as set forth *supra* Section VI.A.1.iii.

- ix. [10.h] *"selecting, based on values QI1, QI2, QI3, QI4 and weights c1, c2, c3, c4, at least one appropriate suggestion from a pre-stored table of suggestions of how a user may cause at least on said value to be above or below a threshold and to present said appropriate suggestion to the user."*

As discussed above in *supra* Section VI.A.1.vi, Anon describes a camera system that evaluates a plurality of image-based characteristics, computes a composition measure for a proposed image, and makes suggestions to an user to

improve an image. The suggestions are based on an overall composition measure being below a threshold or, alternatively, on an individual quality indicator being below a threshold. *See supra* Section VI.A.1.vi; EX1004, 4:13-16. Further, the combination of Anon, Takeuchi, and Kosaka would have suggested the use of a pre-stored table (or database) of suggestions or rules for improving image quality in several ways. Anon relies on pre-defined rules or criteria—whether stored as rule sets, lookup tables, or evaluation routines—to analyze the current image and determine if improvement is needed. In particular, Anon discloses, or in combination with Garcia-Molina renders obvious, a pre-stored table in the form of a “rule set” stored in a data structure that includes suggestions for image improvement, which constitutes the claimed “pre-stored table of suggestions.” EX1004, 7:15-29; *see also supra* Section VI.A.1.vi.

A POSA would understand that the combination of Anon, Takeuchi, and Kosaka (together with Jasinski and Garcia-Molina) would result in a system that monitors various image and camera parameters, compare them to thresholds, and provide feedback or suggestions to the user based on the pre-stored table of suggestions described above (EX1003, ¶114):

- Anon describes computing a composition measure based on multiple image-based characteristics and external context, and outputting indications or suggestions

(e.g., “red[/]yellow[/]green” lights, arrows, or text suggestions). *See* EX1004, 5:26-51; *see also* EX1004, Fig. 3, 5:53-6:8, 6:42-7:14.

- Takeuchi teaches evaluating images using multiple methods, assigning scores, and displaying correction information or hints when evaluation items fall below a threshold. *See e.g.*, EX1007, ¶¶[0284], [0290]-[0295], Fig. 25.

- Kosaka teaches detecting finger obstruction and issuing warnings or corrective actions when obstruction is detected (*i.e.*, when a value exceeds a threshold). *See* EX1008, ¶¶[0008], [0098].

When a monitored value (e.g., motion, exposure, object analysis, finger obstruction) is above or below a threshold, the system would consult the pre-stored table and selects the corresponding suggestion to present to the user. A POSA would have known that this is a predictable, modular approach that is explicitly taught and widely used in the art and would have implemented it with a reasonable expectation of success. *See, e.g.*, EX1015, ¶[0018].

2. Claim 13

Claim 13 depends from claim 10 and further requires “grading the image quality according to, or based on, a total value, and wherein the total value is calculated as a weighted average value according to, or based on, $c1*QI1+c2*QI2+c3*QI3+c4*QI4$, where $c1>0$, $c2>0$, $c3>0$ and $c4>0$.” A POSA would recognize the claimed “formula” to be the conventional method of combining

weighted parameters. EX1003, ¶116. As explained above in *supra* Section VI.A.4, Anon teaches conventional weighting: input parameters can be weighted and combined and the overall “composition measure” may be generated where “these [individual] parameters may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:32-35. Further, the resulting “composition measure,” which “provides *rating of the composition of an image* that is a ‘proposed’ image not yet captured,” *id.*, 6:42-45, is a measure “grading the image quality” as claimed. *See also id.*, 8:16 (“judge a properly composed image”); *see generally id.*, 8:14-35.

