

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

DIGIMEDIA TECH, LLC,
Patent Owner.

IPR2021-00176
Patent 7,715,476 B2

Before GEORGIANNA W. BRADEN, JOHN A. HUDALLA, and
MICHAEL T. CYGAN, *Administrative Patent Judges*.

BRADEN, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Determining All Challenged Claims Unpatentable

35 U.S.C. § 318(a)

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine Petitioner has shown by a preponderance of the evidence that claims 1–4, 8–10, 14–16, 21–24, and 27–29 of U.S. Patent No. 7,715,476 B2 are unpatentable.

I. INTRODUCTION AND BACKGROUND

A. Procedural History

Unified Patents, LLC (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–4, 8–10, 14–16, 21–24, and 27–29 (the “challenged claims”) of U.S. Patent No. 7,715,476 B2 (Ex. 1001, the “’476 patent”). DigiMedia Tech, LLC (“Patent Owner”) did not file a Preliminary Response. Pursuant to 35 U.S.C. § 314(a), we instituted an *inter partes* review of all challenged claims on all proposed grounds of unpatentability. *See* Paper 7 (“Dec. to Inst.”), 29.

After institution of trial, Patent Owner filed a Patent Owner Response (Paper 10, “PO Resp.”), to which Petitioner filed a Reply (Paper 12, “Pet. Reply”). Patent Owner then filed a Sur-Reply (Paper 13, “PO Sur-Reply”).

An oral argument was held on March 1, 2022. A transcript of the oral argument is included in the record. Paper 21 (“Tr.”).

B. Real Parties-in-Interest

Petitioner identifies Unified Patents, LLC as the real party-in-interest. Pet. 83. Patent Owner identifies DigiMedia and Brainbox Innovations, LLC as real parties-in-interest. Paper 5 (Patent Owner’s Mandatory Notices), 2. There is no dispute regarding the identification of the real parties-in-interest.

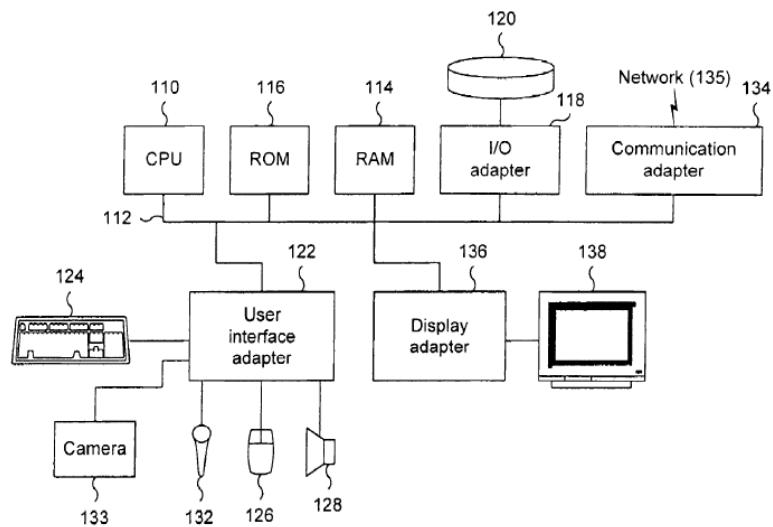
C. Related Proceedings

The parties identify the following infringement actions involving the '476 patent: *DigiMedia Tech, LLC v. FUJIFILM Holdings America Corporation*, Case No. 7:20-cv-04140 (S.D.N.Y.), filed May 29, 2020; *DigiMedia Tech, LLC v. Olympus Corporation et al.*, Case No. 5:20-cv-02549 (E.D. Pa.), filed May 29, 2020; *DigiMedia Tech, LLC v. Sakar International, Inc.*, Case No. 2:20-cv-07226 (D.N.J.), filed June 13, 2020; *DigiMedia Tech, LLC v. JK Imaging Ltd.*, Case No. 2:20-cv-05595 (C.D. Cal.), filed June 24, 2020; and *DigiMedia Tech, LLC v. Elite Brands Inc.*, Case No. 1:20-cv-07573 (S.D.N.Y.), filed September 15, 2020. Pet. 84; Paper 5, 2.

D. The '476 patent

The '476 patent, which is titled “System, Method and Article of Manufacture for Tracking a Head of a Camera-Generated Image of a Person,” issued on May 11, 2010, and describes “tracking [the] head portion of a person[’s] image in camera-generated video images.” Ex. 1001, codes (45), (54), 1:41–44.

Figure 1, reproduced below, is a schematic diagram showing an embodiment of a hardware configuration disclosed in the '476 patent:



The hardware configuration illustrated in Figure 1, above, includes: central processing unit 110; Random Access Memory (RAM) 114; Read Only Memory (ROM) 116; I/O adapter 118 for connecting peripheral devices such as disk storage units 120 to bus 112; user interface adapter 122 for connecting keyboard 124, mouse 126, speaker 128, microphone 132, camera 133 and/or other user interface devices to bus 112; communication adapter 134 for connecting the hardware configuration to communication network 135 (e.g., a data processing network); and display adapter 136 for connecting bus 112 to display device 138. *See Ex. 1001, 4:56–5:3.*

Another embodiment in the '476 patent is shown in Figure 2, reproduced below.

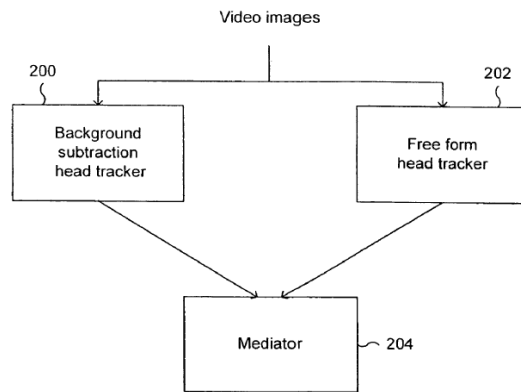


Figure 2 illustrates a flowchart of a process for tracking a head portion of a person image in camera-generated video images. *Id.* at 5:18–20. After “receiving video images generated by a camera, a first head tracking operation 200 is executed for generating a first confidence value.” *Id.* at 5:21–23. The ’476 patent discloses that “[t]he first confidence value generated by the first head tracking operation is representative of a confidence that a head portion of a person image in the camera-generated video images is located.” *Id.* at 5:29–32.

According to the ’476 patent, second head tracking operation 202 is executed “for generating a second confidence value representative of a confidence that the head portion of the person image in the camera-generated video images is located.” *Id.* at 5:32–35. The ’476 patent discloses that “[t]he first confidence value and the second confidence value may then be made available for used by various applications in operation 204.” *Id.* at 5:36–38. Such applications may decide whether the head portion of the person image has moved based on the confidence values. *Id.* at 5:38–40.

E. Illustrative Claim

As noted above, the Petition challenges independent claims 1, 21, and 27, as well as dependent claims 2–4, 8–10, 14–16, 22–24, 28, and 29. Claim 1 is illustrative of the challenged subject matter at issue and is reproduced below:

1. A method performed by a computer for processing images to identify a head portion of a subject in the images comprising:
 - obtaining images of a subject;
 - generating, by the computer, a first confidence value representing a confidence that a first process has identified a location of a head portion of the subject in the images;
 - generating, by the computer, a second confidence value representing a confidence that a second, different process has identified the location of the head portion of the subject in the images; and
 - identifying, by the computer, the location of the head portion of the subject in the images based at least in part on the first confidence value and the second confidence value.

Ex. 1001, 11:21–35.

F. The Asserted Challenges to Patentability and Evidence of Record

Petitioner asserts claims 1–4, 8–10, 14–16, 21–24, and 27–29 of the '476 patent are unpatentable based on the following challenges (Pet. 1):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–4, 8, 14–16, 21–23, 27, 28	103 ¹	Cosatto ²
9, 10, 24, 29	103	Cosatto, Khosravi ³

Petitioner filed a Declaration of Dr. Gregory F. Welch (“Dr. Welch,” Ex. 1002) with its Petition.

G. Principles of Law Regarding Obviousness

A claim is unpatentable under 35 U.S.C. § 103(a) if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *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

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103. For purposes of institution, the application that matured into the '476 patent never contained any claim having an effective filing date on or after March 16, 2013 (the effective date of the relevant amendment), so the pre-AIA version of § 103 applies. *See* AIA, 125 Stat. 284, Sec. 3(n)(1).

² Cosatto et al., U.S. Patent No. 5,864,630, filed Nov. 20, 1996, issued Jan. 26, 1999. Ex. 1005 (“Cosatto”).

³ Khosravi et al., U.S. Patent No. 6,184,926 B1, filed May 21, 1997, issued Feb. 6, 2001. Ex. 1006 (“Khosravi”).

art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.⁴ *See Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17–18 (1966). “While the sequence of these questions might be reordered in any particular case,” *KSR*, 550 U.S. at 407, the U.S. Court of Appeals for the Federal Circuit has “repeatedly emphasized that an obviousness inquiry requires examination of all four *Graham* factors and that an obviousness determination can be made only after consideration of each factor,” *Nike, Inc. v. Adidas AG*, 812 F.3d 1326, 1335 (Fed. Cir. 2016), *overruled on other grounds by Aqua Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017) (en banc). When evaluating a combination of references, an obviousness analysis should address “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418.

We analyze the obviousness issues herein according to these principles.

