

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.,
Petitioner,

v.

DENTAL MONITORING SAS,
Patent Owner.

IPR2023-01369
Patent 10,755,409 B2

Before JEAN R. HOMERE, MICHAEL R. ZECHER, and
KARA L. SZPONDOWSKI, *Administrative Patent Judges*.

HOMERE, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Align Technology, Inc. (“Petitioner”) filed a Petition for *inter partes* review of claims 1–15 of U.S. Patent No. 10,755,409 (Ex. 1001, “the ’409 patent”). Paper 2 (“Pet.”), 1. Dental Monitoring SAS (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”).

Institution of an *inter partes* review is authorized by statute only when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2023). We have authority, acting on the designation of the Director, to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4(a) (2023).

Based on the current record, and for the reasons explained below, we determine that Petitioner has established a reasonable likelihood that it would prevail with respect to at least one challenged claim. Accordingly, we institute *inter partes* review.

B. Real Parties in Interest

Petitioner identifies itself as the sole real party in interest. Pet. 73.

Patent Owner identifies itself as the sole real party in interest. Paper 4, 2.

C. Related Matters

The parties indicate that the ’409 patent is the subject of the following district court proceeding: *Dental Monitoring SAS v. Align Technology, Inc.*,

Case No. 3:22-cv-07335-WHA (N.D. Cal.) (“the California litigation”).
Pet. 73; Paper 4, 2. Patent Owner indicates that the ’409 patent is also
subject of the following district court proceeding: *Dental Monitoring v. Get-
Grin Inc.*, Case No. 1:22-cv-00647-WCB (D. Del.). *Id.*

D. The Challenged ’409 Patent

The ’409 patent relates to a method for analyzing an image of a dental arch of a patient for orthodontic treatment of the patient. Ex. 1001, codes (54), (57). Conventional orthodontic treatments require the patient to make an appointment and transmit captured dental images to the orthodontist, who subsequently uses the images to assess the patient’s conditions to devise a treatment plan accordingly. *Id.* at 1:11–15. The ’409 patent purports to provide an improved method employing a deep learning device specifically trained to assess a simple image of the patient’s dental arch to reconstruct, with a good reliability, a dental arch in the form of an assembled model. *Id.* at 3:13–17, 18:56–59, 23:7–10.

In particular, upon being activated to acquire an image of the patient’s arch (“analysis image”), an acquisition apparatus (e.g., cell phone) acquires the analysis image, which it submits to a deep learning device (preferably, a neural network) trained by a learning base to determine at least one probability relating to an attribute value of at least one tooth represented on a zone in the analysis image “analysis tooth zone”, and/or at least one probability relating to an image attribute value of the tooth. *Id.* at 1:23–50, 8:62–63. More particularly, the ’409 patent states the following:

For example, this image attribute may define whether, in light of the image as a whole or of a part of the image, the dental

situation “is pathological” or “is not pathological”, without each tooth being examined. The image attribute also makes it possible to detect, for example, whether the mouth is open or closed, or, more generally, whether the image is suitable for a subsequent treatment, for example whether it makes it possible to monitor the occlusion.

Id. at 3:28–36.

The deep learning device subsequently assesses the probability relating to the location and/or the type of tooth represented in the analysis of the tooth zone. *Id.* at 1:51–58.

In a preferred embodiment, the shape of a particular tooth model is analyzed so as to define its tooth attribute value, for example its number. This shape recognition is preferably performed by means of a deep learning device, preferably a neural network. Preferably, a library of historical tooth models is created, each historical tooth model having a value for the tooth attribute, as described hereinbelow (step a)[)], the deep learning device is trained with views of the historical tooth models of this library, then one or more views of the particular tooth model are analyzed with the trained deep learning device, so as to determine the tooth attribute value of said particular tooth model.

Id. at 8:39–50.