3. Claim 14

Claim 14 depends from claim 10 and further recites “wherein the estimating of the one of weights (c1, c2, c3, c4) is responsive to at least one of values (QI1, QI2, QI3, QI4) other than its respectively associated one.” Anon expressly teaches that the estimation of one value (*e.g.*, object detection and characteristics (QI3)) influences the determination of the weights attached to other characteristics (*e.g.*, c1, c2, or c4). EX1004, 3:53-4:3; *see also supra* Section VI.A.2. A POSA would understand this disclosure from Anon as teaching that at least one weight is estimated responsive to at least one quality indicator input value. EX1003, ¶117.

4. Claim 17

Claim 17 depends from claim 10 and further recites “wherein at least one of said weights are defined at least partially over a time-dependent confidence level defined over at least one of said values QI1, QI2, QI3, QI4.” As set forth *supra* Section VI.A.5, a POSA would have found this limitation obvious in light of Jasinski’s teaching of a time-dependent confidence level.

5. Claim 18

Claim 18 depends from claim 10 and further recites “wherein the second value (QI2) is further based on an object recognition done for the third value (QI3), where the object recognition can change importance of certain areas in the image for calculating purpose of said second value (QI2): over or under exposure value.” Anon does not expressly teach this limitation. Takeuchi’s system, however, links object detection (such as face or main subject detection) to the calculation of exposure level, assigning greater importance to the detected subject area for exposure purposes. See EX1007, ¶[0137] (“carries out the exposure computation *taking into account the luminance of the main subject*”); see also *id.*, ¶¶[0134]–[0136]. This approach ensures that the most important part of the image, as determined by object detection, is optimally exposed, and the weighting of image regions for exposure calculation is dynamically changed based on what is detected in the scene. EX1003, ¶121. As discussed above in *supra* Section VI.B.1.vi, a POSA would be motivated

to use Takeuchi's object detection and point system as an input to Anon's quality estimation engine.

6. Claim 19

Claim 19 depends from claim 13 and further recites “wherein at least one of said values (QI1, QI2, QI3, QI4, total value) causes change of one of focus point, ISO or aperture of at least of lens module.” Anon discloses that an image capturing device can use inputs such as geographic location, time of day, camera orientation (*i.e.*, location sensor output), and image-based characteristics (including object detection) to influence camera settings and composition recommendations. *See, e.g.*, EX1004, 4:24-33. Anon's engine can automatically adjust or suggest changes to camera parameters such as focus, aperture, and exposure (which includes ISO), based on these inputs. *Id.*, 2:29-36 (“the image capturing device will ***automatically make the change***”). For example, the engine may recommend or directly change the focus point if a subject is detected in a particular area, adjust ISO or aperture in response to external conditions like location or lighting, and optimize settings to improve image quality according to contextual and sensor data before capturing an image. *See* EX1004, 8:36–43, 2:29-36, 1:42–49.

Takeuchi also teaches “automatically correct[ing] the photographic conditions during photography,” including “exposure conditions such as the aperture value, shutter speed and the like, focus adjustment, and photographic sensitivity,” which a

POSA would understand includes focus point, ISO, and the aperture. EX1007, ¶¶[0281]–[0283] (describing “Self-Correction of Photographic Conditions” including “aperture,” “focus adjustment,” and “photographic sensitivity”). A POSA would recognize that Takeuchi’s automatic correction of focus and ISO is beneficial because it does not require a user to manually change settings and is thus more convenient for the user. EX1004, 1:42-49 (“so that the user is freed from having to estimate distances or manually set the focus”). Consumer cameras have long had automatic adjustment of focus, ISO, and aperture settings, as Anon recognizes. EX1003, ¶124; EX1004, 1:42-49. Thus, to the extent PO argues Anon alone fails to disclose this limitation, a POSA would have been motivated to include Takeuchi’s automatic correction of focus and photographic sensitivity in Anon’s camera system with a reasonable expectation of success. EX1003, ¶124.

