

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 IPR2017-00336
Patent 6,959,293 B2

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

CHANG, *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 requesting an *inter partes* review of claims 1, 18, 19, 22, and 29 (“the challenged claims”) of U.S. Patent No. 6,959,293 B2 (Ex. 1001, “the ’293 patent”) and a Declaration of John Hart, Ph.D. (Ex. 1002). Paper 2 (“Pet.”). Image Processing Technologies LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). Upon consideration of the Petition and Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to challenging claim 22, but not with respect to challenging claims 1, 18, 19, and 29, and for only the sole ground that claim 22 is unpatentable under § 103(a) as obvious over Pirim, but not for any other grounds asserted by Petitioner. Paper 15 (“Dec. on Inst.”). Consequently, on May 25, 2017, we entered an Institution Decision, instituting an *inter partes* review only as to claim 22, but not with respect to claims 1, 18, 19, and 29. *Id.* at 53.

Subsequent to institution, Patent Owner filed a Response (Paper 21, “PO Resp.”) and a Declaration of Peggy Agouris, Ph.D. (Ex. 2009), and Petitioner filed a Reply, all directed only to claim 22 and the instituted ground. Paper 24 (“Pet. Reply”). A transcript of the oral hearing held on February 21, 2018, has been entered into the record as Paper 34 (“Tr.”).

On April 24, 2018, the Supreme Court of the United States held that a decision to institute under 35 U.S.C. § 314 may not institute on less than all claims challenged in the petition. *SAS Institute Inc. v. Iancu*, 2018 WL 1914661, at *10 (U.S. Apr. 24, 2018). In light of the Guidance on the

Impact of SAS on AIA Trial Proceedings¹ posted on April 26, 2018, we modified our Institution Decision to institute on *all of the challenged claims*, including claims 1, 18, 19, and 29, and *all of the grounds* presented in the Petition. Paper 37. Both parties affirmatively waived additional briefing, relying on the arguments and evidence already of record, for the newly instituted challenged claims and grounds. *Id.* at 3.

This Final Written Decision addresses all of the challenged claims and all of the grounds presented in the Petition. For the reasons that follow, Petitioner has demonstrated by a preponderance of the evidence that claim 22 of the '293 patent is unpatentable. However, Petitioner has not demonstrated by a preponderance of the evidence that claims 1, 18, 19, and 29 of the '293 patent are unpatentable.

A. Related Matters

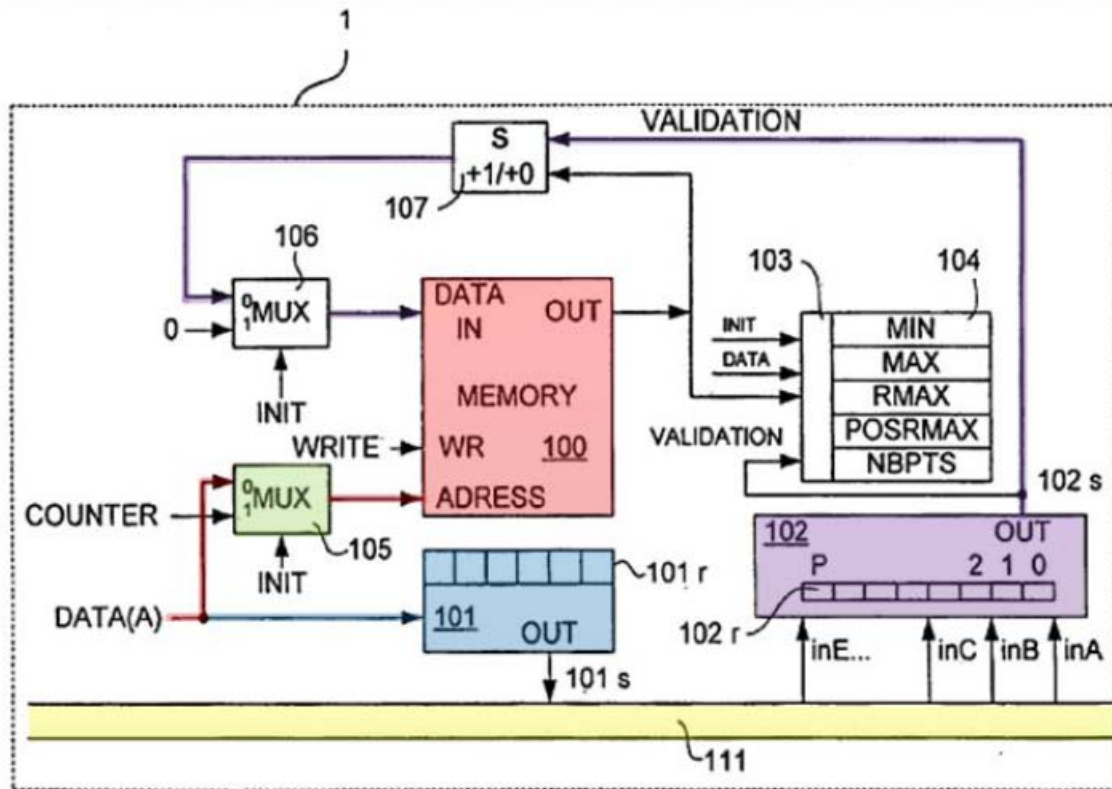
The parties indicate that the '293 patent is involved in *Image Processing Technologies, LLC v. Samsung Electronics Co.*, Case No. 2:16-cv-00505-JRG (E.D. Tex.) and other proceedings. Pet. 2; Paper 4, 2.

B. The '293 Patent

The '293 patent describes a visual perception device, including a device for processing image signals using histogram calculation units. Ex. 1001, 1:6–10. Figure 3 of the '293 patent illustrates a histogram

¹ See <https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>.

calculation unit, and is reproduced below with highlighting added by
Petitioner (Pet. 5).

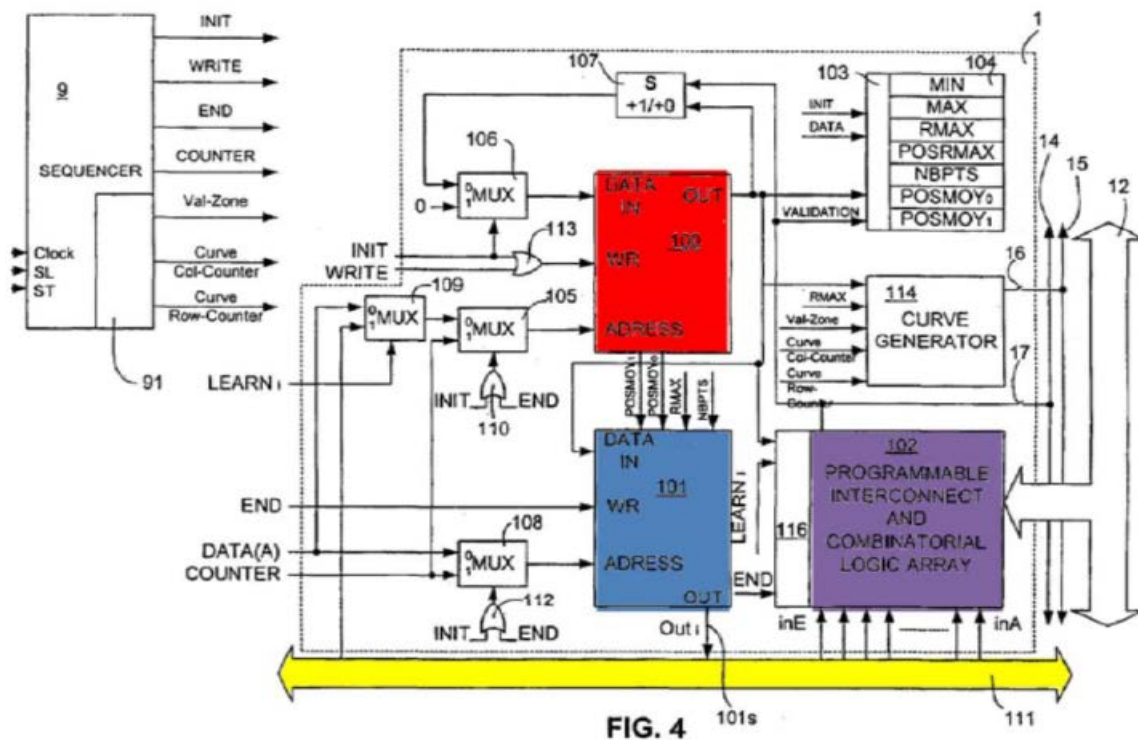


As shown in highlighted Figure 3 above, histogram calculation unit 1 includes analysis memory 100 (in red), address multiplexer 105 (in green), data input multiplexer 106, incrementation unit 107, classifier 101 (in blue), time coincidences unit 102 (in purple), and test unit 103, which is connected to analysis output registers 104. Ex. 1001, 8:37–43, 9:51–54. Output of classifier 101 (in blue) is connected to bus 111 (in yellow). *Id.* at 9:36.

Analysis output registers 104 receive and store statistical information prepared on the basis of the values of parameter A of signal DATA(A) for each frame. *Id.* at 9:51–57. In particular, after processing a complete frame, statistical information representative of this frame is produced and stored in

analysis output registers 104. *Id.* at 10:1–14. This statistical information includes minimum values (MIN) and maximum values (MAX) of the histogram, the number of points (NBPTS) of the histogram, the position (POSRMAX) of the maximum of the histogram, and the number of points (RMAX) at the maximum of the histogram. *Id.* These features are determined in parallel with the formation of the histogram by test unit 103.

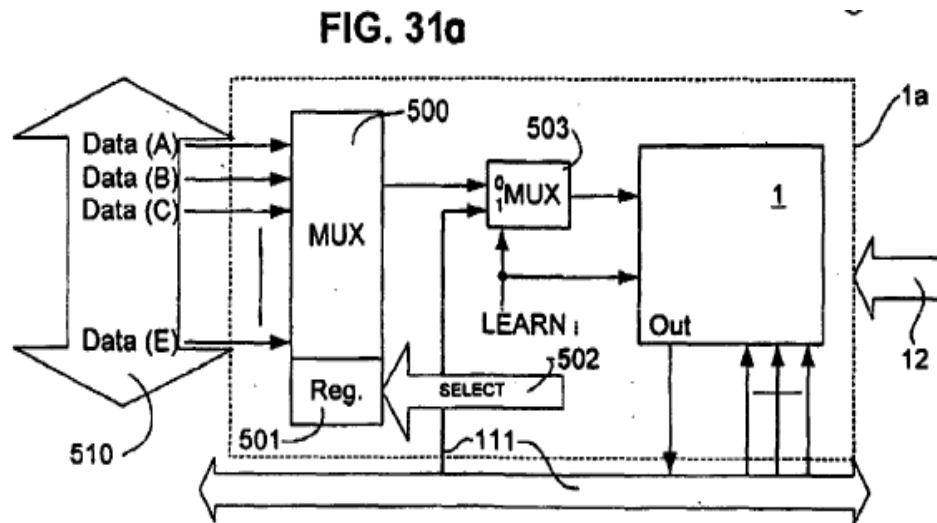
Figure 4 of the '293 patent illustrates a self-adapting histogram calculation unit with anticipation and learning functionalities, and is reproduced below with highlighting added by Patent Owner (Prelim. Resp. 7).



According to the '293 patent, in the self-adapting embodiment illustrated in Figure 4, the content of the memory of classifier 101 (in blue) is updated automatically. Ex. 1001, 11:14–29. To implement the

self-adapting function (i.e., real-time updating of classifier 101), classifier 101 has an addressable memory whose writing is controlled by signal END, which is generated by sequencer 9. *Id.* Histogram calculation unit 1 also includes selection circuit 110 (e.g., an “OR” gate), receiving as its input signals INIT and END and whose output is connected to the selection input of address multiplexer 105. *Id.*

Figure 31a of the '293 patent illustrates a polyvalent histogram calculation unit that can be programmed to process more than one parameter, and is reproduced below (*id.* at 21:18–36).



As shown in Figure 31a above, polyvalent histogram calculation unit 1a comprises histogram calculation unit 1, input multiplexer 500, associated register 501, and learning multiplexer 503. *Id.* In this embodiment, it is possible to use a single histogram calculation unit to process any of parameters Data (A) – Data (E), which are addressed by bus 510 in relation to SELECT command 502. *Id.* at 20:58–66. Additionally,

polyvalent histogram calculation units can be operated in a matrix. *Id.* at 21:37–42.

C. Illustrative Claims

Of the challenged claims, claims 1, 18, 22, and 29 are independent. Claim 19 depends directly from claim 18. Claims 1, 18, and 22 are illustrative:

1. A visual perception processor for automatically detecting an event occurring in a multidimensional space (i, j) evolving over time with respect to at least one digitized parameter in the form of a digital signal on a data bus, said digital signal being in the form of a succession a_{ijT} of binary numbers associated with synchronization signals enabling to define a given instant (T) of the multidimensional space and the position (i, j) in this space, the visual perception processor comprising:

the data bus;

a control unit;

a time coincidences bus carrying at least a time coincidence signal; and

at least two histogram calculation units for the treatment of the at least one parameter,

the histogram calculation units being configured to form a histogram representative of the parameter as a function of a validation signal and to determine by classification a binary classification signal resulting from a comparison of the parameter and a selection criterion C, wherein the classification signal is sent to the time coincidences bus, and wherein the validation signal is produced from time coincidences signals from the time coincidence bus so that the calculation of the histogram depends on the classification signals carried by the time coincidence bus.

Ex. 1001, 26:34–59 (emphasis added).

18. A device for detecting one or more events including aural and/or visual phenomena, the device comprising:

a controller coupled to a controller bus and a transfer bus;

an input portal adapted to receive data describing one or more parameters of the event being detected;

and a data processing block coupled to the input portal, the transfer bus and the controller bus,

the data processing block including:

a histogram unit coupled to the input portal and configured to calculate a histogram for a selected parameter;

a classification unit coupled to the input portal and the histogram unit, and *configured to determine the data in the histogram that satisfy a selected criterion*, and to generate an output accordingly, the classification unit supplying the output to the transfer bus; and

a coincidence unit coupled to receive the output of the classification unit from the transfer bus and to receive selected coincidence criteria from the controller bus,

the coincidence unit being configured to generate an enable signal for the histogram unit when the output of the classification unit satisfies the selected coincidence criterion,

wherein classification is performed automatically by processing statistical information associated with the calculated histogram.

Id. at 29:20–42 (emphases added).

22. A device for detecting one or more events including aural and/or visual phenomena, the device comprising:

a controller coupled to a controller bus and a transfer bus;

an input multiplexer adapted to receive data describing *one or more parameters* of the event being detected, and to output data describing a selected one of the one or more parameters in response to a selection signal; and

a data processing block coupled to the multiplexer, the transfer

bus and the controller bus, the data processing block including:
a histogram unit coupled to the input portal and configured to calculate a histogram for the selected parameter;
a classification unit coupled to the input portal and the histogram unit, and configured to determine the data in the histogram that satisfy a selected criterion, and to generate an output accordingly, the classification unit supplying the output to the transfer bus;
and
a coincidence unit coupled to receive the output of the classification unit from the transfer bus and to receive selected coincidence criteria from the controller bus, the coincidence unit being configured to generate an enable signal for the histogram unit when the output of the classification unit satisfies the selected coincidence criterion.

Id. at 29:61–30:18 (emphases added).

D. Prior Art Relied Upon

Petitioner relies upon the prior art references listed below.

Pirim	WO 99/36893	July 22, 1999	(Ex. 1005)
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Tomitaka	US 5,546,125	Aug. 13, 1996	(Ex. 1007)
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Robert Barclay Rogers, *Real-Time Video Filtering with Bit-Slide Microprogrammable Processors*, Ph.D. Dissertation, New Mexico State University (Dec. 1978) (Ex. 1006, “Rogers” or “Rogers Dissertation”).

Alton L. Gilbert et al., *A Real-Time Video Tracking System*, PAMI-w, No. 1 IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, 47–56 (1980) (Ex. 1008, “Gilbert”).

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 3):

Challenged Claim(s)	Basis	Reference(s)
22	§ 103(a) ²	Pirim alone ³
1, 18, 19, and 29	§ 103(a)	Pirim and Tomitaka
1, 18, 19, 22, and 29	§ 103(a)	Rogers and Gilbert
1, 18, 19, 22, and 29	§ 103(a)	Tomitaka and Rogers

II. DISCUSSION

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). “Under a broadest reasonable interpretation, words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification and

² Because the claims at issue have a filing date prior to March 16, 2013, the effective date of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), we apply the pre-AIA version of 35 U.S.C. § 103 in this Decision.