Further, the ’409 patent also discusses an “embedded monitoring” wherein the image analysis is useful for guiding the image acquisition of a dental arch for remote diagnosis. *Id.* at 23:44–49. Figures 12A–12D, reproduced below, further illustrate the subject matter of the ’409 patent:

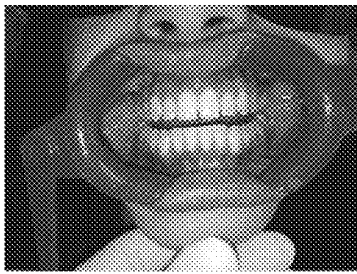


Fig. 12A

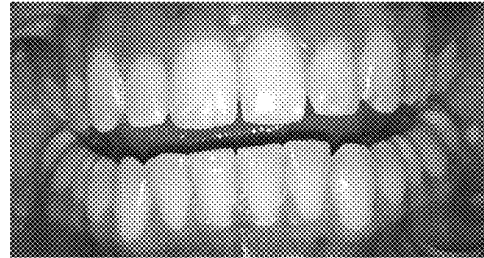


Fig. 12B

FIG. 12A and FIG. 12B above illustrate how a dental retractor is used to facilitate the acquisition of an image, which is cropped, processed, and updated as in FIG. 12B making it possible to determine the contour of the patient's teeth. Ex. 1001, 7:16–20.

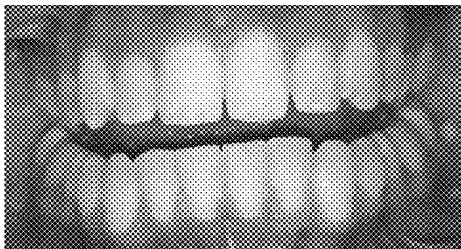


Fig. 12C

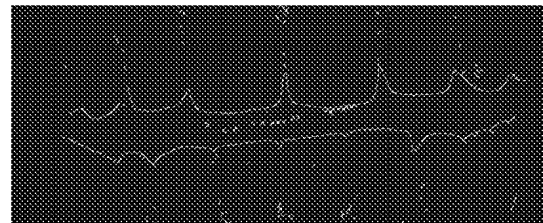


Fig. 12D

FIG. 12C above depicts an updated image, and FIG. 12D represents an updated map relating to the contour of the teeth obtained from the updated image of FIG. 12C. Ex. 1001, 7:22–25.

Additionally, the '409 patent discloses determining whether the quality or another characteristic of an acquired image (e.g., “mouth open” “mouth closed” or “orthodontic appliance”) meets a particular “setpoint” for such an image, requiring adjustments if that “setpoint” is not met, and “guid[ing]” a patient to make the correct adjustments to acquire the correct image. *Id.* at 26:16–26, 28:27–43.

E. The Challenged Claims

Petitioner challenges claims 1–15 of the '409 patent. Pet. 1. Claim 1 is independent. Claim 1 is illustrative of the challenged claims and is reproduced below.

1. A method for acquiring an image of a dental arch of a patient, said method comprising the following steps:
 - a') activation of an image acquisition apparatus so as to acquire an image, called “analysis image”, of said arch;
 - b') analysis of the analysis image by means of a deep learning device trained by means of a learning base;
 - c') determination, for the analysis image, as a function of the results of the analysis in the preceding step, of a value for an image attribute;
 - d') comparison of said image attribute value with a setpoint;
 - e') sending of an information message as a function of said comparison, the information message being related to the quality of the image acquired or to the position of the acquisition apparatus in relation to said arch or to the setting of the acquisition apparatus or to the opening of the mouth or to the wearing of a dental appliance, or to a combination thereof, to check whether the analysis image respects the setpoint and, if it does not respect the setpoint, to guide the operator in order for him or her to acquire a new analysis image.

Ex. 1001, 32:13–33.

F. Prior Art and Asserted Grounds of Unpatentability

The Petition relies on the following prior art references:

Name	Reference	Exhibit
Salah	WO 2016/066651 A1, published May 6, 2016	1008
Carrier	US 2021/0068923 A1, published March 11, 2021	1005

Name	Reference	Exhibit
Maninis	<i>Convolutional Oriented Boundaries: From Image Segmentation to High-Level Tasks</i> , published April 28, 2017	1007

Petitioner asserts claims 1–15 are unpatentable based on the following ground (Pet. 15):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–15	103 ¹	Salah, Carrier, Maninis

Pet. 15. Petitioner submits a declaration of Hassan Foroosh, Ph.D. (Ex. 1002, “Foroosh Declaration”) in support of its contentions.