7. Claim 20

Claim 20 depends from claim 13 and further recites “wherein the total value is above threshold, an image is saved into user persistent memory.” Anon teaches that the composition measure (*i.e.*, combined value) can be compared to a threshold to determine subsequent actions such as user feedback, as discussed in *supra* Section VI.A.4. Anon also discloses a “post-processing” engine that selects images to be stored in an album (*i.e.*, user persistent memory) based on Anon’s “composition judging techniques.” EX1004, 10:1-25. A POSA would have understood that, in

Anon, an image is also saved in memory if it is deemed to be a quality image because the system uses its engine to evaluate an image in real-time based on multiple characteristics and output an indication of the composition measure to the user. EX1003, ¶126. If the user responds to this indication by capturing the image, the device receives the captured image and stores it in memory. *See* EX1004, 2:6-8, 3:10-12. This process ensures that only images meeting certain quality criteria, as determined by the engine, are saved.

C. Ground IC: Claims 5 and 7 Are Obvious in View of Anon, Suzuki, Jasinski, Garcia-Molina and Ramesh

1. Claim 5

Claim 5 depends from claim 1 and further recites “wherein the first, or second weight is respectively associated with an estimated error in the first or second value.” Anon does not expressly disclose associating an error with a first value (QI1) responsive to the device angle to the horizon or a second value (QI2) associated with an aesthetic quality of image based on the composition. Ramesh, however, describes a computer vision system for detecting and tracking multiple objects (*e.g.*, people in crowds) using a probabilistic framework. EX1009, Abstract, Fig. 1, ¶[0039]. Ramesh estimates the number of a people in a scene by using a “weighted sum of partial evidences.” *Id.*, ¶[0034]. An “objects location and attributes are updated using

online uncertainty estimation 110.” *Id.*, ¶[0025]. Ramesh teaches that “less certain guesses” (*i.e.*, guesses with greater error) “are weighted less.” *Id.*, ¶[0030].

In Anon’s image evaluation, the reliability of different features (such as orientation/tilt or aesthetic quality) can vary due to noise, ambiguous scenes, or changing conditions. Indeed, Anon teaches that “what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed completely over time.” EX1004, 10:47-50. A POSA would thus understand that Anon’s engine is meant to be modified and improved. Ramesh’s probabilistic approach provides a principled way to quantify and propagate uncertainty (error) in such situations. Associating an estimated error (*e.g.*, standard deviation, confidence interval) with each weight would have allowed Anon’s system to adaptively adjust the weight of each characteristic based on its reliability and combine output values from multiple sources in a statistically optimal way. In other words, less certain quality indicators would be weighed less than more certain quality indicators. A POSA would understand this result in a more accurate image quality assessment. EX1003, ¶130. The combination of Anon and Ramesh is thus the application of a known technique (weighting parameters with error/uncertainty relatively less, as disclosed by Ramesh) to a known device (Anon) ready for improvement to yield predictable results (an optimized composition engine). EX1003, ¶130.

2. Claim 7

Claim 7 depends from claim 1 and further recites “for use with a probability distribution function using a mean value (μ) and a standard deviation value (σ), wherein the estimating of the first or second weight (c_1 , c_2) is according to, or based on, the respective probability of the first or second value (QI_1 , QI_2), according to the probability distribution function.” Anon does not use a probabilistic approach. Ramesh, however, uses Bayesian inference, probability distributions, and statistical models to estimate the number and locations of objects, update hypotheses, and fuse information from multiple sources. *See* EX1009, ¶¶[0024], [0026]. This approach involves generating hypotheses, refining them using statistical models, and updating the “world state” based on posterior probability distributions. *Id.*, ¶[0025]. Ramesh’s system is adaptive, using uncertainty estimates and predictive distributions to improve tracking and detection robustness. *Id.*, ¶¶[0024], [0026].

A POSA would have recognized that both Anon and Ramesh address the challenge of evaluating complex, multi-dimensional image data in real time, but with different emphases: Anon focuses on real-time composition feedback for photography, while Ramesh focuses on probabilistic tracking and detection in video streams. Given the flexibility and extensibility of Anon’s system—explicitly designed to incorporate training sets, rule sets, and context-dependent evaluation—a POSA would have been motivated to improve the robustness and adaptability of

Anon’s composition measure, especially in situations where image characteristics are ambiguous, noisy, or context-dependent. EX1003, ¶133.