³ Petitioner’s substantive analysis for claim 22 relies upon Pirim alone. Pet. 49–51.

prosecution history.” *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1062 (Fed. Cir. 2016).

In its Petition, Petitioner does not propose any specific claim construction, but merely argues that the claim terms should be interpreted according to their ordinary and customary meaning. Pet. 29–30. In its Preliminary Response, Patent Owner expressly proposed constructions for three claim elements: (1) “the histogram calculation units being configured to form a histogram representative of the parameter,” as recited in claim 1; (2) “a classification unit . . . configured to determine the data in the histogram that satisfy a selected criterion,” as recited in claim 18; and (3) “wherein classification is performed automatically by processing statistical information associated with the calculated histogram,” as recited in claim 18. Prelim. Resp. 10–21.

In our Institution Decision, we addressed each of those claim elements in turn. Dec. on Inst. 10–16. Our claim construction analysis from the Institution Decision is reproduced below in Subsections 1–3 of Section II.A of this Final Written Decision. After institution, neither party challenges any aspect of our claim constructions as to those three claim elements. *See generally* PO Resp.; Pet. Reply; Paper 37, 3 (noting “both parties affirmatively waive additional briefing”). Based on the entire record presented during trial, we discern no reason to alter our analysis or claim constructions of those claim elements in this Final Written Decision.

In its Response, Patent Owner additionally proffers construction for the limitation “an input multiplexer adapted to receive data describing one or more parameters of the event being detected, and to output data describing a

selected one of the one or more parameters in response to a selection signal,” as recited in claim 22. We address Patent Owner’s proposed construction of this claim limitation below in Subsection 4 of Section II.A of this Final Written Decision.

1. “*the [at least two] histogram calculation units being configured to form a histogram representative of the parameter,*” as recited in claim 1

In its Preliminary Response, Patent Owner proposes to construe “the [at least two] histogram calculation units being configured to form a histogram representative of the parameter” as “the at least two histogram calculation units being configured to each form a histogram representative of *at least one common parameter.*” Prelim. Resp. 10–14 (emphasis added). Although Petitioner did not submit an express construction for this claim limitation, Petitioner implicitly applies, in its prior art analysis, a claim construction that is consistent with Patent Owner’s proposed claim construction. See, e.g., Pet. 35, 36 (arguing that “it would have been obvious to modify Tomitaka such that *the two histogram units processed the same parameter*” (emphasis added)).

In support of its proposed construction, Patent Owner explains that each of the “histogram calculation units,” as recited in claim 1, must form a histogram representative of the *singular parameter*. Prelim. Resp. 11. Patent Owner also contends that the Specification describes that more than one polyvalent histogram calculation unit may be tasked to process one parameter. *Id.* at 12–14. Patent Owner directs our attention to Figure 32 of

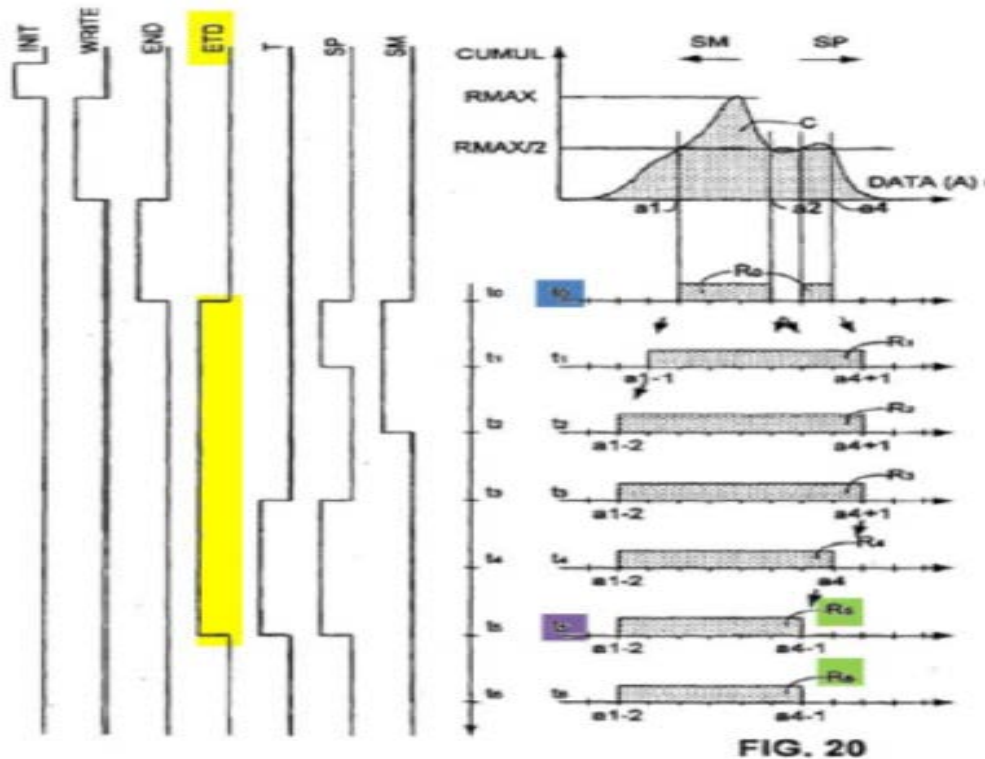
dedicated polyvalent histogram calculation units. *Id.* at 21:42–47.

In light of the Specification and the language of claim 1, we agree with Patent Owner, and adopt its proposed claim construction. In sum, we interpret the claim element “the [at least two] histogram calculation units being configured to form a histogram representative of the parameter” as “the at least two histogram calculation units being configured to each form a histogram representative of *at least one common parameter*.”

2. “*a classification unit . . . configured to determine the data in the histogram that satisfy a selected criterion,*” as recited in claim 18

In its Preliminary Response, Patent Owner proposes to construe “a *classification unit . . . configured to determine the data in the histogram that satisfy a selected criterion*” as “a classification unit . . . configured to determine the data to be included in the histogram based on satisfying a selected criterion.” Prelim. Resp. 14–17 (emphases added). As support for its proposed construction, Patent Owner asserts that the classifier (e.g., classifier unit 101, as shown in Figure 3), as described in the Specification, provides written description support for the claim term “classification unit.” *Id.* at 15–16 (citing Ex. 1001, 11:49–52, Fig. 3). Citing Figure 20 and relevant portions of the Specification, Patent Owner also asserts that the claim term “the data in the histogram” refers to “data that will be used to form the histogram.” *Id.* at 16 (citing Ex. 1001, 16:30–42, Fig. 20).

Figure 20 of the '293 patent is reproduced below with highlighting added by Patent Owner (Prelim. Resp. 17).



The highlighted Figure 20 above shows signals INIT, WRITE, END, ETD, T, SP, and SM on the left with reference to time axis t . Ex. 1001, 16:12–23. Signal INIT starts the processing cycle of a frame. *Id.* Signal WRITE controls the statistical calculations for the frame. *Id.* At the end of signal END, time t_0 (highlighted in blue), the data for the frame is represented by curve C, whose axes represent in abscissa the values of the parameter and in ordinate the number of occurrences, and the content of memory 118 is represented by distribution R_0 . *Id.* at 16:12–35. Signal ETD (highlighted in yellow), which starts at time t_0 , enables the calculation of the range in memory 118 of the classifier. *Id.* Figure 20 shows that signal ETD enables a multi-step calculation from time t_0 through t_5 (highlighted in

purple), resulting in the calculation of distribution R_5 (highlighted in green).
Id. at 16:36–50.

In light of the Specification, we agree with Patent Owner, and adopt its proposed claim construction because it is consistent with the portions of the Specification identified above. In sum, we interpret the claim element “a classification unit . . . configured to determine *the data in the histogram* that satisfy a selected criterion” as “a classification unit . . . configured to determine *the data to be included in the histogram* based on satisfying a selected criterion.”

3. “*wherein classification is performed automatically by processing statistical information associated with the calculated histogram,*”
as recited in claim 18

In its Preliminary Response, Patent Owner proposes to interpret “wherein classification is performed automatically by processing statistical information associated with the calculated histogram” as “wherein classification for the histogram being calculated is performed *using criteria that are updated using data characterizing the distribution of parameter values contained in the histogram.*” Prelim. Resp. 17–21 (emphasis added). According to Patent Owner, the classification criteria for a histogram are updated in real-time while data are being added and the histogram is being calculated. *Id.* (citing Ex. 1001, 11:14–32). Patent Owner further contends that the “statistical information” used for automatic classification must be associated with *the same histogram* for which the classification applies. *Id.* at 20, 39.

As Patent Owner notes, the Specification describes that the statistical information for a histogram of a specific frame and parameter is calculated in parallel with the formation of the histogram. Ex. 1001, 9:51–10:14. The Specification also discloses that the memory of the classifier is updated automatically in real-time and the classification is performed using the statistical information of the histogram. *Id.* at 11:14–52, 12:16–42.

Figure 13a of the '293 patent illustrates an example of a real-time updating classifier, and is reproduced below.

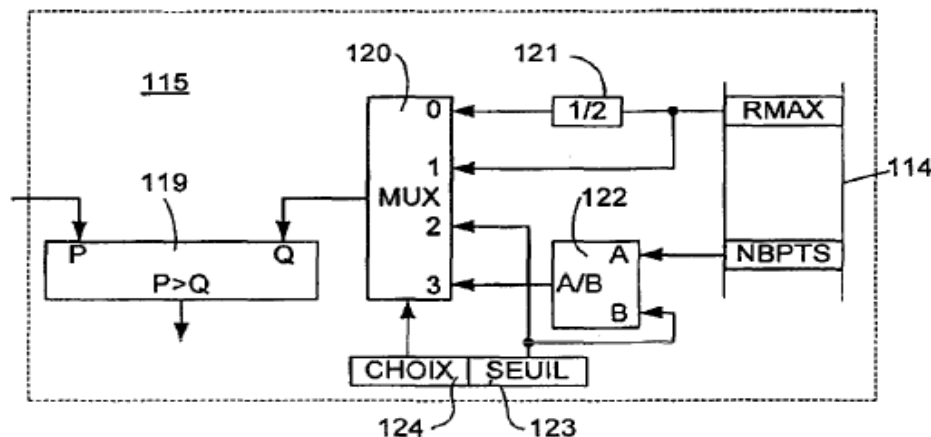


Figure 13a depicts a classifier having multiplexer 120 and comparator 119 that performs a comparison of parameter P to statistical value Q. *Id.* at 12:16–42. Statistical value Q is derived from the statistical information of the histogram being calculated that stored in analysis output register 104, 114⁴ (e.g., RMAX or RMAX/2). *Id.*

⁴ Analysis output register 114, as shown in Figure 13a, is identified improperly with element number 104 in the written description of the Specification. See Ex. 1001, 12:16–39.

We further observe that “the histogram” in this claim element refers back to the histogram for which the classification unit determines data that satisfy a selected criterion. Thus, in light of the Specification and the language of claim 18, we agree with Patent Owner that the “statistical information” used for automatic classification must be associated with *the same histogram* for which the classification applies. We, however, determine that we need not further construe this phrase to resolve the issues before us. *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”).

4. “*an input multiplexer adapted to receive data describing one or more parameters,*” as recited in claim 22

In its Response, Patent Owner argues that the limitation “an input multiplexer adapted to receive data describing *one or more parameters* of the event being detected, and to output data describing a selected one of the one or more parameters in response to a selection signal,” as recited in claim 22, requires a multiplexer that is “capable of receiving data from *multiple parameters* and then outputting data based upon *selecting from among such parameters.*” PO Resp. 14–19, 22 (emphases added).⁵ Patent Owner contends that its construction is supported by the claim language itself, the

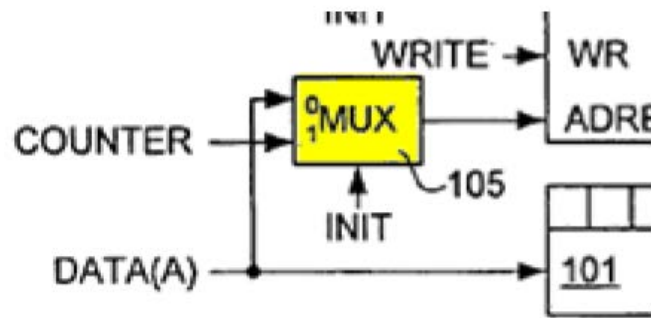
⁵ Patent Owner has filed, as Exhibit 2012, the claim construction opinion and order from the related district court case. Patent Owner, however, does not rely on the order to support any of Patent Owner’s constructions. We have considered the order.

Specification, and other claims, and that its construction is consistent with how one of ordinary skill in the art would have understood the claim language, citing to the testimony of Dr. Agouris for support. *Id.* (citing Ex. 2009 ¶¶ 25–30).

Petitioner argues that Patent Owner’s construction contradicts the plain and ordinary meaning of the claim language, reading “out all of the disclosed embodiments except for one.” Pet. Reply 2–10. Petitioner also argues that Patent Owner’s construction is not supported by the extrinsic evidence relied upon by Patent Owner. *Id.* at 10–11.

We begin our claim construction analysis with the plain language of the claim. In particular, the plain and ordinary meaning of “an input multiplexer adapted to receive data describing *one or more parameters* of the event being detected and to output data describing a selected one of the *one or more parameters* in response to a selection signal” encompasses two alternative structures. Ex. 1001, 29:64–67 (emphases added). The first alternative structure includes a “single parameter” multiplexer. The second alternative structure includes a “multiple parameters” multiplexer. The Specification confirms our understanding of the plain and ordinary meaning of the claim language because the Specification discloses both alternative structures. *Id.* at 2:51–61; 9:1–6, 11:14–48, 17:55–18:23, 20:58–66, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, 25, 31a.

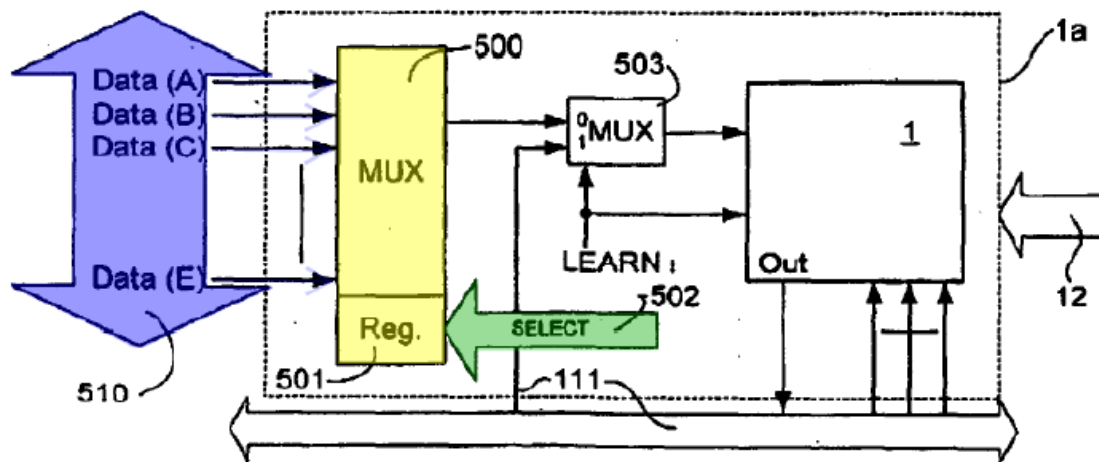
Notably, it is undisputed that the embodiment shown in Figure 3 of the ’293 patent discloses “single parameter” multiplexers. PO Resp. 16–17; Pet. Reply 5, 10. An excerpt of Figure 3 is reproduced below (highlighting added by Petitioner).



The portion of Figure 3 reproduced above depicts multiplexer 105 (in yellow) having two input signals: (1) DATA(A) signal for a single parameter, and (2) COUNTER signal. Ex. 1001, 8:53–64. Multiplexer 105 also receives binary selection control signal INIT, and provides one output signal. *Id.* at 9:1–2. The value of the output signal corresponds to one of the inputs (COUNTER signal) where the selection control signal is equal to one value (e.g., 1), and the other input (DATA(A)) where the control signal is equal to a different value (e.g., 0). *Id.* at 9:2–6. In addition, the “Summary of the Invention” section and the embodiments shown in Figures 4, 12, 13d, 14, 15a, 15b, 17, and 25 of the ’293 patent also disclose “single parameter” multiplexers. *Id.* at 2:51–61 (disclosing “a data input multiplexer with two inputs,” a counting signal COUNTER and a signal DATA(A) for a single parameter), 11:14–48, 17:55–18:23, Figs. 4, 12, 13d, 14, 15a, 15b, 17, 25.

