

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. AND
SAMSUNG ELECTRONICS AMERICA, INC.
Petitioner

v.

IMAGE PROCESSING TECHNOLOGIES LLC,
Patent Owner

CASE IPR2017-00347
Patent No. 8,805,001

**PATENT OWNER IMAGE PROCESSING TECHNOLOGIES LLC'S
PRELIMINARY RESPONSE PURSUANT TO 37 C.F.R. § 42.107**

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Patent Owner Image Processing Technologies LLC (“Patent Owner”) hereby submits this Preliminary Patent Owner’s Response to the Petition filed by Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner”) on November 29, 2016 in case IPR2017-00347 for review of claims 1–4 of U.S. Patent No. 8,805,001 (the “’001 patent”).

I. INTRODUCTION

The Board should not institute review because the Petition fails to establish a reasonable likelihood that the Petitioner would prevail with respect to any of the challenged claims.

As to each of Grounds 1, 2, and 3, Petitioner has not shown that the asserted references, alone or in combination, teach or suggest at least the following elements of claim 1: (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and (ii) “identifying the target in said at least one histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target.”

As to each of Grounds 1, 2, and 3, Petitioner has not shown that a POSA would have combined the three asserted references Gilbert, Hashima, and Ueno to arrive at the subject matter of claim 1 or remaining challenged dependent claims 2–4 which depend from claim 1.

The Board should decline to institute an *inter partes* review of claims 1–4 of the '001 patent.

II. OVERVIEW OF THE '001 PATENT

The '001 patent is directed to efficient, real-time identification and localization of a wide range of moving objects using histograms. *E.g.*, Ex. 1001 at 1:32–36; 3:28–38. The inventor developed a system that can track a target object using multiple characteristics, such as velocity, direction, hue, saturation, etc. *E.g.*, Ex. 1001 at 25:26–38; 25:62–26:4. Tracking techniques known at the time of the invention of the '001 patent were inadequate because, for example, they were memory intensive, limited in terms of the information obtained about an object, could not provide information in real-time, used complex algorithms for computing object information, or were designed to detect only one type of object. *E.g.*, Ex. 1001 at 1:38–2:3; 2:38–3:11.

The '001 patent overcame the limitations of the prior art through a number of novel techniques, including generating histograms of multiple pixel parameters being detected with the aid of classifiers that enable only data having selected

classification criteria for possible inclusion in the histograms; providing a validation unit that processes multiple items of classification information from different histogram formation blocks in parallel to determine whether a corresponding histogram formation block will utilize data for a particular pixel in forming its own histogram; and tracking a target using histograms that are formed based on determined boundaries of the target. *E.g.*, Ex. 1001 at 18:16–19; 18:51–57; 21:54–22:9; 24:6–25:6.

In Figure 10 of the '001 patent, an image processing system (11) is shown in connection with a histogram processor 22a. Image processing system (11) receives digital video signal S(PI) originating from a video camera or other imaging device. Ex. 1001 at 9:20–23. S(PI) represents the pixel values PI of video signal S, in a succession of frames, each representing an instant in time. Ex. 1001 at 9:32–48, 9:56–67; 11:42–45. Image processing system (11) outputs signals SR (delayed video signal) and also calculated values such as speed (V) and oriented direction of displacement (DI) for pixels in the image. Ex. 1001 at 9:56–10:4. A bus Z–Z₁ (the dotted line which appears in both Figures 10 and 11) transfers output signals of the image processing system (11) to histogram processor (22a). Ex. 1001 at 16:50–58.

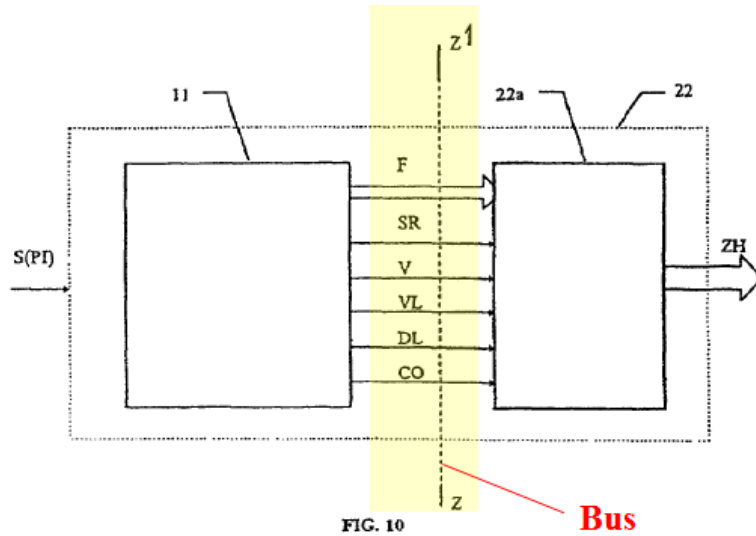
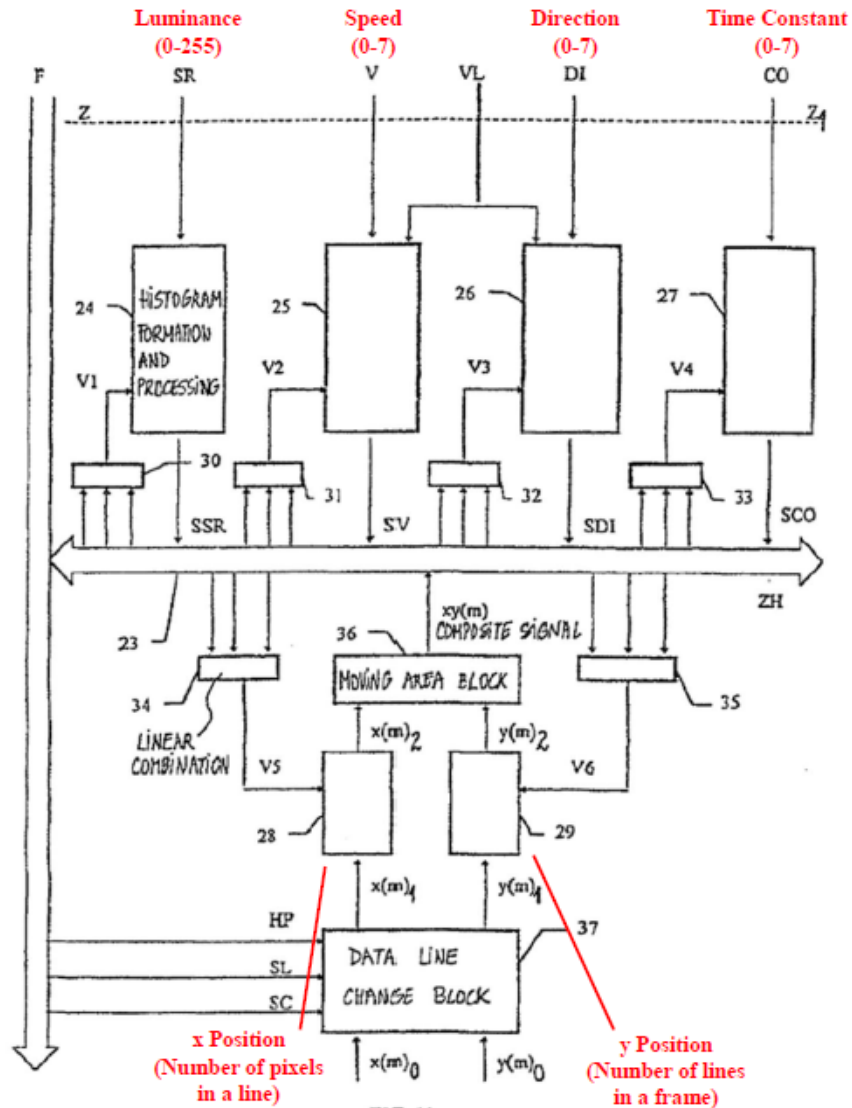


Figure 11 of the '001 patent shows an example of histogram processor 22a with multiple histogram formation blocks 24–29. Ex. 1001 at 16:59–65. Block 24 enables a histogram to be formed in the luminance domain (ranging from 0–255). *Id.* at 16:67–17:8. Similarly, the domain for Block 25 is speed (V) (ranging from 0–7). *Id.* at 17:9–15. The domain for Block 26 is oriented direction (DI) (ranging from 0–7). *Id.* at 17:16–23. The domain for Block 27 is time constant (CO) (ranging from 0–7). *Id.* at 17:24–31. The domain for Block 28 is position on the x-axis (range corresponding to the number of pixels in a line). *Id.* at 17:32–43; 18:58–63; 20:60–21:16. The domain for Block 29 is position on the y-axis (range corresponding to the number of lines in a frame). *Id.* The histogram formation blocks and other components are interconnected by a bus 23. *Id.* at 16:59–61.



Ex. 1001 at Fig. 11 (annotations added).

A validation unit (30–35) accompanies each histogram formation block of Figure 11. Figure 13, referring to histogram formation block 25 (speed domain) and validation unit 31 of Figure 11, shows a histogram formation block with a classifier 25b. The classifier has registers that permit classification criteria to be individually selected: “[b]y way of example, register 106 will include, in the case

of speed, eight registers numbered 0–7. By setting a register to ‘1’, e.g., register number 2, only data that meet the criteria of the selected class, e.g., speed 2, will result in a classification output of ‘1.’” Ex. 1001 at 18:25–29.

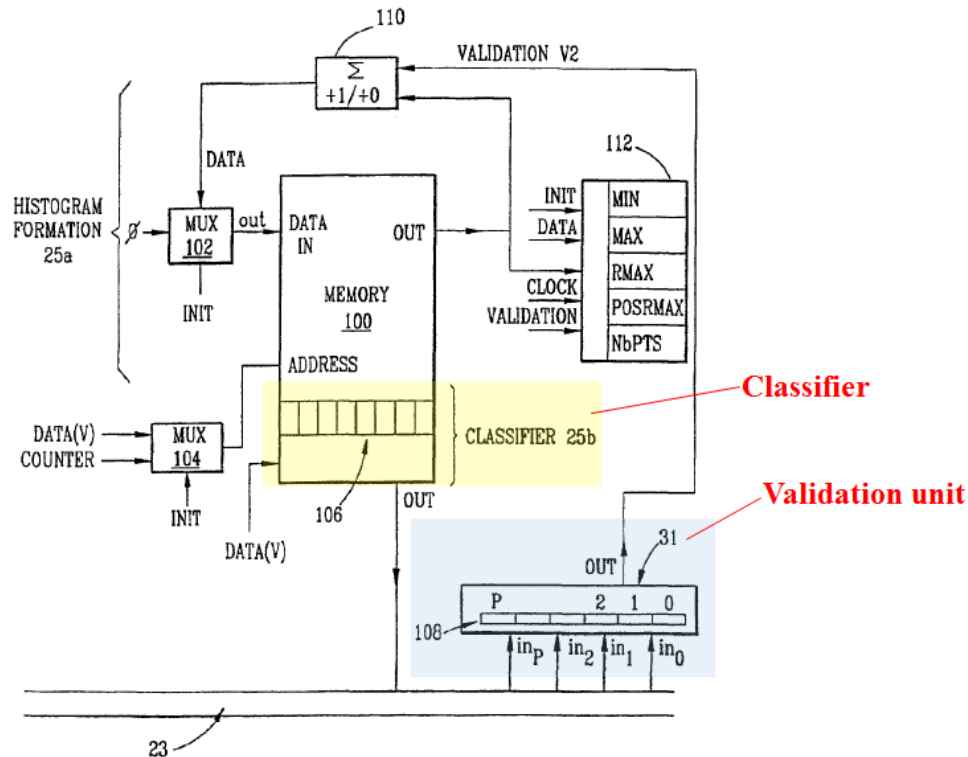


FIG.13

The number of registers can vary depending on the domain of the classifier. *E.g.*, Ex. 1001 at 18:34–47. For example, “[t]he classifier associated with histogram formation block 24 preferably has 256 registers, one register for each possible luminance value of the image.” Ex. 1001 at 18:35–37. The interaction between the classifiers and the validation units in connection with histogram formation is significant. In particular, “[t]he output of each classifier is communicated to each of the validation blocks 30–35 via bus 23, in the case of