H. Burden of Proof

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion

⁴ The trial record does not include any evidence of secondary considerations of nonobviousness.

never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review). Furthermore, Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Thus, to prevail in an *inter partes* review, Petitioner must explain how the proposed prior art or combinations of prior art would have rendered the challenged claims unpatentable. At this final stage, we determine whether a preponderance of the evidence of record shows that the challenged claims would have been obvious over the cited prior art. 35 U.S.C. § 316(e).

II. Analysis

A. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. “The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991).

The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). The level of ordinary skill in the art may be reflected by the prior art of record. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Factors that may be considered in determining the level of ordinary skill in the art include, but are not limited to, (1) the educational level of the inventor; (2) the type of problems encountered in the art; (3) prior-art solutions to those problems; (4) the

rapidity with which innovations are made; (5) the sophistication of the technology; and (6) the educational level of workers active in the field. *GPAC*, 57 F.3d at 1579; *Envtl. Designs, Ltd. v. Union Oil Co. of Calif.*, 713 F.2d 693, 696–97 (Fed. Cir. 1983). In a given case, one or more factors may predominate. *GPAC*, 57 F.3d at 1579. Generally, it is easier to establish obviousness under a higher level of ordinary skill in the art. *Innovation Toys, LLC v. MGA Entm’t, Inc.*, 637 F.3d 1314, 1323 (Fed. Cir. 2011) (“A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.”).

Relying on the testimony of Dr. Welch, Petitioner contends that [a] person of ordinary skill in the art (“POSA”) as of the earliest claimed priority date for the ’476 patent would have had a Bachelor’s Degree in Computer Science or Computer Engineering and two or more years of experience working with image processing or computer vision. [Ex. 1002 ¶ 34]. Additional education, such as a Master’s degree of Computer Science or Computer Engineering with an emphasis on image processing or computer vision, could substitute for professional experience and significant work experience could substitute for formal education. *Id.*

Pet. 5.

Patent Owner proposes that a person of ordinary skill in the art in July 1999 would have had at least a bachelor’s degree in electrical engineering or computer science, and two years of industry experience in the field of image processing. PO Resp. 3. According to Patent Owner, “[h]igher levels of education may substitute for less experience, and more experience may substitute for the specific level of education.” *Id.* Patent Owner acknowledges that its proposed level of skill is similar to that proposed by Petitioner. *Id.*

Based on our review of the '476 patent, the types of problems and solutions described in the '476 patent and cited prior art, and the testimony of Dr. Welch (*see* Ex. 1002 ¶ 34), we adopt Patent Owner's definition. Thus, we find that a person of ordinary skill in the art at the time of the claimed invention would have had at least a bachelor's degree in electrical engineering or computer science, and two years of industry experience in the field of image processing. Our disposition of this case does not turn on the differences between Petitioner's and Patent Owner's definitions, however, and we note that our conclusion would be the same under either definition.

B. Claim Construction

In an *inter partes* review, the Board construes each claim "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b). Under the same standard applied by district courts, claim terms have their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure.

Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

"There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Neither party addresses claim construction during this proceeding. Based on our analysis, we too find no need to construe any claim term. *See, e.g., Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d

1013, 1017 (Fed. Cir. 2017); *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

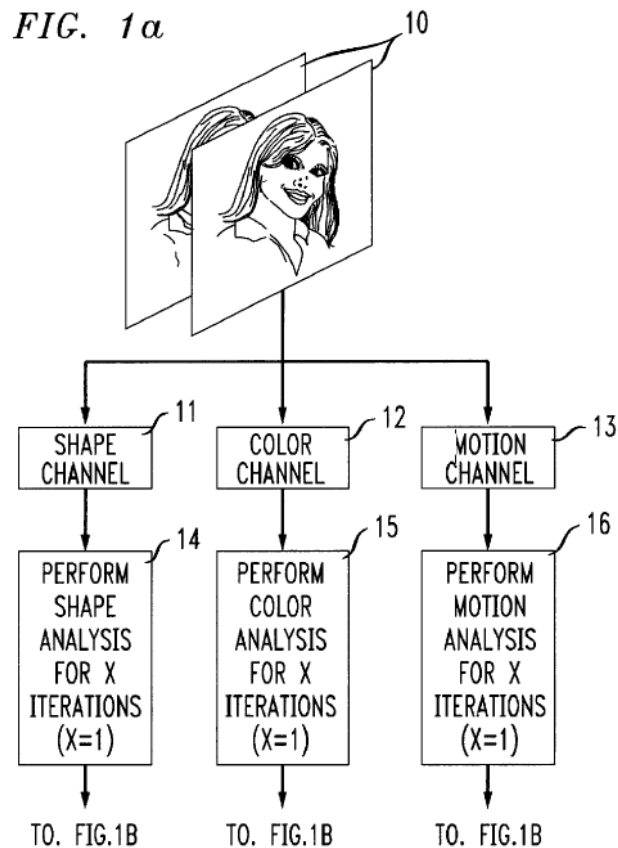
III. ANALYSIS AND DISCUSSION

A. *Alleged Obviousness of Claims 1–4, 8, 14–16, 21–23, 27, and 28 in view of Cosatto*

Petitioner relies on teachings of Cosatto to allege obviousness of claims 1–4, 8, 14–16, 21–23, 27, and 28. *See* Pet. 12–67. Patent Owner disputes Petitioner’s contentions and argues that Cosatto fails to render several claim limitations obvious. PO Resp. 7–27. For reasons that follow, we determine Petitioner has shown by a preponderance of the evidence that the challenged claims would have been obvious to a person of ordinary skill in the art at the time of the alleged invention in view of Cosatto under 35 U.S.C. § 103.

1. *Overview of Cosatto (Exhibit 1005)*

Cosatto, a U.S. Patent titled “Multi-Modal Method for Locating Objects in Images,” describes methods for identifying and tracking objects of varying shapes, sizes, and orientations (including heads and faces) within complex images. Ex. 1005, code (54), 1:5–7, 3:37–40. One embodiment disclosed in Cosatto includes an algorithm for tracking objects in an image. Figure 1a, reproduced below, depicts a flow chart of such an algorithm.



In Figure 1 of the '476 patent, images 10 are selected for tracking and comprise heads and facial features. Ex. 1005, 5:28–33. According to Cosatto, images 10 selected for tracking may comprise a single frame or a sequence of frames, and may originate from any of an unlimited number of sources. *Id.* at 5:34–36. Cosatto discloses that “the algorithm is initiated by the activation of all three channels: the shape channel 11, the color channel 12, and the motion channel 13.” *Id.* at 5:40–43. A system controller or other appropriate hardware device operate channels 11, 12, and 13, or a software program can control the channels. *Id.* at 5:43–46. Channels 11, 12, and 13 perform their analysis for a predetermined number of iterations or frames. *Id.* at 5:55–56. Cosatto discloses that “[t]he data produced by each channel comprise a list of areas which may contain head outlines and facial features.” Ex. 1005, 5:66–67. According to Cosatto,

“each channel generates an intermediate feature representation.” *Id.*
at 5:6:1–2.

Following the analyses, the channels relay their respective tracking data to a system classifier or other device as shown in Figure 1b, reproduced below. *Id.* at 5:57–60 (Fig. 1b steps 17, 18, and 19).

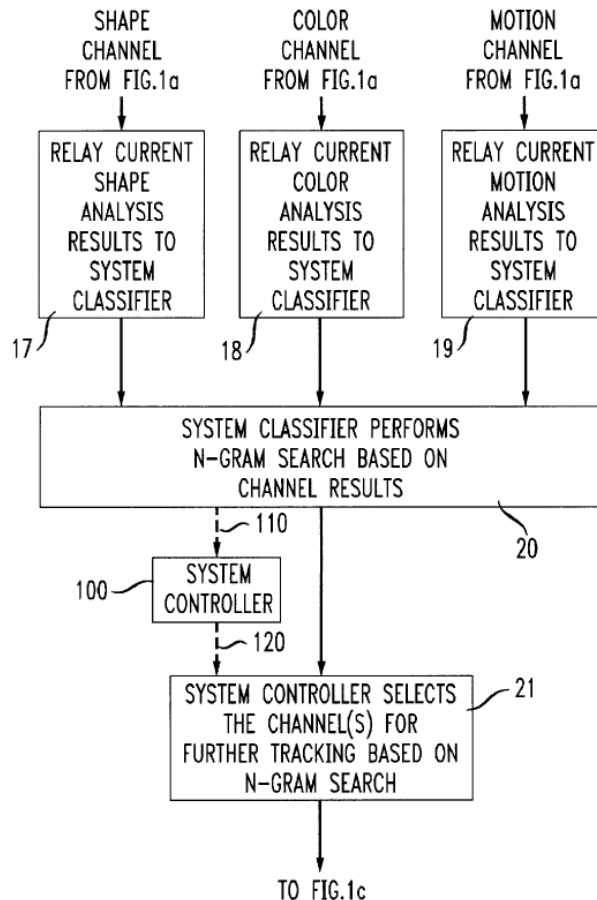
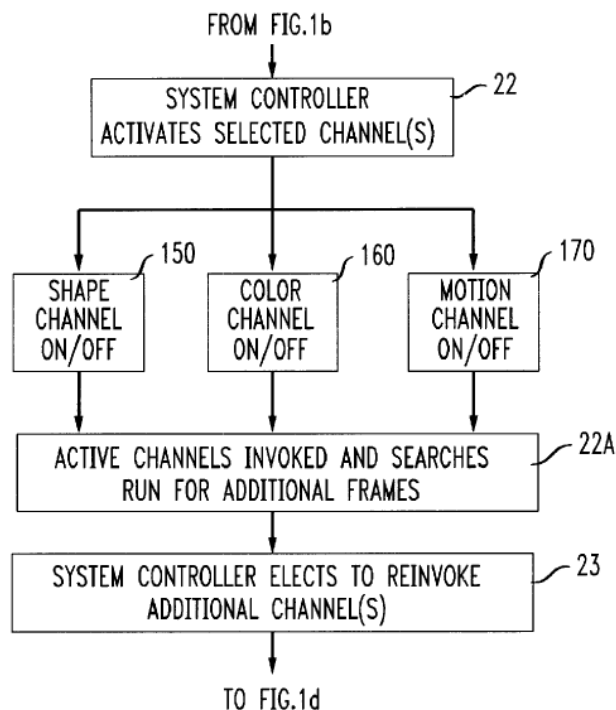


Figure 1b, reproduced above, continues the algorithm flow chart from Figure 1a. “As indicated by the succeeding step 20 in FIG. 1b, the system classifier compares, evaluates and integrates” the intermediate feature representations by performing a n-gram search. *Id.* at 5:20–21. Cosatto teaches that “[a]n n-gram search uses information obtained from all three channels to evaluate the quality of individual features, as well as combinations of features, within the representations.” Ex. 1005, 6:25–28.

