Trials@uspto.gov
571-272-7822

Paper No. 40
Entered: September 28, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.; AND
SAMSUNG ELECTRONICS AMERICA, INC.
Petitioners

v.

IMAGE PROCESSING TECHNOLOGIES, LLC
Patent Owner

IPR2017-01218
Patent 8,983,134 B2

Before JONI Y. CHANG, MIRIAM L. QUINN, and SHEILA F. McSHANE, *Administrative Patent Judges.*

McSHANE, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 3 of U.S. Patent No. 8,983,134 B2 (Ex. 1001, "the '134 patent") is unpatentable, and Petitioner has not shown, by a preponderance of the evidence, that claims 4–6 of the '134 patent are unpatentable.

A. Procedural Background

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. ("Petitioner") filed a Petition requesting *inter partes* review of claims 3–6 ("the challenged claims") of the '134 patent pursuant to 35 U.S.C. §§ 311–319. Paper 2 ("Pet."). The supporting Declaration of Dr. John C. Hart ("Hart Declaration") was filed. Ex. 1002. Image Processing Technologies, LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 8 ("Prelim. Resp."). Pursuant to 35 U.S.C. § 314(a), on October 3, 2017, we instituted *inter partes* review on the following grounds:

whether claim 3 would have been obvious under 35 U.S.C. § 103(a) in view of Gerhardt[1] and Bassman[2]; and

whether claim 3 would have been obvious under 35 U.S.C. § 103(a) in view of Gilbert[3], Gerhardt, and Hashima[4].

---

[1] U.S. Patent No. 5,481,622 (issued January 2, 1996) (Ex. 1013).
[2] U.S. Patent No. 6,044,166 (issued March 28, 2000) (Ex. 1014).
[3] Alton L. Gilbert, *A Real-Time Video Tracking System*, PAMI-2, NO. 1, IEEE TRANSACTIONS ON PATTERN ANALYSIS ANDMACHINE INTELLIGENCE, January, 1980. (Ex. 1005).
[4] U.S. Patent No. 5,521,843 (issued May 28, 1996) (Ex. 1006).

See Paper 11 ("Inst. Dec." or "Dec."). Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 15, "PO Resp."). Petitioner filed a Reply (Paper 22, "Pet. Reply") to the Patent Owner Response.

On April 24, 2018, the Supreme Court held that a final written decision in an *inter partes* review must decide the patentability of all claims challenged in the petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018) ("*SAS*"). Pursuant to *SAS*, on May 3, 2018, we instituted *inter partes* review on the following additional grounds:

> whether claims 4–6 would have been obvious under 35 U.S.C. § 103(a) in view of Gerhardt and Bassman; and
>
> whether claims 4–6 would have been obvious under 35 U.S.C. § 103(a) in view of Gilbert, Gerhardt, and Hashima.

See Paper 25; *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360–61 (Fed. Cir. 2018) (reading "the *SAS* opinion as interpreting the statute to require a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition"); *Guidance on the Impact of SAS on AIA Trial Proceedings* (April 26, 2018) (available at https://www.uspto.gov/patents-application-process/patent-trial-and-appealboard/trials/guidance-impact-sas-aia-trial) ("[I]f the PTAB institutes a trial, the PTAB will institute on all challenges raised in the petition."). The parties were requested to advise the Board if they wished to change the case schedule or submit further briefing in light of the institution on additional claims and grounds. Paper 25, 1. Petitioner requested additional supplemental briefing, and the request was granted. Paper 26, 4–5. Leave for additional supplemental briefing for both parties was also granted. Paper 31. Petitioner filed a Supplemental Reply (Paper 29, "Pet. Supp. Reply").

Patent Owner filed a Response to Petitioner's Supplemental Brief (Paper 34, "PO Supp. Resp.), and Petitioner filed a Reply to Patent Owner's Supplemental Response (Paper 35, "Pet. Supp. Resp.).

An oral hearing was held on June 29, 2018. A transcript of the hearing is included in the record. Paper 39 ("Tr.").

B. Related Proceedings

The parties indicate that a related matter is *Image Processing Technologies LLC v. Samsung Elecs. Co.*, No. 2:16-cv-00505-JRG (E.D. Tex.) ("the district court case"). Pet. 1, Paper 5, 1. Petitioner also indicates that it filed Case IPR2017-00353 against other claims of the '134 patent. Pet. 2, 5–6. In Case IPR2017-00353, *inter partes* review was instituted. *See Samsung Electronics Co., Ltd. v. Image Processing Tech. LLC*, Case IPR2017-00353 (PTAB May 25, 2017) (Paper 12) ("the '353 IPR"). A Final Written Decision issued in that *inter partes* review, with the determination that claims 1 and 2 of the '134 patent are unpatentable. *Samsung Electronics Co., Ltd. v. Image Processing Tech. LLC*, Case IPR2017-00353 (PTAB May 9, 2018) (Paper 37) ("'353 Final Written Decision").

C. The '134 Patent

The '134 patent is entitled "Image Processing Method," and issued on March 17, 2015 from an application filed on March 17, 2014. Ex. 1001, [22], [45], [54]. The '134 patent claims priority to application FR 96 09420, dated July 26, 1996. *Id*. at [30]. The '134 patent also claims priority to the following applications: (1) U.S. Patent Application No. 12/620,092, filed on November 17, 2009—now U.S. Patent No. 8,805,001; (2) U.S. Patent Application No. 11/676,926, filed on February 20, 2007—now U.S. Patent No. 7,650,015; (3) U.S. Patent Application No. 09/792,294, filed on

February 23, 2001—now U.S. Patent No. 7,181,047; (4) U.S. Patent Application No. 09/230,502, filed on July 22, 1997—now U.S. Patent No. 6,486,909; and (5) Application No. PCT/EP98/05383, filed on August 25, 1998. *Id*. at [60].

The ’134 patent is directed to an image processing system that identifies and localizes moving objects. Ex. 1001, 1:35–39. The input signal used in the system has “a succession of frames, each frame having a succession of pixels.” *Id*. at 3:31–34. Figure 14a of the ’134 patent is reproduced below.

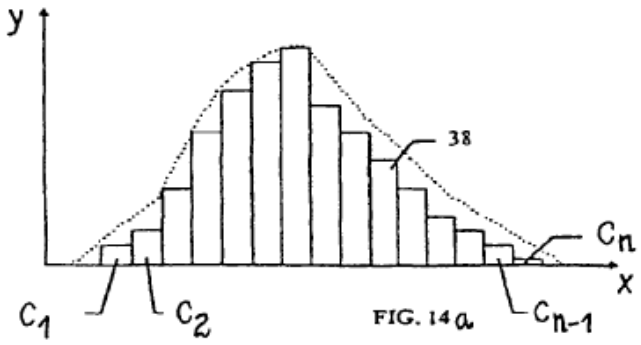


Figure 14a, above, depicts a velocity histogram, with classes C_1–C_n representing a particular velocity. Ex. 1001, 20:49–54. Figures 16 and 17 of the ’134 patent are reproduced below.

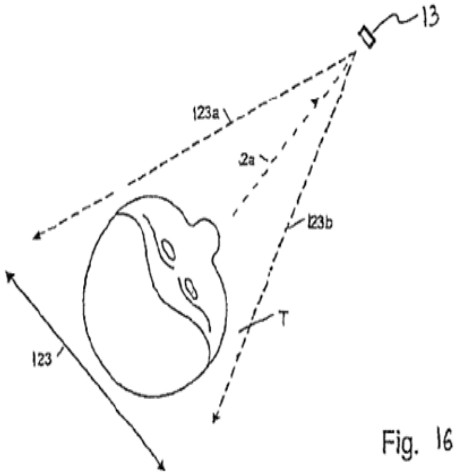


Fig. 16

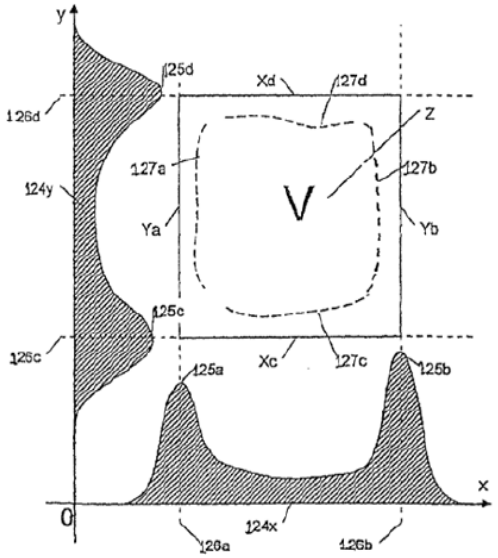


Fig. 17

Figure 16, above, a system for video-conferencing, which depicts camera 13 viewing a head. Ex. 1001, 8:59–60. Figure 17 depicts x axis and y axis histograms of a head from a video conference. *Id*. at 8:66–67, 22:4–6, 22:55–67. Face V is approximately defined by the peaks in the two respective histograms. *Id*. at 23:1–9. Figure 22 of the '134 patent is reproduced below.

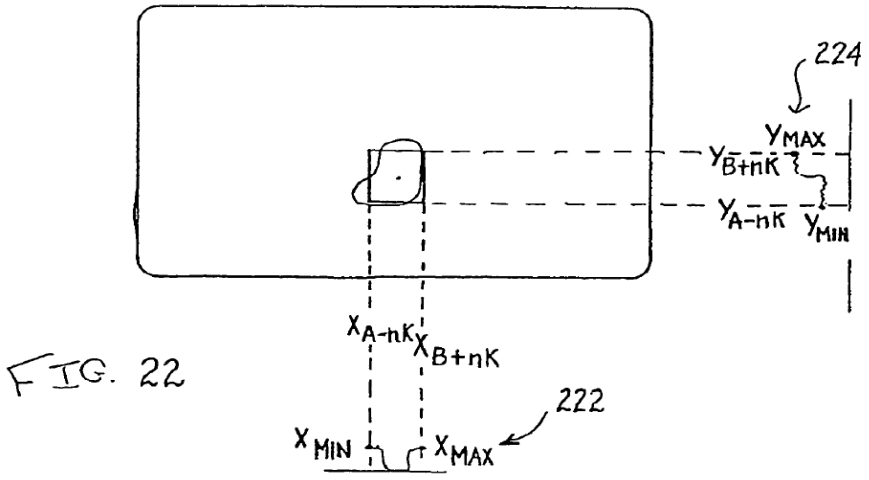


FIG. 22

Figure 22, above, illustrates a situation where an area under consideration begins to cross the borders of a target. Ex. 1001, 24:38–42. Under these circumstances, histograms 222 and 224 for the x and y projections,

respectively, include pixels with significant variation, that allow the detection of target edges. *Id*. at 24:38–42. In a preferred embodiment, the center of the area "is determined to be $(X_{MIN}+ X_{MAX})/2$, $(Y_{MIN}+ Y_{MAX})/2$, 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 . . . Other methods of relocating the center of the target box may be used if desired." *Id*. at 24:46–54.

Claim 1, reproduced below, is not challenged here, but all the challenged claims at issue depend, directly or indirectly, from claim 1. *See* Ex. 1001, 26:36–27:3.

> 1. A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis:
>
> 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,
>
> wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target.

Ex. 1001, 26:36–50.

II. ANALYSIS

A. The Parties' Post-Institution Arguments

In our Decision on Institution, we concluded that the arguments and evidence advanced by Petitioner demonstrated a reasonable likelihood that

claim 3 of the ’134 patent would have been unpatentable under 35 U.S.C. § 103 over Gerhardt and Bassman and over Gilbert, Gerhardt, and Hashima. Dec. 7–29. We subsequently instituted review on claims 4–6 of the ’134 patent on obviousness grounds based on the same prior art. Paper 25. We now determine whether Petitioner has established by a preponderance of the evidence that claims 3–6 are unpatentable under 35 U.S.C. § 103(a) over Gerhardt and Bassman and over Gilbert, Gerhardt, and Hashima. 35 U.S.C. § 316(e). We previously instructed Patent Owner that “any arguments for patentability not raised and fully briefed in the [Patent Owner Response] will be deemed waived.” Paper 12, 3; *see also* 37 C.F.R. § 42.23(a) (“Any material fact not specifically denied may be considered admitted.”); *In re Nuvasive, Inc*., 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding Patent Owner waived an argument addressed in Preliminary Response by not raising the same argument in the Patent Owner Response). Additionally, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

With a complete record before us, we note that we have reviewed arguments and evidence advanced by Petitioner to support its unpatentability contentions where Patent Owner chose not to address certain limitations in its Patent Owner Response and Patent Owner’s Response to Petitioner’s Supplemental Brief. Based on the preponderance of the evidence before us, we conclude that the art identified by Petitioner teaches or suggests all of the limitations of claim 3, but does not teach or suggest all of the limitations of claims 4–6 of the ’134 patent.

B. Claim Construction

The parties concur that a district court-type claim construction under *Phillips v. AWH Corp*. should apply because the '134 patent will expire within 18 months of the Notice of the Filing Date. Pet. 3–4; PO Resp. 12; *see Phillips v. AWH Corp*., 415 F.3d 1303 (Fed. Cir. 2005) (en banc); *see also* 37 C.F.R. § 42.100(b). Under that standard, and absent any special definitions, terms are given "the meaning that [a] term would have to a person of ordinary skill in the art in question at the time of the invention." *Phillips*, 415 F.3d at 1316.

Challenged claims 3–6 depend directly or indirectly from independent claim 1, and include all its limitations. *See* Ex. 1001, 26:36–27:3. Therefore, we address disputed limitations of claim 1 as required to evaluate the challenges.

"said at least one histogram referring to classes defining said target"

In the Final Decision of the '353 IPR, the Board considered the construction of the term "said at least one histogram referring to classes defining said target" of claim 1 of the '134 patent. *See* '353 Final Written Decision, 10–12. In the '353 Final Written Decision, the Board found the term is not limited to "said at least one histogram referring to only classes defining said target." *Id*. at 12.

Here, Patent Owner proposes the same construction as in the '353 IPR: that the term "forming at least one histogram . . . said at least one histogram referring to classes defining said target" should be construed as "forming at least one histogram . . . at least one histogram being formed of pixels in the one or more classes that define said target." PO Resp. 28.

Patent Owner further asserts that interpreting the term to not limit the histogram to pixels that meet the classification criteria that define the target is too broad. *Id*. at 29–30. In other words, as in the '353 IPR, Patent Owner is arguing that the term be limited to only data for the pixels that match the classes that define the target.

In addition to the arguments presented in the '353 IPR, Patent Owner argues that an important aspect of the invention is a limitation reflected in the specification of the '134 patent that allegedly describes that pixel data used to form histograms is limited to only those pixels with certain speed, color, or direction values. *Id*. at 28–29 (citing Ex. 1001, 25:51–67). Patent Owner avers that its proposed construction was adopted in the district court case, and that broadly interpreting the claim term is at odds with *Phillips*-type construction. *Id*. at 29–31 (citing Ex. 2001, 46). It is also argued that in the claim language "referring to" is different from "comprising" and indicates a more limited scope. *Id*. at 29, 31.