It also is undisputed that the embodiment shown in Figure 31a discloses a “multiple parameter” multiplexer. PO Resp. 15–16; Pet. Reply 4. Figure 31a is reproduced below (highlighting added by Patent Owner).

FIG. 31a



As shown above in highlighted Figure 31a, data for multiple parameters Data (A) . . . and Data (E) (in purple) feed into multiplexer 500 (in yellow). Ex. 1001, 20:58–60.

Therefore, in light of the Specification, a person of ordinary skill in the art would have understood that the plain and ordinary meaning of the disputed language in claim 22 encompasses these two alternative structures.

Interpreting the disputed claim limitation to require a multiplexer “be capable of receiving data from multiple parameters and then outputting data based upon selecting from among such parameters,” as urged by Patent Owner (PO Resp. 14–15, 22), would unduly limit the claim scope to only the second structure (a “multiple parameter” multiplexer), ignoring the first alternative structure (a “single parameter” multiplexer). Such a construction directly contradicts the plain and ordinary meaning of the claim language. As our reviewing court has explained, “[t]he construction that stays true to the claim language and most naturally aligns with the patent’s description of

the invention will be, in the end, the correct construction.” *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998).

Patent Owner’s argument that the “multiplexer must be capable of receiving *both* ‘one’ or ‘more’ than one parameter” is inapposite. PO Resp. 14–17 (emphases added). As used in the claim, the word “or” is used to link two alternatives. Nothing in the Specification requires us to construe “or” to mean “and.” As discussed above, the Specification, in fact, discloses both alternative structures. Ex. 1001, 2:51–61, 9:1–6, 11:14–48, 17:55–18:23, 20:58–66, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, 25, 31a. We, therefore, decline to rewrite the claim language “one or more parameters” to be “multiple parameters.”

We also do not agree with Patent Owner’s argument that, if the claim were not limited to only “multiple parameter” multiplexers, there would be no need to include “one or more” in the claim and the language could simply state “a” instead of “one or more.” PO Resp. 14–15. Further, Patent Owner’s argument that the claim language could have stated “output data describing the parameter” or “output data describing the selected parameter” also is misplaced. *Id.* The fact that a claim could be rewritten with less words does not provide a sufficient reason to limit the claim scope unduly to only one of the alternative structures, contrary to the plain and ordinary meaning of the claim language that sets forth two alternative structures.

As noted by our reviewing court, we should “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). We do not discern, nor does

Patent Owner argue, that there is such lexicography or disavowal here. See *Thorner v. Sony Comput. Entm't A. LLC*, 669 F.3d 1362, 1367–68 (Fed. Cir. 2012) (“Both [lexicography and disclaimer] require a clear and explicit statement by the patentee.”); *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) (To act as a lexicographer, the patentee must “clearly set forth a definition of the disputed claim term.”). The Specification does not describe the invention as limited to “multiple parameter” multiplexers. Instead, the Specification repeatedly describes embodiments that include “single parameter” multiplexers. Ex. 1001, 2:51–61, 9:1–6, 11:14–48, 17:55–18:23, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, and 25.

We also do not find the claim language “to output data describing a selected one of *the one or more parameters* in response to a selection signal” supports Patent Owner’s argument that a selection must be made from among the *multiple parameters*. PO Resp. 14–15 (emphasis added). This claim language confirms that the plain and ordinary meaning sets forth two alternative structures. Patent Owner’s argument again contradicts the plain and ordinary meaning of the claim language. Moreover, the Specification discloses that, in the “single parameter” multiplexer embodiments, the output selection is made among two input signals (a data signal for a single parameter DATA(A) and a counter signal), as opposed to in the “multiple parameter” multiplexer, the selection is made among the multiple parameters. Compare Ex. 1001, 2:51–61, 9:1–6, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, 25, with *id.* at Fig. 31a. As discussed above regarding the “single parameter” multiplexer shown in Figure 3, the value of the output signal

corresponds to one of the inputs (COUNTER signal) where the selection control signal is equal to one value (e.g., 1), and the other input (DATA(A)) where the control signal is equal to a different value (e.g., 0). *Id.* at 9:2–6. Therefore, neither the claim language nor the Specification supports Patent Owner’s argument that a selection must be made from among the *multiple parameters*.

Patent Owner’s construction also would improperly import a limitation from the “multiple parameter” embodiment shown in Figure 31a into the claim, as well as read out other preferred embodiments disclosed in the Specification (Figures 4, 12, 13d, 14, 15a, 15b, 17, and 25) and the embodiment described in the “Summary of the Invention” section (*id.* at 2:51–61). Nothing in the claim language suggests that claim 22 is directed only to the embodiment shown in Figure 31a. Our reviewing court “has repeatedly cautioned 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”). Furthermore, “a claim interpretation that excludes a preferred embodiment from the scope of the claim is rarely, if ever, correct.” *On-Line Techs., Inc. v. Bodenseewerk Perkin-Elmer GmbH*, 386 F.3d 1133, 1138 (Fed. Cir. 2004).

In light of the foregoing, Patent Owner’s arguments (PO Resp. 14–17) that the claim language itself and the Specification support its claim construction are unavailing.

We also are not convinced by Patent Owner’s argument that its proposed construction is supported by reference to different types of multiplexers identified in claims 3, 4, 12, and 13, under the doctrine of claim differentiation. *Id.* at 17–18. As our reviewing court has explained, the doctrine of claim differentiation “is based on the common sense notion that different words or phrases used in separate claims are presumed to indicate that the claims have different meanings and scope.” *Andersen Corp. v. Fiber Composites, LLC*, 474 F.3d 1361, 1369 (Fed. Cir. 2007). The doctrine is applied to resolve ambiguity when a claim would otherwise be superfluous. *See id.* at 1369–70 (“To the extent that the absence of such difference in meaning and scope would make a claim superfluous, the doctrine of claim differentiation states the presumption that the difference between claims is significant.”). Importantly, our reviewing court “has declined to apply the doctrine of claim differentiation where the claims are not otherwise identical in scope,” as here. *Apple, Inc. v. Ameranth, Inc.*, 842 F.3d 1229, 1238 (Fed. Cir. 2016); *see also Andersen*, 474 F.3d at 1370 (holding that another “reason for not applying the doctrine of claim differentiation in this case is that the []claims are not otherwise identical . . . [i]nstead, there are numerous other differences varying the scope of the claimed subject matter”). Here, independent claim 3, from which claims 4, 12, and 13 depend, includes numerous limitations not recited by independent claim 22—e.g., “two or more histogram calculation units” and “a counter of each address in the memory corresponds to the value d of a_{ijT} at a given instant, which is incremented by one unit when the time coincidences unit outputs a positive global enabling signal.” *Compare* Ex. 1001, 26:65–27:59,

with id. at 29:59–30:18. Therefore, Patent Owner’s reliance on the doctrine of claim differentiation is misplaced.

Lastly, we do not agree with Patent Owner’s argument that its claim construction is consistent with how a person of ordinary skill in the art would have understood the claim language. PO Resp. 18–19 (citing Ex. 2009 ¶ 30; Ex. 2011). Patent Owner’s argument and Dr. Agouris’s testimony are conclusory, conflating parameters with input signals. The dictionary definition relied upon by Patent Owner and Dr. Agouris does not support Patent Owner’s claim construction. Ex. 2011, 3. The cited definition, defining “multiplexer” as a “device that allows the interleaving of two or more *signals* to a single line or terminal” or a “device for selecting one of a number of *inputs* and switching its information to the output,” is silent as to the number of parameters in the input signals. *Id.* (emphases added). Nothing in that definition requires a multiplexer to have the capability of receiving data from *multiple parameters* and outputting data based upon selecting from among *the multiple parameters*, as Patent Owner implies. Instead, that definition of “multiplexer” is consistent with the multiplexers described in the Specification, including “single parameter” multiplexers that have two input signals, a data signal for a *single parameter* (DATA(A)) and a counter signal, and the output selection is made among these two input signals, as shown in Figures 3, 4, 12, 13d, 14, 15a, 15b, 17, and 25, and described in the “Summary of the Invention” section. Ex. 1001, 2:51–61, 9:1–6, 11:14–48, 17:55–18:23, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, 25.

For the foregoing reasons, we decline to adopt Patent Owner’s claim construction. Rather, in light of the Specification, we construe the “multiplexer” claim limitation in accordance with its plain and ordinary meaning to require either a “single parameter” multiplexer or a “multiple parameters” multiplexer, not both.

B. Principles of Law

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) when in evidence, objective evidence of non-obviousness.⁶ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are

⁶ No objective evidence of non-obviousness has been presented in this proceeding.

made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey–Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). In that regard, we do not observe meaningful differences between the parties’ assessments of a person of ordinary skill in the art at the time of the invention. Pet. 28–29; PO Resp. 13. For instance, both the parties agree that such an artisan would have had a degree in electrical engineering or a related field and experience in the field of image processing. *Id.* We further 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). Our analysis in this Decision is supported by either assessment.

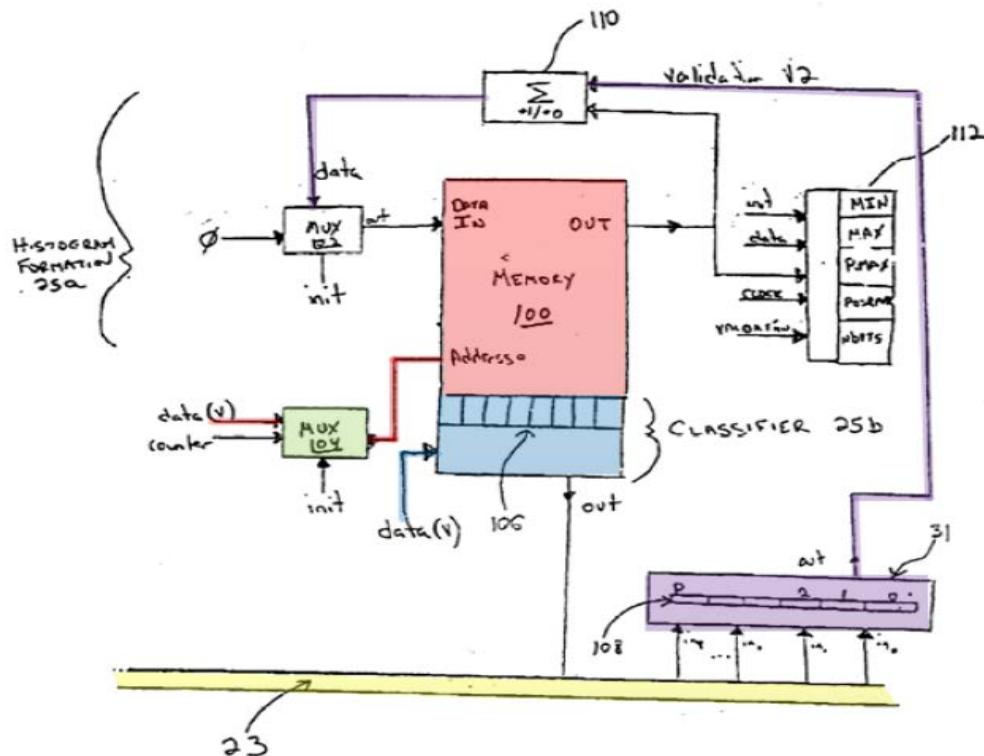
D. Obviousness over Pirim alone

Petitioner asserts that claim 22 is unpatentable under 35 U.S.C. § 103(a) as obvious over Pirim alone, citing to the Declaration of Dr. Hart for support. Pet. 30–53; Ex. 1002 ¶¶ 63–107. Patent Owner opposes relying upon the Declaration of Dr. Agouris (Ex. 2009) for support. PO Resp. 22–26. In our discussion below, we first provide a brief overview of Pirim, and then we address the parties’ contentions in turn, focusing on the disputed claim limitations.

Overview of Pirim

The parties do not dispute that Pirim qualifies as prior art under 35 U.S.C. § 102(b) because it was published on July 22, 1999, more than

one year from the filing date of the '293 patent (February 23, 2001). Pet. 8; *see generally* PO Resp. Pirim discloses an image processing system for detecting whether a driver is falling asleep by acquiring pictures of the driver and forming histograms to analyze opening and closing the driver's eyes. Ex. 1005, 5.⁷ Figure 14 of Pirim depicts a histogram formation block and is reproduced below with highlighting added by Petitioner (Pet. 10).



As shown in highlighted Figure 14 above, histogram formation block 25 has histogram forming portion 25a, which includes memory 100 (in red) and classifier 25b (in blue) for selecting the criteria of pixels for which the

⁷ All references to the page numbers in Pirim are the page numbers in Exhibit 1005 inserted by Petitioner in the bottom, right-hand corner of each page—not the original page numbers that appear in the middle of each page.

histogram is to be formed. Ex. 1005, 28–29. Classifier 25b enables only data having selected classification criteria to be considered further. *Id.* at 29. The output of classifier 25b proceeds to bus 23 (in yellow), which also carries the output of other classifiers in the system. *Id.* at 31. These signals proceed to validation unit 31 (in purple), which generates a validation signal. *Id.* at 30.

A device for detecting an event and controller

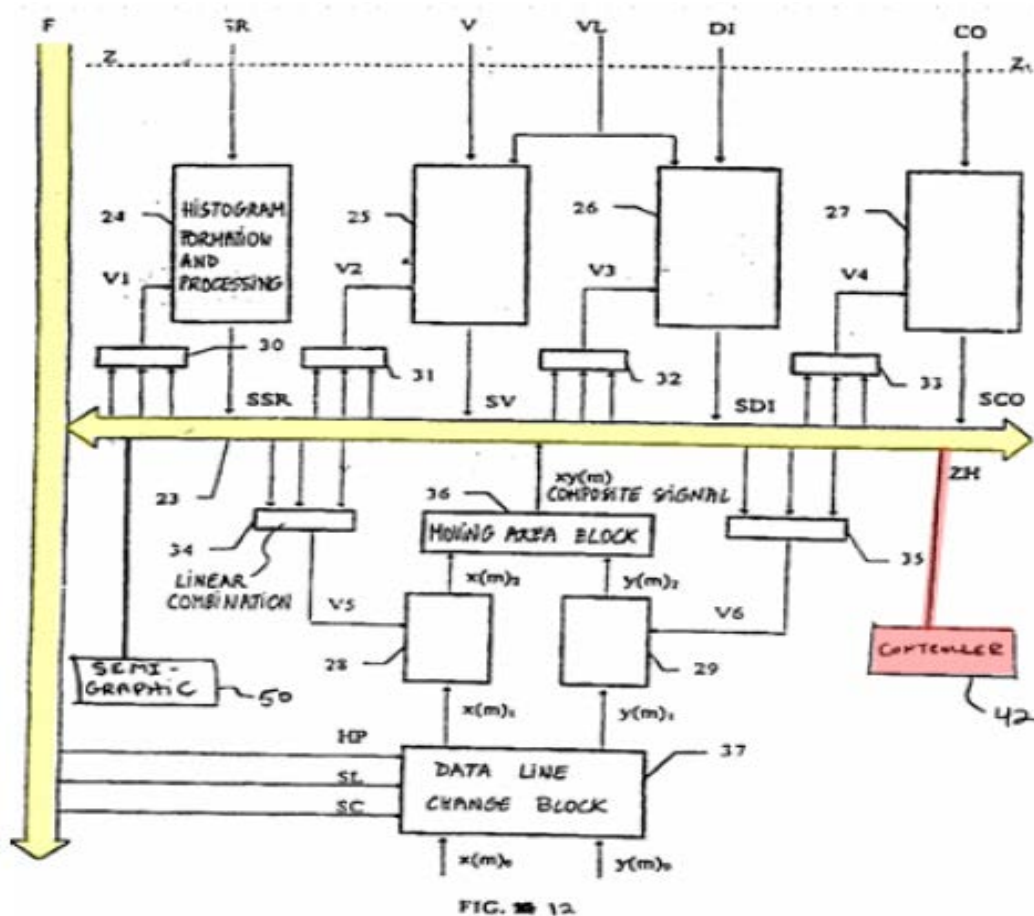
Petitioner relies on Pirim to teach or suggest all of the limitations of claim 22, citing to Dr. Hart’s testimony for support. Pet. 30–31, 49–51; Ex. 1002 ¶¶ 80–96. Upon review of Petitioner’s detailed explanations and Dr. Hart’s supporting testimony, we determine that Petitioner has shown sufficiently that Pirim teaches or suggests every limitation of claim 22, thereby rendering claim 22 obvious.