The system classifier marks candidate facial features in the images marked with blobs of connected pixels. It then analyzes the shape of each individual feature and discards those that definitely cannot represent a facial feature.

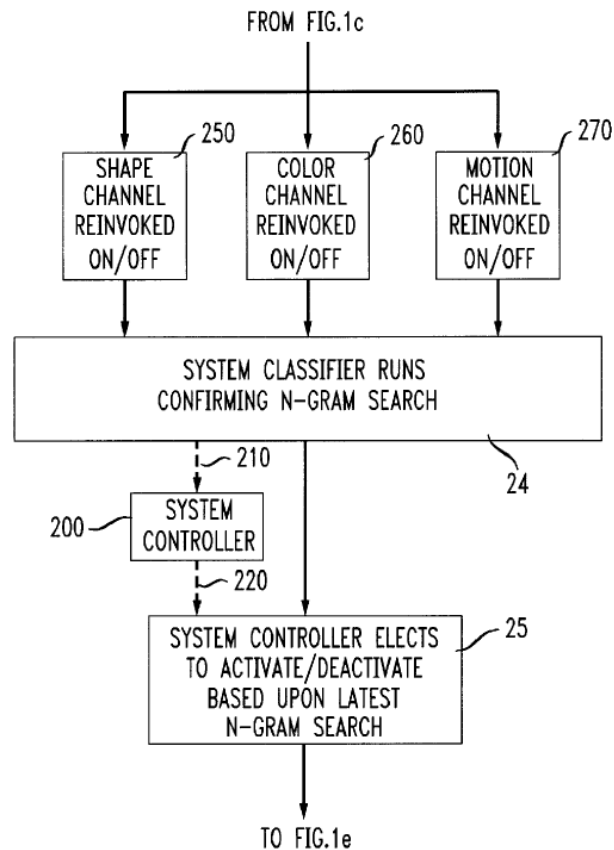
Id. at 6:37–41.

Subsequently, as shown in the Figure 1c reproduced below, the system controller implements the selected channels to run for a selected number of frames. *Id.* at 8:20–22.



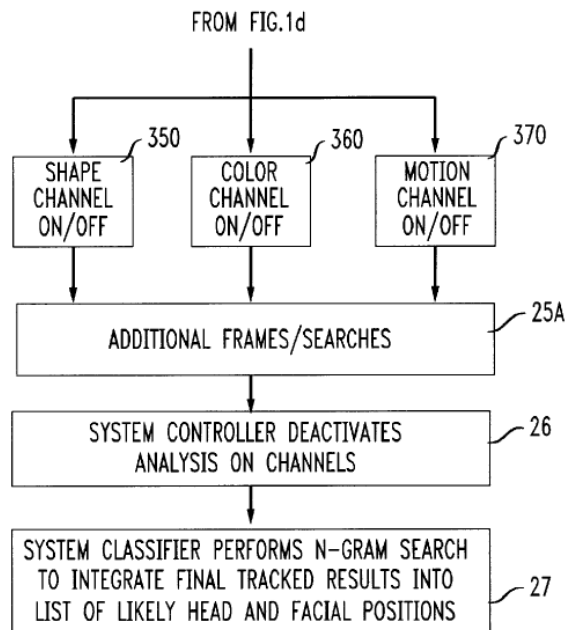
Following this sequence of steps representing the initial channel selection by the system, the active channels continue to extract information in subsequent frames. *Id.* at 8:39–42. The system controller can continue to track the head portions in future frames (step 22). *Id.* at 8:44–49.

Next Cosatto teaches that, as shown in the Figure 1d reproduced below, “the controller invokes the classifier as usual to perform an n-gram search to evaluate the newest results (step 24, Fig. 1d).” *Id.* at 8:67–9:3.



According to Cosatto, “[b]ased on these search results, the controller may activate or deactivate one or more selected channels to maintain tracking speed and accuracy (step 25, FIG. 1d).” Ex. 1005, 9:3–5.

Finally, as shown in Figure 1e reproduced below, “[t]ogether with information already obtained from previous frames, the system classifier evaluates and integrates the final data (step 27, FIG. 1e).” *Id.* at 9:67–10:3.



Cosatto explains

An n-gram search is preferably used to integrate the final output data. Using the n-gram method, features and combinations of features are again evaluated and classified, and the controller selects lists of perceived areas based on these classifications. In the end, the tracked output comprises a list of likely head and facial positions within the tracked images.

Ex. 1005, 10:3–9.

2. *Analysis of Cosatto as Applied to Challenged Independent Claim 1*

- a. “[a] method performed by a computer for processing images to identify a head portion of a subject in the images comprising:”

Claim 1’s preamble recites “[a] method performed by a computer for processing images to identify a head portion of a subject in the images comprising.” Ex. 1001, 11:21–23. Petitioner contends that to the extent the preamble is considered limiting, Cosatto teaches “methods which track

objects such as heads and faces within complex images.” Pet. 12 (quoting Ex. 1005, 3:38–40).

“Whether to treat a preamble term as a claim limitation is determined on the facts of each case in light of the claim as a whole and the invention described in the patent.” *Am. Med. Sys., Inc. v. Biolitec, Inc.*, 618 F.3d 1354, 1358 (Fed. Cir. 2010) (internal quotation marks omitted). Where “the body of the claim fully and intrinsically sets forth the complete invention, including all of its limitations, and the preamble offers no distinct definition of any of the claimed invention's limitations, but rather merely states, for example, the purpose or intended use of the invention, then the preamble is of no significance to claim construction because it cannot be said to constitute or explain a claim limitation.” *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999).

Patent Owner does not dispute Petitioner’s contentions regarding the preamble of claim 1. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entire record of this proceeding, we find that Cosatto teaches methods for tracking objects such as heads and facial features within complex images. *See* Ex. 1005, 3:38–40.

b. “obtaining images of a subject”

Claim 1 recites “obtaining images of a subject.” Ex. 1001, 11:24.

Petitioner contends Cosatto teaches this limitation because Cosatto “discloses that its head-tracking methods or algorithm start with selecting images 10 for tracking, as shown in Figure 1a below.” Pet. 14 (citing Ex. 1005, 5:27–29, 5:33–37 (“The images 10 . . . may comprise a single frame or a sequence of frames” that are “derive[d] from a camera set up in a

room)). Thus, Petitioner argues that a person of ordinary skill in the art “would have understood that the camera in *Cosatto* performs the step of ‘obtaining images.’” *Id.* (citing Ex. 1002 ¶ 69).

Patent Owner does not dispute Petitioner’s contentions. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entire record of this proceeding, we determine Petitioner has shown that *Cosatto*’s disclosure of “obtaining images of a subject” teaches the challenged claim limitation. *See* Ex. 1005, 5:27–29, 5:33–37.

c. “*generating, by the computer, a first confidence value representing a confidence that a first process has identified a location of a head portion of the subject in the images*”

Claim 1 recites “generating, by the computer, a first confidence value representing a confidence that a first process has identified a location of a head portion of the subject in the images.” Ex. 1001, 11:25–27.

Petitioner contends *Cosatto* meets this limitation because it discloses that the system classifier “compares, evaluates and integrates the generated features” (step 20) and “assigns a measure of confidence for each feature and each of combination of features.” Pet. 18–19 (citing Ex. 1005, 6:20–22, 6:28–30; *see also id.* at 4:11–13 (“In particular, a system classifier evaluates the quality of each channel’s generated head and facial features.”)). For the claimed “confidence value,” Petitioner cites *Cosatto*’s disclosure that the measure of confidence is “compared to a ‘fixed threshold measure of confidence’ which is a ‘fixed quantity,’ ‘lowest possible score,’ or ‘threshold value[.]’” Pet. 20 (citing Ex. 1005, 7:62–65 (“In addition, a fixed threshold measure of confidence may optionally be identified with each channel. This fixed quantity may, for example, represent the lowest permissible score for a

channel.”), 8:4–8 (“As another example, if the shape 11 and motion 13 channels’ confidence measures exceed their respective threshold values, the system controller may decide to run only the shape analysis for a designated number of frames.”)). Petitioner argues that a person of ordinary skill in the art “would have understood that *Cosatto*’s measure of confidence would be represented as a numerical value, before it can be compared by a computer to another quantity/score/value.” Pet. 20 (citing Ex. 1002 ¶ 81).