We do not agree with Patent Owner's arguments. As discussed in the '353 Final Written Decision, the specification contains disclosures that do not require limiting the recited histogram to only classes defining the target. '353 Final Written Decision, 12. Patent Owner's contention that "referring to" is more limiting fails to support or explain why the term should effectively be construed to require "*only* referring to," and using that construction would impermissibly import a limitation into the claim.[5] Finally, although the district court case's construction uses the same language of Patent Owner's proposed construction, the district court did not

[5] The district court found that the "'referring' word simply means that the histogram is formed of pixels." Ex. 2001, 45.

address the variation that Patent Owner argues here, which is that the histogram be formed *only* of pixels whose properties match the classes that define the target. *See* Ex. 2001, 44–46.

We adopt the '353 IPR's interpretation of this term and incorporate related portions of the '353 Final Written Decision into this decision. '353 Final Written Decision, 10–12.

Accordingly, we determine that "said at least one histogram referring to classes defining said target" is not limited to "said at least one histogram referring to only classes defining said target." We need not further construe the term to resolve the issues before us.

"*wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target*"

In the '353 IPR, Patent Owner contended that the term "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target" of claim 1 does not encompass creating a histogram and then determining the X minima and maxima and Y minima and maxima of the boundaries of the target from that histogram. '353 Final Written Decision, 13. Patent Owner makes the same proposal for the construction of the term here. PO Resp. 20. In the '353 Final Written Decision, the Board found that "claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the 'forming' step." '353 Final Written Decision, 18.

In the ’353 IPR, Patent Owner argued the prosecution history, which the Board considered in determining that, contrary to Patent Owner’s arguments, there was no disavowal of claim scope or other statement in the prosecution history that limited claim 1 to a particular embodiment in the specification. *See* ’353 Final Written Decision 16–18 (citing Ex. 1004, 86, 88, 146, 197–198). Patent Owner makes similar arguments concerning the ’134 prosecution history in this case, referring to the same portions of the prosecution considered in the ’353 IPR. *See* PO Resp. 21–22. Under our review of the ’134 prosecution history, we concur with the ’353 IPR’s determination that the prosecution history does not disavow claim scope to limit it to a particular embodiment.

In addition to the arguments that Patent Owner made in the ’353 IPR regarding the prosecution of the ’134 patent, Patent Owner presents additional arguments regarding the claim construction of the term. Patent Owner refers to the prosecution history of another patent that the ’134 patent is a continuation of, namely, U.S. Patent 8,805,001 (“the ’001 patent”). PO Resp. 14–18, 22–23; PO Supp. Resp. 5–7. Patent Owner argues that the Board’s adopted construction in the ’001 patent prosecution appears to encompass a prior art combination over a similar claim which was allowed. PO Resp. 22. Patent Owner’s arguments are similar to those for the ’134 patent prosecution, and Patent Owner bases its arguments on its interpretation of the prosecution history, including what the Examiner should have understood about the teachings of the prior art and related claim construction. PO Supp. Resp. 5–7. We determine that Patent Owner’s interpretations are unsupported by the facts in the record and, moreover, we do not find a disavowal or other statement regarding an intent to limit the

claims to particular embodiments in the specification in the ’001 patent prosecution. *See* Ex. 1022, 65–66, 140–147, 153–161.

Patent Owner also argues that the claim construction adopted in the ’353 Final Written Decision is overly broad, and reads out the “comprising” language, allowing a “forming” step, and a “determining” step, with no relationship between the steps. PO Resp. 23–25; PO Supp. Resp. 1–2. Patent Owner additionally argues that the lock-on tracking embodiment in the ’134 patent teaches claim 1 under its proposed construction, which is that X and Y minima and maxima of boundaries of a target are determined as part of forming the histogram. PO Resp. 25–26; PO Supp. Resp. 2–3. We do not agree with Patent Owner’s arguments. The language of claim 1 itself does not limit it to Patent Owner’s proposed construction. And the construction of the ’353 Final Written Decision would be broad enough to cover the lock-on tracking embodiment.

We adopt the ’353 IPR’s interpretation of this term and incorporate related portions of the ’353 Final Written Decision into this decision. ’353 Final Written Decision, 13–18.

Accordingly, we determine that the term “wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target” does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the “forming” step. We need not further construe the term to resolve the issues before us.

"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." PO Resp. 38. Patent Owner refers to intrinsic evidence that allegedly supports its proposed construction. *Id*. at 38–39.

We do not agree with Patent Owner's arguments because its proposed construction conflicts with the recited language of the claims which states that the forming of the histogram of the pixels is in "one or more" of the classes and domains and does not require that it be "two or more." The district court also rejected Patent Owner's similar arguments. *See* Ex. 2001, 41–43.

Accordingly, we determine that the term "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" does not require that the histogram be formed of pixels in two or more classes that are in two or more domains. We need not further construe the term to resolve the issues before us.

Other Terms

We determine that it is not necessary to provide an express interpretation of any other term of the claims. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

C. Level of Ordinary Skill in the Art

Petitioner's expert, Dr. Hart, testifies that a person of ordinary skill at the time of the '518 patent invention would have had

> either (1) a Master's Degree in Electrical Engineering or Computer Science or the equivalent plus at least a year of experience in the field of image processing, image recognition, machine vision, or a related field or (2) a Bachelor's Degree in Electrical Engineering or Computer Science or the equivalent plus at least three years of experience in the field of image processing, image recognition, machine vision, or a related field. Additional education could substitute for work experience and vice versa.

Ex. 1002 ¶ 51; *see also* Pet. 4.

The proposed qualifications were adopted in the Decision to Institute (Dec. 10 n.5), and Patent Owner also applied them. *See* PO Resp. 14.

We adopt and apply the assessment of the level of ordinary skill in the art articulated by Petitioner to our obviousness analysis in this proceeding. In addition, we note that the art of record in this proceeding—namely, Gerhardt, Bassman, Gilbert, and Hashima—is indicative of the level of ordinary skill in the art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

D. Obviousness of Claims 3–6 over Gerhardt and Bassman

Petitioner contends that claims 3–6 are obvious over Gerhardt and Bassman. Pet. 37–54; Pet. Supp. Reply 6–8. To support its contentions, Petitioner provides evidence and explanations as to how the prior art combination teaches each claim limitation. *Id*. Petitioner also relies upon the Hart Declaration (Ex. 1002) to support its positions. Patent Owner counters that the prior art combination does not render claims 3–6 obvious because the prior art fails to teach or suggest some limitations of the claims

and a person of ordinary skill in the art would not have selected and combined the prior art. PO Resp. 53–72; PO Supp. Resp. 1–7.

On this record, we determine that Petitioner has demonstrated that the preponderance of evidence shows that claim 3 is unpatentable as obvious over Gerhardt and in combination with Bassman for claim 3, but obviousness has not been demonstrated for claims 4–6. We begin our discussion with a brief summary of the prior art, and then address the evidence, analysis, and arguments presented by the parties.

1. Gerhardt (Ex. 1013)

Gerhardt is directed to tracking a target using "an eyetracking system" that "process[es] the digital pixel data to substantially determine the position of the user's pupil." Ex. 1013, Abs., 7:45–53. Gerhardt continuously acquires an eye image and attempts to locate the pupil by use of a continuous loop, with pupil location mapping to display screen coordinates, if a pupil is found. *Id*. at 8:45–52. Gerhard uses a "frame grabber," coupled to a "camera means" used to acquire a video image, to subsequently generate a histogram using pixel intensity value, and to identify and track the position of a user's pupil. *Id*. at 2:25–44, 9:39–61. Figure 5, reproduced below, is an example of a histogram for the captured eye image (*id*. at 4:38–39).

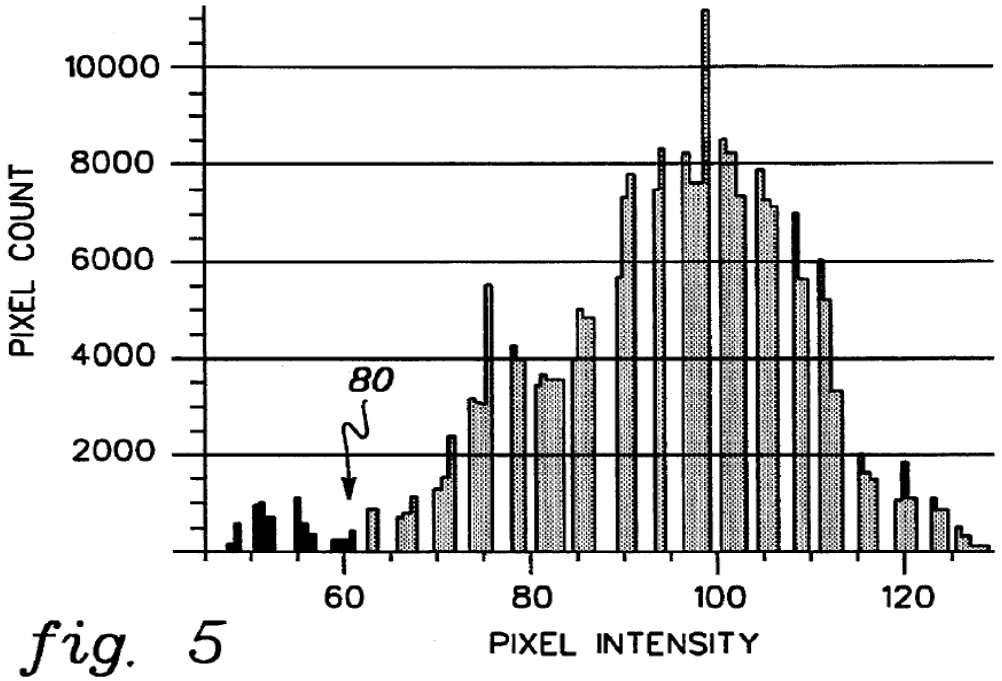


fig. 5

Figure 5, above, depicts a vertical axis indicates "the pixel count of each bin, and the horizontal axis indicates the magnitude of the pixel intensity of each bin," with several bins of pixel intensity data, as "represented by a 7-bit greyscale . . . divided . . . into 128 bins." Ex. 1013, 9:39–46.

2. Bassman (Ex. 1014)

Bassman is directed to image processing for sequences of images. Ex. 1014, Abs. Bassman discloses a traffic monitoring system using a video camera, deriving successive image frames, and digitally processing the pixels of the successive image frames. *Id*. at 2:39–45. Figure 5, reproduced below, depicts an image derived from a video camera.

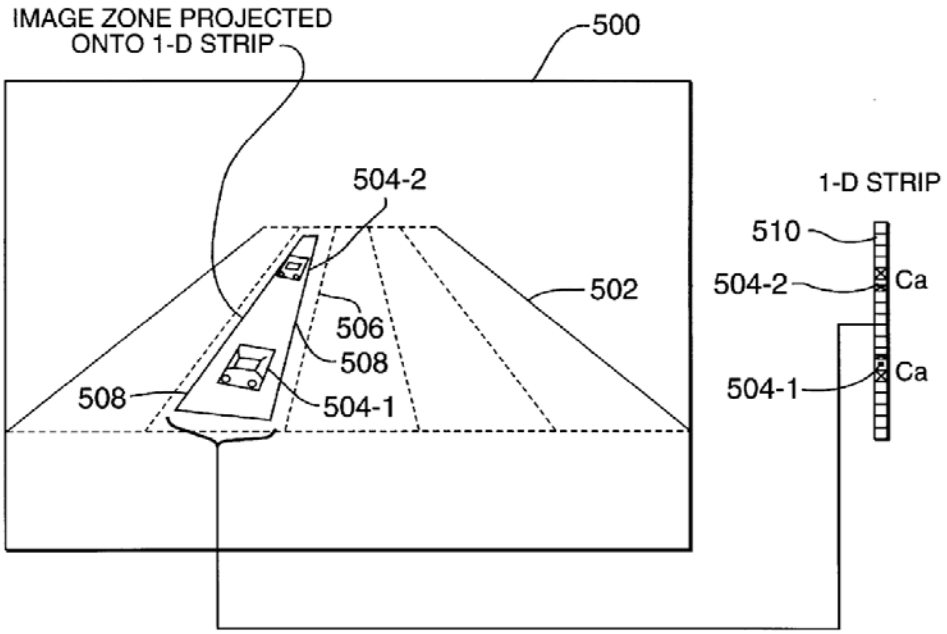


FIG. 5

Figure 5, above, illustrates an image in which image pixels are integrated into a "1D strip," with 1D strip 510 computed by integrating horizontally the amplitudes of the pixels across the image zone and subsampling the vertically-oriented integrated pixel amplitudes along the center of zone 508. Ex. 1014, 2:28–30, 6:16–20. Object detection may be done by computing a histogram of the image intensity values within the integration window centered at a pixel position. *Id*. at 6:60–63. Bassman discloses the use of an image-flow estimator with delay that "permit[s] objects to be tracked over time" by "computing and storing the average value contained within the integration window," and "[b]y performing this operation at each strip pixel, a one-dimensional array of average brightness values is constructed." *Id*. at 7:7–12. Bassman also discloses that with "two corresponding arrays for images taken at times t-1 and t, the one-dimensional image 'flow' that maps pixels in one array to the other is computed," and this is "used to track objects between each pair of successive image frames." *Id*. at 7:12–17.

3. Analysis

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.[6] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

Independent Claim 1

Challenged claims 3–6 depend directly or indirectly from independent claim 1, and, therefore, include all its limitations. *See* Ex. 1001, 26:36–27:3. Petitioner provides evidence and explanations in support of the contention that Gerhardt and Bassman teach all the limitations of claim 1 of the '134 patent.[7] Pet. 37–46.

[6] Patent Owner has not argued that there are objective indicia of nonobviousness.

[7] As discussed in the Decision on Institution, Petitioner contends that both Gerhardt and Bassman individually teach every element of claim 1, except Gerhardt alone teaches the last limitation of claim 1. Dec. 10 (citing Pet. 39–45). The Decision on Institution considered Gerhardt's teachings for the majority of elements of claim 1, except for the "identifying the target" limitation where Bassman was also considered. *Id*. at 11. Here, we similarly consider the prior art, and in light of the determination that the evidence is sufficient to demonstrate the teachings of the claim 1, as discussed below, we need not reach other of Petitioner alternative assertions.