II. DISCRETIONARY DENIAL OF INSTITUTION

A. Discretion to Deny Under 35 U.S.C. § 325(d)

Patent Owner asserts that the Director should exercise her discretion under 35 U.S.C. § 325(d) to deny institution because “Petitioner has not met its burden of showing that the same [Salah] or substantially the same [Carrier] art and arguments were not already considered and appropriately rejected by the Examiner with respect to the ’409 [p]atent.” Prelim. Resp. 25. We decline to exercise discretion to deny institution under § 325(d) for the reasons discussed below.

¹ The application resulting in the ’409 patent does not claim priority to a date prior to the date when the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (2011), took effect. Thus, we refer to the AIA version of section 103.

1. Standards of Law

In evaluating the exercise of discretion to deny institution under § 325(d), the Board uses the following two-part framework: (1) determining whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of the first part of the framework is satisfied, determining whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims. *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential).

In applying the two-part framework, we consider several non-exclusive factors, including:

- (a) the similarities and material differences between the asserted art and the prior art involved during examination;
- (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
- (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;
- (d) the extent of the overlap between the arguments made during examination and the manner in which petitioner relies on the prior art or patent owner distinguishes the prior art;
- (e) whether petitioner has pointed out sufficiently how the examiner erred in its evaluation of the asserted prior art; and

(f) the extent to which additional evidence and facts presented in the petition warrant reconsideration of the prior art or arguments.

Becton, Dickinson & Co. v. B. Braun Melsungen AG, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential as to Section III.C.5, first paragraph) (“*Becton, Dickinson*”). *Becton, Dickinson* factors (a), (b), and (d) relate to whether the art or arguments presented in the Petition are the same or substantially the same as those previously presented to the Office. *Advanced Bionics*, Paper 6 at 10. Factors (c), (e), and (f) “relate to whether the petitioner has demonstrated a material error by the Office” in its prior consideration of that art or arguments. *Id.* Only if the same or substantially the same art or arguments were previously presented to the Office do we consider whether the petitioner has demonstrated a material error by the Office. *Id.* “At bottom, this framework reflects a commitment to defer to previous Office evaluations of the evidence of record unless material error is shown.” *Id.* at 9.

2. Whether the Same or Substantially the Same Art or Arguments Were Previously Presented to the Office

It is undisputed that Salah was before the Examiner during prosecution of the ’409 patent. Pet. 71; Prelim. Resp. 9, 10, 25, 26.

There is no assertion that Carrier or Maninis was before the Examiner, nor any assertion that the proposed combination of Salah, Carrier and Maninis was before the Examiner. *See generally* Prelim. Resp. In other words, Petitioner’s ground relies on additional prior art references that were not before the Examiner, i.e., Carrier and Maninis. *See, e.g.*, Pet. 71. Patent Owner’s assertion that Carrier and Maninis are cumulative of prior art

evaluated during examination is not persuasive as it is unsupported by evidence in the record before us. Prelim. Resp. 27. For example, Patent Owner does not meaningfully address the art or arguments evaluated by the Examiner during prosecution, nor does the Patent Owner submit a copy of the references applied by the Examiner during prosecution (e.g., U.S. Patent Application No. 2018/0168780 issued to Kopelman) into the record of this proceeding. Put simply, Patent Owner does not explain why Carrier and Maninis are cumulative to the references considered by the Examiner and thus, does not sufficiently support the position that the Examiner considered combinations the same as, or similar to, those presented by Petitioner.

Under these circumstances, we find the first part of the *Advanced Bionics* framework is not satisfied because the Petition sets forth a combination of prior art and arguments that are not the same or substantially the same as that considered by the Examiner during prosecution. Accordingly, we decline to exercise our discretion to deny institution pursuant to 35 U.S.C. § 325(d).

B. Discretion to Deny Institution Under 35 U.S.C. § 314(a)

Patent Owner contends that we should exercise our discretion to deny institution under 35 U.S.C. § 314(a) in light of the California litigation. Prelim. Resp. 28–34. Patent Owner contends that the factors identified in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”), weigh in favor of denying institution. *Id.*

On June 21, 2022, the Director of the U.S. Patent and Trademark Office (“USPTO”) issued a Memorandum titled “Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings With Parallel District

Court Litigation” (“Memorandum”),² which states, among other things, that “the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” Memorandum 3 (citing *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential as to § II.A)).