Petitioner then asserts that for the claimed “representing a confidence that a first process has identified a location of a head portion of the subject in the images,” *Cosatto* teaches that “the measure of confidence for the intermediate feature representation generated by the color channel is based on a level of accuracy of likely head positions.” *Id.* (emphasis omitted) (citing Ex. 1005, 6:44–46 (“The classifier associates a measure of confidence for each such feature based on its perceived level of accuracy.”); Ex. 1002 ¶ 82). Petitioner specifically argues that *Cosatto*’s “system classifier generates the measure of confidence by performing an n-gram search in multiple stages, e.g., ‘uni-gram search,’ ‘bi-gram search,’ ‘tri-gram search,’ etc.” *Id.* at 20–21 (citing Ex. 1005, 4:54–55, 6:41, 6:46–48, 6:53–64, 7:1–10). Petitioner further argues *Cosatto* discloses that the “searches produce a list of likely head positions” Pet. 21 (citing Ex. 1005, 4:54–55; 10:3–9).

Patent Owner disputes Petitioner’s contentions and contends the measure of confidence taught by *Cosatto* does not qualify as the first confidence value recited in the claims. Patent Owner specifically argues that *Cosatto*’s “measure of confidence does not represent a confidence that a *particular* process has identified a location of a head portion of the subject in

the images.” PO Resp. 8. Rather, according to Patent Owner, “the confidence measure is specific to a particular (potential) facial feature rather than a value specific to a particular head-identifying process,” as required by the claims. *Id.*

Patent Owner further argues that “Cosatto’s measure of confidence for potential facial features is assigned based on the *integrated* results generated by the three channels (shape, color, and motion).” *Id.* at 9; PO Sur-Reply 3 Patent Owner asserts that the confidence measure in Cosatto for any particular facial feature does not represent a confidence value that a particular head-identification process has located the head portion of a subject. PO Resp. 9. Instead, according to Patent Owner, “it represents a confidence measure that a particular facial feature has been identified by Cosatto’s *three* disclosed channels (color, shape, and motion).” *Id.* Patent Owner concludes that “[t]his measure of confidence for individual features therefore does not constitute a first confidence value *that a first head-identifying process* has identified the location of the head portion of the subject.” *Id.*

Patent Owner then asserts that Cosatto discloses two types of “measures of confidence” with the first being “a measure of confidence for particular facial features or combinations thereof” “based on the aggregate input from all channels (e.g., color, motion, shape).” PO Sur-Reply 3 (citing Ex. 1005, 6:20–30). Patent Owner argues that the second “measure of confidence” in Cosatto is “a general score for each channel,” which is derived from the system’s analysis of the first set of facial-feature scores.” *Id.* According to Patent Owner, Cosatto’s system does not use the general score to identify a head portion of the subject, as required by the claims, but

instead “selects additional channel(s) to be used based on the channels’ general scores.” *Id.* at 4 (citing Ex. 1005, 7:55–56); PO Sur-Reply 3–4.

Patent Owner further argues that Petitioner continuously conflates the two types of measures of confidence. PO Resp. 12; Tr. 26:23–27:12. Then Patent Owner asserts that a measure of confidence is not assigned for each channel in Cosatto; rather, “the measure of confidence is only calculated and assigned after you’ve aggregated the data from all three channels.”

Tr. 30:13–15. Thus, Patent Owner concludes that neither of Cosatto’s measures of confidence for any particular facial feature qualifies as the first confidence value that a first head-identifying process has identified the location of a head portion of a subject. PO Sur-Reply 4–6; Tr. 26:10–12.

We do not agree with Patent Owner’s reading of Cosatto. First, Cosatto explicitly states that “a fixed threshold measure of confidence may optionally be identified with each channel.” *See* Ex. 1005, 7:61–62. Although Patent Owner argues that Cosatto’s disclosure is only relevant to generating an intermediate representation and creating a general score so as to determine which channels will be used in future analysis (Tr. 30:23–32:3), we do not agree because Cosatto also discloses that its analysis may continue only using one or two of its channels (Ex. 1005, 4:30–32, 8:3–4, 9:30–32). Cosatto further discloses that if “the perceived areas of skin colors reported from the color channel” is “inaccurate,” then “the classifier would likely assign a low measure of confidence for the skin color area [feature]” and would not use that channel’s feature data. Ex. 1005, 7:1–10. Additionally, we credit the testimony of Dr. Welch who explains that Cosatto generates measures of confidence for each different channel without relying on the other channels. Ex. 1002 ¶¶ 87–88.

Second, Cosatto discloses that data produced by each channel (shape channel, color channel, and motion channel) are collected and the results for are analyzed to determine if the data potentially reflects whether a specific channel has low reliability or high reliability. Ex. 1005, 6:58–7:12. Cosatto further discloses “[i]f color channel 11 receives a high general score Y2 for each frame based on [a] high feature-based measures of confidence, the accuracy of the color channel is confirmed.” *Id.* at 9:27–35. We find such disclosures to indicate that each channel has a specific measure of confidence such that the confidence assigned to the color channel constitutes a first measure of confidence. We agree with Petitioner that “[t]his clearly explains how the measures of confidence assigned to both individual and combinations of features in Cosatto as mapped by the petition relates to the reliabilities of individual specific channels.” Tr. 50:13–15.

Third, we do not agree with Patent Owner’s argument regarding a face versus head distinction because we find that a person of ordinary skill in the art would have understood the facial color analysis of Cosatto as a head tracking process. *See* Pet. 18; Ex. 1002 ¶¶ 72–79; *see also* Tr. 43 (Mr. Alexander: Cosatto “in column 4, line 7 it says all three channels ideally produce identical representations of tracked head and facial positions”).

Lastly, given the explicit disclosures in Cosatto that each channel is analyzed individually and assigned measures of confidence, we find that each channel embodies a different process. We also credit the testimony of Dr. Welch, who testifies that

a skilled artisan would have understood that the color channel and motion channel are different processes. . . . [B]efore the claimed priority date of the ’476 patent, concurrent and parallel computing had been widely used to carry out multiple processes

at the same time. Thus, a computer can run the color and motion channels in parallel to analyze a frame.

Ex. 1002 ¶ 88.

Accordingly, based on the entire record of this proceeding, we determine Petitioner has shown that Cosatto's disclosures regarding the functions of the system classifier satisfies the challenged claim limitation of "generating, by the computer, a first confidence value representing a confidence that a first process has identified a location of a head portion of the subject in the images."

- d. *"generating, by the computer, a second confidence value representing a confidence that a second, different process has identified the location of the head portion of the subject in the images"*

Petitioner contends "Cosatto in view of the knowledge of a [person of ordinary skill in the art] renders obvious the claimed 'second confidence value.'" Pet. 22 (citing Ex. 1002 ¶¶ 85–91). According to Petitioner, "Cosatto discloses that the motion channel (coupled to the claimed 'second, different process') generates an intermediate feature representation that 'comprise[s] shapes where facial features or the outlines of heads may be present.'" *Id.* (citing Ex. 1005, 4:1–6) (alteration in original). Petitioner argues that Cosatto's motion channel is "different" from the color channel, and by disclosing that each channel "uses a different parameter (color, motion, and shape) to obtain" the intermediate feature representations of head portions and comparing the tracking results of these channels, Cosatto generates the required "second confidence value." *Id.* at 22–25 (citing Ex. 1005, 3:56–57 ("The methods use three channels for tracking three separate parameters.") 6:2–6; Ex. 1002 ¶ 86).

Petitioner explains that if the “perceived areas of skin colors reported by the color channel . . . fall[] within the perceived left and right head outlines obtained from the motion channel,” “the classifier would likely assign a high measure of confidence to the . . . left head outline, right head outline” and “may deduce that the color and motion channels are producing reliable information.” *Id.* at 25 (citing Ex. 1005, 6:58–66) (alterations in original). Petitioner then argues the disclosure that the head outlines matches the areas of skin colors teaches the motion channel “has identified the location of the head portion of the subject in the images” as required by the claim. *Id.* (citing Ex. 1005, 4:7–8 (“All three channels ideally produce identical representations of tracked head and facial positions.”); Ex. 1002 ¶ 89). Thus, according to Petitioner, the “disclosure of assigning a high measure of confidence to the head outlines teaches the claimed ‘generating . . . a second confidence value representing a confidence that’ the motion channel has identified the location of the head portion.” *Id.* (alteration in original, emphasis omitted)

Petitioner relies on the testimony of Dr. Welch to support its position. *See* Pet. 26. Specifically, Dr. Welch testifies as follows:

[A]lthough the system classifier assigns the high measure of confidence to the head outlines because they correspond to the same image location as the areas of skin colors identified by the color channel, this does not mean that the generating of the *second confidence value* must depend on the generating of the *first confidence value* assigned to the areas of skin colors. *Cosatto* teaches that the system classifier (i.e., the computer) can generate the *first confidence value* and *second confidence value* simultaneously. *See, e.g.,* [Ex. 1005], 9:21–27 (“The motion channel 13 and the color channel 12 run concurrently for X2 frames. The quantity X2 is selected by the controller. Preferably, $X2 < 10$. After the passage of each frame during the

X2 frames, the controller compares the results of the motion channel 13 and the color channel 11 as previously described.”).

Ex. 1002 ¶ 90. Thus, Petitioner concludes that the generating of the second confidence value is a different process from the generating of the first confidence value. Pet. 26 (citing Ex. 1002 ¶ 91).