Ramesh’s probabilistic approach would have provided a well-established framework for handling uncertainty, combining multiple sources of evidence, and updating beliefs as new data arrives. The use of probability distributions, Bayesian inference, and uncertainty estimation allows for more nuanced, data-driven decision-making, which is highly relevant to real-time image evaluation where conditions can change rapidly and user preferences may be uncertain or evolving, and a POSA would be motivated to incorporate this approach into Anon in a predictable manner and with a reasonable expectation of success. EX1003, ¶134.

D. Ground ID: Claim 16 Is Obvious in View of Anon, Takeuchi, Jasinski, Kosaka, Garcia-Molina and Ramesh

1. Claim 16

Claim 16 depends from claim 10 and further recites “wherein the third weight (c3) is estimated according to, or based on, an estimated error in the analyzing the captured image for detecting or recognizing objects in the image.” Anon does not expressly disclose estimating a third weight (c3) based on an estimated error in the analyzing of the captured image for detecting or recognizing objects in the image. As discussed in *supra* Section VI.C.1, Ramesh, however, describes a computer vision system for detecting and tracking multiple objects (*e.g.*, people in crowds)

using a probabilistic framework. In Anon’s system, the reliability of different features (such as object detection) can vary due to noise, ambiguous scenes, or changing conditions. *See* EX1004, 10:47–50. Ramesh’s probabilistic approach provides a principled way to quantify and propagate uncertainty (error) in such situations. Associating an estimated error (e.g., standard deviation, confidence interval) with weighted factors would allow Anon’s system to adaptively adjust the weight of each characteristic based on its reliability and combine output values from multiple sources in a statistically optimal way. As discussed in *supra* Section VI.C.1-2, a POSA would have been motivated to combine Anon and Ramesh with a reasonable expectation of success. EX1003, ¶137.

E. Ground IE: Claim 9 Is Obvious in View of Anon, Suzuki, Jasinski, Garcia-Molina and Liu

1. Claim 9

Claim 9 depends from claim 8 and further recites “wherein the analyzing of the captured image comprises applying multiple algorithms selected from a group consisting of an aesthetic algorithm, an artificial neural network employing deep learning algorithm, a corner detection algorithm, a blur detecting algorithm, and Peak Signal-to-Noise Ratio (PSNR) calculation, and the method further comprising obtaining a respective second value (QI2i) associated with each of multiple algorithms, and calculating or estimating the second value (QI2) based on the

multiple respective second values (QI2i) from the multiple algorithms.” As discussed in *supra* Section VI.A.1.iv, Anon’s composition measure is intended to reflect the aesthetic quality of the image, particularly as it relates to compositional rules and guidelines and is based on at least one input—QI2—associated with an aesthetic quality, *e.g.*, “energy” of the image.

Liu teaches that “[various] image quality assessment methods have been developed to reflect human visual quality experience” and describes many types of aesthetic quality algorithms, which are listed in Table 1 of Liu. EX1012, at 1793. Each algorithm in Table 1 is an example of a claimed “aesthetic algorithm.” Liu also discloses that one of the algorithms is the “Peak Signal-to-Noise Ratio” (*i.e.*, the claimed “Peak Signal-to-Noise Ratio (PSNR) calculation”). *Id.* Liu teaches that it is “possible to achieve significantly better performance by fusing multiple methods.”

Id. For example, Liu describes its Multi-Method Function approach:

To achieve MMF, we adopt a regression approach (*e.g.*, support vector regression (SVR)). First, **we collect a number of image quality evaluation methods.** Then, **we set the new MMF score to be the nonlinear combination of scores from multiple methods with suitable weighting coefficients.** Clearly, these weights can be obtained by the regression approach.