Petitioner alleges, and we agree, that Gerhardt discloses tracking a pupil that "process[es] pixel data to substantially determine the position of the user's pupil" in a continuous loop to map images, with the use of a "frame grabber," and credit Dr. Hart's supporting testimony as it is consistent with the disclosure. Pet. 39–40 (citing Ex. 1013, 2:25–39, 2:40–44, 7:45–53, 8:45–52; Ex. 1002 ¶¶ 102,103). Petitioner contends, and we agree, that Gerhardt teaches the histogram formation as claimed, and we credit Dr. Hart's supporting testimony as it is consistent with Gerhardt's disclosure. *Id*. at 41 (citing Ex. 1013, 9:39–61, Fig. 5; Ex. 1002 ¶¶ 107, 108). Petitioner alleges, and we agree, that both Gerhardt and Bassman teach the limitation of "identifying the target" in the histogram by Gerhardt's pupil identification (Ex. 1013, 9:39–61, 10:6–34, Figs. 4–6), and Bassman's classification of strip pixels as either "detection" or "background" (Ex. 1014, 6:60–7:17), and credit Dr. Hart's testimony as it is consistent with the disclosures (Ex. 1002 ¶¶ 112–115). *Id*. at 43–45. Gerhardt is relied upon for the teaching of the limitation of determining the "X minima and maxima" and the "Y minima and maxima," with its determination of "blob descriptors," that include determination of X and Y coordinates. *Id*. at 45–46 (citing Ex. 1013, 12:32–61, Fig. 10). We agree with Petitioner that Gerhardt teaches the limitation, and credit Dr. Hart's supporting testimony (Ex. 1002 ¶ 116) as it is consistent with Gerhardt's disclosure. *Id.*

Petitioner asserts that a person of ordinary skill in the art would have been motivated to combine Gerhardt and Bassman because both references are directed to similar systems that operate in a similar manner which is identifying and tracking a target from frame to frame using an image processing system with a video input. Pet. 37 (citing Ex. 1013, 2:35–3:3,

7:45-8:23; Ex. 1014, 2:39–54, 6:60–7:17; Ex. 1002 ¶ 98). Petitioner also alleges that Gerhardt identifies problems with identifying and tracking a pupil "such as blinking, changing conditions, incorrect threshold setting, setting the eye-tracking device to consider the wrong subset of pixels, etc." *Id*. at 38 (citing e.g., Ex. 1013, 10:18–11:24, 13:50–15:14, 16:1–10; 21:12–18, Figure 13). Petitioner contends that although Gerhardt gives some solutions for accurately locating the eye, Bassman provides explicit instruction on improving target tracking by linking the position of the target in a current frame to its position in a previous frame. *Id*. Petitioner avers that a person of skill in the art would have been motivated to combine Gerhardt and Bassman because "an explicit process for linking the target in this manner would have resulted in greater reliability by limiting false positives and being able to predict where the pupil is located even when the user is blinking." *Id*. at 38 (citing Ex. 1002 ¶ 100). Petitioner also alleges that the combination would have increased the processing speed of Gerhardt by quickly eliminating some dark pixel blobs from consideration and the eye-tracking system would not have needed to perform further analysis on those portions. *Id*. at 38–39 (citing Ex. 1002 ¶ 101). Additionally, Petitioner contends that a person of ordinary skill would have expected the combination of the references would yield predictable results because it would have involved applying known techniques to similar systems. *Id*. at 37–38 (citing Ex. 1002 ¶ 99).

We determine that Petitioner has demonstrated sufficient rationale for the combination of Gerhardt and Bassman. We credit the testimony of Dr. Hart that the addition of Bassman's frame linking would improve Gerhardt, for instance, by eliminating some dark pixel blobs from consideration so that

the Gerhardt eye-tracking system would not have needed to perform further analysis. The combination applies known techniques to similar systems and would yield predictable results. *KSR*, 550 U.S. at 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

Having considered the complete record now before us, we determine that Petitioner has provided sufficient evidentiary support that the prior art of Gerhardt alone or the combination of Gerhardt and Bassman teach each limitation of claim 1 and also has provided a sufficiently persuasive rationale for combining the teachings of Gerhardt and Bassman.

Patent Owner disputes whether the asserted prior art teaches some claim limitations. Patent Owner also disputes whether a person of skill in the art would have combined Gerhardt and Bassman. We address these issues in turn.

Patent Owner argues that the prior art does not teach the limitation of "forming at least one histogram . . . said at least one histogram referring to classes defining said target." PO Resp. 53–54. Patent Owner bases this argument on Gerhardt's reliance on a complete set of all pixel data for the area being included in the histogram in order to permit a later analysis of the histogram. *Id*. at 54. Patent Owner further contends that Gerhardt does not teach or suggest the formation of a histogram limited to pixels in a subset of intensity values, spatial values, or any other values in classes defining the target. *Id*.

We do not agree with Patent Owner's arguments on this limitation. As discussed *supra* Section II.B, the adopted claim construction does not

limit pixel data to classes defining the target *only*, nor, is the claim limited to forming histogram limited to pixels in a subset of classes defining the target.

Patent Owner also argues that the prior art fails to teach the limitation of "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" because there is "no suggestion of forming a histogram of the pixels in two or more classes that are in two or more domains as required by the claim." PO Resp. 55. We do not agree with this contention because, as discussed *supra* Section II.B, this claim term does not require that the formation of histograms be in two of more classes in two of more domains.

Patent Owner also argues that the prior art fails to teach the claim limitation of "forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target." PO Resp. 55–56. This contention is premised on Patent Owner's proposed construction which would limit the forming of a histogram to including the determination of the target boundaries, and we have declined to adopt that construction.

Patent Owner additionally contends that Petitioner's rationale to combine Gerhardt and Bassman is inadequate. PO Resp. 64–69. Patent Owner argues that Petitioner's alleged basis for Gerhardt's improvement from Bassman's teachings would be unnecessary because Gerhardt already includes mechanisms for improving pupil tracking, differentiating eyebrows, and using the location of targets from a prior frame is unnecessary. *Id*. at 64–67. Patent Owner alleges that introducing the computational complexity of Bassman into Gerhardt to track the pupil based on past frame data is unnecessary and would be avoided, and there is no need to introduce the

additional computational complexity of Bassman into Gerhardt. *Id*. at 67–68. Patent Owner further alleges that the image flow from Bassman would not be applicable to Gerhardt because Bassman's technique is for use with dark groups representing vehicles and not to Gerhardt's eye analysis. *Id*. at 69.

We are not persuaded by Patent Owner's arguments. Patent Owner essentially argues a potential offset of the advantages offered by the combination compared to the possible disadvantages or that the improvements would be unnecessary. Petitioner's assertions of offered benefits by the combination are supported by Dr. Hart's testimony (*see* Ex. 1002 ¶¶ 100, 101). There is no expert testimony provided by Patent Owner concerning how a person of ordinary skill in the art would have compared and weighed the advantages of the combination relative to the alleged disadvantages, such as increased computational complexity.

Claim 3

Claim 3 recites a "process according to claim 1, wherein said image processing system comprises at least one component selected from a memory, a temporal processing unit, and a spatial processing unit." Ex. 1001, 26:53–56. Petitioner maps Gerhardt's graphics card with memory, as well as the memory of its computer, to the claimed "memory," and its use of running averages function as a "temporal processing unit." Pet. 46–48 (citing Ex. 1013, 13:29–37, 20:58–67, 22:27–32, 24:47–52, Fig. 3). Petitioner also contends that Bassman's system contains a memory, temporal processing unit, and spatial processing unit. *Id*. at 48–49. The Petition identifies the memories in Bassman. *Id*. at 48 (citing Ex. 1014, 8:65–9:7, 9:64–67, Fig. 6). Bassman's image and updating means is

asserted to be analogous to a temporal process unit. *Id*. at 49 (citing Ex. 1014, 7:5–17). Petitioner argues that Bassman discloses a spatial processing unit by its disclosure of an image flow estimator that permits objects to be tracked over time. *Id*. (citing Ex. 1014, 7:5–17). We agree with Petitioner's contentions and the presented evidence as summarized.

Having considered the complete record now before us, we determine that Petitioner has provided sufficient rationale to combine and sufficient evidentiary support that Gerhardt and Bassman teach each limitation of claim 3.

Patent Owner presents no arguments on the obviousness challenge to claim 3, except for the arguments addressed as to claim 1, which we do not find persuasive for the reasons discussed above. PO Resp. 53–56.

Therefore, based on the record before us, we determine that Petitioner has shown by a preponderance of the evidence that claim 3 is unpatenable as obvious over Gerhardt and Bassman.

Claims 4, 5, and 6

Claim 4 depends from the process of claim 1, "wherein forming the at least one histogram further comprises successively increasing the size of a selected area until the boundary of the target is found." Ex. 1001, 26:57–60. Claim 5 depends from claim 4, "wherein forming the at least one histogram further comprises adjusting a center of the selected area based upon a shape of the target until substantially the entire target is within the selected area." *Id*. at 26:61–64. Claim 6 depends from claim 5, wherein "setting the X minima and maxima and Y minima and maxima as boundaries in X and Y histogram formation units such that only pixels within the selected area will be processed by the image processing system." *Id*. at 26:65–27:3.

Petitioner contends that Gerhardt teaches that its system speed can be improved "by limiting examination, and thus blob definition, to only a portion of the full pixel image (say, a 320x240 or 220xl60 pixel subset)." Pet. 51 (quoting Ex. 1013, 21:1–11). Petitioner alleges that Gerhardt teaches the limitation of claim 4, with the explanation "that when only a portion of the full pixel image is considered and when pupil detection fails, 'the size of the active window can be incrementally increased until the pupil blob is again successfully selected.'" *Id*. (citing Ex. 1013, 21:1–18; *see also* Ex. 1002 ¶ 125, pages 94–98 (claim 4 chart)). Bassman is not relied upon by the Petitioner for teaching claim 4, except to the extent it depends from claim 1.

Claim 4 depends from claim 1, which recites that "[a] process of tracking a target in an input signal implemented using a system comprising an image processing system, . . . the process performed by said system comprising, *on a frame-by-frame basis*." Ex. 1001, 26:36–42 (emphasis added). As discussed in the Decision on Institution, the determinative issue is whether Gerhardt teaches the claim 4 limitation of "successively increasing the size of a selected area until the boundary of the target is found," as a part of forming the histogram on a "frame-by-frame basis.'" Dec. 15–18. More specifically, the Decision to Institute considered whether a histogram is formed by increasing the size of a selected area until the boundary of a target is found in a single frame. *Id*. at 18.

In its supplemental briefing, Petitioner contends that Patent Owner's arguments in the Preliminary Response concerning claim 4 hinge on the view that the implicit construction of the claim term "wherein forming the at least one histogram further comprises . . ." excludes "(i) any actions taken before or after putting data in the histogram (creating the histogram), and (ii)

any actions taken over multiple frames," and this is not correct. Pet. Supp. Reply 1–2.

Petitioner asserts that forming the histogram does not exclude actions that occur before or after creating the histogram. Pet. Supp. Reply 2. It is also argued that Figures 21 and 22 increase the size of the selected area after a histogram is selected and over several frames. *Id*. at 3–4 (citing Ex. 1001, 24:38–42, Figs. 1, 2). Petitioner contends that the '134 patent describes that the size of the selected area is changed over multiple, successive frames, referring to its disclosure that "[i]t will be appreciated that in the course of tracking a target, the tracking box will be ***enlarged and reduced*** as appropriate to maintain a track of the target, and is preferably ***adjusted on a frame-by-frame basis***." *Id*. at 4 (citing Ex. 1001, 24:66–25:2) (emphasis by Petitioner).

Petitioner goes on to argue that the '134 patent does not describe a process where "the size of a selected area is being adjusted ***while*** a histogram is being formed (i.e., simultaneous with data being placed in the histogram)," and a construction where "exclud[ing] adjusting the selected area's size after a histogram is created and over multiple frames, is incorrect for excluding the only disclosed embodiments of this process." Pet. Supp. Reply 5 (emphasis by Petitioner). Petitioner also asserts that the only mechanism described in the '134 patent to allow a new histogram to be created operates between frames. *Id*. (citing Ex. 1001, 17:55–62 (describing clearing memories between frames), 19:63–20:2 (describing memory clearing and re-initialization for processing subsequent frames)).[8]

[8] The issue of whether multiple histograms could be created based upon a single frame under the '134 patent was further discussed at oral hearing. *See*

Petitioner also contends that "[e]ven if increasing the size of the selected area must occur within a single frame, Gerhardt discloses claim 4." Pet. Supp. Reply 6. Petitioner refers to Gerhardt's teaching of forming "a brightness histogram of an image frame," selecting target pixels based on brightness, and then successively enlarging the spatial region until the target has been found. *Id*. at 7 (citing Ex. 1013, 9:40–61, 11:52–12:14, 12:32–61; Figs. 5, 10).

We do not agree with Petitioner's arguments. Petitioner conflates the issue with the construction of the term "wherein forming the at least one histogram further comprises . . ." with the specific issue associated with claim 4. As discussed *supra* Section II.B, we have determined that the term "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target" does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram. The issue for evaluation in claim 4 is not, however, whether the "forming the histogram . . ." step is limiting as to the "wherein" determination, but rather it is whether the steps are done on a "frame-by-frame" basis. That is, whether the correct interpretation of claim 4 is that the steps are performed on a single frame.

Our reading of the plain language of claim 4, together with claim 1, as recited, is that the successive increase of the size of a selected area until the

---

Tr. 44–52. Petitioner further argued the view that once a frame scan is done there is no way that the pixel data can be reprocessed to make new histograms. *Id*. at 46:11–13.

boundary of the target is found is done on a "frame-by-frame" basis, that is, on a single frame.

Petitioner directs us to, *inter alia*, Figure 21, reproduced below.

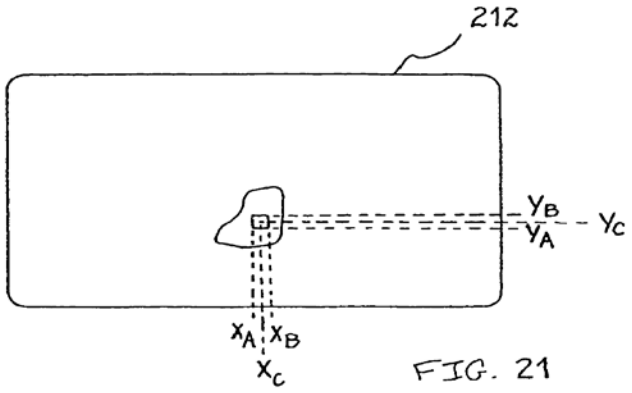


FIG. 21

Figure 21 is described in the '134 patent specification as follows:

> Histograms are then formed by x and y histogram formation units 28 and 29. In the example shown in FIG. 21, an insignificant number of pixels would be identified as having DP=1, since the selected area does not include the border of target 218, so no histogram would be formed. The size of the area under consideration is then successively increased, preferably by a constant size K, so that in subsequent iterations, the pixels considered would be in the box bounded by X_{A-nk}, X_{B+nK}, Y_{A-nk} , Y_{B+nk} ,where n is the number of the current iteration.
>
> This process is continued until the histogram formed by either of histogram formation units 28 and 29 contains meaningful information, i.e., until the box overlaps the boundary of the target.

Ex. 1001, 24:25–38.

The specification goes on to state that "Once a target is locked onto, the K may be reduced." Ex. 1001, 24:65–66. The specification then states: "It will be appreciated that in the course of tracking a target, the tracking box will be enlarged and reduced as appropriate to maintain a track of the target,

and is preferably adjusted on a frame-by-frame basis." *Id*. at 4 (citing Ex. 1001, 24:66–25:2). Contrary to Petitioner's 's view, our reading of the specification's description of Figure 21 is that it does not state or suggest that the process of successively increasing the size of a selected area until the boundary of the target is found is done on *multiple* frames. Only in the process of tracking, not in the determination of target limits, is there a suggestion of multiple frames. And Figure 21 itself is depicted as a single frame.