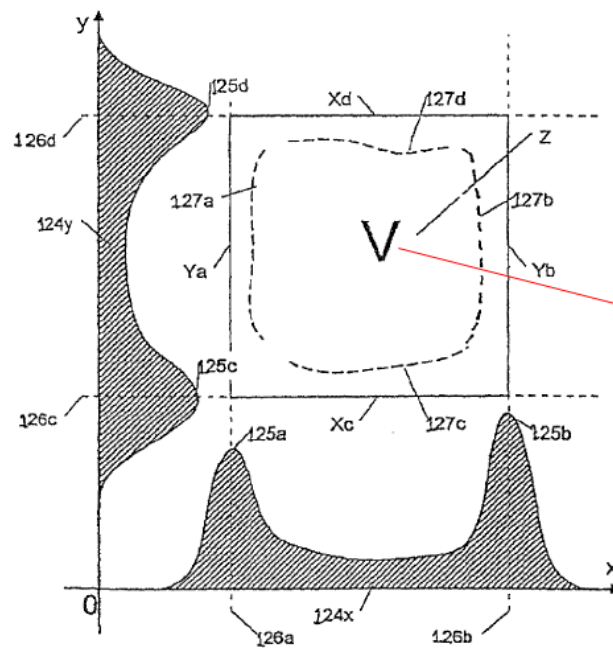
histogram formation blocks 28 and 29, through combination unit 36,” and “[v]alidation units 30–35 receive the classification information in parallel from all classification units in histogram formation blocks 24–29.” Ex. 1001 at 18:47–53. Each validation unit contains a register block (108) with a register for each data domain that the system is capable of processing. *Id.* at 18:58–65. Thus, based on the register settings, each validation unit generates a validation signal (“Validation V2” in Fig. 13), and that determines “for each incoming pixel, whether the histogram formation block will utilize that pixel in forming it [sic] histogram.” Ex. 1001 at 18:53–57. “The validation signal from each validation unit will only be ‘1’ if for each register in the validation unit that is set to ‘1’, an input of ‘1’ is received from the classifier for the domain of that register. *Id.* at 19:4–8. The output of the validation unit may be expressed by the following formula:

$$\text{out} = \frac{(\bar{\text{in}}_0 + \text{Reg}_0) \cdot (\bar{\text{in}}_1 + \text{Reg}_1) \cdot \dots \cdot (\bar{\text{in}}_n + \text{Reg}_n)}{(\text{in}_0 + \text{in}_1 + \dots + \text{in}_n)}$$

,where Reg_0 is the register in the validation unit associated with the input in_0 . *Id.* at 19:7–12.

The ’001 patent teaches the use of histograms to track a target and compute the target’s center. In the example of Figure 17, the locations of coordinates 126a (“Ya”), 126b (“Yb”), 126c (“Xc”) and 126d (“Xd”) correspond to the four peaks of the x- and y-axis histograms 124x and 124y; the purpose of this center computation

is to “better define and center the position of the face V of the subject in the image.” Ex. 1001 at 22:60–23:14. “The center of face V may be determined, for example, by locating the pixel position of the center of the box bounded by Ya, Yb, Xc, and Xd $((Xc+(Xd-Xc)/2), (Ya+(Yb-Ya)/2))$ and by comparing this position to a desired position of face V on the screen.” Ex. 1001 at 23:18–22.



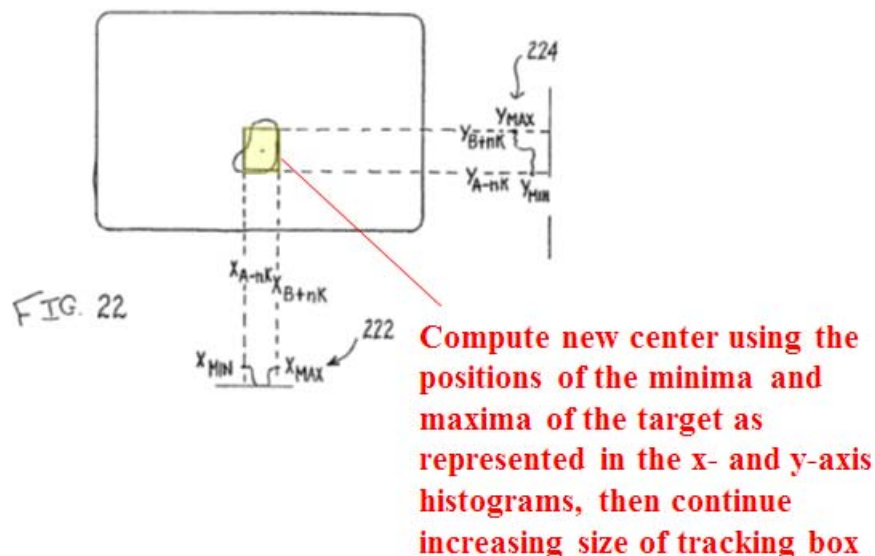
**Center computed
using the locations
of peaks in the x-
and y-axis
histograms**

Fig. 17

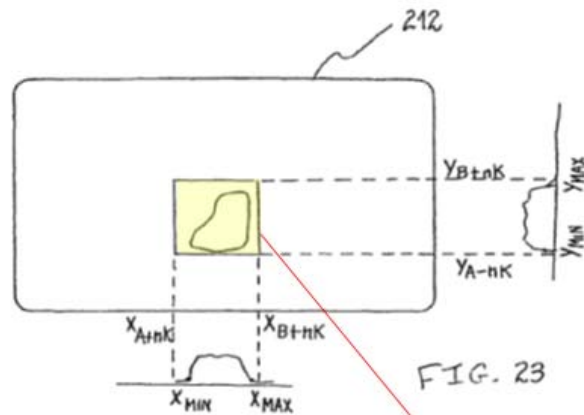
Center calculations can also be used to identify a target based on a histogram, as taught in the example of Figures 20–23. In Figure 21, an initial starting pixel is designated and the system “will process the pixels in successively larger areas surrounding the [starting] pixel, adjusting the center of the area based upon the shape of the object, until substantially the entire target area is being tracked.” Ex. 1001 at 24:6–12. A bounded area (X_A, X_B, Y_C, Y_D) corresponding to the tracking box is set by configuring the classification units of x and y histogram

formation blocks 28 and 29 (Figure 11), so that the only pixels that will be processed by the system are those falling within the bounded area. Ex. 1001 at 24:12–17.

After the bounded area is set, the x and y histogram formation blocks attempt to form histograms, but since there are an insignificant number of pixels meeting the selected criteria (in this example, $DP=1$), no histograms are actually formed at this point. Ex. 1001 at 24:29–33. The size of the bounded area is then successively increased, for example, to X_{A-nK} , X_{B+nK} , Y_{A-nK} , Y_{B+nK} (where n is the current iteration and K is a constant) until “the histogram formed by either of histogram formation blocks 28 and 29 contains meaningful information, i.e., until the box overlaps the boundary of the target.” Ex. 1001 at 24:33–42. Figure 22 shows the bounded area beginning to cross the borders of the target, together with corresponding histograms 222 and 224. When this occurs, the center of the area under consideration, i.e., the bounded area, is adjusted based upon the content of histograms 222 and 224. Ex. 1001 at 24:42–50.



The new center is “determined to be $(X_{\text{MIN}}+X_{\text{MAX}})/2$, $(Y_{\text{MIN}}+Y_{\text{MAX}})/2$, where X_{MIN} and X_{MAX} are the positions of the minima and maxima of the x projection histogram, and Y_{MIN} and Y_{MAX} are the positions of the minima and maxima of the y projection histogram.” Ex. 1001 at 24:50–55. After additional iterations, the tracking box will become larger than the target, as shown in Figure 23. *Id.* at 24:59–63. “When this occurs, the entire target is bounded, and the constant K may then be reduced, to thereby reduce the size of the tracking box.” *Id.* at 24:63–66. In particular, the constant K is preferably relatively large to expedite locking onto the target, and “[o]nce a target has been locked onto, K may be reduced.” *Id.* at 24:66–25:6.



Reduce tracking
box after
locking onto
target

In this manner, the minima and maxima of the histograms may be used to identify the target over the course of multiple iterations in which the tracking box is adjusted with respect to its size and location, preferably on a frame-by-frame basis. *Id.* at 25:3–6.

A. Person of Ordinary Skill in the Art

For purposes of this *inter partes* review, Patent Owner submits that a person of ordinary skill in the art (or “POSA”) in 1996 (the foreign priority date of the ’001 patent) would be someone with an undergraduate degree in electrical engineering or image processing or a related field, followed by at least two years of graduate coursework and also at least early-stage thesis research, in digital image processing. The requisite knowledge and experience would have been acquired, for example, by someone who had completed all coursework in a two year

master's program focused on digital image processing, along with at least some thesis research qualifying towards a degree in such a program.

B. Claim Construction

Petitioner proposes that the claims be construed pursuant to the standard in *Phillips v. AWH Corp.*, under which “the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005).

Patent Owner agrees that the *Phillips* standard should apply for purposes of this *inter partes* review.

1. “Domain”

Patent Owner proposes that “domain” should be construed for purposes of this proceeding as “the complete set of values for a parameter.”

The patent specification supports Patent Owner's proposed construction. Examples of domains are: (i) luminance, (ii) speed (V), (iii) oriented direction (D1), (iv) time constant (CO), (v) hue, (vi) saturation, (vii) first axis (x(m)), or (viii) second axis (y(m)). *E.g.*, Ex. 1001 at 3:62–4:6. For example, the luminance domain is the set of all possible values that can be taken on by the luminance parameter. For luminance, generally represented by a number in the range 0–255,

an eight-bit memory is used. Ex. 1001, 17:3–8. As is commonly understood, an eight-bit memory is capable of holding 2^8 or 256 values, that is, each possible value 0–255. *See* <https://en.wikipedia.org/wiki/8-bit>. Similarly, in an HSL (hue, saturation, luminance) color space, hue and saturation represent the complete set of values for “tone” and “brilliance” of the color being specified, for example. Ex. 1002 at ¶30 (Pages 13–14 of 155 (exhibit stamp)).