Notably, Petitioner explains that Pirim teaches a “device for detecting one or more events including aural and/or visual phenomena,” as recited in the preamble of claim 22.⁸ Pet. 40, 49. Petitioner specifically notes that Pirim discloses that “[i]n a process of detecting a person falling asleep, an image of the face of the person is acquired,” and that “[p]ixels of the image having characteristics corresponding to an eye of the person are selected and a histogram is formed of the selected pixels.” Ex. 1005, [57].

Petitioner also asserts that Pirim teaches “a controller coupled to a controller bus and a transfer bus,” as recited in claim 22. Pet. 40–41, 49.

⁸ Petitioner treats the preamble of claim 22 as limiting. Pet. 40, 49. Patent Owner does not argue otherwise. *See generally* PO Resp.

Petitioner cites to Figure 12 of Pirim (reproduced below with highlighting added by Petitioner), which depicts a histogram processor. *Id.*



Petitioner explains that the histogram processor shown in Figure 12 of Pirim above includes controller 42 (in red) and controller and transfer buses (in red and yellow). *Id.*; Ex. 1005, 27 (“[H]istogram processor 22a includes a bus 23 for communicating signals between the various components thereof, for receiving input commands from a controller 42 and for transmitting output signals to controller 42.”), 75, Fig. 12. Petitioner also explains that the buses connect controller 42 to histogram blocks 24–29 and to validation blocks 30–35. Pet. 40–41. Petitioner asserts that histogram

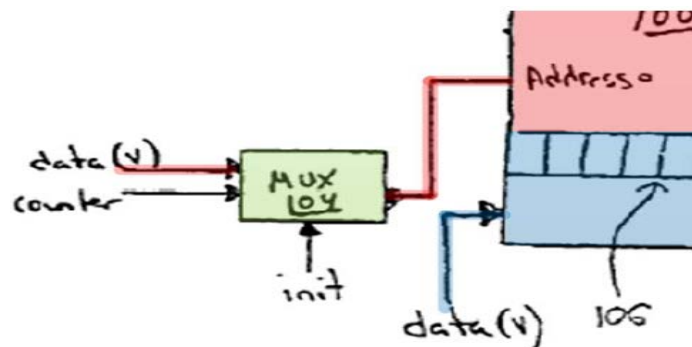
blocks 24–29 include classifiers and validation blocks 30–35 are coincidence units. *Id.*

Based on the evidence before us, we determine that Petitioner has established by a preponderance of the evidence that Pirim teaches or suggests a “device for detecting one or more evidence including aural and/or visual phenomena” and “a controller coupled to a controller bus and a transfer bus,” as required by claim 22. Patent Owner does not present separate, specific arguments for these limitations. *See generally* PO Resp.

Input multiplexer

Claim 22 also recites “an input multiplexer adapted to receive data describing one or more parameters of the event being detected, and to output data describing a selected one of the one or more parameters in response to a selection signal.” Petitioner asserts that Pirim teaches or suggests this “multiplexer” limitation, citing to Figure 14 of Pirim. Pet. 50; Ex. 1005, 77.

An excerpt of Figure 14 of Pirim is reproduced below with highlighting added by Petitioner.



Petitioner explains that multiplexer 104 (in green), as shown in Figure 14 of Pirim above, receives one parameter, data(V) of the event being

detected, and, in response to selection signal “init,” multiplexer 104 outputs the selected data(V) signal. Pet. 50.

Patent Owner counters that Pirim does not disclose the claimed multiplexer because Pirim’s multiplexer does not have the capability of receiving data from *multiple parameters*. PO Resp. 1–2, 22–23 (citing Ex. 2009 ¶¶ 36–42). Patent Owner also contends that a person of ordinary skill in the art would not have modified Pirim’s “multiplexer to include more than one parameter data signal.” *Id.* at 2, 24–25 (citing Ex. 2009 ¶¶ 40–47). Patent Owner further avers that, in response to the “init” control signal, Pirim resets the data in the histogram and blocks the data(V), not outputting the selected data(V) signal. *Id.* at 23–24 (citing Ex. 2009 ¶¶ 40–42). According to Patent Owner, Pirim’s “init” control signal is not a “selection signal” because the parameter passes through multiplexer 104 only when the “init” control signal is “off,” not “on.” *Id.*

The parties’ dispute mainly centers on (1) whether Pirim’s “single parameter” multiplexer meets the aforementioned “multiplexer” claim limitation, and (2) whether Pirim’s binary “init” control signal teaches a “selection signal,” as required by claim 22.

Having reviewed the parties’ contentions and supporting evidence, we determine that Petitioner has established sufficiently that Pirim discloses an input multiplexer and a selection signal, as recited in claim 22. Patent Owner’s arguments and supporting evidence do not undermine Petitioner’s showing.

At the outset, Patent Owner’s arguments rest on its unduly narrow claim construction, which we decline to adopt for the reasons discussed

above in Section II.A. Notably, Patent Owner’s construction, requiring a multiplexer that is “capable of receiving data from *multiple parameters* and then outputting data based upon *selecting from among such parameters*” (PO Resp. 14–19, 22 (emphases added)), would improperly import limitations from the embodiment disclosed in Figure 31(a) of the ’293 patent into the claim, contradict the plain and ordinary meaning of the claim language, and read out other embodiments disclosed in the Specification (Figures 3, 4, 12, 13d, 14, 15a, 15b, 17, and 25) and the embodiment described in the “Summary of the Invention” section (Ex. 1001, 2:51–61).

As stated above, in light of the Specification, we construe the “multiplexer” claim limitation in accordance with its plain and ordinary meaning to require either a “single parameter” multiplexer or a “multiple parameters” multiplexer, not both. The Specification confirms our understanding of the plain and ordinary meaning of the claim language because the Specification discloses both alternative structures. *Id.* at 2:51–61; 9:1–6, 11:14–48, 17:55–18:23, 20:58–66, Figs. 3, 4, 12, 13d, 14, 15a, 15b, 17, 25, 31a.

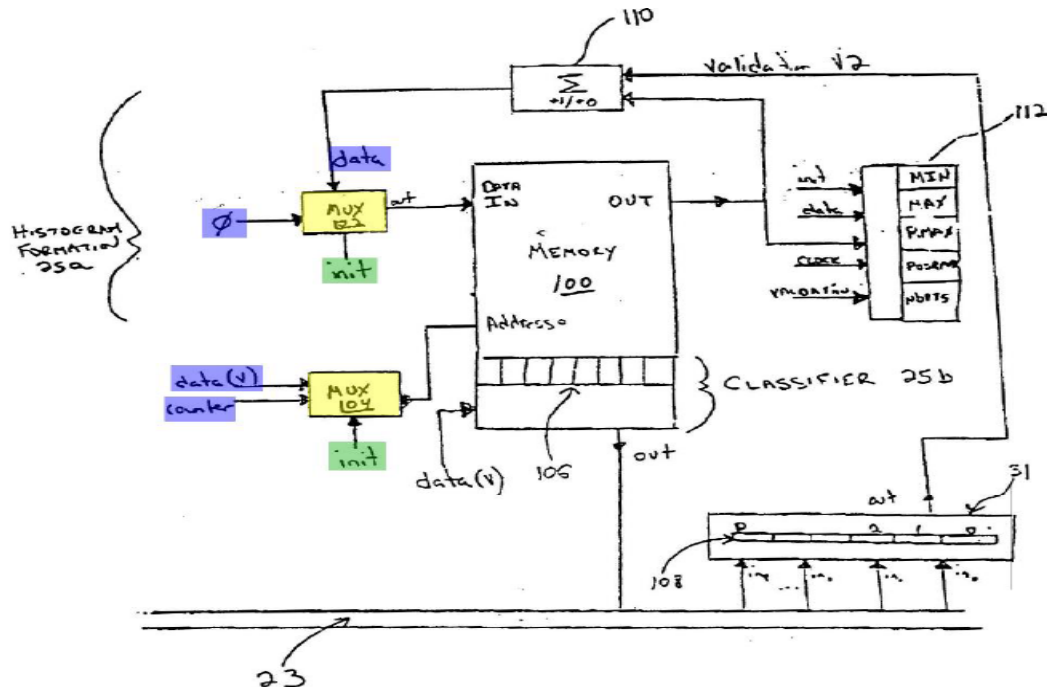
Consequently, Pirim teaches or suggests the dispute limitation if it teaches or suggests *either* a “single parameter” multiplexer *or* a “multiple parameters” multiplexer. *Cf Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001) (holding that “[w]hen a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within the scope of the claim is known in the prior art”) (citing *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1984)).

Here, we determine that Petitioner has shown sufficiently that Pirim discloses a “single parameter” multiplexer. As Petitioner notes, Figure 14 of Pirim shows that multiplexer 104 receives two input signals (a data(V) signal and a counter signal), and, in response to selection signal “init,” multiplexer 104 outputs one of the input signals, including the data(V) signal. Pet. 50; Ex. 1005, 29 (stating that, if “the *init* line is set to zero . . . the V data [would be] sent to the Address line of memory 100”), 77, Fig. 14. Therefore, Patent Owner’s argument that the claim requires a multiplexer that is capable of receiving data for *multiple parameters* and then selecting output data from one among *those parameters* is unavailing. Further, Patent Owner’s contention that a person of ordinary skill in the art would not have modified Pirim’s “multiplexer to include more than one parameter data signal” also is inapposite. Such a modification was not asserted in the Petition. Nor is it necessary for Pirim to render claim 22 obvious under our claim interpretation.

We also do not agree with Patent Owner’s argument that, in response to the “init” control signal, Pirim resets the data in the histogram and blocks the data(V), not outputting the selected data(V) signal. PO Resp. 23–24. That argument is conclusory and not supported by Pirim’s disclosure. In fact, it contradicts the testimony of Patent Owner’s own expert, Dr. Agouris, and Patent Owner’s understanding of Pirim.

As Petitioner and Dr. Hart explain, Figure 14 of Pirim discloses multiplexer 104 that receives one parameter, data(V), and in response to the “init” control signal, the multiplexer outputs the selected data(V) signal.

Pet. 50; Ex. 1002 ¶ 96 (citing Ex. 1005, 77). Figure 14 of Pirim is reproduced below with highlighting added by Dr. Agouris. Ex. 2009 ¶ 39.



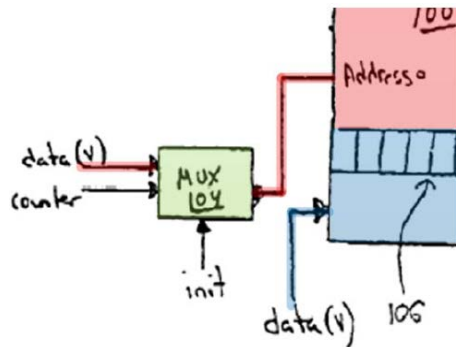
In regard to Figure 14 of Pirim above, Dr. Agouris confirms that “Pirim’s multiplexers 102 and 104 (yellow) both take only ‘init’ (green) as the control signal to *determine which of the two input signal[s] (blue) to output,*” and that “[t]he two possible input data signals for multiplexer 104 are data(V), i.e. the ‘V’ or *velocity parameter data*, and the Counter signal.” *Id.* ¶ 40 (citing Ex. 1005, 28–29) (emphases added). Patent Owner also concedes that “each multiplexer of Pirim relies on *a binary signal to determine whether the single parameter data is passed to the histogram unit or instead whether a ‘counter’ or ‘zero’ signal is passed.*” PO Resp. 2 (emphases added). Hence, Patent Owner’s argument that, in response to the “init” control signal, Pirim resets the data in the histogram and blocks the

data(V), not outputting the selected data(V) signal (PO Resp. 23–24), is unavailing.

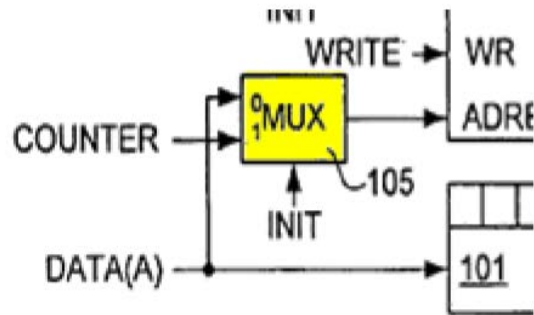
In addition, we do not agree with Patent Owner’s argument that Pirim’s “init” control signal is not a “selection signal” because the parameter passes through multiplexer 104 only when the “init” control signal is “off,” not “on.” PO Resp. 23–24 (citing Ex. 2009 ¶¶ 40–42). That argument and Dr. Agouris’s supporting testimony are based on the premise that, when the “init” control signal is set to the value of “zero,” the “init” control signal is “off,” not “on.” Nothing in Pirim suggests that the “init” control signal is “off” when the “init” control signal is set to the value of “zero.” Ex. 1005, 29. In fact, Pirim’s “init” control signal is similar to the “INIT” control signal disclosed in Figure 3 of the ’293 patent. Like the “INIT” control signal in the ’293 patent, Pirim’s “init” control signal also is a binary selection control signal. *Compare* Ex. 1005, 29, 77, Fig. 14, *with* Ex. 1001, 9:1–6, Fig. 3.

A side-by-side comparison of Pirim’s multiplexer in Figure 14 (an excerpt with highlighting added by Petitioner (Pet. 50) is reproduced on the left) and the multiplexer in Figure 3 of the ’293 patent (an excerpt with highlighting added by Petitioner (Reply 10) is reproduced on the right) is provided below.

The multiplexer shown in
Pirim's Figure 14



The multiplexer in Figure 3
of the '293 patent



As shown above in the side-by-side comparison of Pirim's multiplexer in Figure 14 (on the left) and the multiplexer disclosed in Figure 3 of the '293 patent (on the right), Pirim's "init" control signal operates in a very similar manner as the "INIT" control signal disclosed in Figure 3 of the '293 patent. Like the multiplexer in Figure 3 of the '293 patent, Pirim's output signal corresponds to one of the inputs (the Counter signal) where the control signal is equal to one value ("1"), and the output signal corresponds to the other input (data (V)) where the control signal is equal to a different value ("0"). Ex. 1005, 29, 77, Fig. 14; Ex. 1001, 9:1-6, Fig. 3.

Moreover, as discussed above, Dr. Agouris confirms that "Pirim's multiplexers 102 and 104 (yellow) both take only 'init' (green) as the control signal to determine which of the two input signal[s] (blue) to output," and that "[t]he two possible input data signals for multiplexer 104 are data(V), i.e. the 'V' or *velocity parameter data*, and the Counter signal." Ex. 2009 ¶ 40 (citing Ex. 1005, 28-29) (emphases added). Patent Owner also concedes that "each multiplexer of Pirim relies on a *binary signal to determine whether the single parameter data is passed to the histogram unit*

or instead whether a ‘counter’ or ‘zero’ signal is passed.” PO Resp. 2 (emphases added). Accordingly, we are convinced that an ordinarily skilled artisan would have understood that Pirim’s “init” control signal teaches or suggests a “selection signal,” as recited in claim 22.

For the foregoing reasons, we determine that Petitioner has established by a preponderance of the evidence that Pirim teaches or suggests “an input multiplexer adapted to receive data describing one or more parameters of the event being detected, and to output data describing a selected one of the one or more parameters in response to a selection signal,” as recited in claim 22.

Data processing block including a histogram unit, classification unit, and coincidence unit

We also have considered Petitioner’s detailed explanations and supporting evidence as to the remaining limitations of claim 22. Pet. 40–45, 50–51; Ex. 1002 ¶¶ 77–78, 80–86, 94–101; Ex. 1005, 27–31, 75, 77, Figs. 12, 14. These limitations mainly require a data processing block that includes a histogram unit, a classification unit, and a coincidence unit. We agree with Petitioner’s explanations and Dr. Hart’s unrebutted testimony, which is supported by Pirim’s disclosure. We credit Dr. Hart’s testimony as it is consistent with Pirim, and adopt Dr. Hart’s analysis, as our own. Patent Owner does not address these remaining limitations with separate, specific arguments. PO Resp. 22–26. Based on the evidence in this entire trial, we determine that Petitioner has established adequately that Pirim teaches or suggests these limitations.