Id., 1793. A POSA would understand that the “number of image quality evaluation methods” are the claimed “respective second value[s] (QI2i) associated with each of multiple algorithms”—a value “associated with an aesthetic quality of an image”—

and that the “MMF score” is the claimed “QI2” that is based on the multiple (QI2i) values from the multiple algorithms. EX1003, ¶140.

A POSA would be motivated to use Liu’s MMF method with the Anon–Suzuki system for several reasons. For example, Liu teaches the benefits of a multi-method fusion approach—“there is not a single quality index that significantly outperforms others” and that “[s]ome method may be superior for one image distortion type but inferior for others.” EX1012, at 1793. As a result, “the idea of multi-method fusion (MMF) *arises naturally*.” *Id.* Liu also explains that a single method is challenging, but “it is possible to achieve significantly better performance by fusing multiple methods.” *Id.* A POSA would recognize these benefits based on Liu’s teachings and be motivated to achieve them in the Anon–Suzuki system by using Liu’s multi-factor fusion approach to aesthetic quality algorithms. EX1003, ¶141. Anon teaches that “what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed completely over time.” EX1004, 10:47-50. A POSA would thus understand that Anon’s composition engine is meant to be modified and improved and would look to Liu for such an improvement. EX1003, ¶141.

**F. Ground IF: Claims 11 and 12 Are Obvious in View of Anon,
Takeuchi, Jasinski, Kosaka, Garcia-Molina and Liu**

1. Claim 11

Claim 11 depends from claim 10 and further recites in the alternative:

wherein the device comprises multiple motion or location sensors for sensing the device motion selected from a group consisting of a gyroscope, accelerometer, Global Positioning System (GPS), 9 Degrees of Freedom (DOF) sensing component, and 10 Degrees of Freedom (DOF) sensing component, wherein the method comprising obtaining a corresponding first value (QI1i) from each of the multiple motion or location sensors responsive to the device motion from the respective motion or location sensor; and estimating or calculating the first value (QI1) based on the multiple first values (QI1i) from the multiple motion or location sensors,

or wherein:

the analyzing of the captured image comprises ***applying multiple algorithms*** selected from a group consisting of an aesthetic algorithm, an artificial neural network employing deep learning algorithm, a corner detection algorithm, a blur detecting algorithm, and Peak Signal-to-Noise Ratio (PSNR) calculation, an object movement algorithm, a face quality algorithm, and the method further comprising obtaining a respective third value (QI3i) associated with each of multiple algorithms, and calculating or estimating the third value (QI3) based on the multiple third values (QI3i) from the multiple algorithms.

As discussed in *supra* Section VI.B.1.vi, Anon’s composition measure is intended to reflect the aesthetic quality of the image, particularly as it relates to compositional rules and guidelines. As part of that measure, Anon detects and recognizes specific objects, such as faces or distinctively colored objects, within the image. EX1004, 3:62–4:3. Similarly, Takeuchi also makes extensive use of object detection as part of its image quality evaluation process and incorporates a “face quality algorithm” that evaluates, among other things, the over or underexposure of a detected face. EX1007, ¶¶[0146]–[0147].

A POSA would be motivated to combine this algorithm with other aesthetic algorithms that evaluate image or object characteristics in light of Liu. Liu teaches that “[various] image quality assessment methods have been developed to reflect human visual quality experience” and describes many types of aesthetic quality algorithms, which are listed in Table 1 of Liu. EX1012, at 1793. Each algorithm in Table 1 is an example of a claimed “aesthetic algorithm.” Liu also discloses that one of the algorithms is the “Peak Signal-to-Noise Ratio” (*i.e.*, the claimed “Peak Signal-to-Noise Ratio (PSNR) calculation”). Liu teaches that it is “possible to achieve significantly better performance by fusing multiple methods.” *Id.* A POSA would have understood that Liu’s “number of image quality evaluation methods” comprise the “respective third value[s] (QI3i) associated with each of multiple algorithms”

and that the “MMF score” is the claimed “QI3” that is based on the multiple (QI3i) values from the multiple algorithms. EX1003, ¶144.