Similarly, the speed domain is the set of all possible values that can be taken on by the speed parameter. For example, the '001 patent discloses that speed preferably has a value between 0–7. Ex. 1001 at 17:60–65, 18:16–22. The classifier in the speed domain contains registers for the complete set of values for speed, that is, eight registers numbered 0–7. Ex. 1001 at 18:25–26. A three-bit memory is used for speed. Ex. 1001, 17:12–15. As is commonly understood, a three-bit memory is capable of representing 2^3 or 8 values, that is, each possible value 0–7.

Consistent with Patent Owner’s proposed construction, the IEEE Standard Dictionary of Electrical and Electronics Terms (6th ed. 1996) defines “domain” as “[t]he set of all possible values that can be taken on by an independent variable.” Ex. 2001 at 312.

Therefore, based on intrinsic and extrinsic evidence, “domain” should be construed for purposes of this proceeding as “the complete set of values for a parameter.”

2. “Class”

Patent Owner proposes that “class” should be construed for purposes of this proceeding as “a selected subset of values of a parameter.”

Patent Owner’s construction is based on a natural reading of the claim language “classes . . . in domains.” Also, the patent specification supports Patent Owner’s proposed construction, as the specification teaches that classification criteria are applied to form a group of pixels having common characteristics, and these pixels can potentially be used in forming a histogram. The ’001 patent teaches that a system determines, through the use of classifiers, whether a pixel under consideration meets selected classification criteria: “[c]lassifier 25b enables only data having selected classification criteria to be considered further, meaning to possibly be included in the histograms formed by histogram formation blocks 24–29.” Ex. 1001 at 18:16–19. As explained by the specification of the ’001 patent, “[a]s shown in FIGS. 10–14, image processing system 11 is used in connection with a histogram processor 22a for identifying objects within the input signal based upon user specified criteria for identifying such objects.” Ex. 1001, 16:50–53. “[F]or any data domain, e.g., speed, the output of the classifier for that

data domain will only be ‘1’ if the particular data point being considered is in the class of the registers set to ‘1’ in the classifier for that data domain.” Ex. 1001 at 19:1–4. The ’001 patent describes classifiers that are configured to consider specific values selected from among a larger range of values:

For example, with respect to speed, which is preferably a value in the range of 0–7, classifier 25b may be set to consider only data within a particular speed category or categories, e.g., speed 1, speeds 3 or 5, speed 3–6, etc. Classifier 25b includes a register 106 that enables the classification criteria to be set by the user, or by a separate computer program. By way of example, register 106 will include, in the case of speed, eight registers numbered 0–7. By setting a register to “1”, e.g., register number 2, only data that meets the criteria of the selected class, e.g., speed 2, will result in a classification output of “1”.

Ex. 1001 at 18:19–29.

As another example of values that are a selected subset of the possible values of the domain, the ’001 patent teaches the “selected classes” within “selected domains” of speed of 2, a direction of 4, and a luminance of 125. Ex. 1001 at 19:17–22. Yet another example taught by the ’001 patent is a speed of 2 and a direction of 4. Ex. 1001 at 21:54–59.

The patent further explains that histogram formation blocks can be set to process pixels in a selected subset of the x domain and y domain, in other words, in a selected area:

In order to process pixels only within a user-defined area, the x-direction histogram formation block may be set to process pixels only in a class of pixels defined by boundaries, i.e. XMIN and XMAX. Any pixels outside of this class will not be processed. Similarly, the y-direction histogram formation block may be set to process pixels only in a class of pixels defined by boundaries YMIN and YMAX. Thus, the system can process pixels only in a defined rectangle by setting the XMIN and XMAX, and YMIN and YMAX values as desired. Of course, the classification criteria and validation criteria from the other histogram formation blocks may be set in order to form histograms of only selected classes of pixels in selected domains in selected areas.

Ex. 1001 at 21:17–29.

Consistent with the construction proposed by Patent Owner, Webster's New Universal Unabridged Dictionary (1996) defines "class" as "[a] number of persons or things regarded as forming a group by reason of common attributes, characteristics, qualities, or traits; kind; sort." Ex. 2002 at 381.

Therefore, based on intrinsic and extrinsic evidence, a class is a selected subset of parameter values.

3. “Forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains”

Patent Owner proposes that “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains” should be construed as “forming at least one histogram of the pixels in two or more classes that are in two or more domains.”

Patent Owner’s proposed construction is required by the language of the claim. The natural reading of claim limitation is that the term “one or more” modifies “plurality of classes” and that the separate repetition of the term “one or more” modifies “plurality of domains.” A plurality means “two or more”, i.e., “a number greater than one.” *See* Ex. 2002 (Webster’s Unabridged (1996)) at 1490. Accordingly, the claim limitation requires at least one set of “two or more” (i.e. a plurality of) classes, and at least one set of “two or more” (i.e. a plurality of) domains, which means there must be at least two classes and at least two domains. Therefore, the claim requires at least one plurality, meaning two or more, of classes. Likewise, the claim requires at least one plurality, meaning two or more, of domains. By contrast, construing the claim to merely require at least one class selected from multiple classes, and at least one domain selected from multiple

domains, would render the term “plurality” superfluous, so that the claim limitation would be reduced to “one or more classes in one or more domains.”

The intrinsic evidence firmly supports a construction requiring formation of a histogram using two or more classes in two or more domains. For example, the Abstract of the '001 patent refers to forming histograms in each of multiple domains: “[i]n *each of several domains*, [a] histogram of the values in the first and second matrices falling in such domain is formed. Using the histograms, it is determined whether there is an area having the characteristics of the particular domain.” (emphasis added). Further, Figures 10–13 of the '001 patent and the description at 16:50–19:45 teach an exemplary set of histogram formation and processing blocks for multiple domains: luminance (block 24), speed V (block 25), oriented direction (block 26), time constant (block 27), x-axis position (block 28) and y-axis position (block 29). *See* Ex. 1001 at 16:67–17:35. In the exemplary case of a color camera, the '001 patent teaches that two histogram formation blocks for hue and saturation are included. Ex. 1001 at 25:52–56. In this example, multiple histogram formation processors of the type taught in Figure 11 (which include blocks 24–29 as described above), are controlled so that luminance, hue, and saturation (collectively, color) can be used to track a target.¹ *See* Ex. 1001 at

¹ “Color” is specified by three values, with the specific three values depending on the color space used. For example, in HSV color space, the values are Hue,

16:65–17:8, 25:52–54, 62–26:4. Thus, a POSA would understand based on the specification that the claim language requires histogram formation in two or more domains.

A POSA would also have understood the specification of the '001 patent to contemplate multiple classes in multiple domains. For example, the specification states that “[t]he process further includes the steps of forming histograms along coordinate axes for the pixels *within the classes selected* by the classifier *within each domain selected* by the validation signal, and forming a composite signal corresponding to the spatial position of such pixels within the frame.” Ex. 1001 at 6:10–15 (emphasis added). Similarly, the specification refers to “means for forming a histogram for pixels of the output signal *within the classes selected* by the classifier *within each domain selected* by the validation signal.” Ex. 1001 at 7:55–57 (emphasis added). Classes can be selected by configuring the classifiers: “[f]or example, with respect to speed, which is preferably a value in the range of 0–7, classifier 25b may be set to consider only data within a particular speed category or categories, e.g., speed 1, speeds 3 or 5, speed 3–6, etc.” Ex. 1001 at 18:19–22.

The '001 patent describes the specific method by which a histogram is formed using two or more classes in two or more domains. For example, the '001

Saturation, Value. Another example of a color space is RGB (Red, Green, Blue). See Ex. 1002 (Hart Declaration) at ¶30.

patent discusses the selection of multiple domains using a validation unit in conjunction with the classifiers via which classes within each domain are selected:

[F]or any data domain, e.g., speed, the output of the classifier for that data domain will only be “1” if the particular data point being considered is *in the class of the registers set to “1”* in the classifier for that data domain. The validation signal from each validation unit will only be “1” if *for each register in the validation unit that is set to “1”*, an input of “1” is received from the classifier for the domain of that register. This may be expressed as follows:

$$\text{out}=(\text{In}_0+\text{Reg}_0)\cdot(\text{In}_1+\text{Reg}_1)\dots(\text{In}_n+\text{Reg}_n)\dots(\text{in}_0+\text{in}_1+\dots\text{in}_n).$$

Ex. 1001 at 19:1–12 (emphasis added). Therefore, the histogram formation block can be configured to select multiple pluralities of classes and multiple pluralities of domains. For example, the registers of the classifier 25b of Figure 13 may select a first plurality of classes in one domain, while the registers of the validation unit 31 may, in conjunction with the registers of corresponding classifiers in other histogram formation blocks, select additional pluralities of classes in additional domains.

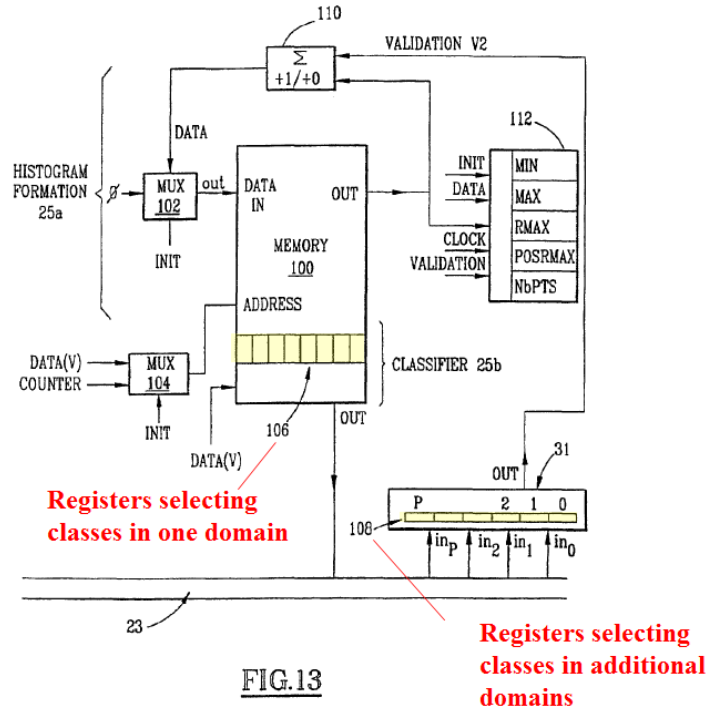


FIG.13

Therefore, based on the language of the claim as supported by the disclosure of the specification of the patent, a POSA would have understood “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains” to mean “forming at least one histogram of the pixels in two or more classes that are in two or more domains.”

4. “Said at least one histogram referring to classes defining said target”

Patent Owner proposes that “said at least one histogram referring to classes defining said target” should be construed as “at least one histogram being formed of pixels in at least two classes that define said target.”