Notably, for the “data processing block” limitation, Petitioner explains (Pet. 40–45, 50–51) that Figure 14 of Pirim depicts components of a data processing block, including histogram memory 100, classifier 25b (classification unit), and validation block 31 (coincidence unit). Ex. 1005, 77, Fig. 14. Referring to Figures 12 and 14, Pirim states that “[h]istogram formation block 25 includes a histogram forming portion 25a, which forms the histogram for that block, and a classifier 25b, for selecting the criteria of pixels for which the histogram is to be formed.” Ex. 1005, 28, Figs. 12, 14. As shown in Figures 12 and 14, histogram forming portion 25a (histogram unit) includes histogram memory 100, and is coupled to multiplexer 104 and buses (transfer and controller buses) for connecting to controller 42. *Id.* at 27 (“[H]istogram processor 22a includes a bus 23 for communicating signals between the various components thereof, for receiving input commands from a controller 42 and for transmitting output signals to controller 42.”). Based on the evidence before us, we determine that Petitioner has shown adequately that Pirim teaches or suggests “a data processing block coupled to the multiplexer, the transfer bus and the controller bus” and the data processing clock includes a histogram unit, a classification unit, and a coincidence unit, as recited in claim 22.

For the limitation “a histogram unit coupled to the input portal and configured to calculate a histogram for the selected parameter,” Petitioner explains that Figure 14 of Pirim shows an input portal, in which input data(V) describes velocity pixels in scene, and that Figure 12 of Pirim shows histogram formation units 24–29 coupled to the input portal and configured to calculate a histogram for the selected parameter. Pet. 41–43, 49–51;

Ex. 1002 ¶¶ 83–84; Ex. 1005, 27 (“Histogram formation block 25 receives speed signal V and enables a histogram to be formed for the various speeds present in a frame.”), 75, 77, Figs. 12, 14. Upon our review of Pirim, we determine that Petitioner has demonstrated sufficiently that Pirim describes “a histogram unit,” as recited in claim 22.

For the “classification unit” limitation, Petitioner, referring to Figure 14 of Pirim, asserts that Pirim’s classifier 25b receives the data(V) input, which also is routed to histogram memory 100, and that classifier 25b compares the data(V) to the criterion programmed in register 106 and generates an output to bus 23 (the transfer bus). Pet. 38–39, 42–43, 51; Ex. 1002 ¶¶ 77–79; Ex. 1005, 29–30, 77, Fig. 14. Indeed, as shown in Figure 14 of Pirim, classifier 25b is coupled to an input portal to receive data(V) and coupled to histogram memory 100 of histogram formation portion 25a. Ex. 1005, 77, Fig. 14. Pirim states that “[c]lassifier 25b enables only data having selected classification criteria to be considered further, meaning to possibly be included in the histograms formed histogram formation blocks 24–29.” *Id.* at 29. Based on the evidence in this entire trial, Petitioner has shown adequately that Pirim teaches or suggests “a classification unit coupled to the input portal and the histogram unit, and configured to determine the data in the histogram that satisfy a selected criterion, and to generate an output accordingly, the classification unit supplying the output to the transfer bus,” as recited by claim 22.

With respect to the “coincidence unit” limitation, Petitioner explains, referring to Figure 14 of Pirim, that the output of classifier 25b proceeds to bus 23 and then to validation unit 31 (coincidence unit). Pet. 38–39, 44–45,

51; Ex. 1002 ¶¶ 77–79, 86, 94–101; Ex. 1005, 29–31, Fig. 14. Petitioner further explains that coincidence unit 31 determines whether the classification outputs meet a validation condition and, if so, enables histogram memory 100 via validation signal V2 to accumulate that data point. Pet. 39, 44–45; Ex. 1005, 30. Indeed, Pirim states that “[e]ach validation unit generates a validation signal which is communicated to its associated histogram formation block 24–29” and that “[t]he validation signal determines, for each incoming pixel, whether the histogram formation block will utilize that pixel in forming its histogram.” Ex. 1005, 30. As Petitioner also notes, “validation unit 31 includes a register block 108 having a register associated with each histogram formation block” and the “content of each register in register block 108 is a binary value that may be set by a user or by a computer controller.” Pet. 44–45; Ex. 1005, 31, 77, Fig. 14. Dr. Hart testifies that one of ordinary skill in the art would have known that controllers communicate over busses, and therefore, would have recognized that “the data path by which the controller sets the validation unit registers is the claimed controller bus by which the coincidence criteria are sent.” Ex. 1002 ¶ 86.

Given the evidence in this trial, we determine that Petitioner has shown sufficiently that Pirim teaches or suggests “a coincidence unit coupled to receive the output of the classification unit from the transfer bus and to receive selected coincidence criteria from the controller bus, the coincidence unit being configured to generate an enable signal for the histogram unit when the output of the classification unit satisfies the selected coincidence criterion,” as recited in claim 22.

Conclusion

For the foregoing reasons, Petitioner has demonstrated by a preponderance of the evidence that claim 22 of the '293 patent is unpatentable under § 103(a) as obvious over Pirim.

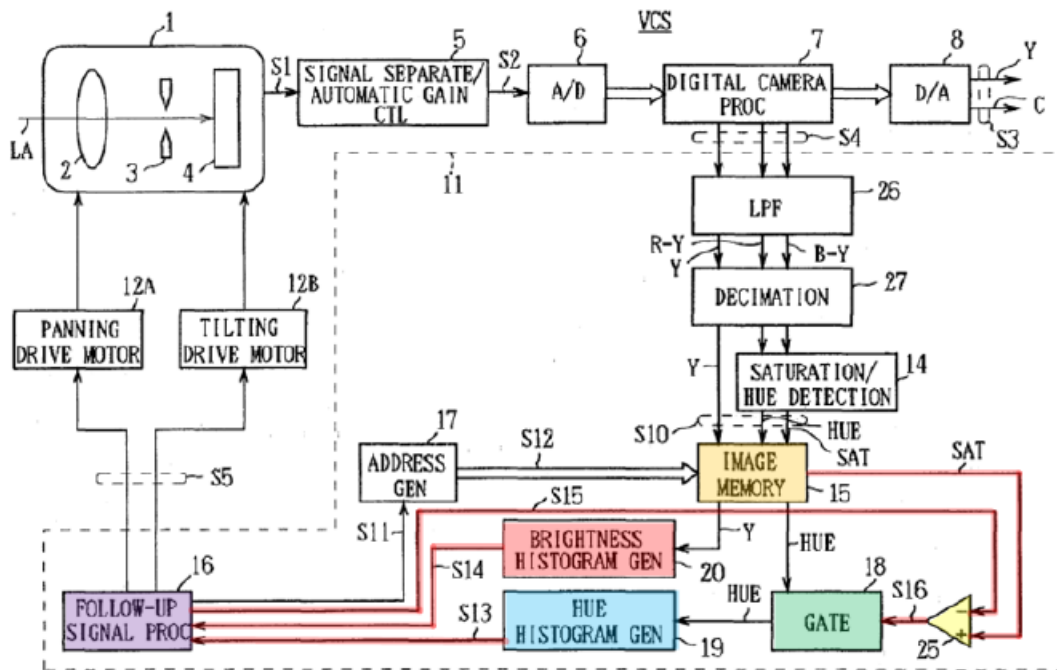
E. Obviousness over Pirim and Tomitaka

Petitioner asserts that claims 1, 18, 19, and 29 are unpatentable under 35 U.S.C. § 103(a) as obvious over Pirim in combination with Tomitaka, citing to the Declaration of Dr. Hart for support. Pet. 30–53; Ex. 1002 ¶¶ 63–107. Patent Owner opposes. Prelim. Resp. 25–64. In our discussion below, we first provide a brief overview of Tomitaka⁹ and then we address the parties' contentions in turn, focusing on the disputed claim limitations.

Overview of Tomitaka

Tomitaka discloses a video signal follow-up processing system for tracking a moving object. Ex. 1007, at [57]. Figure 1 of Tomitaka is reproduced below with highlighting added by Petitioner (Pet. 15).

⁹ A brief description of Pirim was provided previously in Section II.D of this Final Written Decision.



As illustrated in highlighted Figure 1 above, color video signal S1 from optical system 1 is provided to signal separation/automatic gain control circuit 5 and then digitized in analog-to-digital conversion circuit 6.

Ex. 1007, 3:61–4:11. The color of each pixel is separated into brightness (Y or L) and chroma (C) signals. *Id.* at 4:7–16. The chroma color signal is further demodulated into individual color difference signals R-Y and B-Y to form three color values: Y, R-Y, and B-Y. *Id.* at 4:17–32. The color data are converted into the HLS color coordinate system and written to image memory 15 (highlighted in orange) for processing. *Id.* at 4:39–50.

Brightness and hue are then processed separately by histogram units 19, 20 (highlighted in blue and red, respectively). Signals S13, S14 from histogram units 19, 20 are sent to follow-up signal processor 16 (highlighted in purple), which forms feature patterns from the hue and brightness histograms that are

compared with reference measurements to track an object. *Id.* at 5:42–65, 6:64–7:2.

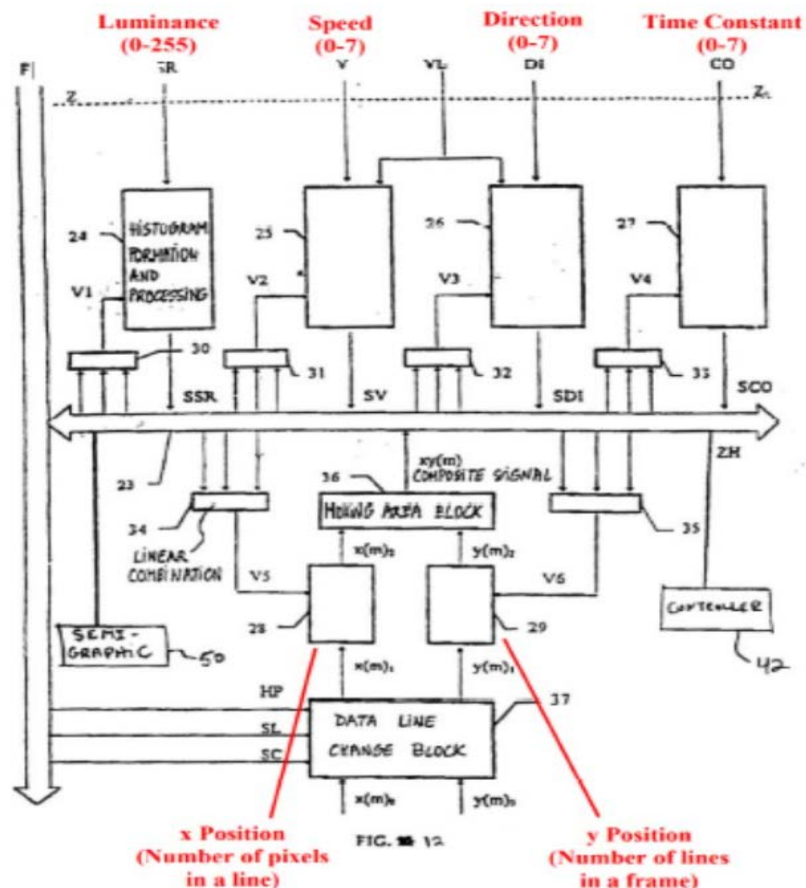
Claim 1

Claim 1 recites “at least two histogram calculation units . . . being configured to form a histogram representative of the parameter as a function of a validation signal.” Ex. 1001, 26:47–50. As discussed above in the claim construction section, we interpret this claim element as “the at least two histogram calculation units being configured to each form a histogram representative of *at least one common parameter*.” *See supra* Section II.A.1.

In this regard, Petitioner takes the position that Pirim, in combination with Tomitaka, teaches or suggests a plurality of histogram calculation units, as recited in claim 1. Pet. 34–36. In particular, Petitioner avers that Pirim discloses a plurality of histogram formation units (e.g., elements 24–29 in Figure 12), and that a *single parameter* (e.g., x-position of a pixel) may be processed by multiple histogram units simultaneously. *Id.* (citing Ex. 1005, 27, 28, 39, Figs. 12, 15a; Ex. 1002 ¶¶ 71–72). Alternatively, Petitioner argues that Pirim’s histogram units “could be replaced by the histogram units of Tomitaka, wherein two histogram units process components of color.” *Id.* at 36 (citing Ex. 1007, 4:12–32). In Petitioner’s view, “it would have been obvious to modify Tomitaka such that the two histogram units processed the same parameter,” and it would have been “obvious to use multiple histogram units processing a color component with Pirim’s system.” *Id.* at 36, 37 (citing Ex. 1005, 47; Ex. 1002 ¶¶ 73–75).

Patent Owner counters that neither Pirim nor Tomitaka discloses at least two histogram calculation units being configured to form a histogram of *at least one common parameter*. Prelim. Resp. 30–34. Upon review of the parties’ contentions and supporting evidence, we agree with Patent Owner. As Patent Owner points out, Figure 12 of Pirim shows each histogram block processing a different parameter, not the same parameter. *Id.* at 30–32 (citing Ex. 1005, 27–28, Fig. 12).

Figure 12 of Pirim is reproduced below with annotations added by Patent Owner (*id.* at 31).



As shown in annotated Figure 12 above, Pirim's histogram formation blocks 24–29 receive input signals for different parameters. Notably, histogram formation block 24 forms histograms for the *luminance values*. Ex. 1005, 25. Histogram formation block 25 forms histograms for *speed* signals; histogram formation block 26 forms histograms for *direction* signals; histogram formation block 27 forms histograms for *time constant* signals; and histogram formation blocks 28 and 29 form histograms for the *x and y positions* of pixels, respectively. *Id.* at 25–27. In short, each of the histogram formation blocks in Pirim is configured to process a different parameter, and no two histogram formation blocks are configured to process the same parameter, as required by claim 1.

We do not agree with Petitioner's argument that Pirim discloses a single parameter (x-position of a pixel) that may be processed by multiple histogram units simultaneously (Pet. 35–36) because each of the 16 x-direction histogram formation units is processing a different x-axis, not the same x-axis. Petitioner relies upon the following passage of Pirim:

Fig. 15A shows a histogram of certain points under consideration, where the histogram is taken along the x-axis, i.e., projected down onto the x-axis. . . . In operation, on successive frames, or on the same frame if multiple x-direction histogram formation units are available, it is advantageous to calculate R at different angles, e.g., 33.75° and 57.25° (assuming *the axes are limited to 16 degrees of rotation*), in order to constantly ensure that R is at minimum. For applications in which it is desirable to detect lines, and assuming the availability of *16 x-direction histogram formation units*, it is advantageous to carry out the calculation of R simultaneously along all possible axes

Ex. 1005, 37 (emphases added).

As Patent Owner points out (Prelim. Resp. 32–33), the axes are described as rotated at different angles (16 degrees of rotation). Ex. 1005, 36–37, Figs. 15A–B. Figures 15A and 15B of Pirim are reproduced below.

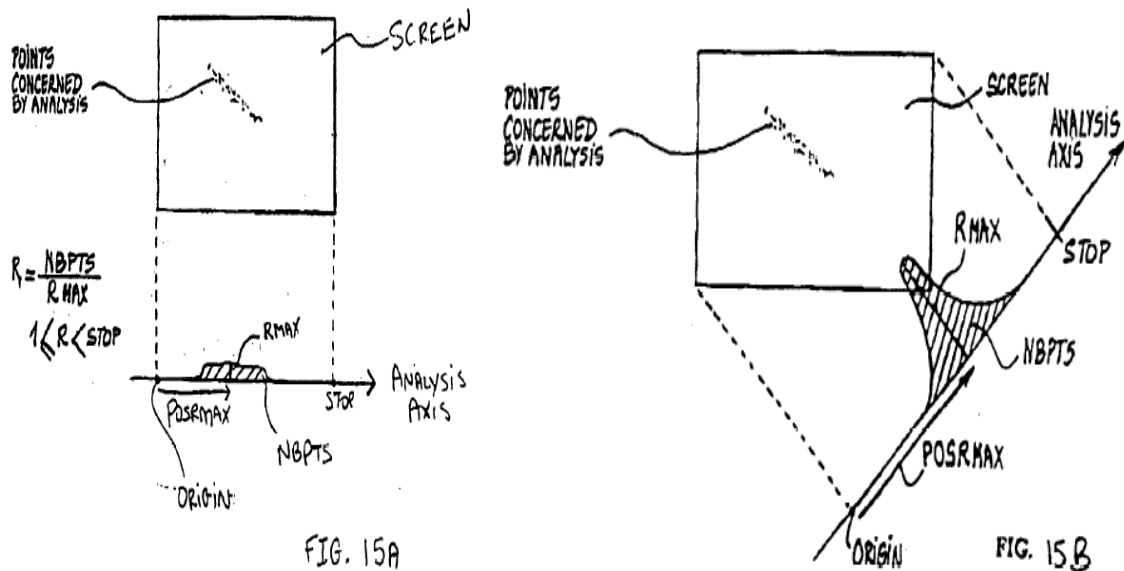


Figure 15A above (left) depicts a histogram that is taken along the x-axis (with zero rotation), whereas Figure 15B above (right) depicts a histogram of an x-axis that is *rotated at approximately 45°*. Ex. 1005, 39. Each of the 16 x-direction histogram formation units is configured to form a histogram for a *different rotated axis, not the same axis*—using 16 units for 16 degrees of rotation and calculating the R value at different angles, simultaneously. *Id.* Petitioner does not explain how these different rotated axes are the same parameter. Pet. 35–36. Therefore, Petitioner has not shown that Pirim teaches or suggests a plurality of histogram calculation units being configured to form a histogram representative of *at least one common parameter*, as required by claim 1.