As discussed above, the language of claim 4, together with claim 1, requires that the successive increase of the size of a selected area until the boundary of the target is found is done on *one* frame. We are not persuaded by Petitioner's argument that we should not adopt the plain reading of the claim because the only embodiments disclosed in the '134 patent process histograms on a succession of frames. As stated above, the '134 patent's discussion on the process to find the boundary of the target as depicted in Figure 21 is directed to the use of only one frame during the target boundary finding. Further, the '134 patent discloses the storage of frame data in a memory and the use of a matrix for the signal processing data for a frame (Ex. 1001, 5:21–23, 13:8–30), which does not support Petitioner's allegation that the processes under the '134 patent could not be performed on one frame because stored data would not be available for successive processing on one frame under the '134 patent's disclosures.

Accordingly, we interpret claim 4 to require that the successive increase of the size of a selected area until the boundary of the target is found be done in a frame-by-frame manner, that is, on one frame.

In the Petition, Petitioner asserts that Gerhardt teaches the limitations of claim 4, with the explanation: "when only a portion of the full pixel image is considered and when pupil detection fails, 'the size of the active window can be incrementally increased until the pupil blob is again successfully selected.'" Pet. 51 (citing Ex. 1013, 21:1–18). As discussed in the Decision on Institution (Dec. 15–18), Gerhardt discloses that the manner in which this is done for blobs is similar to that disclosed for percentage comparison tolerances. Ex. 1013, 21:12–18. Figure 16, depicting an embodiment of the pupil location process, which includes the percentage comparison tolerance, is reproduced below.

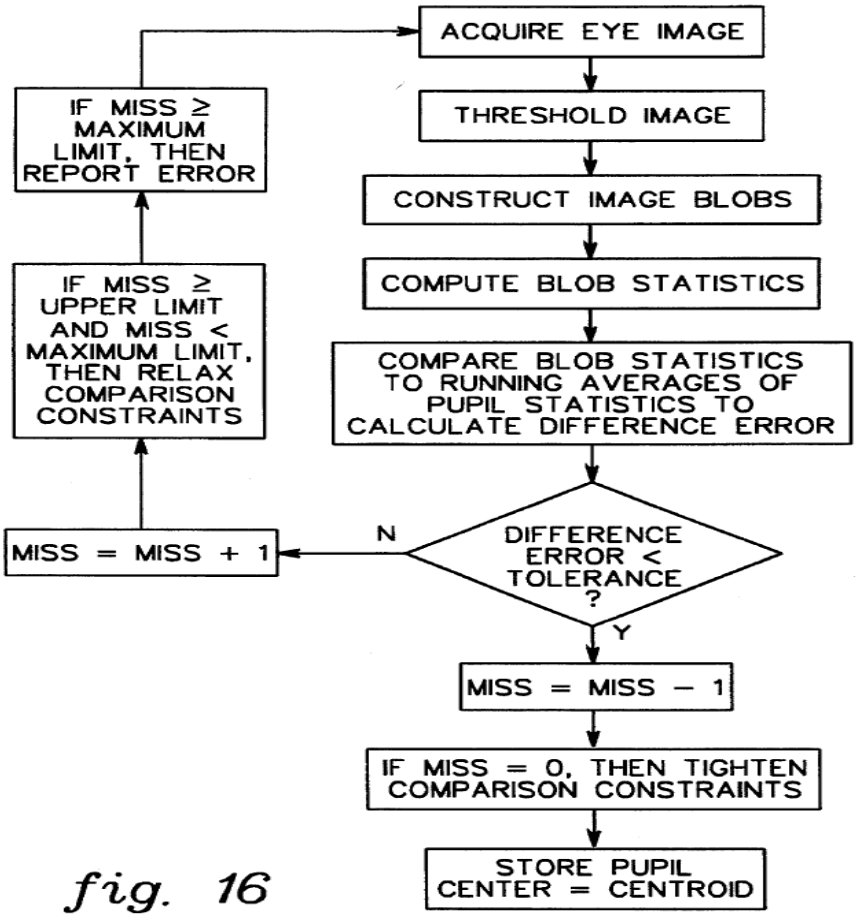


fig. 16

In the related percentage comparison tolerance process depicted in Figure 16, above, if the blob characteristics do not meet required tolerances, ("DIFFERENCE ERROR < TOLERANCE"), new eye images (frames) are successively acquired. *See id.* at Fig. 16. The portions of Gerhardt that Petitioner relies upon therefore require the use of multiple frames. Although a histogram is formed as part of the process in the "Threshold Image" step shown in Figure 16, Gerhardt does not teach increasing the size of a selected area until the boundary of a target is found in one frame. Accordingly, this evidence in not sufficient to teach the limitations of claim 4.

In Petitioner's Supplemental Reply, Petitioner also relies on Gerhardt's teachings relating to the selection of target pixels based on brightness and using a region-growing method to add adjacent pixels to support the teaching of claim 4. Pet. Supp. Reply 6–7 (citing Ex. 1013, 9:40–61, 11:52–12:14, 12:32–61; Figs. 5, 10). However, the brightness process disclosed in Gerhardt does not find the boundary of the target and is not part of histogram formation. Accordingly, this evidence in not sufficient to teach the limitations of claim 4.

Claims 5 and 6 depend, directly or indirectly, from claim 4. In light of the insufficiency of the evidence demonstrating that the limitations of claim 4 are taught by Gerhardt and Bassman, there is also insufficient evidence of the teachings of the limitations of claims 5 and 6.

Based on the complete record before us, we determine that Petitioner has not shown by a preponderance of the evidence that claims 4–6 are unpatentable as obvious over Gerhardt and Bassman.

E. Obviousness of Claims 3–6 over Gilbert, Gerhardt, and Hashima

Petitioner contends that claims 3–6 are obvious over Gilbert, Gerhardt, and Hashima. Pet. 55–80; Pet. Supp. Reply 7–8. To support its contentions, Petitioner provides evidence and explanations as to how the prior art teaches each claim limitation. *Id*. Petitioner also relies upon the Hart Declaration (Ex. 1002) to support its positions. Patent Owner counters that the prior art does not render claims 3–6 obvious because the prior art fails to teach or suggest some limitations of the claim and a person of ordinary skill in the art would not have selected and combined the prior art. PO Resp. 57–64, 69–71; PO Supp. Resp. 1–7.

We begin our discussion with a brief summary of the prior art, and then address the evidence, analysis, and arguments presented by the parties.

1. Gilbert (Ex. 1005)

Gilbert relates to an object identification and tracking system, which includes an image processing system having a video processor, a projection processor, a tracker processor, and a control processor. Ex. 1005, 47–48. Gilbert's video processor receives a digitized video signal in which each field consists of pixels. *Id*. at 48. Gilbert discloses that "[e]very 96 ns, a pixel intensity is digitized and quantized into eight bits (256 gray levels), counted into one of six 256-level histogram memories, and then converted by a decision memory to a 2-bit code indicating its classification (target, plume, or background.)." *Id*. Gilbert's projection processor then uses pixels identified as being part of the target to create x- and y-projections. *Id*. at 50. Figure 4 of Gilbert is reproduced below.

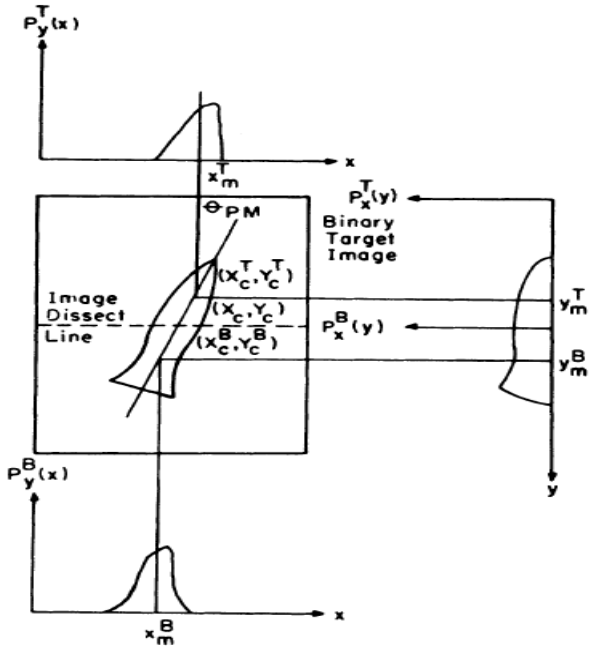


Fig. 4. Projection location technique.

Figure 4 of Gilbert depicts a Y-projection and X-projections of the target. Ex. 1005, 51. Gilbert's system uses these projections to determine the center of the upper and lower portions of the target, and those points are then used to determine the center of the target (X_C, Y_C). *Id.* at 50–51.

2. Hashima (Ex. 1006)

Hashima relates to a system and method of recognizing and tracking a target mark with a video camera. Ex. 1006, Abs. In Hashima, the target mark can be a black circle with a white triangle as depicted in Figure 3, as reproduced below.

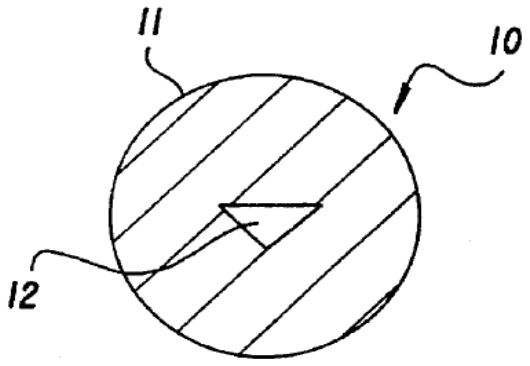


Figure 3, above, depicts Hashima's target mark. Ex. 1006, 5:16. Figure 6 of Hashima is reproduced below.

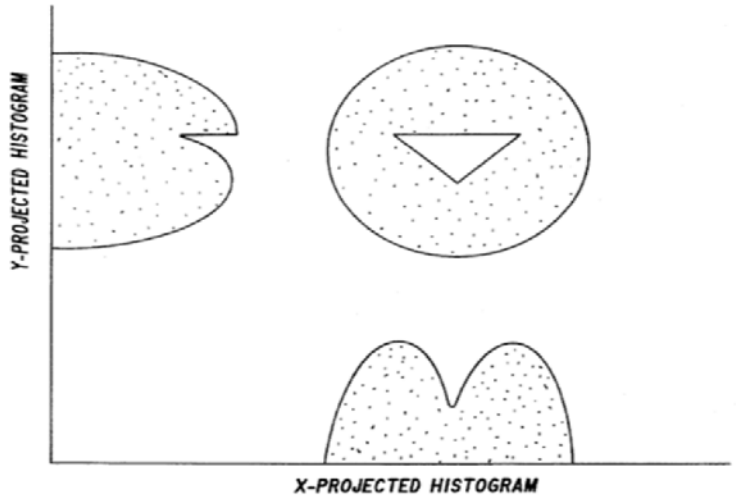


FIG.6

Figure 6, above, depicts x- and y-projected histograms of a target mark. Hashima describes creating these histograms by summing the number of black pixels at each x- or y- location. Ex. 1006, 8:18–9:7. Hashima also describes finding the central position of the detected mark as shown in reproduced Figure 15 below.

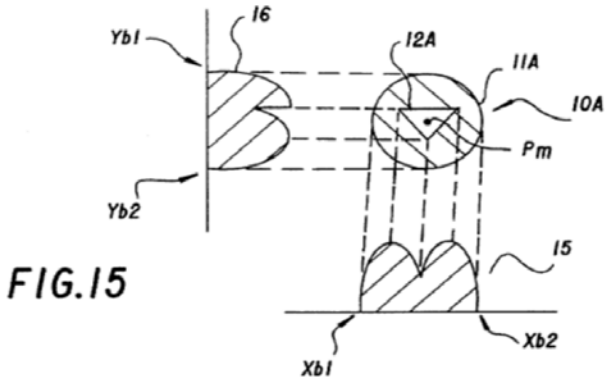


FIG.15

Figure 15, above, depicts a process of finding central position Pm of the target mark. Hashima describes finding Pm (mx, my) using the

equations (1) mx = (Xb1+Xb2)/2 and (2) my = (Yb1+Yb2)/2. Ex. 1006, 11:6–25.

3. Analysis

Independent Claim 1

Petitioner asserts that Gilbert, Hashima, and Gerhardt teach all the limitations of independent claim 1. Pet. 59–63. As discussed above, *supra* Section I.A, *inter partes* review was previously instituted for claim 1 of the '134 patent over Gilbert and Hashima in the '353 IPR, and a Final Written Decision issued finding that the teachings of the prior art were sufficient for an obviousness determination. '353 Final Written Decision, 19–28. Petitioner relies upon similar evidence and explanations in this Petition, and adds reliance on Gerhardt's teachings. Pet. 55–68. We adopt and incorporate portions of the '353 Final Written Decision on the determination of unpatentability of claim 1 as obvious over Gilbert and Hashima. *See* '353 Final Written Decision, 19–28, 33–35.

The Petition also relies upon Gerhardt for the "identifying the target" step of claim 1, and as discussed *supra* Section II.D, we have determined that Petitioner has provided sufficient evidentiary support that Gerhardt teaches this limitation of claim 1. *See* Ex. 1013, 9:39–61, 10:6–34, Figs. 4–6.

Petitioner asserts that a person of ordinary skill in the art would have been motivated to combine Gilbert, Gerhardt, and Hashima because the references are directed to similar systems that operate in a similar manner, and one of skill in the art would have recognized that Gerhardt's and Hashima's inventions could improve a similar device, such as that in Gilbert, in the same way. Pet. 55–56 (citing Ex. 1002 ¶¶ 136, 137). Petitioner also

contends that with known prediction of target trajectory, and in light of Gilbert's many computation steps with its techniques, one of ordinary skill in the art would have looked to the techniques of Hashima or Gerhardt for simpler and more efficient tracking. *Id*. at 57–59 (citing Ex. 1002 ¶¶ 140–143). More specifically, Petitioner contends that it would have been recognized by a person of ordinary skill that Gerhardt uses intensity histograms to identify a target and improves the identification functionality with the use of an adaptive threshold technique, and a person of ordinary skill in the art would have been motivated to incorporate this technique to Gilbert to improve on processing speed while adjusting to varying lighting conditions. *Id*. at 56–57 (citing Ex. 1002 ¶138; Ex. 1013, 9:62–10:5). Petitioner also alleges that a person of ordinary skill in the art would have expected the combination to yield a predictable result because it would have involved applying known techniques to similar systems. *Id*. at 56 (citing Ex. 1002 ¶ 137). Additionally, it is argued that there was a reasonable expectation of success that the combination would result in a more efficient computational system. *Id*. at 59 (citing Ex. 1002 ¶ 143).

We determine that Petitioner has demonstrated sufficient rationale for the combination of Gilbert, Hashima, and Gerhardt. The '353 Final Written Decision considered the combination of Gilbert and Hashima and determined that there was sufficient persuasive rationale provided for their combination. '353 Final Written Decision, 25–26. We have reviewed the determination and its basis and adopt and incorporate the related portions of the '353 Final Written Decision. *Id.* We also determine that Petitioner has provided sufficiently persuasive rationale for combining the teachings of Gerhardt to the combination of Gilbert and Hashima. We credit the

testimony of Dr. Hart that the addition of Gerhardt's adaptive threshold technique would improve Gilbert, and this applies known techniques to similar systems and would yield predictable results. *KSR*, 550 U.S. at 416 ("[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

Having considered the complete record now before us, we credit Dr. Hart's testimony, and we determine that Petitioner has provided sufficient evidentiary support that the prior art teaches each limitation of claim 1 and also has provided a sufficiently persuasive rationale for combining the teachings of Gilbert, Gerhardt, and Hashima.