The plain language of the claim requires interpreting “classes,” a plural term, to mean “two or more.” *See* Ex. 2002 at 1490. Patent Owner’s proposed construction is also supported by the ’001 patent including, for example, Figure 11 (showing a histogram processor with multiple histogram formation blocks 24–29), Figure 13 (showing classifier 25b, one example of the classifiers in Blocks 24–29) and the corresponding description in the specification. Ex. 1001 at 16:50–19:4.

In one embodiment represented in Figures 20–23, tracking is performed by using the class DP=1 (DP=1 representing motion) and classes in the x-axis and y-axis domains that are selected by the user to locate a target. Ex. 1001, 23:64–24:28. As taught by the specification, DP=1 is selected to identify the edges of the target, but other classes that define the target may also be used:

Those pixels with DP=1 would normally be located on the peripheral edges of target 218, unless the target had a strong color or luminance variation throughout, in which case, many of the pixels of the target would have DP=1. In any case, in order to locate pixels with DP=1, the validation units would be set to detect pixels with DP=1. Thus, the only pixels that will be considered by the system are those in the bounded area with DP=1. Alternatively, the system may be set to detect a velocity greater than zero, *or any other criteria that define the edges of the object.*

Ex. 1001 at 24:19–28 (emphasis added).

Other examples of the '001 patent also employ multiple classes to define the target. For example, “[a]ssuming that it were desired to identify an object with a speed of ‘2’ and a direction of ‘4’, the validation units for speed and direction would be set to ‘1’, and the classifiers for speed ‘2’ and direction ‘4’ would be set to ‘1’.” Ex. 1001 at 21:55–59. Similarly, the '001 patent describes tracking a target using “velocity, and/or color, and/or direction, etc.”² Ex. 1001 at 25:62–26:4.

Therefore, Patent Owner’s proposed construction gives effect to the plain language of the claim, and is supported by the written disclosure of the '001 patent. Claim 1 requires that at least one histogram is formed of pixels in at least two classes that define the target.

III. LEGAL STANDARDS

Petitioner has the burden to show that it is likely to prevail as to at least one claim of the '001 patent. 35 U.S.C. § 314. The Board may decline to institute the petition as to any claim for which the Board determines that Petitioner has not shown it is likely to prevail. *SAS Institute, Inc. v. ComplementSoft, LLC*, 825 F.3d 1341, 1352 (Fed. Cir. 2016); *Synopsys, Inc. v. Mentor Graphics Corp.*, 814 F.3d 1309, 1316–17 (Fed. Cir. 2016).

² As explained in FN2, above at Section II.B.3, color is specified by three values including, for example, hue and saturation.

All three of Petitioner’s Grounds rely on obviousness combinations. To make a prima facie showing of obviousness for a challenged claim under 35 U.S.C. § 103, the Petition must, among other requirements, fulfill the requirements set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966), including demonstrating that the cited references, in combination, disclose each element of the claim. *In re Magnum Oil Tools Int’l.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016); *see Apple Inc. v. Contentguard Holdings, Inc.*, IPR2015-00442, Paper 9 at 12 (P.T.A.B. July 13, 2015).

A legal conclusion of obviousness must be based on a factual background developed by consideration of each of the following factors: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) the level of ordinary skill in the art at the time of the invention. *See* 35 U.S.C. § 103(a); *Graham*, 383 U.S. 1 at 17–18. Without exception, consideration of every factor in the *Graham* framework is mandatory. *Kinetic Concepts*, 688 F.3d at 1360 (Fed. Cir. 2012); *see Liberty Mut. Ins. Co. v. Progressive Cas. Ins. Co.*, CBM-2012-00003, Paper 7 at 3 (Order) (P.T.A.B. Nov. 26, 2012).

In particular, an obviousness analysis must identify the difference(s) between the claim and the prior art. *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012) (“Indeed, courts must consider all of the

Graham factors prior to reaching a conclusion with respect to obviousness.”); *Whole Space Indus Ltd.*, IPR2015-00488, Paper 14 at 15 (P.T.A.B. July 24, 2015) (differences between the prior art and the claims at issue is one of the fundamental factual inquiries underlying an obviousness analysis); *Google, Inc. v. Everymd.com LLC*, IPR2014-00347, Paper 9 at 25 (P.T.A.B. May 22, 2014) (“Rather, Petitioners’ summaries, quotations, and citations from both references, with Belanger’s figures, place the burden on us to . . . *identify any differences between the claimed subject matter and the teachings of Shah and Belanger.*”) (emphasis added); *Liberty Mut.*, CBM-2012-00003, Paper 7 at 2–3 (“Differences between the claimed invention and the prior art are a critically important underlying factual inquiry for any obviousness analysis.”).

Petitioner also has the burden to show whether there would have been a motivation or reason to combine the asserted prior art, and whether the proposed combination would render the patented claims obvious. *In re Magnum Oil Tools*, 829 F.3d at 1376.

A petition must provide an explicit rationale to make proposed modifications to or combinations of the prior art references, despite the differences between the claimed invention and the prior art, without relying on the patent disclosure itself. *Apple Inc. v. Contentguard*, Paper 9 at 15; *see also Proctor & Gamble Co. v. Teva Pharm. USA, Inc.*, 566 F.3d 989, 995 (Fed. Cir. 2009).

A petition must also explain why a person of ordinary skill in the art would simultaneously make multiple changes and implementation choices to arrive at a particular invention. *Apple Inc. v. Contentguard*, Paper 9 at 16–17 (“[W]e are not persuaded that the Petition sufficiently explains why a person of ordinary skill would simultaneously make all of the many particular proposed changes and implementation choices”) (internal citations omitted). Even if individual modifications or choices were obvious, a petition must explain why making all of the changes at once would be obvious. *Id.* at 16–17 (“[T]he mere fact that individual changes might have been obvious does not make doing all of the changes at once obvious.”).

Most inventions rely on known building blocks, so Petitioner must show that a POSA would *both select and combine* the building blocks “in the normal course of research and development to yield the claimed invention.” *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011) (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)) (emphasis added). It is important to identify a reason and motivation that would have prompted a POSA to combine the prior art elements in the way claimed in the challenged patent, to achieve the invention. *Proctor & Gamble Co.*, 566 F.3d at 994; *KSR*, 550 U.S. at 418–19. “Obviousness requires more than a mere showing that the prior art includes separate references covering each separate limitation in a claim under

examination.” *Unigene Labs*, 655 F.3d at 1360 (citing *KSR*, 550 U.S. at 418). The lack of a technological obstacle to combining references, in and of itself, does not justify a finding of obviousness. *See In re Omeprazole Patent Litigation*, 536 F.3d 1361, 1380–81 (Fed. Cir. 2008). A reason for combining disparate prior art references is critical and should be made explicit. *InTouch Tech., Inc. v. VGo Communs., Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014) (citing *KSR*, 550 U.S. at 418).

Hindsight analysis is inappropriate; obviousness must be measured “*at the time the invention was made.*” *Ortho-McNeil Pharm. v. Mylan Labs*, 520 F.3d 1358, 1364 (Fed. Cir. 2008) (emphasis in original). The Petitioner must not use the patent as a roadmap. *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011) (citing *Grain Processing v. American-Maize Prods*, 840 F.2d 902, 907 (Fed. Cir. 1988)); *see also KSR*, 550 U.S. at 421.

IV. NO REVIEW SHOULD BE INSTITUTED FOR CLAIMS 1–4

A. Petitioner Has Not Shown that the Asserted References Teach or Suggest All Elements of Claim 1 of the '001 Patent

As to each of Grounds 1, 2, and 3, Petitioner has not shown that the asserted references teach or suggest all elements of claim 1. Accordingly, no review should be instituted for claim 1 and its dependent claims 2–4.

All three Grounds suffer from the same deficiencies. First, none of the asserted references teaches or suggests, alone or in the asserted combinations:

“forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” as required by claim 1.

As explained above in Section II.B (Claim Construction), the claim language would have been understood to mean: “forming at least one histogram of the pixels in [two or more [selected subset[s] of values of a parameter] that are in two or more domains], said at least one histogram referring to [selected subset[s] of values of a parameter] defining said target, identifying the target in said at least one histogram itself.”

The claim language requires that the at least one histogram of “pixels in the one or more of a plurality of classes in the one or more of a plurality of domains” be the *same* histogram that refers to “classes defining said target.” The claim also requires “identifying the target in” this same at least one histogram.

Second, no asserted prior art combination teaches or suggests “identifying the target in said at least one histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target,” as required by claim 1.

Thus, as explained below, no asserted prior art combination teaches or suggests that at least one histogram is (i) formed of pixels in two or more selected

subsets of values of a parameter, where (ii) that (one or more) histogram refers to two or more selected subsets that define the target; (iii) the target is identified in that (one or more) histogram; and (iv) identifying the target in that (one or more) histogram comprises determining a center of the target between X and Y minima and maxima of the target.

1. Petitioner Has Not Shown that Gilbert and Hashima Teach or Suggest All Elements of Claim 1

As to Ground 1, Gilbert and Hashima do not, alone or in combination, teach or suggest: (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and that (ii) the step of identifying the target in said at least one histogram further comprises “determining a center of the target to be between X and Y minima and maxima of the target,” as required by claim 1.

a. Gilbert

Gilbert does not teach or suggest these claim limitations, because neither the intensity histogram of Gilbert nor the x-position and y-position projection histograms of Gilbert satisfy the claim language. Gilbert discloses intensity histograms that are used to calculate a decision rule to identify a target, but those histograms are of a single domain (intensity), and those histograms do not refer to a selected subset (class) of intensity that defines the target. Gilbert also discloses

projection histograms of x-position and y-position, but the target is identified from the intensity histograms, not these projection histograms. Also, intensity, not x-position or y-position, defines the target, so the projection histograms do not refer to “classes” defining the target, as required by the claim language.

(1) The Intensity Histograms Do Not Satisfy the Claim Language

The intensity histograms of Gilbert that are relied upon in the Petition (Petition at 37–40) do not satisfy the claim language. Gilbert forms an intensity histogram for each of several areas (or windows) in the image, BR, PR, and TR. Ex. 1005 at 49. Figure 2 shows these windows:

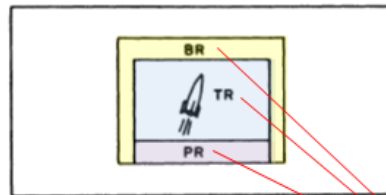


Fig. 2. Tracking window.

**Separate intensity
histograms for each
of three windows**

The distribution of pixels over intensity, or “feature histogram,” is formed for each window as $h_i^{BR}(x)$ for the region BR (top of Fig. 2); $h_i^{PR}(x)$ for the region PR (bottom of Fig. 2); and $h_i^{TR}(x)$ for the region TR (middle of Fig. 2). Ex. 1005 at 49. For each feature histogram, all pixels in the window are used to create the histogram. *Id.* at 49 (left column) (“When the entire region has been scanned, h contains the distributions of pixels over intensity and is referred to as the feature

histogram of the region *R*.”). Therefore, the feature histograms represent the distribution of pixel intensity for all pixels in the windows. Once formed, the feature histograms of the PR, BR, and TR are used to develop a rule that is used to classify pixels in the image as target or non-target (specifically, background, plume, or target). Ex. 1005 at 50 (left column).