We also do not agree with Petitioner’s alternative argument that the combination of Pirim and Tomitaka discloses a plurality of histogram calculation units, as recited in claim 1. Pet. 36–37. The cited portions of Tomitaka do not support Petitioner’s argument. Indeed, Petitioner confirms that “Tomitaka decomposes color into hue, luminance (brightness), and saturation.” *Id.* (citing Ex. 1007, 4:12–32). Tomitaka describes histogram generation unit 19 processes *hue* signals, while histogram generation unit 20 processes *brightness* signals separately. Ex. 1007, 5:36–41, Fig. 1. As Patent Owner points out, brightness and hue are different parameters, not the same parameter. Prelim. Resp. 34; *see also* Ex. 1001, 21:37–63 (luminance L, tone T, saturation S, speed V, and direction D are separate parameters for generating histograms); Ex. 1007, 4:66–5:5 (explaining that, unlike hue that is not susceptible to lightness of the light source, saturation and brightness are not “best suited as parameters”). Moreover, Petitioner’s declarant, Dr. Hart, also confirms that color is represented typically by three values: hue (tone), saturation, and luminance (brightness). Ex. 1002 ¶ 26. In short, Petitioner has not shown sufficiently that Tomitaka teaches or suggests a plurality of histogram units processing the same parameter. As such, Petitioner’s proposed combination—replacing Pirim’s histogram units with Tomitaka’s histogram units—would not teach or suggest at least two histogram calculation units processing the same parameter, as required by claim 1.

Furthermore, Petitioner does not explain sufficiently why a person of ordinary skill in the art would have had a reason “to modify Tomitaka such that the two histogram units processed *the same parameter*.” Pet. 36–37

(emphasis added). As discussed above, Tomitaka teaches using two histogram generation units (hue histogram generation unit 19 and brightness histogram generation unit 20) each dedicated to process two different parameters, hue and brightness, separately. Ex. 1007, 5:36–41, Fig. 1.

For the foregoing reasons, we determine that Petitioner has not demonstrated sufficiently that Pirim, in combination with Tomitaka, teaches or suggests at least two histogram calculation units being configured to form a histogram representative of at least one parameter, as required by claim 1. As such, Petitioner fails to meet its burden to demonstrate by a preponderance of the evidence that claim 1 is unpatentable under § 103(a) as obvious over Pirim in combination with Tomitaka.

Claims 18, 19, and 29

Claim 18 recites a classification unit “configured to *determine the data in the histogram that satisfy a selected criterion . . .*, wherein *classification is performed automatically* by processing statistical information associated with *the calculated histogram.*” Ex. 1001, 29:31–35, 43–45 (emphases added). As discussed above in the claim construction section, the “statistical information” used for automatic classification must be associated with *the same histogram for which the classification applies*. See *supra* Section II.A.2.

By virtue of its dependency, claim 19 also requires this “classification” limitation. Ex. 1001, 29:46–50. Further, claim 29 recites a similar limitation—“classifying the data by comparing its value to classification criteria stored in a classification memory,” and “automatically

updating, for each instant of time, the classification criteria stored in the classification memory based on statistical information associated with the histogram.” *Id.* at 32:5–13.

For these claims, Petitioner argues that Pirim, in combination with Tomitaka, discloses the aforementioned “classification” limitations. Pet. 30–31, 40–49, 52–53 (citing Ex. 1002 ¶¶ 63–67, 86–92). Petitioner notes that Pirim’s “classifier 25b includes a register 106 that enables the classification criteria to be set by the user, or by a separate computer program.” *Id.* at 45 (citing Ex. 1005, 29–30). According to Petitioner, Pirim collects histogram statistics in that “each histogram formation unit calculates the following values for its respective histogram: MIN, MAX, NBPTS, RMAX, [and] PORSMAX,” and Pirim discloses three examples in which histogram data are used to update the classification criteria automatically. *Id.* (citing Ex. 1005, 38). As to the “first example,” Petitioner contends that Pirim’s position histogram units have associated classifiers that select pixels bounded by XMIN, XMAX, YMIN, and YMAX, and these criteria may be adjusted automatically based on histogram data. *Id.* at 45–46 (citing Ex. 1005, 35, 39–40). With respect to the “second example,” Petitioner asserts that Pirim’s velocity classification limits may be set as a fraction of the maximum value derived from the histogram. *Id.* at 46–47 (citing Ex. 1005, 36–37). For the “third example,” Petitioner maintains that Pirim’s luminance classifiers may be set dynamically to a fraction of the observed maximum luminance. *Id.* at 47–48 (citing Ex. 1005, 54).

Patent Owner counters that neither Pirim nor Tomitaka discloses “wherein classification is performed automatically by processing statistical

information associated with the calculated histogram.” Prelim. Resp. 36–41. Having reviewed the parties’ contentions and evidence, we agree with Patent Owner.

As to the “first example” relied upon by Petitioner, we agree with Patent Owner that Petitioner does not explain adequately how Pirm’s XMIN, XMAX, YMIN, and YMAX are “statistical information associated with the calculated histogram.” *Id.* at 36–37 (citing Pet. 45–46; Ex. 1005, 35). The portion of Pirm cited by Petitioner discloses that these values can be “automatically modified to compensate for the speed and direction of the target” by determining values for I-MVT and O-MVT, corresponding to the intensity (velocity) and orientation (direction) of movement, respectively. Pet. 45–46; Ex. 1005, 40. However, speed and direction are not “statistical information associated with *the calculated histogram*,” as required by the claims, because I-MVT and O-MVT are calculated for each pixel based on changes in intensity *from the previous frame*, not the same frame for which the histogram is calculated. Ex. 1005, 4, 16, 21, Fig. 11; Prelim. Resp. 37 (emphasis added).

With respect to the “second example,” Petitioner does not explain sufficiently how Pirm’s velocity classification limits l_a , l_b , l_c , and l_d are used for classification; nor does Petitioner adequately identify any teaching of Pirm that these limits are used for classification. Pet. 47; Ex. 1005, 36–37, Fig. 13. Pirm merely describes these limits “set as a ratio of the maximum of the histogram” for the x-axis or y-axis, and the lines of these values (as shown in Figure 13 of Pirm) “form a rectangle that surrounds the cross hatched area 40 of *significant speeds* (for all x and y directions).” Ex. 1005,

36–37 (emphasis added). As Patent Owner also notes, Petitioner does not link the use of these values with classification in generating the *x-axis or y-axis histograms*. Prelim. Resp. 38; Pet. 47.

For the “third example,” we agree with Patent Owner that Pirim merely teaches using information from one unit (luminance histogram formation unit 24) to modify the criteria for different units (x and y histogram formation units), not updating the criteria for *the same histogram formation unit* or for generating *the same histogram*, as required by the claims. Prelim. Resp. 38–39 (citing Pet. 47–48; Ex. 1005, 52). As discussed above in the claim construction section, the claimed “statistical information” used for automatic classification must be associated with *the same histogram for which the classification applies*. See *supra* Section II.A.2.

In addition, we do not agree with Petitioner’s argument that Tomitaka discloses the aforementioned “classification” limitation. Pet. 48–49. As Patent Owner notes, Tomitaka calculates hue and brightness histograms before making a noise determination for generating a *subsequent histogram*, not the same histogram for which the classification applies. Ex. 1007, 5:49–60, Figs. 1, 4, 5. Indeed, Petitioner does not provide a sufficient explanation or creditable evidence to show that the statistical information used for Tomitaka’s classification is associated with the same histogram for which the classification applies.

For the foregoing reasons, we determine that Petitioner has not demonstrated that Pirim, in combination with Tomitaka, teaches or suggests a classification unit “configured to determine the data in the histogram that satisfy a selected criterion, . . . wherein classification is performed

automatically by processing statistical information associated with the calculated histogram,” as required by claims 18 and 19, and similarly required by claim 29. As such, Petitioner fails to meet its burden to demonstrate by a preponderance of the evidence that claims 18, 19, and 29 are unpatentable under § 103(a) as obvious over Pirim in combination with Tomitaka.

Conclusion

For the foregoing reasons, Petitioner fails to meet its burden to demonstrate by a preponderance of the evidence that claims 1, 18, 19, and 29 are unpatentable under § 103(a) as obvious over Pirim in combination with Tomitaka.

F. Obviousness over Rogers and Gilbert

Petitioner asserts that claims 1, 18, 19, 22, and 29 are unpatentable under § 103(a) as obvious over Rogers in the combination with Gilbert. Pet. 53–68.

Whether Rogers is a printed publication

Petitioner asserts that Rogers, a doctoral dissertation, qualifies as prior art under § 102(b), arguing that Rogers was catalogued with the New Mexico State University library more than one year prior to the critical date—namely, February 23, 2001, which is the earliest effective filing date of the ’293 patent. *Id.* at 17. In support of its contentions, Petitioner proffers a Declaration of Susan E. Beck, Ph.D. (Ex. 1009, 1–4), along with a copy of a screen shot from the WorldCat database, showing the records

relating to Rogers (Ex. 1009, 5, Exhibit A), and a copy of the screen printout of the loan record of Rogers in the Voyager Integrated Library system (Ex. 1009, 6, Exhibit B).

Patent Owner opposes, arguing that Petitioner fails to establish that Rogers is a printed publication within the meaning of § 102(b). Prelim. Resp. 21–25. In Patent Owner’s view, Petitioner has not shown that Rogers was “publicly accessible” prior to the critical date, and Dr. Beck’s Declaration does not establish that the library database search application was publicly accessible before the critical date. *Id.* Patent Owner contends that Dr. Beck does not state that she has personal knowledge of the library’s practices and systems prior to the last four years, or that she investigated these practices and systems to obtain this knowledge. *Id.* at 22.

Upon consideration of the parties’ contentions, we do not agree with Patent Owner’s arguments. Rather, based on the entirety of the record, we find Petitioner has established sufficiently that Rogers was available to the public more than one year prior to the critical date.

The determination of whether a given reference qualifies as a prior art “printed publication” involves a case-by-case inquiry into the facts and circumstances surrounding the reference’s disclosure to members of the public. *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed. Cir. 2004). “Because there are many ways in which a reference may be disseminated to the interested public, ‘public accessibility’ has been called the touchstone in determining whether a reference constitutes a ‘printed publication’ bar under 35 U.S.C. § 102(b).” *In re Hall*, 781 F.2d 897, 898–99 (Fed. Cir. 1986). To qualify as a prior art printed publication, the reference must have been

disseminated or otherwise made accessible to persons interested and ordinarily skilled in the subject matter to which the document relates prior to the critical date. *Kyocera Wireless Corp. v. Int’l Trade Comm’n*, 545 F.3d 1340, 1350 (Fed. Cir. 2008).

The facts in the instant proceeding are similar to those in *Hall*, in which the Board relied upon the testimony of the university library’s director regarding the general library procedure as to indexing, cataloging, and shelving of doctoral theses. *Hall*, 781 F.2d at 897–98. Our reviewing court in *Hall* held that such evidence “may be relied upon to establish an approximate time when a thesis became accessible.” *Id.* at 899. The court explained that it did not hold that “accessibility can only be shown by evidence establishing a *specific* date of cataloging and shelving before the critical date,” and rejected the argument that “a single cataloged thesis in one university library does not constitute sufficient accessibility to those interested in the art exercising reasonable diligence.” *Id.* at 899–900 (holding a dissertation shelved and indexed in the catalog at a university library is a printed publication under § 102).

Here, Dr. Beck testifies that she is “a professor and Head of Access Services at New Mexico State University Library.” Ex. 1009 ¶ 1. Contrary to Patent Owner’s argument that Dr. Beck lacks personal knowledge (Prelim. Resp. 21–23), Dr. Beck testifies that she made “this declaration based on [her] own personal knowledge and experiences.” Ex. 1009 ¶ 1. Dr. Beck indicates that she has been working for the Library for nineteen years and has served as the Head of Access Services for the last four years. *Id.* ¶ 2. Dr. Beck states that she “investigated the submittal date and public

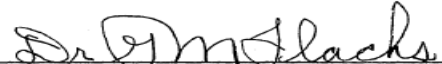
availability of date of [Rogers] using both the Library's online catalog and WorldCat, the worldwide bibliographic [utility] maintained by the On-line Computer Library Center (the 'OCLC' system)." *Id.* ¶ 4. Dr. Beck further testifies that the Library staff relies on the information contained in the Library's cataloging systems, as well as the OCLC system, to perform their activities in carrying out the Library's business. *Id.*

Dr. Beck points out that the disclosure reproduced below in Rogers indicates that the dissertation was approved on December 20, 1978 (Ex. 1006, 5):

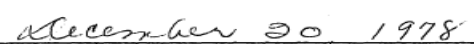
"Real-Time Video Filtering with Bit-Slice Microprogrammable Processors," a dissertation prepared by Robert Barclay Rogers in partial fulfillment of the requirements for the degree, Doctor of Philosophy, has been approved and accepted by the following:



Dean of the Graduate School



Chairman of the Examining Committee

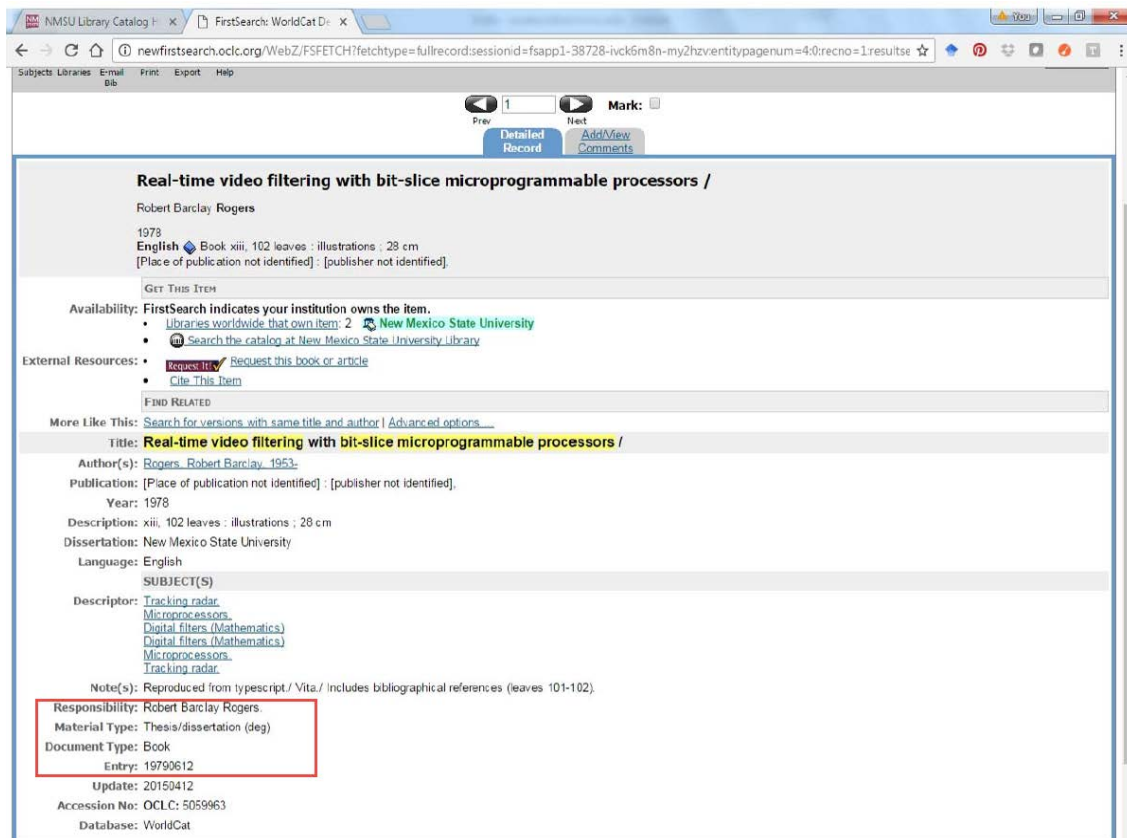


Date

The portion of Rogers reproduced above is a signed approval of Rogers' dissertation dated December 20, 1978. Dr. Beck testifies that it was the Library's general practice to submit approved dissertations to the University Microfilm International ("UMI"), a service that converts dissertations from various universities into microfilm format for cataloging and indexing so that the dissertations can be searchable and accessible to the public. Ex. 1009 ¶ 6.