On January 8, 2024, Petitioner submitted in the California litigation “Defendant Align Technology, Inc.’s Stipulation Re Challenged Claims in IPR2023-01369,” which states the following:

Align hereby stipulates that if the Patent Trial and Appeal Board institutes *inter partes* review on IPR2023-01369, then Align will not pursue in this case, against any of the Challenged Claims, the specific ground advanced in IPR2023-01369 or any ground that reasonably could have been raised in an IPR (i.e., any ground that could be raised under §§ 102, 103 against any of the Challenged Claims only on the basis of prior art patents or printed publications).

Ex. 1028, 2.

With the interim guidance in mind, we decline to exercise our discretion to deny institution in this proceeding under *Fintiv* because Petitioner submitted a *Sotera* stipulation.

² The Memorandum is *available at* https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621.pdf.

III. PATENTABILITY ANALYSIS

A. Principles of Law

1. Inter Partes Review

“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) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Petitioner bears the burden of persuasion to prove unpatentability of each challenged claim by a preponderance of the evidence. 35 U.S.C. § 316(e). This burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

2. Obviousness

A patent claim is unpatentable under 35 U.S.C. § 103 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 the 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 skill in the art, and (4) when in evidence, any objective

evidence of nonobviousness.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). The person of ordinary skill in the art is a hypothetical person 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). In determining the level of ordinary skill in the art, we may consider certain factors, including: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Best Med. Int’l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted). “The patent’s purpose can also be informative.” *Id.*

Petitioner contends that a person having ordinary skill in the art at the time of the invention “would typically have an advanced degree, such as a Masters’ Degree or Ph.D. in computer science, computer engineering, electrical engineering, or a related field, with at least two years of work in computer vision, image analysis, medical imaging, or related areas.” Pet. 14 (citing Ex. 1002 ¶¶ 69–70). Petitioner asserts that such an artisan “could have less education but significant professional experience in one or more of these fields,” or “could be a member of an interdisciplinary team including

³ At this stage of the proceeding, the parties have not directed us to any such objective evidence.

persons with backgrounds such as electrical engineering, computer science, optical imaging, and dentistry or orthodontics, and could call upon the knowledge of other team members as appropriate.” *Id.* at 14–15 (citing Ex. 1002 ¶¶ 69–70).

Patent Owner does not contest Petitioner’s proffered definition of the level of ordinary skill in the art or offer a definition of its own. *See generally* Prelim. Resp.

We find Petitioner’s description to be consistent with the problems and solutions disclosed in the ’409 patent and prior art of record, and adopt it as our own for purposes of institution. *See, e.g., In re GPAC Inc.*, 57 F.3d at 1579 (approving the determination of the level of ordinary skill in the art by appeal to the references of record).

C. Claim Construction

In an *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art in view of the specification and the prosecution history pertaining to the patent. *See* 37 C.F.R. § 42.100(b). “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention” and “after reading the entire patent.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313, 1321 (Fed. Cir. 2005) (en banc). In addition to the specification and prosecution history, we also consider use of the terms in other claims and extrinsic evidence including

expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Id.*

at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

Petitioner contends that the claim term “image attribute” should be construed to “include[] an attribute having a value (which may be a set of values for multiple teeth) relating to an image as a whole, including an attribute related to” position and/or orientation and/or calibration of the apparatus used to acquire the analysis image, a quality relating to brightness, contrast, or sharpness of the analysis image, or the content of the analysis image. Pet. 15–16 (citing Ex. 1001, 3:38–49, 26:16–26).

Petitioner also contends that the claim term “tooth attribute” should be construed to “include[] any attribute related to a tooth,” including tooth type, tooth number, and tooth shape parameter. *Id.* at 16–17 (citing Ex. 1001, 1:22–28, 3:23–37, 3:59–62, 28:58–65).

Petitioner further contends that the claimed “analysis of the analysis image by means of a deep learning device trained by means of a learning base” should be construed to include “analyzing an image and the structure to encompass a device comprising a deep learning neural network trained with a learning base.” *Id.* at 17–18 (citing Ex. 1001, 1:24–25, 1:39–40, 1:51–2:3, 3:14–18, 4:5–6, 8:41–50, 13:64–65, 16:13–50, 24:14–15, 24:46–47, 24:66–25:4, 28:27–29, 29:24–25, 29:54–55).