Intensity is indisputably a single domain. As Petitioner concedes, Gilbert merely discloses that other alleged domains, such as texture, edge, and linearity measures, *could* be used (although Gilbert describes only the use of pixel intensity). Ex. 1005 at 48 (right column); Petition at 37. Tellingly Gilbert does not describe, or even suggest, forming a histogram including *both* intensity and one or more of texture, edge, and linearity measures, and Gilbert does not explain how this would be accomplished in the context of real-time tracking of, for example, a fast-moving rocket. Instead, Gilbert discloses that pixel classification is performed at high speed by using a single parameter, by comparing pixel intensity to the contents of a memory containing the intensity classification rule. Ex. 1005 at 50 (left column). Gilbert’s disclosure of other possible parameters (such as texture), but lack of disclosure of the possibility or manner of making use of more than a single parameter (intensity) in combination, would in fact lead the reader away from forming histogram(s) of the pixels in two or more selected subsets of

parameter values that are in two or more domains, where the histogram(s) refer to selected subsets of parameter values that define the target.

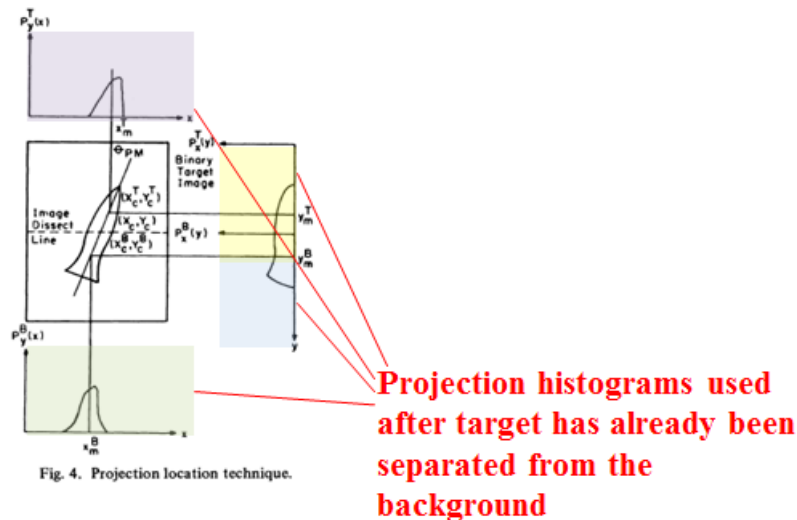
Additionally, Gilbert's intensity histograms are not formed of pixels in two or more *selected subsets of values of a parameter (classes)*, in this case, intensity, that define the target. As Petitioner admits, the intensity histograms include pixels with *all* intensity values. *See* Petition at 13. Petitioner mischaracterizes the intensity histograms of Gilbert by analogizing to the velocity histogram in Figure 14a of the '001 patent, (Petition at 39), but in fact Figure 14a is consistent with Patent Owner's proposed construction of "class" and different from the intensity histograms of Gilbert. Figure 14a shows an example of successive classes, each representing a particular velocity. Ex. 1001 at 20:54–59. The classes in Figure 14a are a selected subset of values, not (as is the case for the intensity histograms of Gilbert), all possible values. Figure 14a shows a categorization 15 of 16 possible velocities. The 15 velocities shown on the figure are a selected subset of the 16 possible values. *Id.* Thus, Petitioner's attempt to analogize Gilbert's intensity histogram to Figure 14a of the '001 patent fails.

Also, identifying the target based on Gilbert's intensity histograms does not comprise determining a center of the target to be between x and y minima and maxima of the target. Gilbert's feature histograms of intensity do not determine a center at all, therefore the requirement of claim 1 that "identifying the target in said

at least one histogram” further comprise “determining a center of the target” is not satisfied by Gilbert’s use of intensity histograms to determine a decision rule that is used to identify the target.

(2) The Projection Histograms Do Not Satisfy the Claim Language

The projection histograms of Gilbert also do not satisfy the claim language. Petitioner relies on the disclosure of four different projection histograms in the x and y domains at Figure 4 of Gilbert. Petition at 14–16.



However, the projection histograms permit the target to be tracked *after the target has already been identified* and separated from the background. See Ex. 1005 at 50 (“Projection Processor” section). Thus, these projection histograms are not formed of pixels in at least two classes, where the classes are in two or more domains, and *where the classes define the target*. The target is not identified from the projection histograms as is required by the claim,

because the target has already been identified previously by the intensity histograms. That is, the x-position or y-position domains do not *define* the target.

Additionally, the projection histograms are not used to *identify* the target by determining a center of the target to be between x and y minima and maxima of the target. Again, Petitioner relies on Gilbert's disclosure regarding the intensity histogram for identifying the target, not the projection histograms, and the projection histograms do not identify the target. See Petition at 40. In any case, Petitioner admits that Gilbert's center calculation does not involve x and y minima and maxima of the target, but instead uses the center of areas of the target's upper and lower halves. *Id.* at 41. As Gilbert describes, "[to] precisely determine the target position and orientation, the target center-of-area points are computed for the top section (X_C^T, Y_C^T) and bottom section (X_C^B, Y_C^B) of the tracking parallelogram" using the top-half and bottom-half projections. Ex. 1005 at 50 (right column). The top-half and bottom-half projections are used to determine a target center. *Id.*

In fact, Gilbert teaches away from identifying and using minima and maxima of the target (i.e., nose and tail). See *Allergan, Inc. v. Sandoz Inc.*, 796 F.3d 1293, 1305 (Fed. Cir. 2015) (a reference teaches away if a POSA would be discouraged from, or led in a different direction from, the path taken by the inventor). Gilbert explains that it is difficult to determine nose and tail position and the determination is sensitive to noise. *Id.* at 50 (right column).

Because neither the intensity histograms nor the projection histograms of Gilbert satisfy the claim language, and Gilbert in fact relies on the use of a single domain, instead of multiple domains, to rapidly identify the target, and as Gilbert does not identify the target in any histogram by determining a center of the target to be between x and y minima and maxima of the target, Gilbert neither teaches nor suggests all the elements of claim 1.

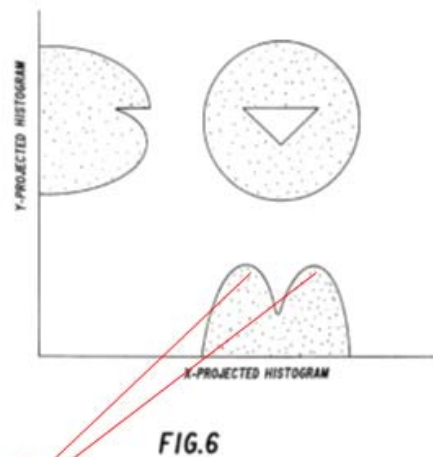
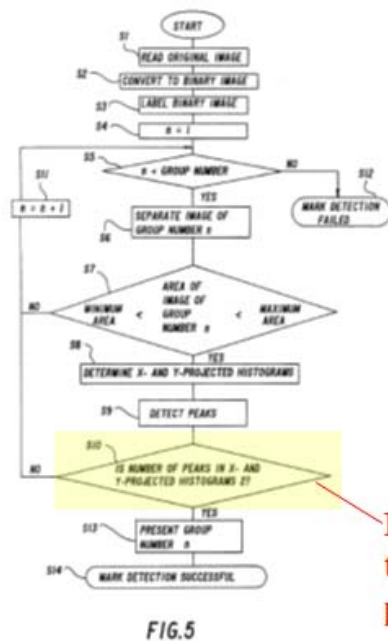
b. Hashima

Hashima was cited by the examiner during prosecution of the '001 patent. Ex. 1001 at 2 (Hashima shown with “*”, indicating “cited by examiner”); Ex. 1004 at 71. Thus, Hashima was of record and the examiner fully considered Hashima’s potential relevance. Tellingly, Hashima was never applied in any rejection of the claims. That is because, as explained below, Hashima is deficient in numerous respects.

Hashima does not cure the deficiencies of Gilbert, because the x-axis and y-axis histograms of Hashima on which Petitioner relies do not satisfy the language of the claim. Hashima describes the selection of a window in the image, but the x-axis and y-axis limits of the window do not define a target. Instead, these histograms include *all* of the pixel data in the window. Ex. 1006 at 24:50–25:15. The target is identified from the shape of the projection histograms after the histograms are formed using all pixels in the window. *Id.* at 9:8–23 and Fig. 6.

Therefore, the projection histograms are not formed of pixels in two or more selected subsets of values of a parameter in two or more domains and do not refer to two or more selected subsets of values of a parameter defining a target.

In Hashima, the target is a predefined mark, for example, a black circle and a white triangle mounted centrally on the black circle and three-dimensionally shifted from the black circle. Ex. 1006 at 2:64–3:3. Hashima’s histograms are formed by converting an original image into a binary image, then forming projected histograms in the x- and y-axis directions. *Id.* at 15:1–11. To detect the mark, Hashima identifies two “peaks” in each projected histogram; there are always two peaks and one valley even if the mark is rotated. *Id.* at 8:18–31; 9:11–23; Fig. 5 (S10) and Fig. 6.



Determine if there are two peaks

Thus, Hashima's histograms are not formed of pixels in *classes that define the target*. Instead, Hashima analyzes histograms to determine, for example by counting the number of peaks, whether the histograms suggest the presence of the predefined mark. As Petitioner admits, Hashima forms *separate* histograms in x-position and y-position domains. Petition at 38–39. And all pixels in the window are used. Ex. 1006 at 24:50–25:15.

Additionally, Hashima's use of projection histograms to compute the center point of the target is not part of the step of "*identifying the target*" by determining a center of the target to be between x and y minima and maxima of the target, as required by claim 1. As explained above, Hashima identifies the target by counting the number of peaks and valleys in the histograms. Ex. 1006 at 9:8–23 and Fig. 6. In fact, Petitioner relies on this aspect of Hashima as disclosing identifying the target. Petition at 40. By contrast, the center calculation in Hashima is used for computing the shift in the x and y directions of the target, not for identifying the target: "the difference between the central position P_m (m_x, m_y) and the preset target position P_o (t_x, t_y) represents shifts of the target mark 10 in the X and Y directions." Ex. 1006 at 11:26–29. Therefore, the disclosure of Hashima does not satisfy this claim element.

Tellingly, contrary to the assertion on page 41 of the Petition, Hashima's center calculation is not used for the same purpose as described in the '001 Patent

at 24:50–55. As explained above in Section I, in connection with the example of Figures 20–23, this section of the patent refers to an iterative process for locking onto the target by computing histograms based on a tracking box that is adjusted by determining x and y minima and maxima of the target. Hashima has no similar disclosure, and so Petitioner’s attempt to analogize asserted prior art disclosures to the patent again fails.