Patent Owner disputes Petitioner’s contentions. Specifically, Patent Owner argues that Cosatto’s “measure of confidence for potential facial features is assigned based on the integrated results generated by the three channels (shape, color, and motion)” and does not constitute “a second confidence value that *a second head-identifying process* has identified the location of the subject’s head portion.” PO Resp. 9. Thus, Patent Owner concludes that Cosatto’s measure of confidence for any particular facial feature does not qualify as either the first or second confidence values that a first or second head-identifying process has identified the location of a head portion of a subject, as recited in claim. *Id.* at 10–11; PO Sur-Reply 5–7.

We do not agree with Patent Owner. Rather, we agree with Petitioner’s argument that if Cossato’s confidence values did not relate to an individual channel (i.e., color, motion) and only related to a confidence that all channels collectively identified some feature, then (1) Cossato would not be able to determine which channel should be indicated as “reliable” by generating general scores from the confidence values, and (2) Cossato would not be able to determine whether to maintain or switch off individual channels based on reliability. *See* Pet. 18–21, 25–26; Ex. 1002 ¶¶ 72–91; Ex. 1005, 6:25–28, 6:56–7:12, 8:1–12. Furthermore, we find Petitioner’s position supported by Cossato’s disclosure regarding its “general scores,” which are ‘compute[d] from the measures of confidence determined by the

system classifier for individual features and combinations in the n-gram search,” to show how selecting channels for further tracking and identifying of a head portion using such general scores is based on the computed measures of confidence *See* Ex. 1005, 7:52–55; *see* Pet. 18–19, 28; Reply 13–17. Therefore, we find that Cossato’s measures of confidence relate to individual channels and that the process used by Cossato for its motion channel is “different” from the process used for its color channel. *See* Ex. 1002 ¶ 91.

Accordingly, based on the entire record of this proceeding, we determine Petitioner has shown that Cosatto’s teaching regarding its “color and motion channels” as explained by Dr. Welch satisfies the challenged claim limitation of “a second confidence value representing a confidence that a second, different process has identified the location of the head portion of the subject in the images.”

- e. *“identifying, by the computer, the location of the head portion of the subject in the images based at least in part on the first confidence value and the second confidence value”*

Petitioner contends “Cosatto in view of the knowledge of a [person of ordinary skill in the art] renders obvious this limitation.” Pet. 27 (citing Ex. 1002 ¶¶ 92–99). According to Petitioner, Cosatto teaches using the different confidence values assigned to the output from the color, shape, and motion channels to identify the head portion of a subject in an image. *Id.* at 27–28 (citing Ex. 1005, 4:24–30, 6:30–34, 7:13–19, 7:38–40, 8:39–42, Figs. 1a–1e; Ex. 1002 ¶ 93). Petitioner specifically points to Cosatto’s disclosure of the system classifier, which “runs an n-gram search to ‘evaluate[] and classif[y]’ ‘features and combinations of features’ identified in each frame, and assigns measures of confidence to the features and

combinations of features.” Pet. 30 (citing Ex. 1005, 10:4–7; 6:58–7:12 (describing that the n-gram search assigns high measure of confidence to perceived head portions); Ex. 1002 ¶¶ 97–99). Petitioner explains that Cosatto’s “controller selects lists of perceived areas [of head portions] based on these classifications” that comprise “likely head and facial positions within the tracked images.” *Id.* at 30–31 (citing Ex. 1005, 10:4–9).

Petitioner further relies on the testimony of Dr. Welch to support its position. Dr. Welch testifies that “a skilled artisan would have understood that ‘the location of the head portion of the subject’ in the additional frames (i.e. future frames) is identified by the active channel(s), which is/are selected ‘based at least in part on the first confidence value and the second confidence value,’” as claimed. Ex. 1002 ¶ 95 (emphasis omitted).

Patent Owner contends Cosatto’s process does not identify the location of the head portion of the subject in the images as recited in the claim. PO Resp. 10–11; PO Sur-Reply 5–7. Rather, according to Patent Owner, Cosatto describes a process for “determin[ing] which channel(s) should be used for further tracking to arrive at the final result.” PO Resp. 11 (citing Ex. 1005, 6:32–34). Patent Owner further argues that Petitioner conflates the measure of confidence that Cosatto calculates for individual features (Ex. 1005, 6:20–22) with a distinct score that Cosatto calculates for individual channels (*id.* at 7:47–49). PO Resp. 12. Patent Owner asserts that the general score created by Cosatto is only used to select channel for future analysis. *Id.* at 13. Patent Owner then argues that Cosatto’s measure of confidence “is specific to individual features based on a *combination* of different processes, and it does not represent a distinct first confidence value

for a first head-identifying process and a second distinct confidence value for a second head-identifying process.” *Id.* at 14.

As explained above, we find Cossato’s measures of confidence relate to individual channels and that the process used by Cossato for its motion channel is “different” from the process used for its color channel. Given that finding and crediting the testimony of Dr. Welch, which is consistent with the disclosure of Cosatto, we determine Petitioner has shown that Cosatto’s teachings regarding its “system controller” and the “assigned n-gram values” for the different channels satisfies the challenged claim limitation.

f. Conclusion regarding Claim 1

Accordingly, based on the foregoing discussion, we conclude Petitioner has demonstrated by a preponderance of the evidence that challenged independent claim 1 would have been obvious to a person of ordinary skill in the art under 35 U.S.C. § 103 in view of Cosatto.

3. Analysis of Cosatto as Applied to Challenged Independent Claims 21 and 27

Independent claims 21 and 27 recite many of the same or similar limitation recited by independent claim 1, except that claim 21 is a system claim and claim 27 is directed to a computer-readable medium with executable instruction. Ex. 1001, 13:14–24; 14:15–29.

Relying on many of the same or similar arguments with respect to claim 1, Petitioner provides a similar showing for independent claims 21 and 27. *See* Pet. 53–58, 62–66. For claim 21 specifically, Petitioner contends that Cosatto discloses a system controller, which includes a microprocessor. *Id.* at 56 (citing Ex. 1005, 8:14–17, 12:21–24, 13:45–47; Ex. 1002 ¶¶ 141–145). Petitioner further argues that Cosatto discloses that “the results of the n-gram search are made available to the system

controller 100” to perform two functions: “(1) to calculate, based on the obtained measures of confidence, which channel(s) is/are best suited for further tracking; and (2) to integrate, using the classifier or other dedicated program, the individual feature representations into a net representation for maintaining the tracked results.” Pet. 56 (citing Ex. 1005, 7:13–19, 7:38–40).

Regarding independent claim 27, Petitioner specifically contends that Cosatto teaches that the disclosed color, shape, and motion channels “may also be controlled by a software program” and “the system classifier . . . for analyzing data obtained from the channels” can be a “software program.” *Id.* at 63 (citing Ex. 1005, 5:45–46, 5:6–62). Petitioner relies on the Dr. Welch to support its position. Dr. Welch testifies that a person of ordinary skill in the art at the time of the alleged invention “would have understood that the ‘algorithm’ or ‘software program’ is a sequence of computer ‘instructions . . . that, if executed by a computing device, cause the computing device to” perform certain operations.” Ex. 1002 ¶¶ 167–169. Petitioner asserts that Cosatto teaches that the disclosed methods (“instructions”) can be performed by a tracking system “controller” that includes a “microprocessor” (“computing device”). Pet. 63 (citing Ex. 1005, 3:49–54, 5:43–45, 8:13–16). Additionally, Petitioner argues that although Cosatto does not expressly disclose the recited “computer-readable medium,” a person of ordinary skill in the art would have understood that Cosatto’s “algorithm” or “software program” needs to be, or at least was common and well-known to be, stored in a memory device so that they can be assessed by the “controller.” *Id.* (citing Ex. 1002 ¶ 170; Ex. 1005, 4:21–22).

Patent Owner relies on arguments similar to those made regarding claim 1. PO Resp. 22–27. Specifically with regards to claim 21, Patent Owner contends that Cosatto does not stat that its final integration for its n-gram search is based in part on a first confidence value and a second confidence value. PO Resp. 22–26. Regarding claim 27, Patent Owner contends that Petitioner’s position fails for the same reasons Petitioner fails to met its burden for claim 1. *Id.* at 27.

We have considered carefully all arguments and supporting evidence in light of the limitations recited in challenged independent claims 21 and 27, including the testimony of Dr. Welch (Ex. 1002 ¶¶ 135–149, 164–182). For the same reasons discussed previously for claim 1, we do not agree with Patent Owner. Rather, we find that Cosatto teaches the recited first and second confidence values. Regarding claim 27, we agree with Petitioner’s position as supported by the uncontested testimony of Dr. Welch. Specifically, we credit Dr. Welch’s testimony that “[w]hen the controller is implemented in software, it needs to include a memory for storing the software, so that a microprocessor can read and execute the software.” Ex. 1002 ¶ 170.

Accordingly, based on the entirety of the record, we conclude Petitioner has shown by a preponderance of the evidence that challenged independent claims 21 and 27 would have been obvious to a person of ordinary skill in the art in view of Cosatto under 35 U.S.C. § 103.

4. *Analysis of Cosatto as Applied to Dependent Claims 2 and 4*

Dependent claim 2 requires “the first confidence value is based at least in part on information associated with a previously identified head

portion.” Ex. 1001, 11:36–38. Dependent claim 4 likewise recites “a previously identified head portion.” *Id.* at 11:43–44.