Patent Owner argues that the prior art fails to teach some of the limitations of claim 1. *See* PO Resp. 57–61. The majority of the arguments are based upon Patent Owner's proposed construction of some of the claimed limitations, which we decline to adopt. *Id*.; *see also* Section II.B. Patent Owner also asserts that Gilbert fails to teach the "identifying the target" limitation. This issue was addressed in the '353 IPR Decision, and consistent with that Decision, we agree that the Petitioner has demonstrated that Gilbert teaches this limitation, as well as Hashima. *See* '353 Final Written Decision, 26–27.

Patent Owner argues that a person of ordinary skill in the art would not have combined Gerhardt, Gilbert, and Hashima, and the rationale to combine the references is insufficient. PO Resp. 61–64, 69–71. Patent Owner asserts that Petitioner's rationale to combine ignores the myriad of choices available to a person of ordinary skill in the art, the Petitioner's analysis is superficial, and impermissible hindsight is employed. *Id*. at 61–64. It is also asserted that it was not known whether the combination of

techniques would be successful. *Id*. at 62–63. Patent Owner argues that a person of skill in the art would not have looked to apply the techniques of Hashima, which were adapted for an easier case with high contrast black and white, to the "noisier" environment of Gilbert. *Id*. at 70–71. Patent Owner asserts that a person of ordinary skill in the art would not have sought to combine Gerhardt with Gilbert because Gilbert disfavors the consideration of endpoints, and Gerhardt's threshold method would not be applicable to Gilbert. *Id*. at 70–72. Further, Patent Owner contends that the importation of a single–centroid approach of Hashima or Gerhardt is incompatible with Gilbert because it does not provide sufficient information for the precise determinations of the orientation of a target. *Id*. at 70.

Patent Owner's arguments include those directed to alleged incompatibilities among the references. The operative issue is whether a person of ordinary skill would be discouraged from following the path set out in the references or where the reference's disclosure would be unlikely to be productive of the result sought. *See In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994); *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). Petitioner's assertions of the support for the combination and the offered benefits in the view of one of ordinary skill in the art are supported by Dr. Hart's testimony (*see* Ex. 1002 ¶¶ 135–143). On these issues Patent Owner provides only attorney argument concerning the conclusions on alleged incompatibility.[9] Patent Owner's assertions also include that it was not

[9] Patent Owner provides some limited citations to the deposition testimony in the '353 IPR of its expert, Dr. Alan C. Bovik, regarding Gilbert, but there is no testimony proffered on the views of a person of ordinary skill regarding the combination of the prior art. PO Resp. 71 (citing Ex. 2012, 145:5–146:5, 147:17–149:21). This testimony appears to be related to Dr. Bovik's

known whether the combination of techniques would be successful. The legal requirement is a skilled artisan would have had a reasonable expectation of success in the combination of the prior art. *Procter & Gamble Co. v. Teva Pharms. USA, Inc*., 566 F.3d 989, 994 (Fed. Cir. 2009) (citing *Pfizer, Inc. v. Apotex, Inc*., 480 F.3d 1348, 1361 (Fed. Cir. 2007)). Dr. Hart also provides testimony in support of the expected success—a person of ordinary skill in the art would have also expected the combination to yield a predictable results, and a reasonable expectation of success for the combination to produce a more efficient computation system. Ex. 1002 ¶¶ 137, 143.

We do not find Patent Owner's arguments persuasive, and as discussed above, we find Petitioner's support of the rationale to combine the prior art to be sufficient in light of the benefits offered, with the reasoning supported by expert testimony (Ex. 1002). *See KSR*, 550 U.S. at 417 ("[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.").

Claim 3

In its obviousness challenge to claim 3, Petitioner argues that Gilbert teaches the use of a "control processor," a "tracker processor," a "projection processor," and a "video processor," and includes "memory, a temporal processing unit, and a spatial processing unit" as claimed. Pet. 69–71. Petitioner relies on Figure 1 of Gilbert, reproduced below.

---

understanding of Gilbert's use in tracking high speed targets, which was an issue addressed in the '353 IPR. *See* '353 Final Written Decision 27.

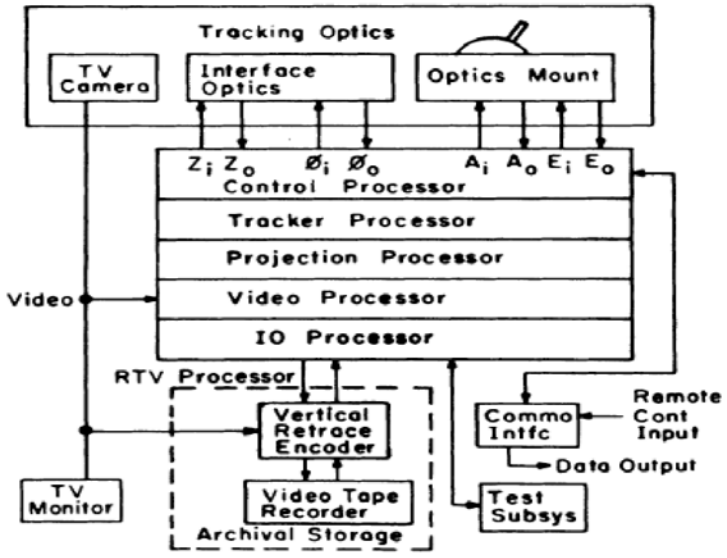


Fig. 1. RTV tracking system.

As identified in Figure 1 of Gilbert, above, Petitioner maps the "tracer processor" to a "temporal processing unit." Pet. 70–71 (citing Ex. 1005, 52–54). Gilbert's tracking system includes video processor, and Petitioner identifies several memories used in Gilbert. *Id*. at 70 (citing Ex. 1005, 48–50).

Petitioner also maps Gerhardt's graphics card with memory or the memory of its computer to the claimed "memory," and its use of running averages function is equated to the "temporal processing unit." Pet. 71–73.

Having considered the complete record now before us, we determine that Petitioner has provided sufficient rationale to combine and sufficient evidentiary support that Gilbert, Gerhardt, and Hashima teach each limitation of claim 3.

Patent Owner presents no additional arguments on the obviousness challenge to claim 3, except for the arguments addressed as to claim 1,

which we do not find persuasive for the reasons discussed above. PO Resp. 57–61.

Therefore, based on the complete record before us, we determine that Petitioner has shown by a preponderance of the evidence that claim 3 is unpatenable as obvious over Gilbert, Hashima, and Gerhardt.

Claims 4, 5 and 6

In addition to Gerhardt's alleged teaching of the elements of claim 4, which we addressed, *supra* Section II.D, Petitioner also relies upon the disclosures in Gilbert and Hashima for their respective teachings of the limitations of claim 4. *See* Pet. 73–75. The Petition relies upon Gilbert's disclosure that the selected size of its "tracking window" may be made "larger" for the teaching of the claim 4 limitation. *Id*. at 73–74 (citing Ex. 1005, 52; Ex. 1002 ¶ 170, pages 163–165 (claim 4 chart)). In the alternative, Petitioner asserts that Hashima discloses increasing a window area around a target, with alleged recalculation of target and window locations using histograms, as follows:

> When the target mark 10 starts to be tracked, the window is established using the projected histogram information obtained when the target mark image is recognized. When the target mark 10 is subsequently tracked, the window [44] is established using new projected histogram information obtained upon each measurement made by the camera 20.

Ex. 1006, 14:29–34.

Petitioner refers to Figure 23 of Hashima where window 44 acts as a mask, with only the pixels inside that window considered during histogram formation. Pet. 75 (citing Ex. 1006, 14:4–28; Ex. 1002 ¶¶ 173–174). Petitioner alleges that "[b]ecause the size and position of the Hashima's window 44 is determined by the size of the target . . . the

window size increases as the size of the target in the image increases [and] a person of ordinary skill in the art [POSA] would have recognized that the size of the window (the selected area) is successively increased until the boundary of the target is found." *Id*. (citing Ex. 1002 ¶ 174, *see also* pages 169–170 (claim 4 chart)).

Neither Petitioner nor Patent Owner address the issue of Gilbert or Hashima's alleged teaching of the limitations of claim 4 in supplemental briefing.

Based upon the record, we find that the Petition lacks sufficient evidence to demonstrate that the prior art teaches the limitations of claim 4.

As discussed above, *supra* Section II.D, we determined that the evidence and explanation provided in the Petition is insufficient to demonstrate that Gerhardt teaches claim 4.

For Gilbert, the portion that the Petition relies on states that its tracking window may be "made larger," where the size of that window is computed "on the basis of the size and shape" of the target image. *See* Ex. 1005, 52. However, although Gibert reaches making a tracking window larger, and the size of the tracking window can be changed based on the target image size and shape, this evidence fails to demonstrate sufficiently that Gilbert teaches that the size of a selected area is increased until the boundary of the target is found in a frame in histogram formation.

Hashima's Figure 23, reproduced below, depicts the steps used for tracking windows. Ex. 1006, 13:64–14:34.

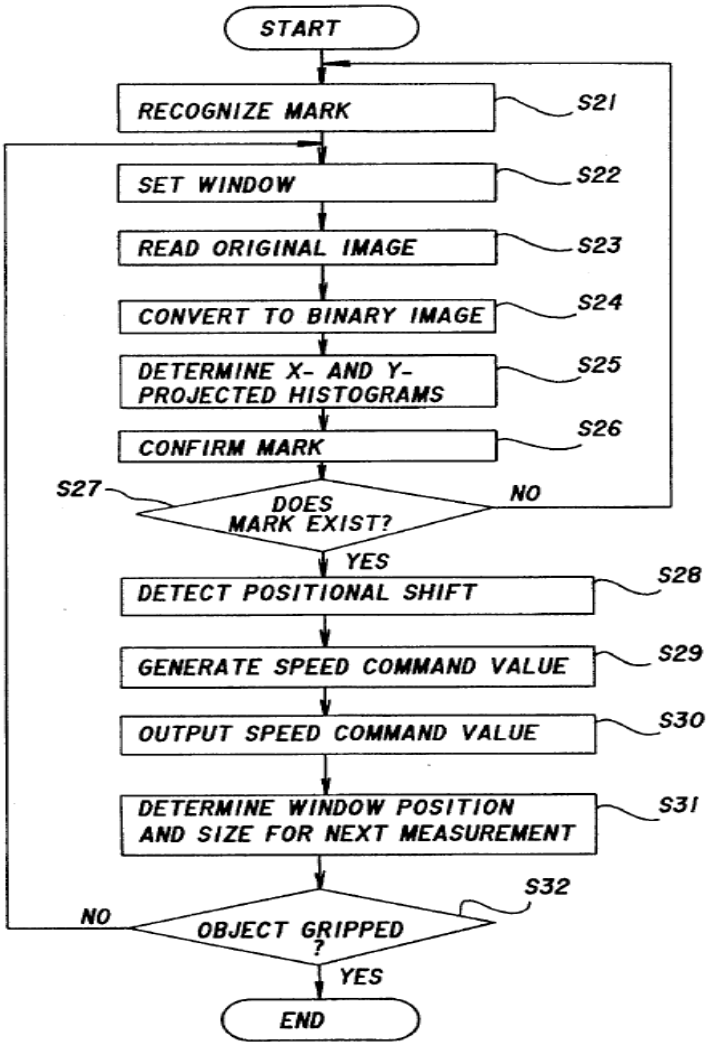


FIG.27

Figure 27, above, depicting the steps used for tracking windows, shows that the "X- AND Y- PROJECTED HISTOGRAMS" (step S25) are determined earlier than "SIZE FOR NEXT MEASUREMENT" (step S31), therefore, the window is established based on *already-formed histograms* and not a part of "forming the at least one histogram" as claimed. *See* Ex. 1006, 14:29–34. Accordingly, Petitioner, fails to demonstrate sufficiently that Hashima teaches that the size of a selected area is increased until the boundary of the target is found in a frame in the formation of histograms.

Claims 5 and 6 depend, directly or indirectly, from claim 4. In light of the insufficiency of the evidence to demonstrate that the limitations of claim 4 are taught by Gilbert, Hashima, and Gerhardt, there is also insufficient evidence of the teachings of the limitations of claims 5 and 6.

Accordingly, based on the record before us, we determine that Petitioner has not shown by a preponderance of the evidence that claims 4–6 are unpatenable as obvious over Gilbert, Hashima, and Gerhardt.

III. CONSTITUTIONALITY ISSUE

Patent Owner objects to the constitutionality of this inter partes review. PO Resp. 3 (citing *Oil States Energy Services, LLC v. Greene's Energy Group, LLC*, No. 16-712 (U.S. Nov. 23, 2016, cert. granted June 12, 2017)). However, on April 24, 2018, the U.S. Supreme Court held that "inter partes review does not violate Article III or the Seventh Amendment" of the Constitution. *Oil States Energy Servcs., LLC v. Greene's Energy Grp., LLC*, 138 S. Ct.1365 (2018). Therefore, Patent Owner's argument is moot.

IV. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that:

A. Claim 3 is unpatentable as obvious over Gerhardt and Bassman; and

B. Claim 3 is unpatentable as obvious over Gilbert, Gerhardt, and Hashima.

I. ORDER

Accordingly, it is:

ORDERED that claim 3 of the '134 patent is unpatentable;

FURTHER ORDERED that claims 4–6 have not been shown to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

PETITIONER:
John Kappos
Nick Whilt
Brian M. Cook
Marc Pensabene
Clarence Rowland
O'MELVENY & MYERS LLP
jkappos@omm.com
nwhilt@omm.com
bcook@omm.com
mpensabene@omm.com
crowland@omm.com

PATENT OWNER:

Chris J. Coulson
Michael Zachary (*pro hac vice*)
Lauren N. Robinson
Craig Y. Allison
BUNSOW DE MORY LLP
ccoulson@bdiplaw.com
mzachary@bdiplaw.com
lrobinson@bdiplaw.com
callison@bdiplaw.com

Trials@uspto.gov
571-272-7822

Paper 37
Entered: May 9, 2018

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 IPR2017-00353
Patent 8,983,134 B2

Before JONI Y. CHANG, MICHAEL R. ZECHER, and JESSICA C. KAISER, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Petitioner") filed a Petition pursuant to 35 U.S.C. §§ 311–19 requesting an *inter partes* review of claims 1 and 2 of U.S. Patent No. 8,983,134 B2, issued on March 17, 2015 (Ex. 1001, "the '134 patent"). Paper 2 ("Pet."). Image Processing Technologies LLC ("Patent Owner") filed a Preliminary Response. Paper 6 ("Prelim. Resp."). Applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we granted Petitioner's request and instituted an *inter partes* review of all challenged claims. Paper 12 ("Inst. Dec."), 29.