A POSA would have been motivated to use Liu’s MMF method with the Anon–Takeuchi–Kosaka system for several reasons. Anon’s system is designed to automate the process of evaluating images, and it is explicitly open to using a variety of “image-based characteristics” as inputs. See EX1004, 3:53-59. Anon expressly suggests detecting objects, such as faces, as part of its image quality analysis. *Id.*, 3:53-4:3. Takeuchi’s point system is a high-level input that encapsulates multiple technical quality factors in a single, objective score, *see* EX1007, ¶[0289], and expressly teaches evaluating the quality of faces in an image, *id.*, ¶¶[0146]–[0147]. Liu teaches the benefits of a multi-method fusion approach to formulating quality scores—“there is not a single quality index that significantly outperforms others” and that “[s]ome method may be superior for one image distortion type but inferior for others.” EX1012, at 1793. As a result, “the idea of multi-method fusion (MMF) *arises naturally.*” *Id.* Liu also explains that a single method is challenging, but “it is possible to achieve significantly better performance by fusing multiple methods.” *Id.* A POSA would have recognized these benefits based on Liu’s teachings and would have been motivated to achieve them by using Liu’s multi-factor fusion approach. EX1003, ¶145. Anon teaches that “what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed

completely over time.” EX1004, 10:47-50. A POSA would have thus understood that Anon’s engine is meant to be modified and improved and would look to Liu for such an improvement. EX1003, ¶¶141, 145.

2. Claim 12

Claim 12 depends from claim 11 and further recites “where suggestions to the user can be “blurred image due to camera shake”, or “blurred subject due to subject movement”, or “Image dynamic range is beyond the sensor dynamic abilities—choose area of interest, or take a high dynamic range (HDR) shot.” Anon does not disclose the express text of these user suggestions as claimed. Anon does disclose, however, making textual suggestions to the user and that the lack of sharp edges in an image might indicate a lack of appropriate focus and further teaches that “[s]uggestions might be presented in a viewfinder display” for taking corrective action. EX1004, 3:53-57, 6:4-8. Thus, it would have been a matter of design choice to make the suggestion using the express textual suggestions recited in claim 12. EX1003, ¶147.

G. Ground IG: Claim 15 Is Obvious in View of Anon, Takeuchi, Jasinski, Kosaka, Garcia-Molina and Alhadeff

1. Claim 15

Claim 15 depends from claim 10 and further recites “wherein the first weight (c1) is estimated according to, or based on, a precision error, reading resolution, or

drift in time, of the motion or location sensor, and wherein the motion or location sensor consists of, or comprises, an accelerometer, a gyroscope, a Global Positioning System (GPS), or a step counter.” Anon does not expressly teach this feature. Alhadeef, however, addresses the need to compensate for sensor inaccuracies and drift in the process of determining camera position and orientation. EX1011, 10:35-44.

Alhadeef describes the use of GPS and other auxiliary sensors to “permit redundant determinations and, thereby, improve the accuracy of the measurements,” and details the use of “predictive modeling... based upon the use of so-called ‘Kalman’ filters” to compensate for sensor drift and error. *Id.*, 9:35-39, 11:4-6. These passages demonstrate that Alhadeef accounts for the precision error, resolution, and temporal drift of motion or location sensors (including accelerometers, gyroscopes, and GPS) and that such error characteristics are used to adjust or weight the contribution of each sensor in the overall position estimation, thereby teaching the estimation of a first weight (c1) based on these sensor-specific error metrics. EX1003, ¶150.