Petitioner contends dependent claims 2 and 4 of the ’476 patent are unpatentable under 35 U.S.C. § 103 as obvious in view of Cosatto and provides specific arguments for each challenged claim. Pet. 32–39 (citing Ex. 1002 ¶¶ 100–112). Petitioner specifically argues that the “data produced by each channel comprise[s] a list of areas which may contain head outlines and facial features.” Pet. 33 (citing Ex. 1005, 5:66–67), 37–38. According to Petitioner, “Cosatto teaches these head outlines and facial features (i.e., head portions) are identified before the generating of a confidence value, by disclosing that ‘[a]s indicated by the succeeding step 20 in FIG. 1b, the system classifier compares, evaluates and integrates the generated features’ and ‘assigns a measure of confidence for each feature and each combination of features.’” *Id.* at 34 (citing Ex. 1005, 6:20–22, 6:28–30; Ex. 1002 ¶ 101), 38 (citing Ex. 1002 ¶ 112). Petitioner then argues that by perceiving left and right head outlines from its motion channel, Cosatto must identify head portions. Petitioner further explains that these “previously identified head portions” are then used for additional analysis. Pet. 34–35 (citing Ex. 1002 ¶ 102), 38 (citing Ex. 1002 ¶ 112).

Patent Owner contends that Petitioner’s reliance on an “intermediate feature representation (not shown in the figures)” produced by each channel is not a “previously identified head portion” but merely comprises “a list of areas which *may* contain head outlines and facial features.” PO Resp. 15 (citing Ex. 1005, 5:66–7:2); PO Sur-Reply 9–11. According to Patent Owner, this list does not satisfy the additional recitation of claim 2 because “some may be facial features, and some may not. PO Resp. No head

portion has been identified at this point. *Id.* The intermediate results are merely a preliminary stage in the process.” *Id.* Thus, Patent Owner concludes Petitioner fails to establish that the cited disclosure of Cosatto teaches the recitation of claim 2. *Id.*

Based on the disclosure of Cosatto, we agree with Petitioner’s position. Specifically, we find that Cosatto identifies head portions when perceiving left and right head outlines in its motion channel. *See* Ex. 1005, 5:66–67. Cosatto then uses these previously identified head portions to both calibrate and refine its analysis in generating the confidence values. *See id.* at 6:20–22, 6:28–30. Furthermore, we credit the undisputed testimony of Dr. Welch that the head outlines detected in the motion channel constitute “previously identified head portions” that a person of ordinary skill in the art would have understood was used to create confidence values. Ex. 1002 ¶¶ 101–104.

We have considered carefully all arguments and supporting evidence in light of the limitations recited in challenged dependent claims 2 and 4. Based on the entirety of the proceeding record, we conclude Petitioner has demonstrated by a preponderance of the evidence that dependent claims 2 and 4 would have been obvious under 35 U.S.C. § 103 in view of Cosatto.

5. *Analysis of Cosatto as Applied to Dependent Claims 3, 22, 23, and 28*

Claim 3 depends from claim 1 and recites “the head portion is identified in the images based at least in part on a first head portion identified by the first process and a second head portion identified by the second process.” Ex. 1001, 11:39–42. Claim 22 depends from claim 21 and likewise recites “the first confidence value represents a confidence that the first process has identified the location of the head portion of the subject in

the images and the second confidence value represents a confidence that the second process has identified the location of the head portion of the subject in the images.” *Id.* at 13:25–31. Dependent claim 23 recites the limitations of claims 21 and 22 plus requires that “the first confidence value represents a confidence that a first process has identified the location of the head portion of the subject in the images.” Ex. 1001, 13:32–43. Dependent claim 28 requires a “computer-readable medium” as recited in claim 27, wherein “the instructions include instructions that cause the computing device to identify the head portion of the subject in the images based at least in part on the location of the head portion identified by the first process and the location of the head portion identified by the second process.” *Id.* at 14:30–35.

Petitioner contends dependent claims 3, 22, 23, and 28 of the ’476 patent are unpatentable under 35 U.S.C. § 103 as obvious in view of Cosatto and provides specific arguments for each challenged claim. Pet. 35–37, 58–62, 67 (citing Ex. 1002 ¶¶ 105–110, 134–163, 183–185). Petitioner argues that Cosatto teaches a system controller that selects, “based at least in part on the first confidence value and the second confidence value,” one or more of the color, shape, and motion channels for “identifying, by the computer, the location of the head portion of the subject in [future frames of] the images.” *Id.* at 36. According to Petitioner, Cosatto further discloses that if “[a] tri-gram search . . . establish[es] . . . that perceived areas of skin colors reported by the color channel fall[] within the perceived left and right head outlines obtained from the motion channel,” “a high score may be given to the color and motion channels” *Id.* (citing Ex. 1005, 6:66–7:1). Petitioner then points to Cosatto’s disclosure that “if the color channel has a high enough general score Y2, the system controller may select the

color channel 12 to run for a predetermined number of frames.” *Id.* (citing Ex. 1005, 8:25–27).

Petitioner relies on Dr. Welch’s testimony to support its position. Dr. Welch testifies that a person of ordinary skill in the art would have understood that the above disclosure teaches “the head portion is identified in [future frames of] the images” using the color channel which is selected “based at least in part on” whether “a first head portion identified by the first process” matches “a second head portion identified by the second process,” as recited in claim 3. Ex. 1002 ¶¶ 107–109, 150–152, 156–158.

Patent Owner contends that Petitioner’s position fails for the same reasons Petitioner fails to meet its burden for claim 1. PO Resp. 16, 26, 27.

We have considered carefully all arguments and supporting evidence in light of the limitations recited in challenged independent claims 3, 22, 23, and 28, including the testimony of Dr. Welch (Ex. 1002 ¶¶ 107–109, 150–152, 156–158, 183–185). For the same reasons discussed previously for claim 1, we do not agree with Patent Owner. Rather, we find that Cosatto teaches that the head portions are identified in the images based on first and second processes. We also find that Cosatto’s confidence values represent a confidence that processes have identified the locations of the head portion of the subject in the images as required by the challenged claims.

Accordingly, based on the entirety of the record, we conclude Petitioner has shown by a preponderance of the evidence that challenged dependent claims 3, 22, 23, and 28 would have been obvious to a person of ordinary skill in the art in view of Cosatto under 35 U.S.C. § 103.

6. *Analysis of Cosatto as Applied to Dependent Claim 8*

Dependent claim 8 requires “a method as recited in claim 1, wherein the first process includes: identifying areas as possible head portions; and selecting the head portion from the areas based at least in part on a plurality of factors, wherein a confidence value associated with an area is proportional to the number of factors the area satisfies.” Ex. 1001, 11:58–64.

Petitioner contends dependent claim 8 of the ’476 patent is unpatentable under 35 U.S.C. § 103 as obvious in view of Cosatto and provides specific arguments for each challenged claim. Pet. 40–43 (citing Ex. 1002 ¶¶ 113–119); Pet. Reply 19–21. Petitioner argues that Cosatto teaches that its color channel “identif[ies] areas as possible head portions,” as claimed, by disclosing that the color channel “generates an intermediate feature representation” “compris[ing] a list of areas which may contain head outlines and facial feature[s].” Pet. 40 (citing Ex. 1005, 5:66–6:2, Fig. 4). According to Petitioner, Cosatto further discloses that an n-gram search is performed to evaluate the intermediate feature representations generated by the color channel, which “integrate[s] . . . the individual feature representations into a net representation for maintaining the tracked results. *Id.* at 41–42 (quoting Ex. 1005, 6:25–28, 7:16–19). Petitioner specifically relies on Cosatto’s use of “the n-gram method,” where “features and combinations of features are . . . evaluated and classified,” and then the “controller selects lists of perceived areas based on these classifications.” *Id.* at 42 (quoting Ex. 1005, 10:4–7). Petitioner then contends that “the tracked output comprises a list of likely head and facial positions within the tracked images.” *Id.* (citing Ex. 1005, 10:7–9).

Petitioner also relies on Dr. Welch’s testimony to support its position. Dr. Welch testifies that a person of ordinary skill in the art would have understood that “that the n-gram search involves selecting a list of likely head portions from the possible head portions identified by the color channel.” Ex. 1002 ¶¶ 116–117 (citing Ex. 1022 (contemporaneous reference about image feature selection)).

Regarding the limitation “wherein a confidence value associated with an area is proportional to the number of factors the area satisfies,” Petitioner cites Cosatto’s teaching that, in a tri-gram search, the areas of skin colors identified by the color channel are assigned a high measure confidence if they match “the perceived left and right headlines obtained from the motion channel,” but are assigned a low measure of confidence if they do not match “the triple combination of head outlines and the mouth area” obtained respectively from the motion channel and shape channel. Pet. 43 (citing Ex. 1005, 6:58–7:10). Petitioner then cites to Dr. Welch’s testimony explaining that “a common, well-known way for implementing this disclosure of Cosatto in a computer is to make the measure of confidence proportional to the number of features that are matched.” *Id.* (citing Ex. 1002 ¶ 119). Therefore, Petitioner concludes that it would have been obvious, based on Cosatto and the knowledge of a person ordinary skill in the art, “that the areas of skin colors identified by the color channel (the claimed “areas” identified by “the first process”) are assigned higher measure of confidence (the claimed “a confidence”) if they match more of other features (the claimed “proportional to the number of factors the area satisfies”). *Id.*

Patent Owner contends that Petitioner's position fails because Petitioner improperly conflates evaluating and classifying potential combinations of facial features with the "selecting the head portion" based on "a plurality of factors," as recited in claim 8. PO Resp. 18; PO Sur-Reply 12–16. According to Patent Owner, Petitioner makes a conclusory assertion that Cosatto's determination of a measure of confidence for perceived left and right head outlines corresponds to the '476 patent's "position of the motion" factor. PO Resp. 18 (citing Ex. 1001, 10:67–11:2). But Patent Owner argues that "even if this were true, this would only constitute a single factor, whereas claim 8 requires a plurality of factors." *Id.* at 18 n.2. Patent Owner also argues that Petitioner fails to explain how Cosatto's head and face features in the intermediate feature representations teach the claimed "factors." PO Sur-Reply 13. Patent Owner asserts that "Petitioner's interpretation of 'factors' effectively renders that term superfluous given that Petitioner also refers to, for example, shape analysis as one of the processes recited in independent claim 1." *Id.* at 14.