Following institution, Patent Owner filed a Response to the Petition (Paper 17, "PO Resp."), and Petitioner filed a Reply (Paper 22, "Pet. Reply). A final oral hearing was held on February 21, 2018. A transcript of that hearing has been entered in the record. Paper 33 ("Hr'g Tr.").

For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that all challenged claims of the '134 patent are unpatentable.

II. BACKGROUND

A. The '134 Patent (Ex. 1001)

The '134 patent is titled "Image Processing Method." Ex. 1001, at [54]. The Abstract describes the subject matter as follows:

> A method and apparatus for localizing an area in relative movement and for determining the speed and direction thereof in real time is disclosed. Each pixel of an image is smoothed using its own time constant. A binary value corresponding to the existence of a significant variation in the amplitude of the smoothed pixel from the prior frame, and the amplitude of the variation, are determined, and the time constant for the pixel is updated. For each particular pixel, two matrices are formed that include a subset of the pixels spatially related to the particular pixel. The first matrix contains the binary values of the subset of pixels. The second matrix contains the amplitude of the variation of the subset of pixels. In the first matrix, it is determined whether the pixels along an oriented direction relative to the particular pixel have binary values representative of significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of these pixels varies in a known manner indicating movement in the oriented direction. In each of several domains, 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. The domains include luminance, hue, saturation, speed (V), oriented direction (Dl), time constant (CO), first axis (x(m)), and second axis (y(m)).

Id. at [57].

Figure 14a of the ’134 patent is reproduced below.

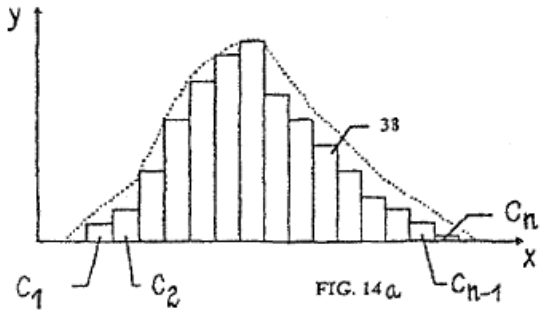


FIG. 14a

Figure 14a depicts a hypothetical velocity histogram with classes C_1–C_n each representing a particular velocity. *Id.* at 20:49–54. Figure 17 of the ’134 patent is reproduced below.

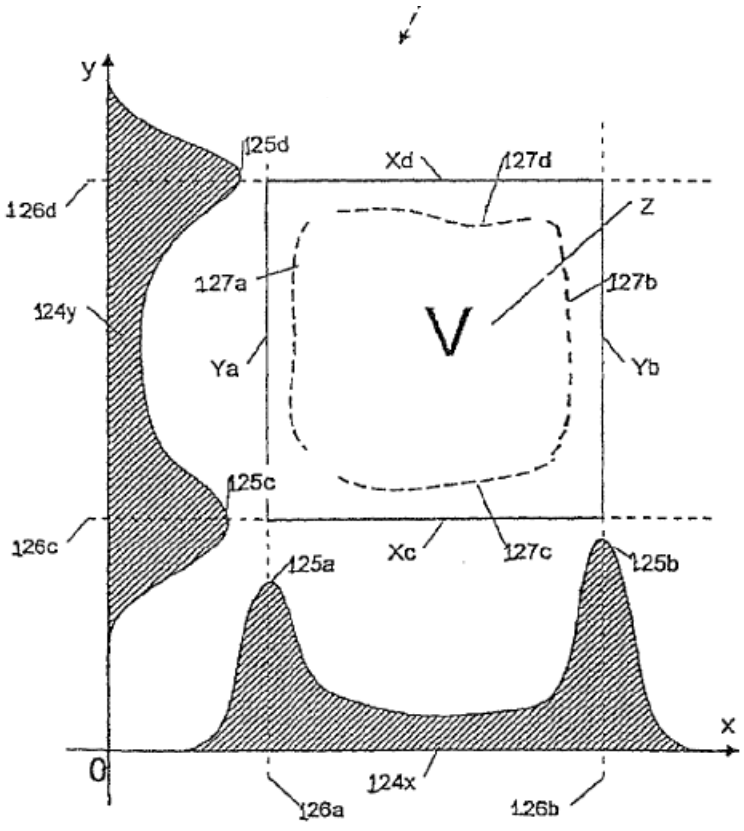


Fig. 17

Figure 17 depicts x axis and y axis histograms of the head of a user in a video conference. *Id.* at 22:4–6, 22:55–67. The face V of the user is approximately defined by the peaks in the two histograms. *Id.* at 23:1–9.

Figure 22 of the '134 patent is reproduced below.

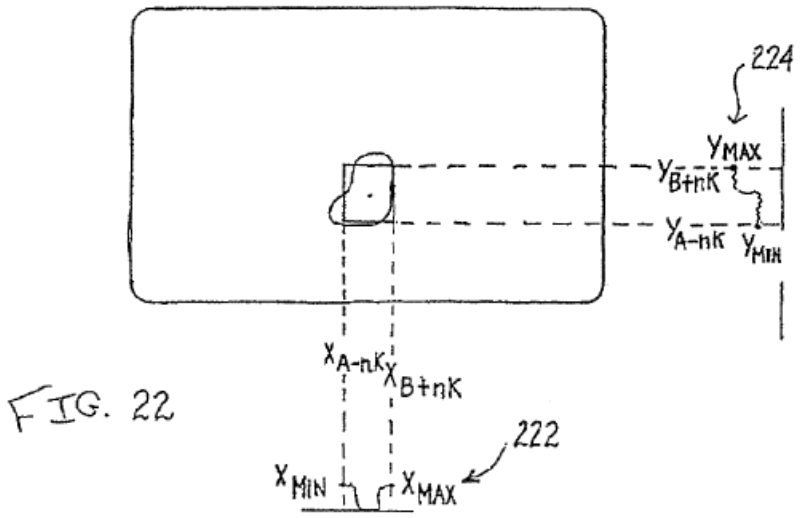


FIG. 22

Figure 22 depicts a circumstance where an area under consideration begins to cross the borders of the target. *Id.* at 24:38–42. In particular, histograms 222 and 224 for x and y projections include pixels in which there is a significant variation, and, thus, the histograms detect the target edge in the x and y axis. *Id.* at 5:18–21, 24:38–42. The '134 patent discloses that in a preferred embodiment, the center of the area "is determined to be $(X_{MIN}+X_{MAX})/2$, $(Y_{MIN}+Y_{MAX})/2$, 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 . . . Other methods of relocating the center of the target box may be used if desired." *Id.* at 24:46–54.

B. Illustrative Claim

Of the challenged claims, claim 1 is independent and is reproduced below:

> 1. A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis:
>
> 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,
>
> wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target.

Id. at 26:36–50.

C. Related Proceedings

Petitioner and Patent Owner identify a related litigation in the U.S. District Court for the Eastern District of Texas involving the '134 patent, as well as other patents, titled: *Image Processing Techs. LLC v. Samsung Elecs. Co.*, No. 2:16-cv-00505-JRG (E.D. Tex.). Pet. 1; Paper 4, 2. Petitioner indicates that it has concurrently filed *inter partes* review petitions for the other patents asserted in that litigation, and Patent Owner also identifies those *inter partes* reviews. Pet. 1; Paper 4, 2.

D. Level of Skill in the Art

Petitioner contends that a person having ordinary skill in the art

> [at] the time of the alleged invention of the '134 Patent would have had either (1) a Master's Degree in Electrical Engineering or Computer Science or the equivalent plus at least a year of experience in the field of image processing, image recognition, machine vision, or a related field[;] or (2) a Bachelor's Degree in Electrical Engineering or Computer Science or the equivalent plus at least three years of experience in the field of image processing, image recognition, machine vision, or a related field.

Pet. 4. Petitioner further contends "[a]dditional education could substitute for work experience and vice versa." *Id.* (citing Ex. 1002 (Declaration of Dr. John C. Hart) ¶¶ 45–48). Patent Owner contends a person of ordinary skill "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." PO Resp. 3; Prelim. Resp. 9. We note that either assessment appears consistent with the level of ordinary skill in the art at the time of the invention as reflected in the prior art in the instant proceeding. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). We determine that our analysis in this Decision is supported by either assessment.

E. References and Other Evidence

We instituted trial based on the following references:

1. "Gilbert" (Alton L. Gilbert, et al., *A Real-Time Video Tracking System*, PAMI-2 No. 1 IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 47–56 (1980)) (Ex. 1005);

2. "Hashima" (U.S. Patent No. 5,521,843; issued May 28, 1996) (Ex. 1006); and
3. "Ueno" (U.S. Patent No. 5,150,432; issued Sept. 22, 1992) (Ex. 1007).

In addition, Petitioner submitted an expert declaration from Dr. Hart (Ex. 1002, "Hart Decl.").

Patent Owner relies on an expert declaration of Dr. Alan Bovik (Ex. 2007, "Bovik Decl."). In addition, the deposition transcript for Dr. Bovik (Ex. 1011) has also been filed.

F. Instituted Grounds

Trial was instituted on the following grounds:

References	Basis	Claims
Gilbert and Hashima	35 U.S.C. § 103(a)	1 and 2
Ueno and Gilbert	35 U.S.C. § 103(a)	1 and 2
Hashima and Ueno	35 U.S.C. § 103(a)	1 and 2

Inst. Dec. 29; Paper 36, 3.

II. ANALYSIS

A. Claim Construction

Claims of an expired patent are given their ordinary and customary meaning in accordance with *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). Petitioner and Patent Owner agree that the '134 patent has expired and thus the claim construction standard applicable to expired patents—namely, the district court-type claim construction standard—applies to this proceeding. Pet. 3–4; Prelim. Resp. 10; Hr'g Tr. 49:18–19. Under that

standard, the "words of a claim 'are generally given their ordinary and customary meaning,'" as would be understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips*, 415 F.3d at 1312 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). We also can consider extrinsic evidence, although it is "less significant than the intrinsic record." *Phillips*, 415 F.3d at 1317.

In the Petition, Petitioner stated it did "not believe any term needs an explicit construction." Pet. 4. In its Preliminary Response, Patent Owner proposed constructions for "domain," "class," "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," and "said at least one histogram referring to classes defining said target." Prelim. Resp. 10–21. In our Institution Decision, we determined we needed to address only the construction of "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 resolve the issues before us. Inst. Dec. 9. In particular, we determined 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" is not limited to "forming at least one histogram of the pixels in two or more classes that are in two or more domains," as Patent Owner had proposed. *Id.* at 10.

Following institution, in its Patent Owner Response, Patent Owner does not reargue our determination not to construe "domain" and "class" or our construction of the "forming" step, and instead states that it has applied our construction of the "forming" step and the plain and ordinary meaning of "class" and "domain" in its Patent Owner Response. PO Resp. 4–5. We determine we need not further construe these terms. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that "only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy"); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs.* in the context of an *inter partes* review). In the Patent Owner Response, Patent Owner proposes constructions for "said at least one histogram referring to classes defining said target" and "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target." PO Resp. 5–14. We address those claim limitations further below.

1. "said at least one histogram referring to classes defining said target"

Patent Owner contends "forming at least one histogram . . . said at least one histogram referring to classes defining said target" should be construed as "forming at least one histogram . . . at least one histogram being formed of pixels in the one or more classes that define said target." PO Resp. 5 (citing Ex. 2006, 46). Patent Owner further contends that "said at least one histogram referring to classes defining said target" requires the histogram to be "made up of only the data for the pixels whose properties match the classes that define the target." *Id.* at 6. In particular, Patent

Owner argues this limitation allows for the histogram to contain classes that include all values in a domain "if and only if those classes all define the target." *Id.* Patent Owner contends its proposed construction is consistent with the language of claim 1 because the histogram is formed of "the one or more of a plurality of classes in the one or more of a plurality of domains," with the emphasized "the" referring back to the plurality of classes of the pixels which comprise the target. *Id.* at 8–9 (citing Ex. 2007 ¶¶ 25–37). Patent Owner also points to examples in the specification of the '134 patent, which Patent Owner contends include only classes defining the target. *Id.* at 9–11 (citing Ex. 1001, Figs. 12, 17).

Petitioner contends neither the claim language nor the Specification requires that the recited histogram include "no pixels except those falling into classes that define the target" or "every pixel defining the target." Pet. Reply 4–8 (emphasis omitted).

We do not agree with Patent Owner's proposed construction. Claim 1 recites "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." Ex. 1001, 26:43–46 (emphasis added). Patent Owner's proposed construction attempts to read "only" into the language of the claim. PO Resp. 7 ("Accordingly, although the target may contain pixels not in classes defining it, the histogram must refer *only* to classes defining said target.") (italicized emphasis added), 11 ("Patent Owner's proposed construction that the histogram only includes values in the target classes"). The claim language, however, does not include the term "only" or require that classes not defining the target be

excluded from the histogram. In other words, the claim language requires only that the recited histogram refer to classes defining the target.

We have reviewed the portions of the specification cited by Patent Owner (i.e., Figures 12 and 17 and the associated description of those figures) and find that they do not require limiting the recited histogram to only classes defining the target. We "depart from the plain and ordinary meaning of claim terms based on the specification in only two instances: lexicography and disavowal," *Hill-Rom Services, Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014), and Patent Owner has pointed to nothing in the specification that amounts to either lexicography or disavowal. In such a circumstance, and in light of the Federal Circuit's caution "against limiting the claimed invention to preferred embodiments or specific examples in the specification," *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1346–47 (Fed. Cir. 2015); *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) (noting that "it is important not to import into claim limitations that are not a part of the claim"), we decline to limit the broad language of claim 1 to the specific examples Patent Owner cites.

Accordingly, we determine "said at least one histogram referring to classes defining said target" is not limited to "said at least one histogram referring to only classes defining said target." We also determine we need not further construe this term to resolve the issues before us.

2. "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target"

Patent Owner contends that "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target" does not encompass creating a histogram and then determining the X minima and maxima and Y minima and maxima of the boundaries of the target from that histogram. PO Resp. 12–13 (citing Ex. 2007 ¶¶ 38–42). In our Institution Decision, in analyzing one of Petitioner's challenges, we determined "claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the 'forming' step. That is, the histogram of claim 1 is not formed until after X minima and maxima and Y minima and maxima of boundaries of the target have been determined." Inst. Dec. 20–21.

Patent Owner contends this interpretation is incorrect because (1) it reads the wherein clause out of the claim, PO Resp. 13; (2) a person of ordinary skill in the art would have understood that "forming the histogram" requires "adding data to the histogram," *id.* at 13–14; and (3) general purpose dictionary definitions of "forming" support that a person of ordinary skill in the art would have understood that "forming a histogram" is the same as "creating a histogram," *id.* at 14. We do not agree with these arguments. First, we disagree that our preliminary interpretation reads the wherein clause out of the claim. As we stated in our Institution Decision, "claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that

histogram, from both being part of the 'forming' step." Inst. Dec. 20–21. In other words, we determined that under our preliminary construction, "determining X minima and maxima and Y minima and maxima of boundaries of the target" would still be part of the "forming" step.