Dr. Beck also points out that, as the OCLC system indicates, Rogers was cataloged on June 12, 1979. According to Dr. Beck, Exhibit A of

Ex. 1009, reproduced below with a red rectangle added, is a true and correct copy of a screen shot from the OCLC's WorldCat database showing the catalog record for Rogers.

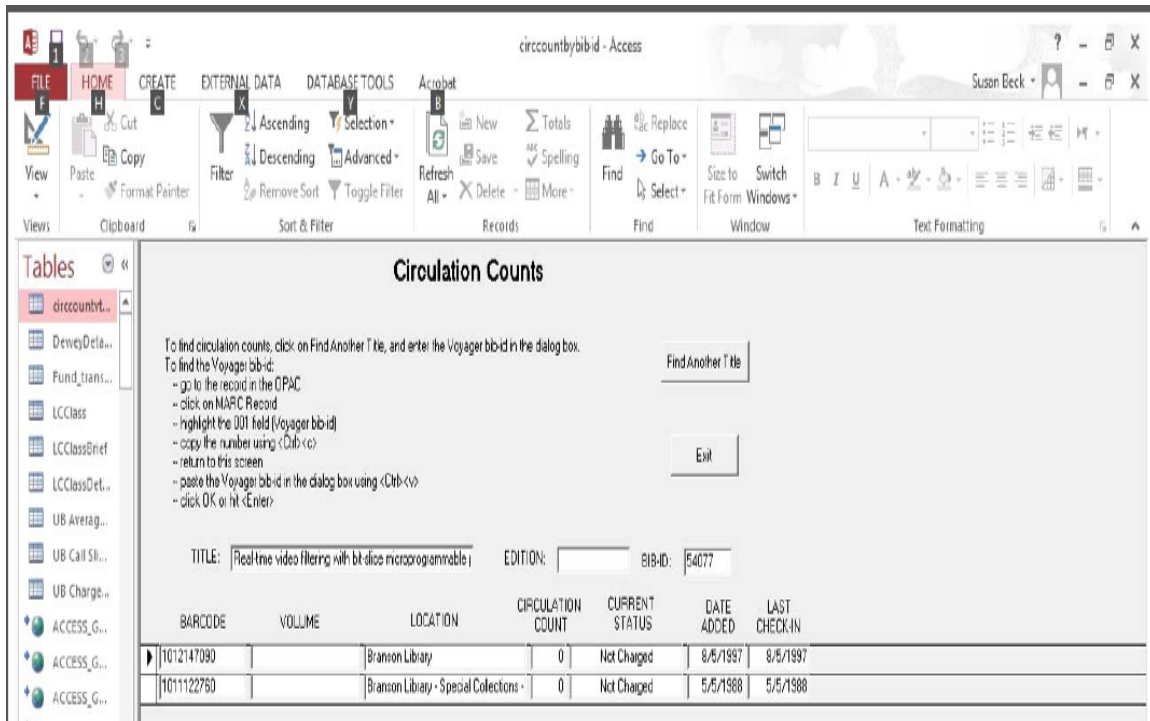


The above image depicts a WorldCat screen shot for Rogers. As the catalog record shows above, the Rogers Dissertation was indexed and cataloged meaningfully with the author's name along with its descriptive title—"Real-Time Video Filtering with Bit-Slice Microprogrammable Processors"—and descriptors: "Tracking radar," "Microprocessors," and "Digital filters (Mathematics)." *Id.* at 5.

Dr. Beck further testifies that it was the general practice of the Library at that time to make a bound volume of manuscript available on the shelf for

Library users within about three to five days after the cataloging date. *Id.*

¶ 7. Dr. Beck also indicates that, although the original bound volume of Rogers' dissertation was lost, the Library replaced the physical copy on August 5, 1997, and has maintained the same physical copy to date. *Id.* ¶ 9. Additionally, Dr. Beck testifies that the Voyager Integrated Library system keeps track of the collections in the Library. *Id.* ¶ 10. Dr. Beck further testifies (*id.*) that Exhibit B of Ex. 1009, reproduced in part below, is a true and correct copy of the screen printout of the record regarding Rogers in the Voyager Integrated Library system.



The screenshot shows the Voyager Integrated Library system interface. The title bar indicates the window is titled "circcountbybibid - Access". The menu bar includes FILE, HOME, CREATE, EXTERNAL DATA, DATABASE TOOLS, and Acrobat. The toolbar contains various icons for file operations, database actions, and text formatting. The main window displays the "Circulation Counts" screen. On the left, a "Tables" pane lists various database tables, with "circcountbybibid" selected. The main area contains instructions on how to find circulation counts, a "Find Another Title" button, and an "Exit" button. Below these, there are input fields for "TITLE", "EDITION", and "BIB-ID". The "TITLE" field contains "Real time video filtering with bit-alloc microprogrammable". The "EDITION" field is empty, and the "BIB-ID" field contains "54077". At the bottom, a table displays circulation records with columns: BARCODE, VOLUME, LOCATION, CIRCULATION COUNT, CURRENT STATUS, DATE ADDED, and LAST CHECK-IN. The table shows two records for Rogers' dissertation.

BARCODE	VOLUME	LOCATION	CIRCULATION COUNT	CURRENT STATUS	DATE ADDED	LAST CHECK-IN
1012147090		Branson Library	0	Not Charged	8/5/1997	8/5/1997
1011122750		Branson Library - Special Collections	0	Not Charged	5/5/1988	5/5/1988

The screen printout above depicts circulation records for Rogers, and it supports Dr. Beck's testimony that (1) an archival copy of Rogers was created on May 5, 1988, and was placed in the Special Collection; and

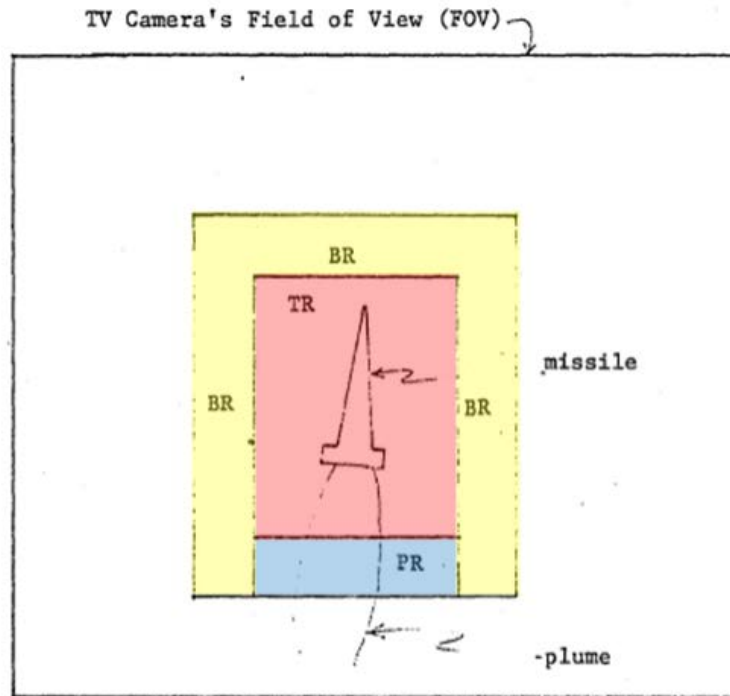
(2) Rogers, as it currently exists in the library, was created on August 5, 1997—more than four years before the critical date of February 23, 2001.

Based on the entirety of the record, we determine that Petitioner has shown sufficiently that Rogers was disseminated or otherwise made accessible to persons interested and ordinarily skilled in the art more than one year prior to the critical date. Therefore, Rogers is prior art to the challenged claims of the '293 patent.

Overview of Rogers

Rogers describes a system for tracking a missile or similar object by digitizing video images and analyzing the pixel intensity (brightness) using histograms. Ex. 1006, 25.¹⁰ Rogers introduces a tracking window concept as the basic image partitioning tool. *Id.* at 10. Figure 1 of Rogers is reproduced below with highlighting added by Petitioner (Pet. 18).

¹⁰ All references to the pages number in Rogers are to page numbers in Exhibit 1006 inserted by Petitioner in the bottom, right-hand corner of each page—not the original page numbers that appear in the top, right-hand corner of each page.



BR -- background sampling region
TR -- target sampling region and classification region
PR -- plume sampling region

Highlighted Figure 1 above depicts that each tracking window is partitioned into three regions: the target region (TR), the plume region (PR), and the background region (BR). Ex. 1006, at 25–28. Histograms are accumulated for these three regions. *Id.* at 29. Statistics from the histograms are used subsequently to derive thresholds and pixel classification rules on a dynamic basis. *Id.* at 10. A threshold classifier classifies each pixel in the target region as target, plume, or background points. *Id.* at 34–35.

Figure 5 of Rogers is reproduced below with highlighting added by Petitioner (Pet. 23). Ex. 1006, 49.

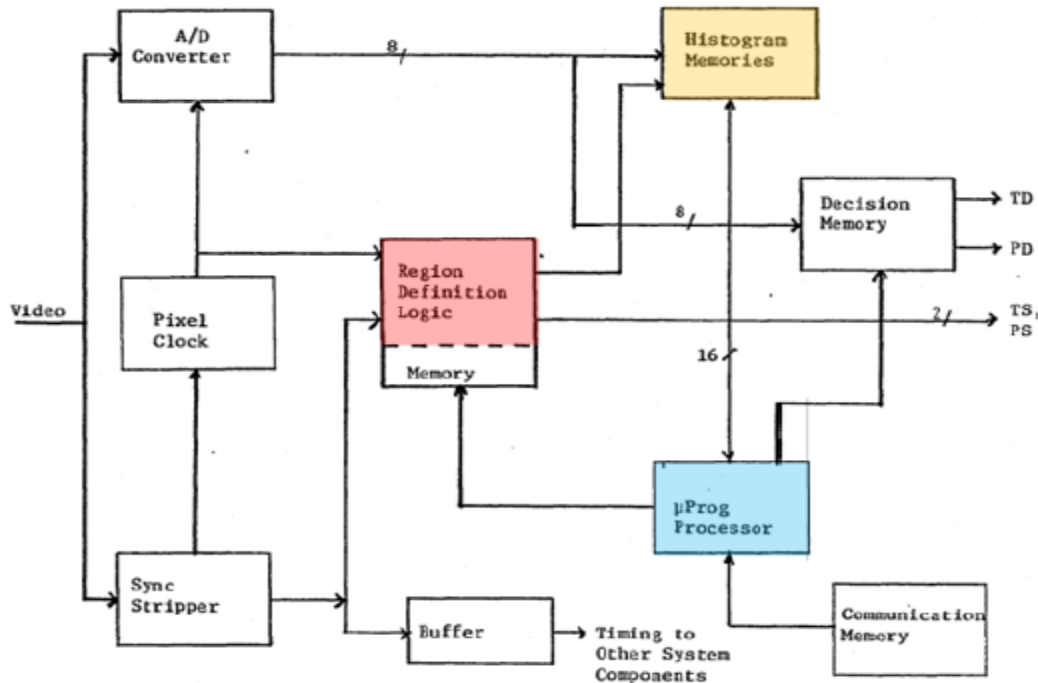


Figure 5 -- VP Block Diagram

Figure 5 of Rogers illustrates a video processor that includes a microprocessor (highlighted in blue), region definition logic (highlighted in red), and histogram memories (highlighted in orange). *Id.* at 48–49.

Overview of Gilbert

Gilbert also describes a missile tracking system. Ex. 1008, Abstract. Figure 1 of Gilbert shows a real-time videotheodolite (RTV) tracking system, and is reproduced below.

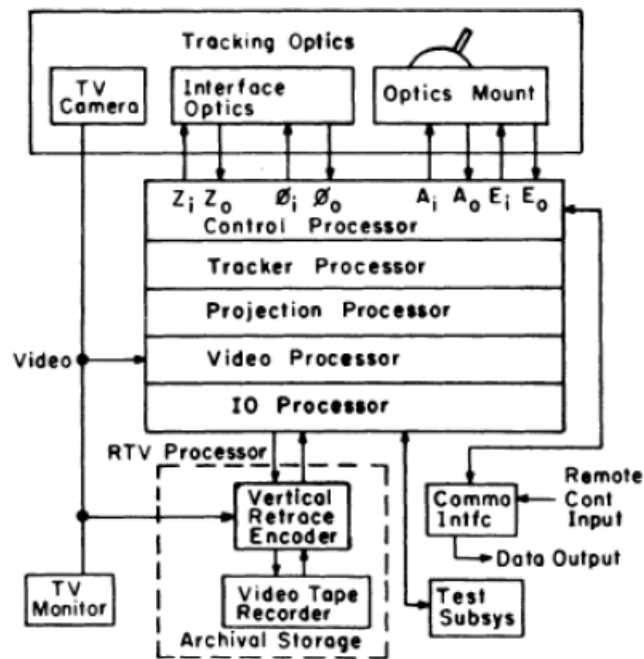


Fig. 1. RTV tracking system.

As shown in Figure 1 of Gilbert, the RTV tracking system includes a control processor, a tracker processor, a projection processor, a video processor, and an input/output (IO) processor.

Claim 1

Petitioner argues that Rogers, in combination with Gilbert, renders claim 1 obvious, citing Dr. Hart's testimony for support. Pet. 53–58 (Ex. 1002 ¶¶ 100, 108–15). As to the limitation “at least two histogram calculation units . . . being configured to form a histogram representative of the parameter as a function of a validation signal,” Petitioner relies only on Rogers, arguing that Rogers discloses forming three histograms of pixel intensity (brightness) for each tracking window. *Id.* at 56 (citing Ex. 1006, 10; Ex. 1002 ¶ 112). Petitioner also avers that Rogers discloses calculating pixel intensity histograms for those pixels that fall within specific regions of

a tracking window, and that logic defining these regions acts as validation signals for those histograms. *Id.* (citing Ex. 1006, 29; Ex. 1002 ¶ 113).

As Patent Owner notes, however, nothing in those portions of Rogers relied upon by Petitioner and Dr. Hart teaches or suggests a plurality of histogram calculation units, much less “at least two histogram calculation units . . . being configure to form a histogram representative of the parameter as a function of a validation signal.” Prelim. Resp. 34–35; Pet. 56; Ex. 1002 ¶¶ 112–13 (citing Ex. 1006, 10, 29). Petitioner’s argument and Dr. Hart’s testimony conflate “histograms” with “histogram calculation units.” Neither Petitioner’s argument nor Dr. Hart’s testimony identifies specific disclosure in Rogers that teaches or suggests forming the three histograms using a plurality of histogram calculation units, nor explain why a person with ordinary skill in the art would have had a reason to do so. Pet. 56; Ex. 1002 ¶¶ 112–13. To the extent that Petitioner suggests it is necessary to use a plurality of histogram calculation units for forming the three histograms in Rogers, neither Petitioner nor Dr. Hart proffers any explanation as to this theory. Pet. 56; Ex. 1002 ¶¶ 112–13.

Merely pointing to the formation of three histograms per tracking window for the same parameter, without more, is not sufficient to establish that Rogers teaches or suggests “at least two histogram calculation units” being configured to form a histogram of the same parameter. The burden is on Petitioner to “specify where each element of the claim is found in the prior art patents or printed publication relied upon.” 37 C.F.R.

§ 42.104(b)(4). We decline to speculate as to how many histogram units Rogers would use for forming the three histograms of pixel intensity. *See*

Alza Corp. v. Mylan Labs., Inc., 464 F.3d 1286, 1290 (Fed. Cir. 2006) (explaining legal determinations of obviousness should be based on evidence rather than on mere speculation or conjecture.).