Patent Owner further contends that Cosatto does not teach the recited limitation "wherein a confidence value associated with an area is proportional to the number of factors the area satisfies." PO Resp. 18. Rather, according to Patent Owner, Petitioner relies on its expert for the unsupported assertion that "a common, well-known way for implementing [Cosatto's disclosure] is to make the measure of confidence proportional to the number of features that are matched." *Id.* Patent Owner contends such testimony is an attempt "to fill in the gaps in the prior art with "hindsight testimony." *Id.*

We do not agree with Patent Owner. First, we find that Patent Owner's argument seeks to improperly limit the scope of the claim language, because nothing in that language requires that factors in the "plurality of factors" must be of a different character. In other words, we do not agree with Patent Owner that it is inappropriate for Petitioner to cite multiple different head outlines for the recited "plurality of factors." Thus, despite Patent Owner's arguments, we find that Cosatto's analysis of head and face features and/or its evaluation of a combination of facial features in the intermediate feature representations teach or at least suggest the claimed plurality of factors. *See* Ex. 1005, 6:25–28, 6:53–56, 6:58–62. Second, we find that Dr. Welch's unrebutted testimony is not hindsight or conclusory as it is properly supported by the disclosure of Cossato itself and Exhibit 1022⁵. *See* Ex. 1005, 6:25–28, 6:39–41, 7:16–19, 10:7–9; Ex. 1022, 5, 7. Third, for the same reasons discussed previously for claim 1, we find Cosatto teaches or at least suggests all the limitations of claim 8.

Accordingly, based on the entirety of the record, we conclude Petitioner has shown by a preponderance of the evidence that challenged

⁵ Dr. Welch testifying that "person of ordinary skill in the art would have understood that one needs to look at each candidate feature and choose (select) only those that satisfy some criteria chosen to define a head portion." Ex. 1002 ¶ 117. Dr. Welch cites to Ex. 1022 when he further testifies that "[a]s an example of a skilled artisan's understanding, the 1991 technical report by Tomasi and Kanade . . . refers to such a selection process: "Then, in chapter 4, we show that the registration idea can be extended also to selecting good features to track. As a consequence, feature selection is no longer based on an arbitrary criterion for deciding what constitutes a feature. Rather, a good feature is defined as one that can be tracked well, in a precise mathematical sense." *Id.* (citing EX1022, 5 (emphases removed)).

independent claim 8 would have been obvious to a person of ordinary skill in the art in view of Cosatto under 35 U.S.C. § 103.

7. *Analysis of Cosatto as Applied to Dependent Claims 14–16*

Dependent claim 14 requires a “method as recited in claim 1, wherein the first process includes: in the event that the first confidence value is below a threshold, identifying an initial location of the head portion; and identifying a current location of the head portion based at least in part on the initial location of the head portion.” Ex. 1001, 11:58–64. Dependent claim 15 recites a “method as recited in claim 1, wherein the first process includes: in the event that the first confidence value is below a threshold, identifying an initial location of the head portion based at least in part on motion detection; and identifying a current location of the head portion based at least in part on the initial location of the head portion. Ex. 1001, 11:58–64. Dependent claim 16 recites a “method as recited in claim 1, wherein the first process includes: in the event that the first confidence value is below a threshold, identifying an initial location of the head portion; and identifying a current location of the head portion based at least in part on the initial location of the head portion and motion detection.” *Id.* at 11:58–64.

Petitioner contends dependent claims 14–16 of the ’476 patent are unpatentable under 35 U.S.C. § 103 as obvious in view of Cosatto and provides specific arguments for each challenged claim. Pet. 44–53 (citing Ex. 1002 ¶¶ 120–137), Pet. Reply 21–23. Petitioner argues that (1) Cosatto’s color channel teaches the claimed “first process” (2) the system classifier determines which channels have high and low measures of confidence, and (3) the system classifier may implement a calibration procedure for the color channel. *Id.* at 44–46 (citing Ex. 1005, 7:2–12,

9:50–55, 10:30–36, 10:55–58, Figs 1b, 2a, 2b). Petitioner then notes that Cosatto’s color channel can be reinvoked after the calibration is complete. *Id.* at 47 (citing Ex. 1005, 9:53–55).

According to Petitioner, Cosatto discloses that the reinvoked color channel is used to track the head portion in “[a]dditional frames.” *Id.* (citing Ex. 1005, 9:57–59). Petitioner argues that as to each of the additional frames, “Cosatto discloses that the color channel produces an intermediate feature representation comprising areas which may correspond to the current location of the head portion in the frame.” *Id.* (citing Ex. 1005, 5:66–67; Ex. 1002 ¶¶ 123–124). Petitioner further argues that Cosatto teaches the claimed “identifying a current location of the head portion based at least in part on the initial location of the head portion” by disclosing that the calibration (i.e., process for pinpointing the initial location of the head portion in the first frame) enables the color channel to accurately identify intermediate feature representations (i.e., current locations of the head portion) in the additional frames. *Id.* (citing Ex. 1005, 4:65–67, 10:23–25, 10:54–55, Fig. 1e).

Petitioner makes similar arguments for claims 15 and 16 but relying on Cosatto’s motion channel. Pet. 48–53 (citing Ex. 1002 ¶¶ 125–137).

Patent Owner contends that Petitioner’s position fails because “nothing in Petitioner’s discussion of the color calibration process explains how the color calibration process—which is used before the color channel is activated—involves ‘identifying an initial location of the head portion’ as recited in claim 14.” PO Resp. 19. Patent Owner argues that everything in claim 14 refers “the first process,” which Petitioner maps to Cosatto’s color channel. PO Sur-Reply 16–17. According to Patent Owner, in the

calibration process, it is not the color channel that identifies the initial location of the head portion when the first process's confidence value is below a threshold. *Id.* Instead, Patent Owner notes, under Petitioner's analysis it is the shape and motion channels. *Id.* at 17.

Patent Owner further contends Petitioner's arguments for claims 15 and 16 fail for the same reason. *Id.* at 20–22.

We do not agree with Patent Owner. Rather, we are persuaded by Petitioner's contention that Cosatto's calibration procedure is used to identify head and facial features when the color channel indicates a low measure of confidence. *See* Pet. 44; Pet. Reply 22 (both citing Ex. 1005, 7:2–12, 9:48–50). Cosatto also teaches that the color channel is reinvoked after calibration. Ex. 1005, 9:50–55. Additionally, we credit the uncontested testimony of Dr. Welch, who explains that calibration data for the color channel representing a head portion is generated by the motion and shape channels and used by the color channel to “pinpoint perceived locations of heads and facial features” (the claimed “identifying an initial location of the head portion”) in a first frame the color channel analyzes. *See* Ex. 1002 ¶¶ 121–122 (citing Ex. 1005, 10:30–36, 10:55–58, Figs. 2a, 2b), 124 (citing Ex. 1005, 5:66–67, 9:57–59, 10:23–25, 10:54–55). Although the calibration process for the color channel involves the motion channel and shape channel generating calibration data, those two channels relay that data to the color channel in order “to pinpoint perceived locations of head and facial features.” Ex. 1005, 10:34–42, 10:55–58. Cosatto includes this calibration step as part of its color channel process, thus we find it is part of the recited “first process.”

Cosatto's calibration is similar to the '476 patent's process of analyzing historical data regarding features in images, where this historical data is generated by more than just the "first process" of background subtraction (because it also uses the "scene parsing" process). *See* Ex. 1001, 6:20–57, 7:22–31. It also is similar to the '476 patent's process of "restarting" its tracker routing 602, where the initial location of the head portion of the person image is identified upon each instance that a second confidence value falls below a predetermined amount. *Id.* at 8:7–13. The '476 patent teaches that for this to occur, "the current location of the head portion of the person image may be tracked starting at the initial location based on motion in operation 610 and based on color in operation 612." *Id.* at 7:60–62, Fig. 6 (motion follower 610, color follower 612). Therefore, we determine that for a first process to "identify[] a current location of the head portion based at least in part on the initial location of the head portion," the use of historical data or data generated from other processes to inform the first process is within the scope of the claim language.

Accordingly, based on the entirety of the record, we conclude Petitioner has shown by a preponderance of the evidence that challenged independent claims 14–16 would have been obvious to a person of ordinary skill in the art in view of Cosatto under 35 U.S.C. § 103.

B. Alleged Obviousness of Claims 9, 10, 24, and 29 over Cosatto and Khosravi

Petitioner relies on the combined teachings of Cosatto and Khosravi to allege obviousness of claims 9, 10, 24, and 29. *See* Pet. 68–81. Patent Owner disputes Petitioner's contentions. PO Resp. 27–28. For reasons that

follow, we determine Petitioner has demonstrated by a preponderance of the evidence that the challenged claims would have been obvious over Cosatto in view of Khosravi under 35 U.S.C. § 103.