We also do not agree that a person of ordinary skill in the art would have understood that "forming" a histogram is limited to adding data to the histogram, as Patent Owner contends. PO Resp. 13–14 (citing Ex. 2007 ¶¶ 40–41). Patent Owner and its expert cite portions of the specification that mention "forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal," and the 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." PO Resp. 14 (quoting Ex. 1001, 6:11–18); Ex. 2007 ¶¶ 40–41 (quoting same). Patent Owner's expert, Dr. Bovik, testifies that each of these involves adding data to the histogram. Ex. 2007 ¶¶ 40–41. These portions of the specification, however, do not show the "forming" step is *limited to* adding data to the histogram. We have also considered the general purpose dictionaries cited by Patent Owner (PO Resp. 14 (citing Ex. 2008; Ex. 2009)), but we find this extrinsic evidence is inconclusive and does not outweigh the intrinsic evidence we discuss below.

In particular, Petitioner contends that Patent Owner's proposed construction is inconsistent with the embodiment disclosed in Figure 17 of the '134 patent. Pet. Reply 9. Figure 17 is reproduced below.

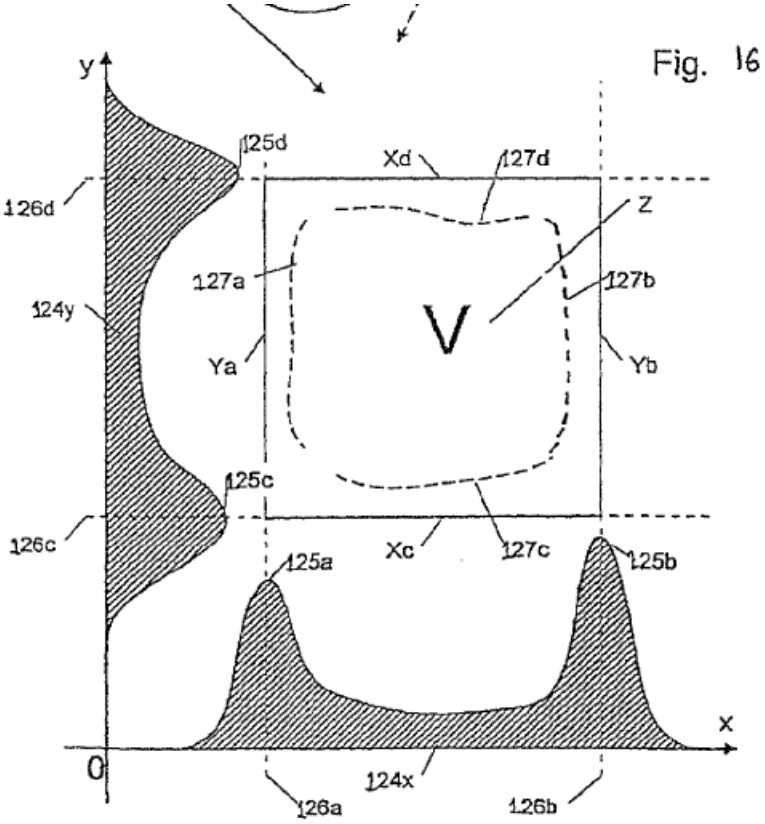


Figure 17 depicts x axis and y axis histograms of the head of a user in a video conference. Ex. 1001, 22:4–6, 22:55–67. As Petitioner points out in Figure 17, (Pet. Reply 9), histograms 124x and 124y are created and then analyzed to determine peaks 125a, 125b, 125c, and 125d. Ex. 1001, 22:55–26:9. We agree with Petitioner that the embodiment in Figure 17 is consistent with a construction of this claim limitation which encompasses determining the recited points (i.e., peaks 125a, 125b, 125c, and 125d) from a created histogram (i.e., histograms 124x and 124y). In other words, Figure 17 is consistent with our preliminary determination that "claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the 'forming' step." Inst. Dec. 20–21.

Patent Owner's contention at the oral hearing that Figure 17 is not an embodiment of claim 1 (*see* Hr'g Tr. 30:13–15, 34:17–19, 36:8–9) is undermined by its reliance on Figure 17 to support its interpretation of other limitations of claim 1 (PO Resp. 9–10) and its contention that the asserted prior art differs from Figure 17 (*id.* at 41–42). Dr. Bovik similarly relied on Figure 17 in his declaration. *See* Ex. 1007 ¶¶ 31–34, 106–108. Indeed, Patent Owner conceded that the first time either Patent Owner or Dr. Bovik contended Figure 17 was not an embodiment of claim 1 was during Dr. Bovik's deposition (i.e., that contention does not appear in Patent Owner's briefs). *See* Hr'g Tr. 40:19–42:19. We have reviewed Dr. Bovik's deposition testimony regarding Figure 17 and do not find it helpful because it assumes, without analyzing, the correctness of Patent Owner's construction of this claim limitation. *See* Ex. 1011, 51:1–8.

For the first time at the hearing, Patent Owner changed tack to assert its proposed claim construction for this limitation is supported by the prosecution history and other disclosures in the specification of the '134 patent not cited in its briefs. *See, e.g.*, Hr'g Tr. 35:4–17, 36:18–39:6, 43:1–18. Petitioner objected to Patent Owner raising new arguments at the oral hearing. *Id.* at 57:5–21. We agree with the Petitioner that these arguments were not made in the briefs. We need not consider Patent Owner's arguments raised for the first time at the oral hearing. *See Dell Inc. v. Acceleron, LLC*, 884 F.3d 1364, 1369 (Fed. Cir. 2018) (holding that the Board was not obligated to consider an "untimely argument . . . raised for the first time during oral argument"). In any event, we do not agree with Patent Owner's new arguments for the reasons discussed below.

Patent Owner's counsel relied on the prosecution history for the first time at the oral hearing. *See* Hr'g Tr. 35:4–17, 43:1–18. Although the prosecution history is in the record (Ex. 1004), neither party relied on the prosecution history in its briefs. Hr'g Tr. 43:13–18, 65:3–17. During the oral hearing, Patent Owner's counsel contended that the applicant added this claim limitation by amendment and pointed to the embodiment in column 24 for support. *Id.* at 35:4–13; *see id.* at 43:4–9. We have reviewed the prosecution history in Exhibit 1004, and do not find support for Patent Owner's construction. Patent Owner is correct that claim 1 was amended during prosecution to add this limitation (specifically, the Examiner found a dependent claim that included that limitation would be allowable if rewritten in independent form and the applicant amended that claim accordingly). *See* Ex. 1004, 86, 88, 146, 197, 198. We do not find, and Patent Owner has not pointed us to, any disavowal of claim scope or any other statement in the prosecution history that clearly limits claim 1 to a particular embodiment in the specification. *See id.*

During the oral hearing, Patent Owner also relied on a statement in the specification that "[f]or the histogram formed in memory 100, key characteristics for that histogram are simultaneously computed in a unit 112," including "the minimum (MIN) of the histogram [and] the maximum (MAX) of the histogram" (Ex. 1001, 19:41–45). Hr'g Tr. 36:18–39:6. As Petitioner points out (*id.* at 14:10–24), and we agree, this disclosure refers to computing the minimum and maximum *of the histogram*, whereas claim 1 recites determining minima and maxima of boundaries *of the target*.

Patent Owner also relied extensively at the oral hearing on the embodiment in Figures 21–23 of the '134 patent, as well as the associated

description of that embodiment. In particular, Patent Owner contends that the last histogram formed in the iterative process in that embodiment maps to the "at least one histogram" recited in claim 1, such that steps occurring prior to the formation of that last histogram can be part of the recited "forming" step. *See*, *e.g.*, Hr'g Tr. 38:21–24. Even if we were to accept these contentions (i.e., even if we were to agree that that embodiment meets the limitations of claim 1), we see nothing in the specification limiting the "forming" step or this limitation of claim 1 to that embodiment, and Patent Owner has not pointed us to any limiting language in the specification. Indeed, Dr. Bovik characterized this embodiment as "one way of . . . practicing claim 1." Ex. 1011, 16:7–12. As discussed above, we are mindful not to limit "the claimed invention to preferred embodiments or specific examples in the specification." *Williamson*, 792 F.3d at 1346–47.

Thus, even considering Patent Owner's belated arguments made during the oral hearing, we conclude our preliminary determination remains correct: "claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the 'forming' step." Inst. Dec. 20–21. We determine we need not further construe this limitation to resolve the issues before us.

B. Asserted Obviousness Over Gilbert and Hashima

1. Overview of Gilbert and Hashima

Gilbert is titled "A Real-Time Video Tracking System," and dated January 1980. Ex. 1005, 47.[1] Gilbert relates to an object identification and tracking system, which includes an image processing system comprising a video processor, a projection processor, a tracker processor, and a control processor. *Id.* at 47–48. Gilbert's video processor receives a digitized video signal in which each field consists of pixels. *Id.* at 48. Gilbert discloses that "[e]very 96 ns, a pixel intensity is digitized and quantized into eight bits (256 gray levels), counted into one of six 256-level histogram memories, and then converted by a decision memory to a 2-bit code indicating its classification (target, plume, or background.)." *Id.* Gilbert's projection processor then uses pixels identified as being part of the target to create x- and y-projections. *Id.* at 50. Figure 4 of Gilbert is reproduced below.

[1] We refer to the original page numbers at the top of the pages in Exhibit 1005 rather than the page numbers added by Petitioner.

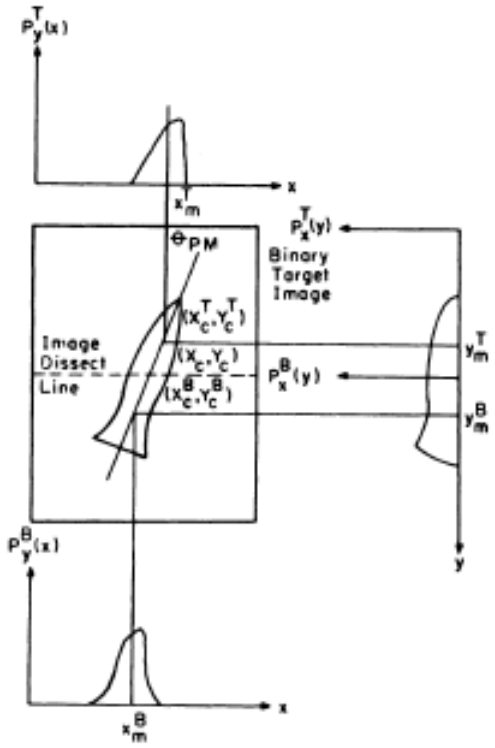


Fig. 4. Projection location technique.

Figure 4 of Gilbert depicts a Y-projection and X-projections of the target. Gilbert's system uses these projections to determine the center of the upper and lower portions of the target, and those points are then used to determine the center of the target (X_C, Y_C). *Id.* at 50–51.

Hashima is titled "System for and Method of Recognizing and Tracking Target Mark," and issued on May 28, 1996. Ex. 1006, at [45], [54]. Hashima relates to a system and method of recognizing and tracking a target mark with a video camera. *Id.* at [57]. In Hashima, the target mark can be a black circle with a white triangle as depicted in Figure 3 (reproduced below).

FIG.3

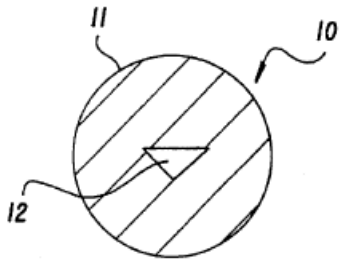


Figure 3 depicts Hashima's target mark. Figure 6 of Hashima is reproduced below.

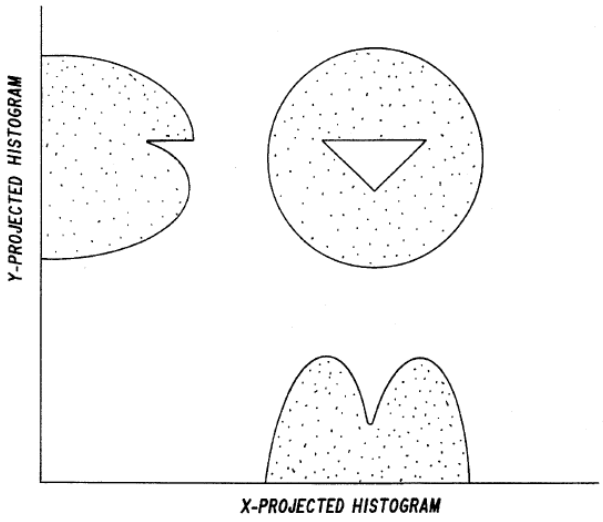


FIG.6

Figure 6 depicts x- and y-projected histograms of a target mark. Hashima describes creating these histograms by summing the number of black pixels at each x- or y- location. *Id.* at 8:18–9:7. Hashima also describes finding the central position of the detected mark as shown in Figure 15 below.

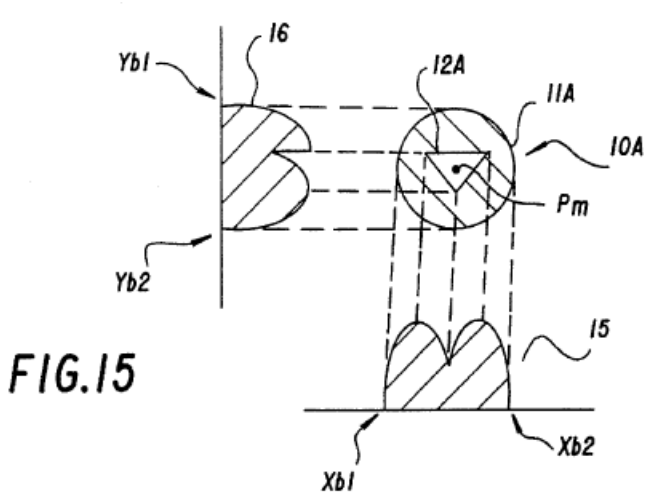


FIG.15

Figure 15 depicts a process of finding central position Pm of the target mark. Hashima describes finding Pm (mx, my) using the equations (1) mx = (Xb1+Xb2)/2 and (2) my = (Yb1+Yb2)/2. *Id.* at 11:6–25.

2. Analysis

Petitioner contends that claims 1 and 2 would have been obvious over Gilbert and Hashima. Pet. 34–50. We have reviewed the information provided by Petitioner, including the relevant portions of the supporting Hart Declaration (Ex. 1002), and, taking into account the arguments presented in the Patent Owner Response, Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima.

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying

factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in the record, objective evidence of non-obviousness.[2] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). In that regard, an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418.

Petitioner's obviousness analysis, as supported by the Hart Declaration, demonstrates where each element of the challenged claims is taught in Gilbert and Hashima. Pet. 39–48; Ex. 1002 ¶¶ 89–108. We agree with and adopt Petitioner's analysis and Dr. Hart's testimony as our own.

For example, for the preamble of claim 1, Petitioner contends Gilbert discloses a process of tracking a target (i.e., a missile) and uses a video signal (i.e., input signal) comprising digitized fields with a frame rate of 60 fields/s (i.e., 30 frames/s in a succession of frames), each image frame comprising a matrix of digitized points (i.e., a succession of pixels). Pet. 39–40 (citing Ex. 1005, 47–48; Ex. 1002 ¶¶ 89–91). Petitioner further contends that Gilbert tracks the target by categorizing pixels into 256 gray-scale levels (i.e., a plurality of classes) according to their pixel intensity (i.e., domain), and Gilbert discloses that a plurality of other domains, such as "texture, edge, and linearity measures" could also be used. *Id.* at 40 (citing

[2] Patent Owner does not present arguments or evidence of such secondary considerations in its Patent Owner Response.