In sum, Gilbert and Hashima do not, either alone or in combination, teach or suggest (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and that (ii) “identifying the target in said at least one histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target,” as recited in claim 1.

2. Petitioner Has Not Shown That Hashima and Ueno Teach or Suggest All Elements of Claim 1

As to Ground 2, Hashima and Ueno do not, alone or in combination, teach or suggest: (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and that (ii) “identifying the target in said at

least one histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target,” as required by claim 1.

a. Hashima

As explained above in Section IV.A.1.b, Hashima does not teach or suggest all the elements of claim 1 because the x-axis and y-axis projection histograms of Hashima are not formed of pixels in selected subsets of values of a parameter (classes) in two or more domains, do not refer to selected subsets of values of a parameter (classes) defining a target, and are not used to identify a target by determining a center of the target to be between x and y minima and maxima of the target.

b. Ueno

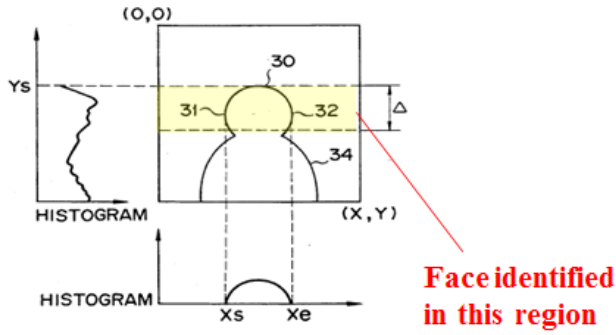
Ueno does not cure the deficiencies of Hashima. The x-axis and y-axis histograms on which Petitioner relies do not satisfy the language of the claim. The x-axis projection histogram is not used to identify the target facial area. The y-axis histogram is not formed of pixels in classes in two or more domains and does not refer to classes defining the target. And in any case, neither of these projection histograms determine a center of the target to be between x and y minima and maxima

As will be explained, Ueno discloses that the target facial region is identified based on two inputs: (1) an interframe difference signal and (2) a y-axis

histogram. The y-axis histogram includes *all* pixel data in the frame that have an interframe difference, and is not limited to a particular selected subset of y-position values. Accordingly, whether or not an interframe difference signal is a “class” (selected subset of values of a parameter), the only other input, the y-axis histogram, is not. Ueno therefore does not teach or suggest a histogram of pixels in **two** or more selected subsets of parameter values.

Ueno describes a process of detecting a facial region in two steps. First, an input signal is binarized (converted to “0” and “1”) depending on whether motion or change is detected between frames. Ex. 1007 at 7:7–16. Using the binarized image data, a y-axis projection histogram is formed of all the pixels that have a value “1” in the binary image, and then all of the pixels representing the facial region are detected solely based on this non-limited y-axis projection histogram. Ex. 1007 at 7:17–20.

The process by which Ueno identifies the facial region based on the y-axis projection histogram uses only one data point—the y-axis position of the top of the head, combined with several assumptions. To accomplish this detection, the y-axis projection histogram is searched, starting from the top, until a y-position with a value exceeding a threshold is detected. *Id.*; see Fig. 3. This y position is the assumed top of the facial region. *Id.*



F I G. 3

The bottom of the facial region is calculated based on the total image height (Y), the y location where the top of the facial area was located (Ys), and a hard-coded factor (1/4th or 1/5th). Specifically, the formula is:

$$\Delta = (Y - Y_s) \times \beta$$

$$\beta = \frac{1}{4} \text{ (or } \frac{1}{5} \text{)}$$

Ex. 1007 at 7:33–36. As Ueno explains, “Y” is the image height. *Id.* at 7:30–32. “Ys” is the location of the top of the facial region identified by searching the full-image y-axis projection histogram. *Id.* at 7:17–20. “β” is a factor such as 1/4 or 1/5. The result of the formula, “Δ”, is a y distance that is used to calculate an assumed bottom of the facial region based only on image height and at the y location found at the top of the facial region. As shown in Figure 3 of Ueno, for example, all of the pixels in the facial region are located based on this calculation (the pixels between the top and bottom of the region marked with Δ). That is,

Ueno assumes that there are no non-face pixels, such as for example hands or arms, in the region colored in yellow in the figure above.

After Y_s and Δ (the y distance) are determined, all pixels in the facial region have been identified. The facial region has been effectively separated from the pixels that correspond to the rest of the person's body, *e.g.*, any pixels below the person's shoulders. Ueno then proceeds to locate the left and right ends (X_s , X_e) of the person's face by searching for two pixels in the x-axis histogram that exceed the threshold. Ex. 1007 at 7:21–25. This permits the face to be more precisely tracked by eliminating pixels beyond the left and right ends from further consideration, but is not the basis on which Ueno identifies the facial region because, unlike the y-axis histogram, no pixels with value “1” in the binary image are excluded from the facial region based on the x-axis histogram.

Ueno's x-axis and y-axis histograms are not used to identify a target by determining a center of the target to be between x and y minima and maxima of the target, as required by claim 1. In fact, as explained above, the facial region is identified by locating Y_s (y position of top of head) in the y-axis histogram, then calculating an assumed bottom of the facial region.

Petitioner's reliance on Ueno at 1:39–68 as disclosing tracking the facial region with a rectangle constructed from x-position and y-position minima and maxima derived from histograms is incorrect. *See* Petition at 26. This section of

Ueno makes no mention of x-position and y-position minima and maxima or determining the center of the target. In fact, Petitioner essentially concedes that Ueno is deficient in this regard by relying solely on Hashima as disclosing this feature in the discussion of Ground 2. Petition at 54.

In sum, Hashima and Ueno do not, either alone or in combination, teach or suggest (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and that (ii) “identifying the target in said at least one histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target,” as recited in claim 1.

3. Petitioner Has Not Shown That Ueno and Gilbert Teach or Suggest All Elements of Claim 1

As to Ground 3, Ueno and Gilbert do not, alone or in combination, teach or suggest all limitations of claim 1. As explained above in Sections IV.A.1.a (Gilbert) and IV.A.2.b (Ueno), respectively, neither reference teaches or suggests: (i) “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” and “identifying the target in said at least one histogram itself,” and that (ii) “identifying the target in said at least one

histogram further comprises determining a center of the target to be between X and Y minima and maxima of the target” as recited in claim 1.

B. Petitioner Has Not Shown That a POSA Would Have Selected and Combined the Asserted References

Petitioner does not adequately explain how a POSA would have combined the references to arrive at the claimed invention or why a POSA would have been motivated to select and combine the references. Therefore, the Petition is deficient because it impermissibly shifts to the Board the burden of figuring out how and why the references would be combined in the manner asserted by the Petition, and in what manner the POSA would achieve the claimed invention through the asserted combination.

The Petition fails to analyze the references as a whole, and therefore ignores disclosures in Gilbert, Hashima and Ueno that would lead a POSA away from the invention of the '001 patent. Institution should be denied due to this failure to address the references as a whole by avoiding any discussion of these problematic disclosures. *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1548, 1550 (Fed. Cir. 1983) (a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention).

Petitioner's reasons for combining the asserted references are generally supported by superficial analysis supported by conclusory statements, for example, that Gilbert and Hashima “are not only in the same field of endeavor but also are

directed to very similar systems and processes” and “[m]oreover, there would have been a reasonable expectation of success that doing so would produce a more accurate target identification system.”³ *See, e.g.*, Petition at 32–33, 35. The fact that certain references may include superficially similar features, such as identifying and tracking a moving target using histograms, does not mean that a POSA would combine the references, and as shown below a POSA would have considered the references as a whole and recognized the differences between the references, and therefore would not have been motivated to select and combine them.

1. Petitioner Has Not Shown That a POSA Would Have Combined Gilbert and Hashima

Petitioner has not shown that a POSA would have looked to apply the disclosure of Hashima to the disclosure of Gilbert in order to arrive at the claimed subject matter of the ’001 patent, as proposed in Ground 1.

The references are directed to different objectives and therefore operate differently, such that a POSA would not have combined them. Gilbert is directed toward tracking a fast-moving object such as a missile where little is known about the object, other than the assumption that intensity value of the plume and target are different than the background. *See* Ex. 1005 at 54 (right column) (referring to

³ Elsewhere, for example, the Petition repeats a conclusory assertion that “[e]ach compliments [sic] the other such that strong disclosures of one make up for weaknesses in the other.” Petition at 46, 58 and 72.

“highly maneuverable targets” and “rapid maneuver from the missile”). The object of Gilbert is to generally follow the target with an optical system, even when the target is partially or (briefly) wholly obscured by, for example, clouds, or when the target changes apparent shape, length, etc. due to its movements relative to the optical system. *Id.* at 51 (right column). By contrast, Hashima is directed toward precision tracking of a known target, for example, to dock a spaceship or move a robot arm. Ex. 1006 at Abstract, 1:19–22, Figure 1. The algorithm of Hashima purports to operate in real-time by *requiring* a known target with known dimensions and colors that remains constantly visible so that the system of Hashima can perform detailed three-dimensional geometric calculations based on the known target shape and colors. *See, e.g.*, Ex. 1006 at 15:23–16:57. These requirements may be appropriate for Hashima, given that a spaceship dock could easily be equipped with a decal of known size and color. However, given the narrow applicability of Hashima’s algorithm to only precisely known targets where the colored surfaces are visible, where the target is approached from certain known angles, a POSA would not apply Hashima to Gilbert.

Gilbert relies on histogram calculations that are directed to identifying and tracking of an object about which little is known. Gilbert’s objective is real-time identification and tracking of objects in a rapidly-changing environment, such as a missile at White Sands Missile Range. Ex. 1005 at 47 (left column, Abstract and

Introduction). Gilbert seeks to determine whether a given pixel belongs to a target, a background or a plume region based on intensity value. Ex. 1005 at 50 (left column). Because Gilbert does not know anything about the target other than the assumption that some of the target pixels have intensity values that are different than the immediate background, Gilbert devotes computational resources to creating several intensity histograms of all of the pixels in several windows. *Id.* at 48 (right column) and 49. Gilbert performs real-time pixel classification to identify the target by calculating a decision rule based on these intensity histograms. *Id.* at 50 (left column).

Gilbert does not know the shape of the target, so Gilbert must also calculate an estimate of target geometry to assist in tracking. Once Gilbert identifies the target based on the intensity histograms, Gilbert attempts to determine shape and orientation to assist in predicting target path to permit real-time adjustments to the optical tracking system. Ex. 1005 at 51–54. For example, Gilbert transforms projection histograms into eight rectangles of equal area, using a process referred to as “[a]rea quantization,” and computes the orientation and shape based on simple ratios using the lengths of the rectangles. Ex. 1005 at 51 (left column), 52 (left column), Figure 5. Figure 5 of Gilbert shows this visually:

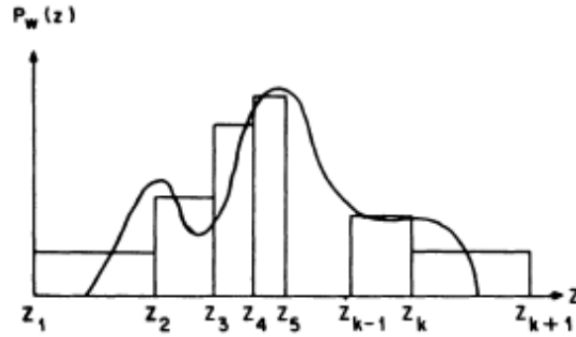


Fig. 5. Projection parameters.