1. Overview of Khosravi (Exhibit 1006)

Khosravi is a U.S. Patent titled “System and Method for Detecting a Human Face in Uncontrolled Environments” and generally relates to “a probabilistic framework that uses a deformable template model to describe the human face.” Ex. 1006, code (54), Abstr. One embodiment in Khosravi describes a “head detection stage 201” that is “performed by the processing system 130” for “the detection of one or more human heads (or equivalent) within the video image from camera 110.” *Id.* at 3:19–24, 3:28–32.

Figure 2, reproduced below, depicts this embodiment.

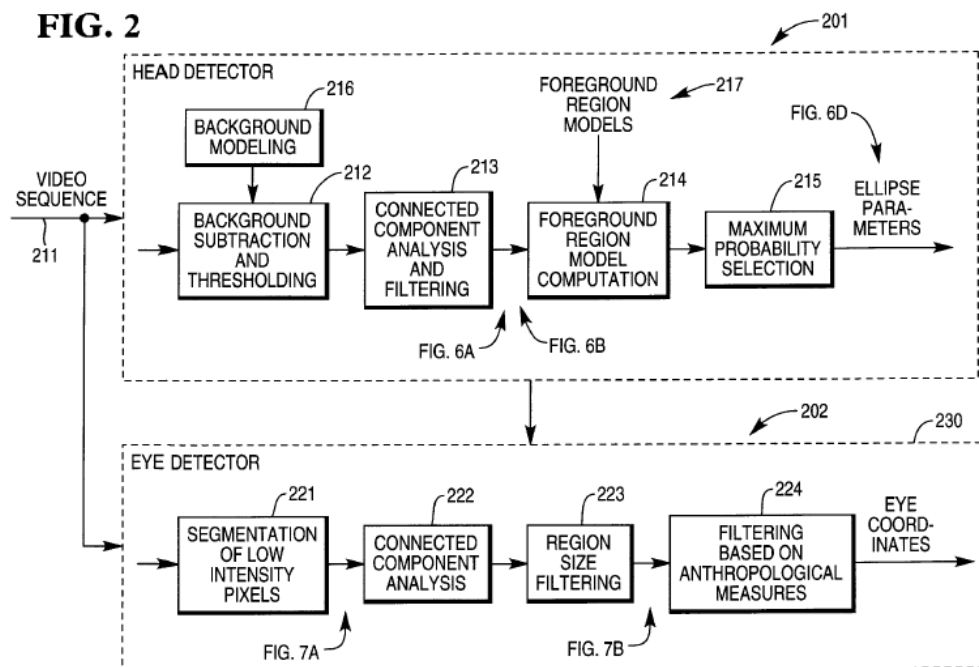


Figure 2, above, is a flow diagram illustrating the overall operation of Khosravi's invention. *Id.* at 2:23–24. Khosravi discloses that for head detection stage 201, “steps 212–213 and 216 . . . [are] the segmentation of

people in the foreground regions of the sequence of video images . . . over time, which is represented in FIG. 2 as video sequence 211.” *Id.* at 3:28–32.

According to Khosravi,

[t]o detect the head of people whose bodies are occluded, a model-based approach is used (steps 214–215, 217). In this approach, different foreground models (step 217) may be used for the case where there is one person in a foreground region and the case where there are two people in a foreground region. The output of step 214 are the probabilities of the input given each of the foreground region models. Step 215 selects the model that best describes the foreground region by selecting the maximum probability computed in step 214.

Id. at 3:43–52. Figure 2, above, also shows an “eye detection stage 202” for “the detection of any eyes associated with the detected human head(s).” *Id.* at 3:21–24, 4:12–13. “The use of the eye detection process of stage 202, in conjunction with the head detection stage 201, improves the accuracy of the head model and removes regions corresponding to back views of faces or other regions that do not correspond to a face.” *Id.* at 9:40–44.

2. *Analysis of Cosatto and Khosravi as Applied to Challenged Dependent Claims 9, 10, 24, and 29*

Claims 9 and 10 of the ’476 patent depend from independent claim 1, while claim 24 depends from independent claim 21 and claim 29 depends from independent claim 27. Each of these dependent claims require removing a background image from an image obtained through a first process. Ex. 1001, 11:65–67, 12:1–5, 13:50–52, 14:36–39. Claim 10 recites “removing a background image from the obtained image to obtain a foreground image” and “identifying a person image in the foreground image.” *Id.* Claim 29 requires a computer-readable medium with

instructions that cause the computing device to remove a background image from at least one of the obtained images with the first process. *Id.*

Petitioner contends that claims 9, 10, 24, and 29 would have been obvious over the combination of Cosatto and Khosravi. *See* Pet. 71–78, 80–81 (citing Ex. 1002 ¶¶ 190–205, 212–214). According to Petitioner, Cosatto’s color channel teaches the claimed “first process,” but it does not expressly disclose that the color channel “includes removing a background image from the obtained image.” *Id.* at 71–72. Petitioner argues that Khosravi does. *Id.* (citing Ex. 1006, Abstr.; Ex. 1002 ¶¶ 190–195). Petitioner notes that Khosravi specifically discloses background subtraction in order to achieve “segmentation of people in the foreground regions.” *Id.* at 72 (citing Ex. 1006, 3:28–35). Petitioner further argues that Khosravi expressly discloses identifying a person image in the foreground image thereby satisfying claim 10. *Id.* at 75 (citing Ex. 1006, 3:43–48, Fig. 2; Ex. 1002 ¶ 201).

Petitioner contends that a person of ordinary skill in the art would have had reasons to combine the teachings of Cosatto with those of Khosravi. Pet. 69–71 (citing Ex. 1002 ¶¶ 186–189). Petitioner argues that combining Khosravi’s teachings with Cosatto’s head-tracking methods would have involved “the mere application of a known technique”—*Khosravi*’s head detection stage 201 and eye detection stage 202—“to a piece of prior art”—*Cosatto*’s multichannel tracking algorithm—“ready for the improvement.” *Id.* at 71 (citing *KSR*, 550 U.S. at 417). Petitioner further argues that the results of the combined teachings “would have been a ‘predictable variation,’ as *Khosravi*’s method would merely have

‘improve[d] similar devices’—*Cosatto*’s head-tracking system—‘in the same way.’” *Id.* (alteration in original).

Petitioner then argues that a person of ordinary skill in the art would have found it desirable to use Khosravi’s background subtraction in *Cosatto*’s color channel to remove the noises due to shadow, noise, and lighting variations, thereby improving the reliability of the color process in *Cosatto*. Pet. 73 (citing Ex. 1002 ¶ 193 (citing Ex. 1027, 22 (contemporaneous article demonstrating that the background subtraction technique was known in the art))). Moreover, according to Petitioner, Khosravi discloses that the result of the background subtraction is fed into “a model-based approach . . . (steps 214–215, 217)” to “detect the head of people whose bodies are occluded.” *Id.* (citing Ex. 1006, 3:43–44, Fig. 2) (alteration in original). Petitioner asserts that a person of ordinary skill in the art at the time of the ’476 patent also would have found it “desirable to use *Khosravi*’s occlusion detection technique to improve *Cosatto*’s color channel in the same way, so that it can accurately identify and track multiple head portions in the same scene.” *Id.* at 73 (Ex. 1002 ¶ 194 (citing Ex. 1010, 14:38–40 (contemporaneous patent stating that “[t]he use of a subset of the color matches is beneficial because it can enable tracking in the presence of partial occlusions”)⁶; Ex. 1011, 1:18–23 (contemporaneous patent recognizing that it is desirable in the art to solve occlusion problems))). Petitioner again asserts that combining Khosravi’s background subtraction with *Cosatto*’s color channel would have yielded predictable results because Khosravi teaches that its technique can be used on color images and thus the

⁶ Christian et al., U.S. Patent No. 6,141,434, filed Feb. 6, 1998, issued Oct. 31, 2000 (“Christian”).

combination only requires simple addition of the background subtraction technique to Cosatto's color channel. Pet. 73 (citing Ex. 1006, 3:1–7; Ex. 1002 ¶ 195).

Patent Owner incorporates its arguments from Petitioner's challenge based on Cosatto alone. PO Resp. 27–28.

We have considered carefully all arguments and supporting evidence in light of the limitations recited in challenged dependent claims 9, 10, 24, and 29. We find Petitioner has provided sufficient reasons based on rational underpinning to combine the teachings of the Cosatto and Khosravi. For the same reasons explained above from Petitioner's challenge to claim 1 based on Cosatto alone, we determine Petitioner demonstrated by a preponderance of the evidence that challenged dependent claims 9, 10, 24, and 29 would have been obvious under 35 U.S.C. § 103 in view of the combined teachings of Cosatto and Khosravi.

IV. CONCLUSION

Based on the evidence presented with the Petition, the evidence introduced during the trial, and the parties' respective arguments, Petitioner has shown by a preponderance of the evidence that the challenged claims would have been obvious in view of Cosatto alone or in combination with Khosravi.⁷

⁷ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding after the issuance of this Final Written Decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent,

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–4, 8, 14–16, 21–23, 27, 28	103(a)	Cosatto	1–4, 8, 14–16, 21–23, 27, 28	
9, 10, 24, 29	103(a)	Cosatto, Khosravi	9, 10, 24, 29	
Overall Outcome			1–4, 8–10, 14– 16, 21–24, 27– 29	

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that claims 1–4, 8–10, 14–16, 21–24, 27–29 in
the '476 patent is determined to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision,
the 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.

we remind Patent Owner of its continuing obligation to notify the Board of
any such related matters in updated mandatory notices. *See* 37 C.F.R.
§§ 42.8(a)(3), (b)(2).

IPR2021-00176
Patent 7,715,476 B2

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