Patent Owner does not propose a definition for any claim term.
Prelim. Resp. 6.

At this stage in the proceeding, and without further argument from the parties, we determine that we do not need to expressly construe any term for

purposes of this Decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)) (only terms that are in controversy need to be construed, and then only to the extent necessary to determine whether to institute *inter partes* review). We note that this determination does not preclude the parties from arguing their proposed constructions of the claims during trial. Indeed, the parties are hereby given notice that claim construction, in general, is an issue to be addressed at trial. A final determination as to claim construction will be made at the close of the proceeding, after any hearing, based on all the evidence of record.

D. Overview of the Asserted Prior Art

1. Salah (Ex. 1008)

Salah relates to “a method for monitoring the positioning and/or shape and/or appearance of a patient’s teeth and a computer program for implementing this method.” Ex. 1008, 1:4–6. Salah recognizes that a patient may wish to monitor any possible movement/change in the shape and/or appearance of their teeth because dental checks carried out by an orthodontist or a dentist can be quite expensive. *Id.* at 1:15–18. Salah therefore provides a method that allows a patient to self-monitor his/her dental condition. *Id.* at 1:25–26. In particular, Salah discloses creating a three-dimensional (3D) digital reference model of the patient’s arch (“tooth model”), and acquiring a two-dimensional (2D) image of the patient’s arch (“updated image”) such that the 2D image can be compared with the 3D

reference image to assess any deformation/displacement since the initial tooth model was produced. *Id.* at 1:26–2:26.

Figures 4a, 4b, and 5a through 5d, reproduced below, further illustrate Salah's dental arch monitoring method:

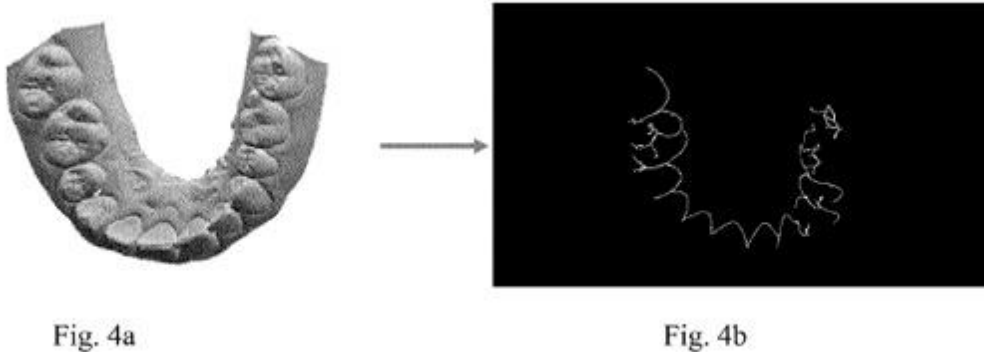


Figure 4a shows a view of the initial reference model processed to reveal changes in the direction of the normal to the modeled surface. Figure 4b shows the inner gingival margin that can be extracted by analyzing the image in figure 4a. *Id.* at 22:18–20. “The initial reference model [IRM] may correspond to the position of the patient’s teeth prior to treatment, or to the positioning of the patient’s teeth that the treatment is designed to achieve.” *Id.* at 20:2–3. The IRM can be prepared by an orthodontic professional using a 3D scanner “from measurements taken on the teeth or on a physical model of the patient’s teeth, such as a plaster model.” *Id.* at 20:13–17. The IRM is then stored in a centralized database. *Id.* at 23:9.