Gilbert does not know the target shape (or color), or the background scene or environment in which it will operate. For example, Gilbert may contend with sun glare, cloud formations, or rapid changes in the (unknown color) background scene for the (unknown color) target. *Id.* at 51 (right column).

By contrast, the system of Hashima is designed to operate in real time based on the benefit of complete, advance knowledge of the shape and color of the target and the ability of the robot hand or grip to move in six dimensions of freedom, such that Hashima can control the position and attitude of the object with respect to the video camera. Ex. 1006 at 1:3–12, 2:64–3:13. Hashima is directed to tracking a predefined mark mounted on an object with known, contrasting colors, in order for, for example, a robot to grip the object. Ex. 1006 at 1:7–16; 7:45–65. Hashima relies on knowing, for example, that the target is a triangle that rests on a post that is offset by a known distance from a circular background of a contrasting color, *Id.* at Figures 2 & 4 and 7:66–8:17, and uses that knowledge to track the target in three-dimensional space in order to guide the robot towards the target. For

example, Hashima computes the target's three-dimensional shift by moving the camera along the x- and y-axes, in addition to rotating the camera about the x-, y- and z-axes of the target coordinate system. *Id.* at 16:50–17:5. Hashima describes that changes in position between the target mark and the camera are “relatively small” in one embodiment because Hashima controls the camera position with respect to the target with six degrees of freedom. *Id.* at 17:6–11.

Hashima's histogram algorithm is incompatible with Gilbert. Gilbert's authors limited the use of projections to computing “target center-of-area points” for the purpose of attempting to determine target position and orientation in an unstable environment with little information, not for identifying the target, because it would not be possible to identify an unknown target shape based on the method of Hashima. Gilbert instead uses simple intensity histograms to rapidly identify the target, based on an assumption that some parts of the target will have a different intensity than does the immediate background. Ex. 1005 at 48–50. The precision-geometrical-calculation based method of Hashima is appropriate for the operating environment of Hashima, but not Gilbert. Hashima, unlike Gilbert, knows target dimensions and assumes continuous target visibility and control of the target location with respect to the camera. *See, e.g.*, Ex. 1006 at 14:51–55, Figure 26 (“The target mark 101 is used when two objects are closely attached to each other as upon docking. For example, as shown in FIG. 26, the target mark

101 is attached to an object 1A and the camera 20 is mounted on an object 1B”); 17:6–11 (“While in the middle of the tracking feedback control process, since any shifts from the certain positional relationship between the video camera 20 and the target mark 10 are relatively small, the video camera 20 may be moved in the various axis directions in a range close to the certain positional relationship.”).

Petitioner has not shown a credible reason why a POSA would attempt to combine the two references. Petitioner asserts that although Gilbert *generally* teaches histograms in multiple domains, Hashima explicitly teaches this feature. Petition at 47–48. However, Petitioner fails to explain why a POSA would have used Hashima’s x- and y-axis histograms in place of Gilbert’s intensity histograms, especially given that the target shape and attitude with respect to the camera are not known to the system of Gilbert. Petitioner merely relies on Gilbert’s alleged teaching that histograms based on other domains “may be used to achieve similar result[s],” Petition at 48, without explaining how Hashima’s histograms could be used to achieve such results in an environment where, as in Gilbert, the target dimensions/colors are not known in advance.

Gilbert could not effectively make use of the Hashima method of detecting “peaks” and “valleys” of histograms, and a POSA would not adopt an algorithm based on x and y minima and maxima for Gilbert based on the disclosures of Hashima as Petitioner incorrectly suggests. *See* Petition at 47. Gilbert teaches

away from using such a method because it would be overly sensitive to noise in the operating environment of Gilbert. Gilbert criticizes the use of nose and tail points, stating that “[t]he top and bottom target center-of-area points are used, rather than the target nose and tail points, since they are *much easier to locate*, and more importantly, they are *less sensitive to noise perturbations*.” Ex. 1005 at 50 (right column) (emphasis added). Gilbert describes noise as a problem to be avoided; certain subintervals in one calculation are not used “since they are quite sensitive to noise.” *Id.* at 52 (left column). As another example, the area quantization employed by Gilbert “offers the advantage of easy implementation and high immunity to noise.” *Id.* at 51 (left column). Thus, a POSA would have been discouraged from using nose and tail points (which Petitioner analogizes to minima and maxima) based on the disclosure of Gilbert and would not have applied Hashima’s techniques, including its center calculation technique, to Gilbert. *See Allergan, Inc., supra.*

Notably, as with the use of histograms formed of pixels in multiple domains, Petitioner apparently concedes that certain features (in this instance, the determination of x and y minima and maxima) are not explicitly taught by Gilbert, and relies on Hashima to remedy this deficiency. Petition at 36 (“Thus, it would have been obvious for a POSA to combine Gilbert with other references teaching simpler center calculations based on the end-points of a target in a histogram (i.e.,

X-minima and maxima and Y-minima and maxima), such as the calculation disclosed by Hashima.”).

Because Gilbert and Hashima are directed towards different objectives and operate in an incompatible manner, and because Petitioner has not offered a credible reason to combine, Petitioner has not shown that a POSA would have sought to combine these references in the manner asserted in the Petition.

2. Petitioner Has Not Shown That a POSA Would Have Combined Hashima and Ueno

A POSA would not have looked to apply the teachings of Ueno to the teachings of Hashima in order to achieve the claimed subject matter of the '001 patent as proposed in Ground 2. A POSA would have seen no need to apply the rule-of-thumb assumption based approach of Ueno to the precise three-dimensional calculation based approach of Hashima. And Ueno's severe limitations and required assumptions mean it would not work if applied to Hashima. *See McGinley v Franklin Sports, Inc.*, 262 F.3d 1339, 1354 (Fed. Cir. 2001) (references teach away where their combination produces a seemingly inoperable device or modification). Petitioner's asserted reason to combine (to make use of a tracking box of Ueno, Petition at 50–51) is a pretext—it is apparent that Petitioner is using the patent as a roadmap to link Hashima and Ueno.

A POSA would not have applied the primitive, assumption-based algorithm of Ueno to Hashima. Ueno detects the top of a head by searching a y-axis

histogram, starting from the top, until a y-position with a value exceeding a threshold is detected, and then calculating the bottom of the facial region based on the total image height (Y), the y location where the top of the facial area was located (Ys), and a hard-coded factor (such as $1/4^{\text{th}}$ or $1/5^{\text{th}}$). Ex. 1007 at 7:17–45. Hashima has no need for such assumptions, because the system of Hashima has full knowledge of all dimensions of the target and the color of the target surfaces.

Ueno is not usable with Hashima. Hashima operates with a camera with six degrees of freedom of movement, with precise geometric calculations based on the observed target to determine, for example, the rotation and angle of the target with respect to the camera. Ex. 1006 at 2:64–3:13, 11:49–66. By contrast, Ueno also requires a specific orientation (upright with head on top of shoulders) and location (approximately middle of frame). *See, e.g.*, Ex. 1007, Fig. 5 (Ys, Ye, Xs and Xe forming a rectangle with sides parallel to the edges of the frame). These constraints would be wholly unsuitable for a system that depended on computing the three-dimensional shift of the target, such as in Hashima.

Petitioner has not shown a credible reason why a POSA would attempt to combine the two references. For example, Petitioner alleges that Ueno’s purported disclosure concerning highlighting a target using a tracking box would enable a user to visually confirm that the correct object has been identified and is being tracked, or to manually specify a target mark to be tracked. Petition at 50–51.

However, Hashima is directed to *automated* control of the robot (Ex. 1006 at 1:20–21) through image processing that produces a speed command for controlling the robot’s gripping arm, and a sensor to detect whether the object bearing the mark has been gripped successfully. Ex. 1006 at 15:14–22. The entire process is fully automated. The robot system knows the target dimensions and color in advance. There is no need in Hashima for a user to visually confirm that the correct object has been identified or manually specify the target in the video image. This purported motivation in fact highlights an important difference between Ueno, which is directed to an interactive teleconference in which a user may wish to focus on a particular portion of the video display, and Hashima, in which there is no need for or benefit from human interaction.

Therefore, because Hashima and Ueno are directed to different objectives and operate in incompatible ways, Petitioner has not shown that a POSA would have sought to combine these references in the manner asserted in the Petition.

3. Petitioner Has Not Shown That a POSA Would Have Combined Ueno and Gilbert

Petitioner has not shown that a POSA would have looked to apply the disclosure of Gilbert to the disclosure of Ueno in order to arrive at the claimed subject matter of the ’001 patent, as proposed in Ground 3.

The references operate differently because they are directed to different objectives, and therefore a POSA would not have combined the references as

asserted by Petitioner. *See McGinley, supra*. As explained above in Section IV.B.1, Gilbert is directed to identification and tracking of a target such as a missile in a rapidly-changing environment, in order to follow the target about which very little is known, with an optical system (that is also moving as it tracks). Gilbert thus places a premium on (i) reducing the effects of noise in the noisy tracking environment with many unknowns; and (ii) rapid performance to track the fast-moving and rapidly-maneuvering target. Rather than attempting to identify the target based on multiple parameters or its (unknown) shape, the algorithm of Gilbert is based on a fast single-parameter analysis (intensity). Gilbert must expend processing resources simply to determine a decision rule to sort pixels based on intensity and to attempt to distinguish the target pixels from the background and plume pixels. Gilbert relies on centroids of large portions of the target, not nose-and-tail identification, when using projection histograms for tracking, using an algorithm that is adapted to minimize the impact of the noisy tracking environment.

By contrast, Ueno is concerned with a simpler tracking problem. The shape and orientation (head-and-shoulders) of the target is known. It is assumed that the target is moving with respect to the background and can be identified based on this movement. Ex. 1007 at 7:7–10 (forming a binary image from an interframe difference image). Ueno relies on both of these assumptions to completely and

reliably identify the head-and-shoulders target and then calculate the head location based on its topmost point. Ueno need not expend resources on a decision rule to find the head-and-shoulders target because it is readily identified by its movement. Unlike Gilbert, there is no need for Ueno to rely on projection histograms for predicting future movement of the head or analyzing its trajectory because Ueno can rely on the interframe difference signal to reliably and repeatedly find the head-and-shoulders shape. Ex. 1007 at 5:35–40. There is no need for Ueno to analyze a changing shape of a target because, unlike a rapidly maneuvering missile and moving tracking optics system, Ueno can rely on a known head-above-shoulders shape. By contrast, as shown in Gilbert, a missile can have a downwards facing trajectory, with nose below tail (Figure 3), or an upward-facing trajectory (Figure 4). Gilbert is concerned with highly-maneuverable, rapidly-moving targets. *E.g.*, Ex. 1005 at 54 (right column).