For the foregoing reasons, we determine that Petitioner has not demonstrated sufficiently that Rogers, in combination with Gilbert, teaches or suggests at least two “histogram calculation units being configured to form a histogram representative of the parameter as a function of a validation signal,” as recited in claim 1. As a result, we conclude that Petitioner has not shown by a preponderance of the evidence that claim 1 is unpatentable under § 103(a) as obvious over Rogers in combination with Gilbert.

Claims 18, 19, and 29

Petitioner argues that Rogers, in combination with Gilbert, renders claims 18, 19, and 29 obvious, citing Dr. Hart’s testimony for support. Pet. 58–64, 66–68; Ex. 1002 ¶¶ 116–124. For the “classification” limitations recited in these claims—namely, a classification unit “configured to determine the data in the histogram that satisfy a selected criterion . . . , wherein classification is performed automatically by processing statistical information associated with the calculated histogram,” as recited in claim 18, required by dependent claim 19, and similarly required by claim 29—Petitioner presents the same contentions, arguing that “Rogers classifies pixels by comparing their intensity to thresholds calculated from histogram data.” *Id.* at 60, 62, 67, 68 (citing Ex. 1006, 33, 35, 37, 49, 59;

Ex. 1002 ¶¶ 116–24). Petitioner contends that the classification thresholds are adjusted automatically based on the histogram data being collected. *Id.*

However, the cited portions of Rogers do not support Petitioner’s contentions. Notably, the classification in Rogers does not involve comparing the pixel *intensities* to the thresholds, as Petitioner alleges. For example, both Petitioner’s argument and Dr. Hart’s testimony rely upon the following equation of Rogers (Pet. 62; Ex. 1002 ¶ 124; Ex. 1006, 34–35):

$$x \in x_T \text{ iff } h^{BR}(x) < t_{BR} \text{ and } h^{PR}(x) < t_{PR}$$

This equation is used for classifying *pixels* in the target region as target pixels, where x is an arbitrary pixel value and X_T is the set of pixel values that are to be classified as target pixels. Ex. 1006, 34–35. Importantly, this equation uses functions $h^{BR}(x)$ and $h^{PR}(x)$ in the comparison, *not the pixel intensities* of the target region. Indeed, as Petitioner confirms, functions $h^{BR}(x)$ and $h^{PR}(x)$ are the normalized histograms of the background and plume regions, respectively. Pet. 20; Ex. 1002 ¶ 55 (testifying that “ $h^R(x)$ is the normalized feature histogram of region R , where R is the background, plume, or target region”); *see also* Ex. 1006, 29. In short, we do not agree with Petitioner’s argument that “Rogers classifies pixels by comparing their intensity to thresholds.” Pet. 62.

In addition, as discussed in the claim construction section, the statistical information must be associated with the *same histogram* for which the classification applies. *See supra* Section II.A.3. Significantly, as Petitioner acknowledges, “the classification thresholds are based on probability densities that are updated based on histogram data from *prior*

video frames” and, therefore, are not associated with the same histogram. Pet. 21, 62 (citing Ex. 1006, 33) (emphasis added). Moreover, Rogers’ thresholds t_{BR} and t_{PR} for classifying pixels in the *target* region are not statistical information associated with the *target* histogram. Ex. 1006, 29, 34–35. In fact, threshold t_{BR} and t_{PR} are *background* and *plume* thresholds based on the intensities found in the background and plume regions. Ex. 1006, 34–35. Therefore, Petitioner fails to show sufficiently that the classification in Rogers “is performed automatically by processing statistical information associated with the calculated histogram.”

For the foregoing reasons, we determine that Petitioner has not demonstrated sufficiently that Rogers, in combination with Gilbert, teaches or suggests the aforementioned “classification” limitation, as required by claims 18, 19, and 29. As a result, we conclude that Petitioner fails to meet its burden to demonstrate by a preponderance of the evidence that claims 18, 19, and 29 are unpatentable under § 103(a) as obvious over Rogers in combination with Gilbert.

Claim 22

Claim 22 recites “a classification unit coupled to the input portal and the histogram unit, and configured to determine the data in the histogram that satisfy a selected criterion.” Ex. 1001, 30:7–9. In this regard, Petitioner relies upon the same argument presented in connection with claim 18, arguing that “Rogers discloses that histogram data is used to construct probability density functions that are used as thresholds, or selection criteria, to which *pixel intensity in the Target Region* is compared to determine if

each pixel is classified as background, plume, or target.” Pet. 66 (citing *id.* at 60; Ex. 1006, 33, 35, 37, 49, 59; Ex. 1002 ¶ 121) (emphasis added).

However, as discussed above, we do not agree with that argument because Rogers’ threshold classifier does not compare pixel intensity of the histogram from the target region with a threshold, but rather it compares functions $h^{BR}(x)$ and $h^{PR}(x)$, which are histograms for the pixels in the background and plume regions, with background and plume thresholds t_{BR} and t_{PR} , respectively.

As such, Petitioner has not established by a preponderance of the evidence that claim 22 is unpatentable under § 103(a) as obvious over Rogers and Gilbert.

Conclusion

For the foregoing reasons, Petitioner has not demonstrated by a preponderance of the evidence that claims 1, 18, 19, 22 and 29 are unpatentable under § 103(a) as obvious over Rogers and Gilbert.

G. Obviousness over Tomitaka and Rogers

Petitioner asserts that claims 1, 18, 19, 22, and 29 are unpatentable under § 103(a) as obvious over the combination of Tomitaka and Rogers.¹¹ Pet. 68–83.

¹¹ An overview of Tomitaka and Rogers has been provided above.

Claim 1

Petitioner provides explanations to account for all of the claim limitations required by claim 1 (*id.* at 71–75), and a reason to combine the technical features of Tomitaka and Rogers (*id.* at 68–71), citing Dr. Hart’s testimony for support (Ex. 1002 ¶¶ 140–53). For the claim limitation “at least two histogram calculation units . . . being configured to form a histogram representative of the parameter as a function of a validation signal,” Petitioner advances two arguments. Pet. 73–74.

First, Petitioner relies upon Tomitaka to teach: (1) two histogram units that form histograms for color components, brightness and hue; and (2) forming hue histograms for pixels validated by gate logic 18 (a validation signal). *Id.* at 73–75 (citing Ex. 1007, 4:12–32, 6:60–49, Figs. 1, 2; Ex. 1002 ¶¶ 148–50). Petitioner asserts that, “[b]ecause brightness and hue are both components of color, it would have been obvious to use multiple histogram units to process the same parameter.” *Id.* at 74 (citing Ex. 1007, 4:12–32, 6:40–49).

However, brightness and hue, as described in Tomitaka, are different parameters, not the same parameter. Ex. 1007, 4:66–5:5. As discussed above, Dr. Hart testifies that color is represented typically by three values: hue (tone), saturation, and luminance (brightness). Ex. 1002 ¶ 26. The Specification of the ’293 patent also confirms that luminance L (brightness), tone T (hue), and saturation S are separate parameters for generating histograms. Ex. 1001, 21:37–63. Tomitaka’s histogram hue unit 19 is dedicated to process hue signals, whereas Tomitaka’s histogram brightness unit 20 is dedicated to process brightness signals. Ex. 1007, 5:36–41, Fig. 1.

Petitioner does not explain why an ordinarily skilled artisan would have had a reason to modify Tomitaka's hue and brightness histogram units 19, 20 so that both units would process the same parameter. Pet. 73–74. Therefore, Petitioner's argument that, “[b]ecause brightness and hue are both components of color, it would have been obvious to use multiple histogram units to process the same parameter” is conclusory and not supported by sufficient evidence. *Id.*

Second, Petitioner argues that “Tomitaka can be combined with Rogers.” *Id.* Petitioner avers that Rogers teaches forming three histograms of the pixel intensity (brightness) for each tracking window. *Id.* Petitioner asserts that “one of ordinary skill would have been motivated to improve Tomitaka, which teaches enabling a color component histogram based on a color condition, with the teaching of Rogers that a histogram can be enabled by applying a condition based on a pixel property (such as location) different from the one being histogrammed (such as intensity).” *Id.* at 68–71. In Petitioner's view, this “would enhance the capability of Tomitaka and improve its ability to locate and track a moving object.” *Id.* at 70–71.

As discussed above, the cited portions of Rogers do not disclose a plurality of histogram units being configured to form a histogram of the same parameter. Ex. 1006, 29, Fig. 1. Rogers merely describes forming three histograms for each tracking window, but does not disclose forming those histograms with a plurality of histogram calculation units. *Id.* Petitioner's argument conflates “histograms” with “histogram calculation units.” Pet. 74. Petitioner does not explain sufficiently why the disclosure

of forming three histograms in Rogers would teach or suggest a plurality of histogram calculation units. *Id.* at 68–71, 74.

Furthermore, Petitioner’s reason to combine Tomitaka with Rogers is merely a general reason to use Roger’s technique of forming three histograms for pixel intensity, which does not describe using a plurality of histogram calculation units. *Id.* at 68–71. Petitioner also does not identify a specific reason for using a plurality of histogram calculation units to process the same parameter. *Id.* Therefore, we are not convinced that Petitioner has provided an adequate reason as to why an ordinarily skilled artisan would have combined the prior art teachings to arrive at the claimed invention. *See In re NuVasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016) (requiring an articulated specific reason why the additional information would benefit an ordinarily skilled artisan in an obviousness determination).

In addition, Petitioner’s obviousness analysis is inconsistent because its proposed combination would eliminate the very feature (gate logic 18) of Tomitaka that Petitioner relied upon to teach “at least two histogram calculation units . . . being configured to form a histogram representative of the parameter as a function of a *validation signal*,” as recited in claim 1. Ex. 1001, 26:47–51 (emphasis added). Petitioner maps this claim limitation onto the prior art teaching that “Tomitaka’s hue histogram is formed by histogram unit 19 for those pixels *validated by gate logic 18*.” Pet. 75 (emphasis added) (citing Ex. 1007, Fig. 1, 6:40–49 (pixels not meeting saturation threshold are removed by gate circuit 18); Ex. 1002 ¶ 151). As Petitioner confirms, Tomitaka emphasizes the advantage of using multiple histogram processors *each dedicated to process different components of*

color. Id. at 68–69. Petitioner also acknowledges (*id.*) that Tomitaka teaches decomposing color into hue, brightness, and saturation, as well as forming histograms of brightness and hue separately by different histogram units, wherein hue histogram unit 9 is enabled by gate circuit 18 only when the saturation meets certain criteria. Ex. 1007, 6:14–19, 40–55, Fig. 1. More importantly, modifying both brightness histogram unit 20 and hue histogram unit 19 to process the same parameter (pixel intensity), as Petitioner suggests, would eliminate these basic functions of Tomitaka’s system, including the very feature (gate circuit 18) that Petitioner relies upon for teaching the “validation signal” of claim 1.

For the foregoing reasons, Petitioner has not articulated a sufficient reason to combine the teachings of Tomitaka and Rogers to arrive at the invention covered by claim 1. As such, Petitioner has not demonstrated by a preponderance of the evidence that claim 1 is unpatentable under § 103(a) as obvious over Tomitaka in combination with Rogers.

Claims 18, 19, and 29

For the aforementioned “classification” limitations required by claims 18, 19, and 29, Petitioner relies upon Tomitaka to disclose the “classification” limitations. Pet. 78, 79, 82; *id.* at 13–16. However, as we previously discussed above in Section II.E., Tomitaka calculates hue and brightness histograms before making a noise determination for generating a *subsequent histogram*—not the same histogram for which the classification applies, as required by the claims. Ex. 1007, 5:49–60, Figs. 1, 4, 5. Therefore, Petitioner has not shown sufficiently that Tomitaka discloses a

classification unit “configured to determine the data in the histogram that satisfy a selected criterion . . . , wherein classification is performed automatically by processing statistical information associated with the calculated histogram.” As such, Petitioner has not demonstrated by a preponderance of the evidence that claims 18, 19, and 29 are unpatentable under § 103(a) as obvious over the combination of Tomitaka and Rogers.

Claim 22

Claim 22 recites “an input multiplexer adapted to receive data describing one or more parameters of the event being detected, and to output data describing a selected one of the one or more parameters in response to a selection signal.” Ex. 1001, 29:64–67. In this regard, Petitioner does not indicate the specific portions of Tomitaka that describe an input multiplexer. Pet. 79–80. Rather, Petitioner asserts that, “[t]o the extent Tomitaka does not disclose an input multiplexer, it can be combined with Rogers” because Roger’s Figure 8 shows analog-to-digital converter (ADC) data describing a parameter of the video signal that enters a multiplexer, which in response to selection signal VSX, outputs the selected ADC data to the histogram memory circuit. *Id.* (citing Ex. 1006, 57, Fig. 8; Ex. 1002 ¶ 168).

However, Petitioner does not explain specifically how the features of Tomitaka and Rogers are being combined. *Id.* More importantly, neither Petitioner nor Dr. Hart explains why one with ordinary skill in the art would have had a reason to use Roger’s multiplexer in Tomitaka’s processing system. *Id.*; Ex. 1002 ¶ 168.

Petitioner’s analysis for the “input multiplexer” limitation of claim 22 does not reference any other section of the Petition. Pet. 79, 80. Nevertheless, we note that the Petition contains another section where Petitioner merely proffers several generic reasons to combine Tomitaka and Rogers. *Id.* at 68–71. Notably, that section does not explain specifically why an ordinarily skilled artisan would be motivated to use Roger’s multiplexer or any multiplexer. *Id.* For example, Petitioner contends that “one of ordinary skill would have been motivated to improve Tomitaka . . . with the teachings of Rogers that a histogram can be enabled by applying a condition based on a pixel property (such as location) different from the one being histogrammed (such as intensity).” Pet. 68–71. However, Petitioner relies upon that assertion for a limitation in claim 1—namely, “at least two histogram calculation units for the treatment of the at least one parameter”—which is not recited in claim 22. *Id.* at 73–74, 79–80.

Petitioner also avers that both Tomitaka and Rogers are directed to the same field and, therefore, one with ordinary skill in the art “would naturally look to the teachings of Tomitaka and Rogers together to solve problems relating to tracking objects using histograms.” *Id.* Petitioner further argues that “because both Tomitaka and Rogers disclose examples of histogram-based image processing devices for tracking objects, one of ordinary skill would have expected such a combination to be successful.” *Id.* These assertions that the references are directed to the same art and same techniques, however, are inadequate to show why an ordinarily skilled artisan would have been motivated *to use Roger’s multiplexer* in Tomitaka’s processing system. *See, e.g., Microsoft Corp. v. Enfish, LLC*, No. 2015-

1734, 2016 WL 6994254, at *6–7 (Fed. Cir. Nov. 30, 2016) (unpublished) (holding that mere assertions that the references were directed to the same art or same techniques, without more, are “inadequate to show persuasively that a relevant skilled artisan would have been motivated to combine the references”).

In short, Petitioner does not identify a sufficient reason how or why an ordinarily skilled artisan would have used Rogers’ multiplexer in Tomitaka’s processing system. *See NuVasive*, 842 F.3d at 1382. Consequently, Petitioner has not established by a preponderance of the evidence that claim 22 is unpatentable under § 103(a) as obvious over Tomitaka and Rogers.

Conclusion

For the foregoing reasons, Petitioner has not demonstrated by a preponderance of the evidence that claims 1, 18, 19, 22, and 29 are unpatentable under § 103(a) as obvious over Tomitaka and Rogers.

III. PROCEDURAL ISSUE

Patent Owner objects to the constitutionality of this *inter partes* review. PO Resp. 3 (citing *Oil States Energy Servs., LLC v. Greene’s Energy Grp., 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 Servs., 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

For the foregoing reasons, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 22 of the '293 patent is unpatentable under § 103(a) as obvious over Pirim.

However, we determine that Petitioner has not demonstrated by a preponderance of the evidence that (1) claims 1, 18, 19, and 29 are unpatentable under § 103(a) as obvious over Pirim and Tomitaka; (2) claims 1, 18, 19, 22, and 29 are unpatentable under § 103(a) as obvious over Rogers and Gilbert; or (3) claims 1, 18, 19, 22, and 29 are unpatentable under § 103(a) as obvious over Tomitaka and Rogers.

V. ORDER

For the foregoing reasons, it is

ORDERED that claim 22 of the '293 patent is unpatentable;

FURTHER ORDERED that claims 1, 18, 19, and 29 of the '293 patent 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.

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