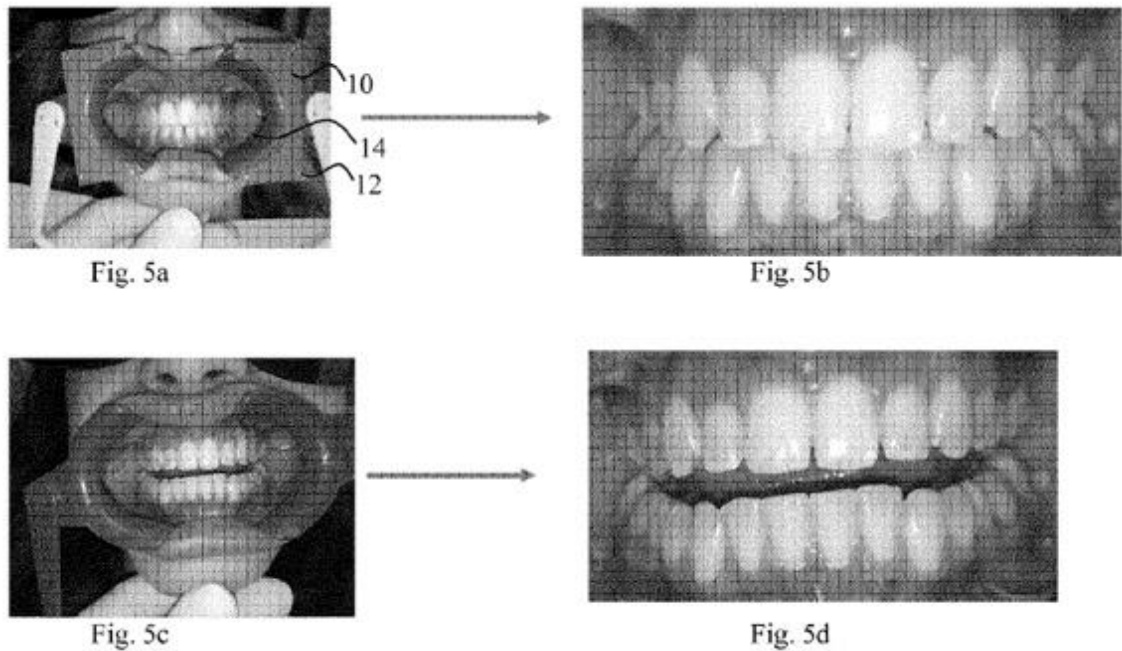


Figure 5 (5a–5d) illustrates the acquisition of updated images by the patient or an assistant using a cell phone with the aid of retractor 10 to improve teeth visibility. *Id.* at 23:24–26, 26:19–22. Retractor 10 may include registration marks 12 to help “guide the positioning of the image acquisition apparatus at the time of image acquisition, by means of corresponding references appearing on the acquisition apparatus display.” *Id.* at 32:26–29. Registration marks 12 also “allow the approximate virtual acquisition conditions approaching the actual acquisition conditions to be determined, which allows data processing to be accelerated.” *Id.* at 33:3–5.

The image-acquisition apparatus is equipped with a verification means including marks on a viewfinder to guide alignment by way of audio-visual prompts to facilitate its approximate positioning relative to the patient prior to acquiring the image. The apparatus may also provide feedback informing the user regarding whether the quality of the image is acceptable or not, and

whether to take another photo from a different position or angle. *Id.* at 27:19–28:10.

The first updated image is created preferably around the same time as the initial reference image or shortly thereafter. *Id.* at 25:1–2. It is stored on a universal serial bus, and subsequently downloaded. *Id.* at 27:5–7. The updated image can then be subsequently cropped, processed and filtered accordingly to reveal discriminant information (e.g., contour detection, convexity points) upon which deep learning can be applied. *Id.* at 33:13–36:14. “Comparison of Figures 5a and 5b, or 5c and 5d, shows the effect of cropping on an updated image.” *Id.* at 34:1–2.

2. Carrier (Ex. 1005)

Carrier relates to a method and apparatus for capturing various images of a patient’s teeth at predetermined viewing angles for remotely pre-screening the patient for possible orthodontic treatment. Ex. 1005, code (57), ¶ 6. In particular, Carrier discloses a telecommunications device (e.g., a cell phone) having a camera equipped with a processor that guides a user to take a series of images of the patient’s teeth in each of a plurality of predetermined views by sequentially displaying, on a screen of the cell phone, each captured image from the camera along with an overlay including an outline of teeth (displayed atop the camera’s view) such that the overlay’s outline approximately matches the patient’s teeth during the acquisition of the dental image. *Id.* ¶¶ 7, 63. Subsequently, the cell phone transmits the captured images to a remote location such that the orthodontist can determine whether the patient is a suitable candidate for the orthodontic treatment. *Id.* ¶ 63.