The circuit of Ueno is directed towards simply improving the clarity of a face displayed in a video conference, with all the attendant assumptions appropriate to that situation (as described above). Ueno requires the assumption of a fixed background of a teleconference or videophone, and further requires that: (i) there is one person in the video signal; (ii) the person is moving and so can be detected by movement; (iii) the person has a particular head-on-top-of-shoulders shape that is approximately centered in the image; and (iv) the person is in an

upright position. Ex. 1007 at 7:17–45. Based on these assumptions, Ueno can identify the entire person (facial region and shoulder region) based on movement, and then use a simple y-projection histogram of all moving pixels, combined with assumptions as to the size of the person with respect to the frame, to identify the facial region.

The assumptions required for the algorithm of Ueno are appropriate because Ueno's facial region detecting circuit need only to be of sufficient resolution to identify, on a macro-block level, whether a macro-block belongs to the face region or not. Ex. 1007 at 6:35–44. The facial region detecting circuit does not need to locate the face with precision, for example, by determining the exact boundaries, shape, orientation or expected movement of the face. Figure 1 of Ueno shows that face detection is used to control a low-pass filter so that regions other than the facial region are filtered by the low-pass filter, thereby removing or suppressing high-frequency components in non-face regions. *Id.* at 6:21–26. This decreases the number of quantizing bits used for encoding non-face regions while allowing the facial region to be maintained at high image quality. *Id.* at 6:26–34.

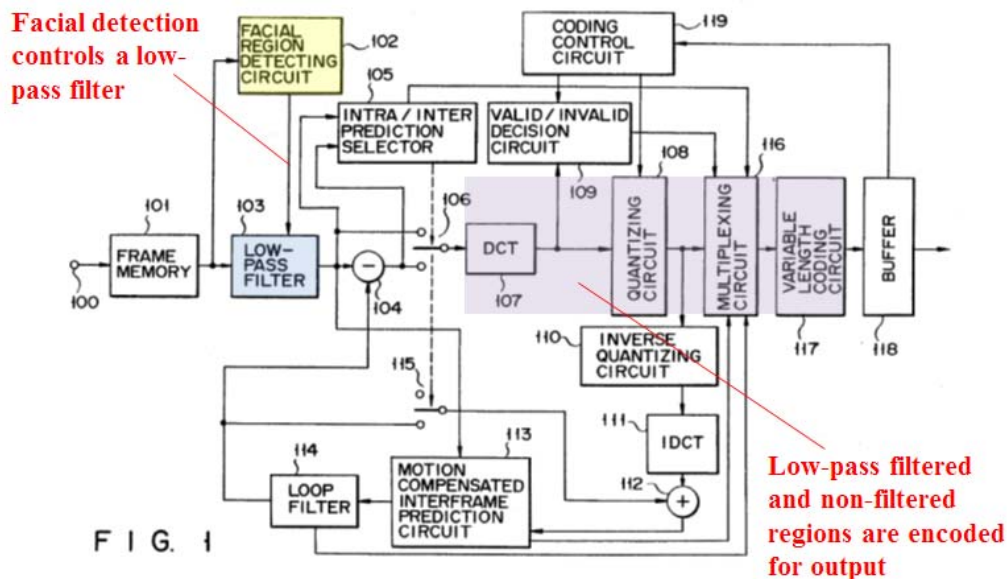


Figure 1 shows Low-Pass Filter 103, which applies filtering to non-face regions based on the output of Facial Region Detecting Circuit 102. The output of Low-Pass Filter 103 may be applied to Discrete Cosine Transform (DCT) circuit 107 via a switch 106, then processed by additional encoding circuits such as Quantizing Circuit 106 and Variable Length Coding Circuit 117.

A POSA would understand that Gilbert and Ueno are incompatible. Gilbert's single-domain (intensity) approach would not differentiate the facial region from the shoulder region if applied to Ueno. Gilbert requires that a plume region (PR), target region (TR), and background region (BR) have different intensities, and uses these intensities to identify the target. Ex. 1005 at 48–50 ("Video Processor" section). This assumption is not applicable in Ueno. Likewise, Gilbert's use of projections in the x and y directions would not

differentiate the facial region from the shoulder region if applied to Ueno because the formation of Gilbert's projections requires that the target pixels be identified in advance, and any pixels included in the projections are assumed to belong to the target. Ex. 1005 at 50–51 (“Projection Processor” section). Gilbert does divide the identified target into halves, but only because using target edges would be too difficult and too noisy. Ex. 1005 at 50 (right column) (emphasis added).

Ueno's approach would likewise not work if applied to Gilbert. Ueno relies entirely on identifying a top edge of the head, the very approach that Gilbert describes as inappropriate in its noisy tracking environment. Ueno relies on interframe difference (movement), which would be unreliable in the changing, unknown background and moving optical tracking environment of Gilbert. Ueno relies on a shape assumption to find an area of interest (face) within the target—this assumption would not apply to Gilbert where shape is unknown. There is also no need for Gilbert to identify a particular portion of the target for enhancement, nor would this be useful given that Gilbert does not know what the different sections of the target are once the target is identified, and has no way to use such information even if it were available.

Petitioner has not shown a credible reason why a POSA would attempt to combine the two references. For example, Petitioner asserts that a POSA would have been motivated to improve Ueno by adding Gilbert's calculation of the

target's center, because the center calculation "enables the addition of other functionality" such as allowing Ueno's camera to adjust its field of view to follow the target as it moved during a video call. Petition at 62. However, a POSA would not see a need to apply Gilbert to determine the center of the target of Ueno—the head-and-shoulders target is easily found based on interframe difference, and the head is found based on a simple assumption, so the location could be tracked without Gilbert. See Ex. 1007 at 5:35–49, 60–62. The intensity histogram based rule of Gilbert would not be needed for Ueno, where interframe difference (motion) reliably determines head-and-shoulders pixels, and the shape (orientation, etc.) of Gilbert would not be needed in Ueno because shape is already known in Ueno.

Petitioner's assertion that Gilbert "recognizes" the use of nose-and-tail points is incorrect because it ignores the disclosure of the reference as a whole, which criticizes use of nose-and-tail points and would teach away from, not towards, the asserted combination. Ex. 1005 at 50 (right column); Petition at 63.

Therefore, because Ueno and Gilbert are directed to different objectives and operate in incompatible ways, a POSA would not have sought to combine these references in the manner asserted in the Petition, but instead would have been led away from such a combination.

C. Petitioner’s Reasons for Combining the References Are Driven by Improper Hindsight Analysis

Based on the structure and content of Petitioner’s arguments, it is clear that Petitioner is applying impermissible hindsight bias by using the ’001 patent as a roadmap to the claim at issue, contrary to established prohibitions against such improper use of a subject patent.⁴ *See Ortho-McNeil, supra; In re NTP, supra; W.L. Gore v. Garlock*, 721 F.2d at 1553 (Fed. Cir. 1983).

The Petition has not convincingly explained how a POSA would have combined the references in the combinations asserted to arrive at the subject matter of the patent claims. Instead, Petitioner argues based on general “reasons to combine” the references, (Petition at 32, 49, 60) without asserting how and why a POSA would have combined the particular teachings from the references that would result in the invention.

By focusing on general “reasons to combine” the references without reaching the question of how the references would combine, Petitioner thereby assumes that the references could be combined without modification. For

⁴ “Indeed, one must ‘be careful not to allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be [modified] to produce the claimed invention.’” *Kinetic Concepts*, 688 F.3d at 1368 (*quoting Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008)).” *See also Trivascular Inc. v. Samuels*, 812 F.3d 1056, 1066 (Fed. Cir. 2016) (repeating *Kinetic Concepts*’ admonishment against using references without explaining how or why the references would be combined).

example, Petitioner asserts that disclosure of a tracking window of Ueno would cause the POSA to combine Ueno with Hashima. Petition at 50–51. But Ueno relies on imprecise rule-of-thumb assumptions as to the target location and dimensions that are not necessary in the context of Hashima, in which the exact target dimensions are known. Ex. 1007 at 7:17–45; Ex. 1006 at 23:22–61 (describing a process for computing the center of gravity of an acute isosceles triangle of less than 45 degrees). Ueno also requires that the target (head and shoulders) face upright at all times, which would not work for the system of Hashima, in which the camera has six degrees of freedom and the target and camera can be at various angles and attitudes with respect to one another. *See* Section IV.B.2, above. Thus, the only plausible source for Petitioner’s knowledge of the advantages of combining the references in the manners asserted is the ’001 patent itself.

The inability of Petitioner to articulate a specific, credible argument to explain *how* a POSA, looking at the references as a whole, would have combined references in the asserted combination is telling. It is apparent that the Petitioner selected the reference combinations using the patent as a roadmap and applied generic and formulaic reasons in an attempt to retroactively achieve the claimed invention. Petitioner has not met its burden to show that a POSA would have been motivated to combine the asserted references, or how the references would have

been combined. No review should be instituted for any of the asserted combinations.

V. CONCLUSION

For the reasons given in this Preliminary Response, Patent Owner respectfully requests that the Board decline to institute review of claims 1–4 of the '001 patent.

Dated: March 20, 2017

/s/ Chris J. Coulson

Chris J. Coulson (Reg. No. 61,771)

Lead Counsel for Patent Owner

ANDREWS KURTH KENYON LLP

One Broadway

New York, NY 10004-1007

Tel.: (212) 425-7200

Fax: (212) 425-5288

chriscoulson@andrewskurthkenyon.com

CERTIFICATE OF WORD COUNT

The foregoing Patent Owner's Response complies with the type-volume limitations of 37 C.F.R. § 42.24(b)(2). Excluding the items listed in 37 C.F.R. § 42.24(a)(1) as not included in the word count, and using the word count of the word-processing system used to prepare the paper (Microsoft Word), the petition contains 13,769 words.

/s/ Chris J. Coulson

Chris J. Coulson

ANDREWS KURTH KENYON LLP

One Broadway

New York, NY 10004-1007

Tel.: (212) 425-7200

Fax: (212) 425-5288

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on March 20, 2017, the foregoing *Patent Owner's Preliminary Response* was served via electronic mail upon the following counsel of record for the Petitioner:

John Kappos (Reg. No. 37,861)
O'Melveny & Myers LLP
610 Newport Center Drive, 17th Floor
Newport Beach, CA 92660
jkappos@omm.com

Nicholas J. Whilt (Reg. No. 72,081)
O'Melveny & Myers LLP
400 South Hope Street, 18th Floor
Los Angeles, CA 90071
nwhilt@omm.com

Brian M. Cook (Reg. No. 59,356)
O'Melveny & Myers LLP
400 South Hope Street, 18th Floor
Los Angeles, CA 90071
bcook@omm.com

IPTSAMSUNGOMM@OMM.COM

/s/ Chris J. Coulson
Chris J. Coulson
ANDREWS KURTH KENYON LLP
One Broadway
New York, NY 10004-1007
Tel.: (212) 425-7200
Fax: (212) 425-5288