Ex. 1005, 48; Ex. 1002 ¶¶ 92–93). Petitioner contends Hashima also teaches the preamble. *Id.* at 40–41.

Petitioner contends Gilbert and Hashima each disclose the step of "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," as recited in claim 1. *Id.* at 41. Specifically, Petitioner relies on Gilbert's intensity histogram (discussed above), Gilbert's X- and Y-projection histograms, as well as Hashima's X- and Y-axis histograms. *Id.* at 41–43 (citing Ex. 1005, 48, 50–51, Fig. 4; Ex. 1006, 8:22–30; Ex. 1002 ¶¶ 94–98, 100). For the limitation of "identifying the target in said at least one histogram itself," Petitioner contends the histograms in both Gilbert and Hashima are used to identify a target. *Id.* at 43–44 (citing Ex. 1005, 48–50; Ex. 1006, 8:18–10:24; Ex. 1002 ¶¶ 101–102).

Regarding "wherein identifying the target in said at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target," as recited in claim 1, Petitioner contends "Gilbert uses the center of areas of the target's upper and lower halves to find a center point," and teaches that "'target nose and tail points' could be used." *Id.* at 44 (citing Ex. 1005, 50; Ex. 1002 ¶ 103). Petitioner further contends that Hashima discloses "determining X maxima and minima and Y maxima and minima of the boundaries of the target in the histogram to calculate the center point of the target using the equations $(X_{MIN} + X_{MAX})/2$ and $(Y_{MIN} + Y_{MAX})/2$." *Id.* (citing Ex. 1006, 11:13–24, Fig. 15; Ex. 1002 ¶¶ 103–104).

Although Petitioner appears to contend Gilbert discloses all of the limitations of claim 1, Petitioner contends that, "[t]o the extent Patent Owner argues Gilbert does not disclose the claimed plurality of domains or method of finding the X- and Y-minima and maxima, it would have been obvious to replace these features of Gilbert with those of Hashima." *Id.* at 44–45 (citing Ex. 1002 ¶ 100). Petitioner further argues the combination of Hashima and Gilbert teaches "an input signal comprising a succession of frames, each frame comprising a succession of pixels," as recited in claim 1. *Id.* at 45.

Petitioner also provides a sufficiently persuasive rationale for combining the teachings of Gilbert and Hashima. For example, Petitioner contends that a person of ordinary skill reading Gilbert would have been motivated to plot histograms in other domains to increase the likelihood of successfully recognizing the target "because each additional domain provides another opportunity for correlation between that domain and the unique target being tracked." *Id.* at 36. Petitioner also contends that it would have been obvious for a person of ordinary skill in the art to modify Gilbert with "simpler location tracking and camera movement 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." *Id.* at 38. Petitioner contends a person of ordinary skill would have been motivated to do so

> because (1) it would enable drawing a tracking box, which can be used to more efficiently track a target, and (2) it would reduce the number of calculations needed to determine the center, which can be used to reposition the camera, resulting in faster, more efficient processing to improve tracking of a target.

Id. at 38–39 (citing Ex. 1002 ¶ 88). To support its rationales for combine the teachings of Gilbert and Hashima, Petitioner relies upon the supporting testimony of Dr. Hart. Ex. 1002 ¶¶ 78–88.

Petitioner provides further analysis of claim 2, detailing where it contends each limitation of that claim is taught by Gilbert and Hashima. *Id.* at 45–48. We have reviewed Petitioner's evidence and argument, and find that Petitioner has shown the cited references teach each limitation of the challenged claims, and that Petitioner has provided a sufficiently persuasive rationale for combining those teachings.

In the Patent Owner Response, Patent Owner argues that neither Gilbert nor Hashima teaches "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target" (PO Resp. 29–32), and neither teaches "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" (*id.* at 36–42). These arguments, however, are based on Patent Owner's proposed constructions of those claim limitations, which as discussed above, we do not adopt. *See supra* Section II.A.

Patent Owner also argues that Gilbert does not teach "identifying the target in said at least one histogram itself." PO Resp. 43–47. As Petitioner points out, Patent Owner has not addressed Petitioner's contentions that Hashima also teaches this limitation. Pet. Reply 19. In addition, as we found in the Institution Decision, identifying the target in the intensity histograms does not preclude the target from also being identified in the projection histograms. Inst. Dec. 20. As shown in Gilbert's Figure 4

(depicted above), Gilbert's projection histograms display target pixels and identify the target in the x- and y- domains. *See* Ex. 1002 (Hart Decl.) ¶ 54. Patent Owner and its expert, Dr. Bovik, contend that the "identifying" step requires a previously unidentified target, but they fail to explain persuasively why this is so. Ex. 2007 ¶ 86; PO Resp. 45–47. We find that Petitioner has shown Gilbert and Hashima teach this limitation.

Regarding Petitioner's rationale to combine Gilbert and Hashima, Patent Owner contends a person of ordinary skill in the art would not have combined Gilbert and Hashima because Hashima is directed to tracking a low speed known target, whereas Gilbert is directed to tracking a high speed unknown target. PO Resp. 47–50. In addition to the reasons provided in the Petition, with which we agree, Petitioner notes Hashima expressly states its system can also track fast-moving targets: "The image processor can thus achieve a high-speed processing and is capable of tracking a target mark that moves at a high speed." Pet. Reply 25 (quoting Ex. 1006, 25:31–34).

In addition, as we stated in our Institution Decision, it is well-settled that simply because two references have different objectives does not preclude a person of ordinary skill in the art from combining their respective teachings. *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983) ("The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned.") (quoting *In re Lemelson*, 397 F.2d 1006, 1009 (CCPA 1968)); *see also EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) ("A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment."). Here, Petitioner provides sufficiently persuasive reasoning for combining the teachings of Hashima

with Gilbert, including that a person of ordinary skill would have been motivated to modify Gilbert to (1) enable drawing a tracking box, which can be used to more efficiently track a target; and (2) reduce the number of calculations needed to determine the center, which can be used to reposition the camera, resulting in faster, more efficient processing to improve tracking of a target. Pet. 38–39 (citing Ex. 1002 ¶ 88). Petitioner's reasoning is supported by its expert's testimony. Ex. 1002 (Hart Decl.) ¶¶ 78–88.

For the reasons discussed above, we determine Petitioner has shown by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima.

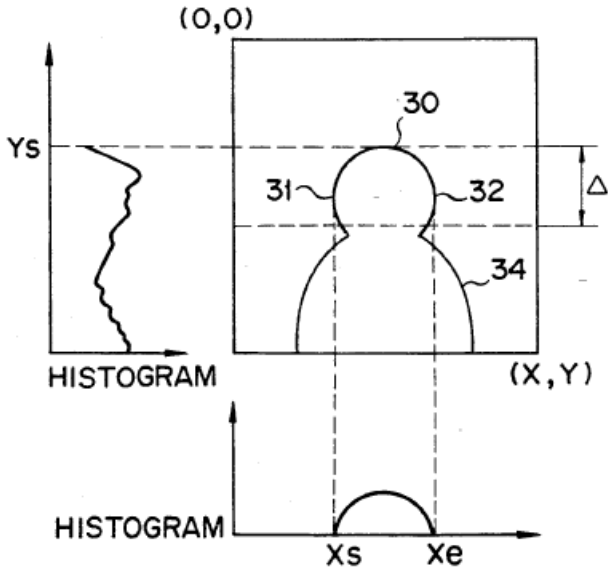
C. Asserted Obviousness Over Ueno and Gilbert

1. Overview of Ueno

Ueno is titled "Apparatus for Encoding/Decoding Video Signals to Improve Quality of a Specific Region," and issued on September 22, 1992. Ex. 1007, at [45], [54]. Ueno's abstract describes its subject matter as follows:

> An image encoding apparatus comprises a region detecting circuit for detecting a specific region from input image signals and outputting the region specifying signals for discriminating the specific region from other regions, a low-pass filter for selectively filtering and outputting the image signals of regions other than the specific region in the input image signals, and an encoding circuit for encoding the image signal output from the low-pass filter.

Id. at [57]. Figure 3 of Ueno is reproduced below.



F I G. 3

Figure 3 shows x- and y-axis histograms in Ueno. Ueno states:

> FIG. 3 shows an interframe difference image input to the facial region detecting circuit 102. Information for the interframe difference image is converted into binary data of "0" or "1" by the preset first threshold level. Then the number of pixels having the binary data value of "1" or the value equal to or more than the first threshold value is counted in the vertical and horizontal directions of the screen and histograms of the pixels (x-and y-axis histograms) are formed. Facial detection is executed according to the histograms.

Ex. 1007, 7:7–16. Ueno detects the top of the head in the y-axis histogram by identifying point Y_S, which exceeds a threshold value. Ueno then determines the left and right sides of the head by selecting points Xs and Xe, which exceed a threshold. Finally, Ueno determines a width Δ from the top of the head so that the region with the shoulders is not detected. *Id.* at 7:17–30.

2. Analysis

Petitioner contends that claims 1 and 2 would have been obvious over Ueno and Gilbert. Pet. 60–73. We have reviewed the information provided by Petitioner, including the relevant portions of the supporting Hart Declaration (Ex. 1002), and, taking into account the arguments presented in the Patent Owner Response, Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

Petitioner's obviousness analysis, as supported by the Hart Declaration, demonstrates where each element of the challenged claims is taught in Ueno and Gilbert. Pet. 53–58, 64–71; Ex. 1002 ¶¶ 143–167. We agree with and adopt Petitioner's analysis and Dr. Hart's testimony as our own.

For example, Petitioner contends Gilbert teaches the preamble of claim 1 as discussed above, and contends Ueno also teaches the preamble by describing a process of tracking a target (i.e., a human face) from a video signal (i.e., an input signal) comprising a succession of frames, each frame comprising a succession of pixels. Pet. 53–54 (citing Ex. 1002 ¶¶ 115–121; Ex. 1007, 7:7–16), 64. Petitioner further contends a face in Ueno is identified in the histograms of the X- and Y-domains (i.e., a plurality of domains). *Id.* at 55 (citing Ex. 1007, 7:7–16; Ex. 1002 ¶¶ 125–127), 64–67. Petitioner further relies on Ueno as teaching "wherein identifying the target in said at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target," and contends Ueno "determines X minima and maxima and Y minima and maxima in the X and Y histograms and draws a rectangle around the target

using the X and Y minima and maxima to mark the target on the display screen." *Id.* at 67–68 (citing Ex. 1007, 7:17–45, 13:3–26; Ex. 1002 ¶¶ 161–162).

Petitioner also provides a sufficiently persuasive rationale for combining the teachings of Ueno and Gilbert. For example, Petitioner contends a person of ordinary skill would have been motivated to modify Gilbert to include histograms in other domains, as discussed above, and to include simpler methods of marking a target on a screen, such as those taught in Ueno, to be less visually distracting. Pet. 61–63. To support its rationales for combining the teachings of Ueno and Gilbert, Petitioner relies upon the supporting testimony of Dr. Hart. Ex. 1002 ¶¶ 137–143.

We have addressed Patent Owner's arguments regarding Gilbert's teachings above, and do not agree with those arguments for the reasons discussed in Section II.B.2.

Patent Owner further contends Ueno does not teach "wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target." PO Resp. 33–35. This argument, however, is based on Patent Owner's proposed construction of this claim limitation, which as discussed above, we do not adopt. *See supra* Section II.A.

Patent Owner also contends a person of ordinary skill in the art would not have combined Ueno and Gilbert because Ueno uses a "low-speed known-target" tracking algorithm, whereas Gilbert uses a "high-speed unknown-target" tracking algorithm. PO Resp. 50–54. Patent Owner further argues a person of ordinary skill would have understood that Ueno

and Gilbert are incompatible. *Id.* at 52. Patent Owner contends Petitioner has not shown a credible reason to combine Ueno and Gilbert. *Id.* at 53.

We are not persuaded by these arguments because it is well-settled that simply because two references have different objectives does not preclude a person of ordinary skill in the art from combining their respective teachings. *See Heck*, 699 F.2d at 1333. Moreover, as discussed above, Petitioner provides sufficiently persuasive reasoning for combining the teachings of Ueno and Gilbert, which is supported by its expert's testimony. Ex. 1002 (Hart Decl.) ¶¶ 137–142. That is, we agree with Petitioner's contention that a person of ordinary skill would have been motivated to modify Gilbert to include histograms in other domains, as discussed above, and to include simpler methods of marking a target on a screen, such as those taught in Ueno, to be less visually distracting. Pet. 61–63. We have considered Dr. Bovik's testimony (Ex. 2007 ¶¶ 139–150), but find that testimony does not sufficiently undermine Dr. Hart's testimony. Indeed, Dr. Bovik recognizes that a person of ordinary skill in the art "would [have understood] that many different approaches to tracking can be taken depending on the context, design goals, processing power, etc." Ex. 2007 ¶ 150.

For the reasons discussed above, we determine Petitioner has shown by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

D. Asserted Obviousness Over Hashima and Ueno

In our Institution Decision, we exercised our discretion and determined not to institute review based on Petitioner's obviousness challenge to claims 1 and 2 over Hashima and Ueno. Inst. Dec. 28–29. On

May 4, 2018, we issued an order modifying our Institution Decision to institute on all of the grounds presented in the Petition. Paper 36, 2. In that order, we noted that the parties affirmatively waived any additional briefing on this ground, namely, that claims 1 and 2 are unpatentable as obvious over Hashima and Ueno. *Id*. at 3. Because we determine claims 1 and 2 are unpatentable under the grounds discussed above, we do not address Petitioner's obviousness challenge to those same claims based on the combined teachings of Hashima and Ueno. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching other rejections after affirming an anticipation rejection).

III. PROCEDURAL ISSUES

Patent Owner also objects to the constitutionality of this *inter partes* review. PO Resp. 54 (citing *Oil States Energy Services, LLC v. Greene's Energy Group, LLC*, No. 16-712 (U.S. Nov. 23, 2016, cert. granted June 12, 2017)). However, on April 24, 2018, the Supreme Court held that "inter partes review does not violate Article III or the Seventh Amendment" of the Constitution. *Oil States Energy Servcs., LLC v. Greene's Energy Grp., LLC*, 2018 WL 1914662, at *12 (U.S. Apr. 24, 2018). Therefore, Patent Owner's argument is unavailing.

IV. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that:

A. Claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima; and

B. Claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

V. ORDER

For the foregoing reasons, it is

ORDERED that claims 1 and 2 of the ’134 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

For PETITIONER:

Nicholas Whilt
John Kappos
Marc Pensabene
Brian Cook
Clarence Rowland
O’MELVENY & MYERS LLP
nwhilt@omm.com
jkappos@omm.com
mpensabene@omm.com
bcook@omm.com
crowland@omm.com

For PATENT OWNER:

Chris Coulson
BUNSOW DE MORY LLP
ccoulson@bdiplaw.com