It would have been obvious to modify the combination of Anon–Takeuchi–Kosaka in view of Alhadeef’s teachings to incorporate a first weight (c1) estimated according to, or based on, the precision error, reading resolution, or drift in time of a motion or location sensor—such as an accelerometer, gyroscope, GPS, or step

counter—because Alhadeef explicitly addresses the need to compensate for sensor inaccuracies and temporal drift in determining camera position and orientation. EX1011, 9:35-39, 11:4-6. A POSA would have recognized that integrating sensor-specific error metrics as weighting factors would have improved the reliability and accuracy of motion or location estimates in camera systems, especially since both Anon and Takeuchi already contemplate the use of sensor data for image evaluation and feedback. EX1003, ¶151.

Given the well-established practice of sensor fusion and error compensation in the field, as well as Alhadeef’s detailed guidance on how to quantify and correct for sensor errors, a POSA would have had a reasonable expectation of success in implementing such a modification, as it would simply require, for example, assigning lower weights to less reliable sensor data and higher weights to more accurate readings, thereby enhancing the overall system performance in a predictable manner. EX1003, ¶151.

VII. SECONDARY CONSIDERATIONS

Petitioner is unaware of any evidence of alleged secondary indicia that would support non-obviousness of the ’901 Patent. To the extent Patent Owner subsequently presents such evidence, Petitioner respectfully requests the right to respond.

VIII. MANDATORY NOTICES

As set forth below and pursuant to 37 C.F.R. § 42.8(a)(1), the following mandatory notices are provided.

A. Real Party in Interest Under 37 C.F.R. § 42.8(b)(1)

Samsung Electronics Co., Ltd.; Samsung Electronics America, Inc.

B. Related Matters

SnapAid, Ltd. v. Samsung Elecs. Co., Ltd. et al., No. 2-25-cv-00378 (E.D. Tex.) (alleging infringement of the '901 Patent).

C. Lead and Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Lead Counsel	Back-Up Counsel
Robert A. Appleby (Reg. No. 40,897) Kirkland & Ellis LLP, 601 Lexington Avenue, New York, NY 10022, Telephone: 212.446.4800 Facsimile: 212.446.4900	W. Todd Baker (Reg. No. 45,265) Kirkland & Ellis LLP, 1301 Pennsylvania Avenue, N.W., Washington, D.C. 20004 Telephone: 202.389.3135 Facsimile: 202.389.5200

D. Service Information Under 37 C.F.R. § 42.8(b)(4)

Petitioner concurrently submits a Power of Attorney, 37 C.F.R. § 42.10(b), and consents to electronic service by email at Samsung-IPR-SnapAid@kirkland.com.

IX. PAYMENT OF FEES UNDER 37 C.F.R. § 42.103

The undersigned authorizes the Office to charge the fee set forth in 37 C.F.R. § 42.15(a)(1) for this Petition to Deposit Account No. 506092, consistent with the requested review of twenty claims, and any additional fees that may be due in connection with this Petition to be charged to the above-referenced deposit account.

X. GROUNDS FOR STANDING UNDER 37 C.F.R. § 42.104(A)

Petitioner certifies pursuant to 37 C.F.R. §42.104(a) that the '901 Patent is available for IPR and that Petitioner is not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified herein.

XI. CONCLUSION

Petitioner requests institution of IPR and cancellation of the Challenged Claims.

Dated: September 5, 2025

Respectfully submitted,

/Robert A. Appleby/

Robert A. Appleby
Counsel For Petitioners
Reg. No. 40,897

CERTIFICATE OF COMPLIANCE

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. § 42.24, totaling 13,722 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/Robert A. Appleby/

Robert A. Appleby (Reg. No. 40,897)

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing document with accompanying exhibits was served on September 5, 2025, via overnight delivery directed to Patent Owners, SnapAid, Ltd., at the following address:

May Patents Ltd.
c/o Dorit Shem-Tov (131926)
P.O.B. 7230
Ramat-Gan 5217102
Israel

A copy was also served via electronic mail on the attorneys of record listed below for the following related matters:

SnapAid, Ltd. v. Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (Case 2:25-cv-00378-RWS-RSP, E.D. Tex)

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