Figures 5A, 5B, and 6B, reproduced below, further illustrate Carrier's method of acquiring a patient's dental images:

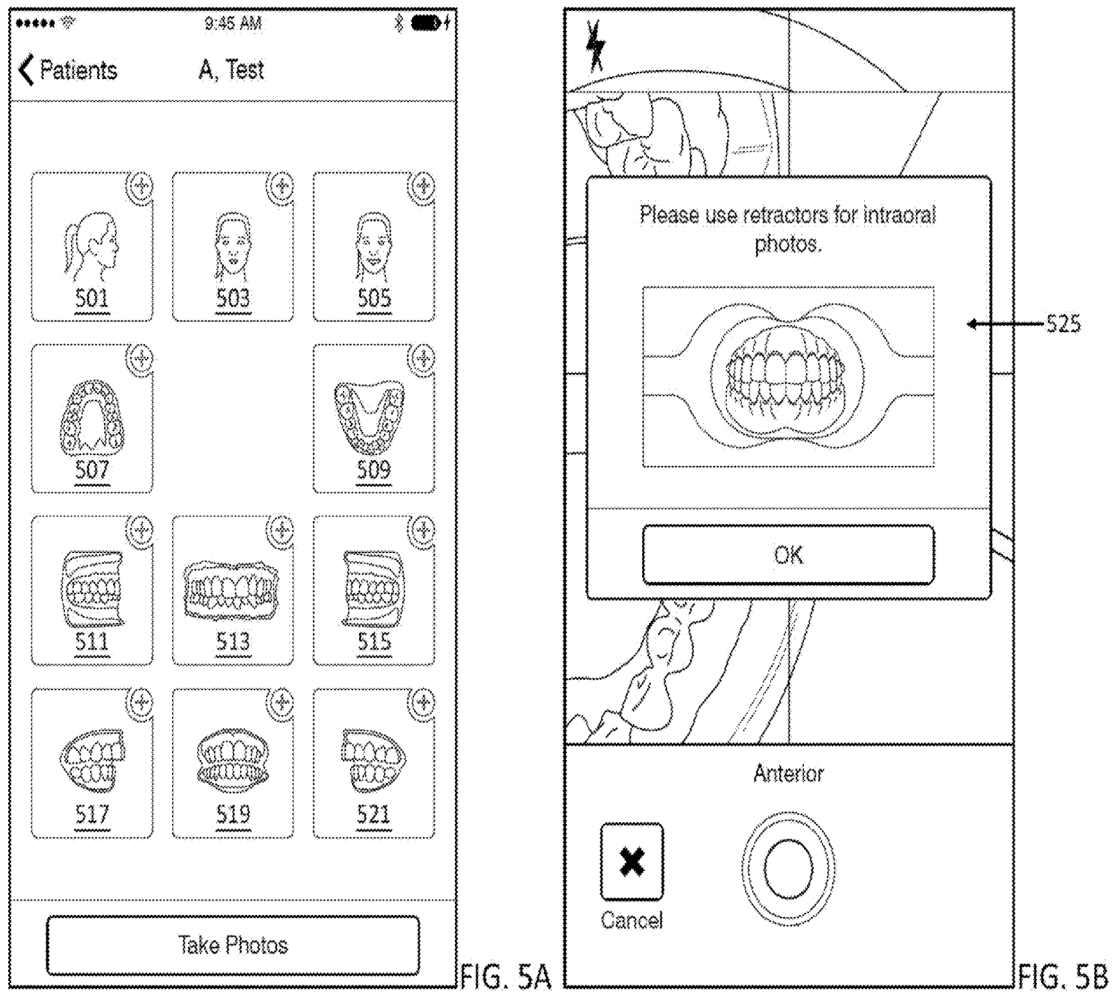


FIG. 5A above illustrates an example of a user interface in a cell phone camera that enables a user viewing on the camera screen the image of a patient's teeth (with or without a retractor) to select one of a plurality of overlays for capturing the patient's dental images in a plurality of predetermined views when the teeth are aligned with the overlay outline. *Id.*

¶¶ 63, 72. FIG. 5B above illustrates an on-screen message to guide the user to take dental images. *Id.* ¶ 73.

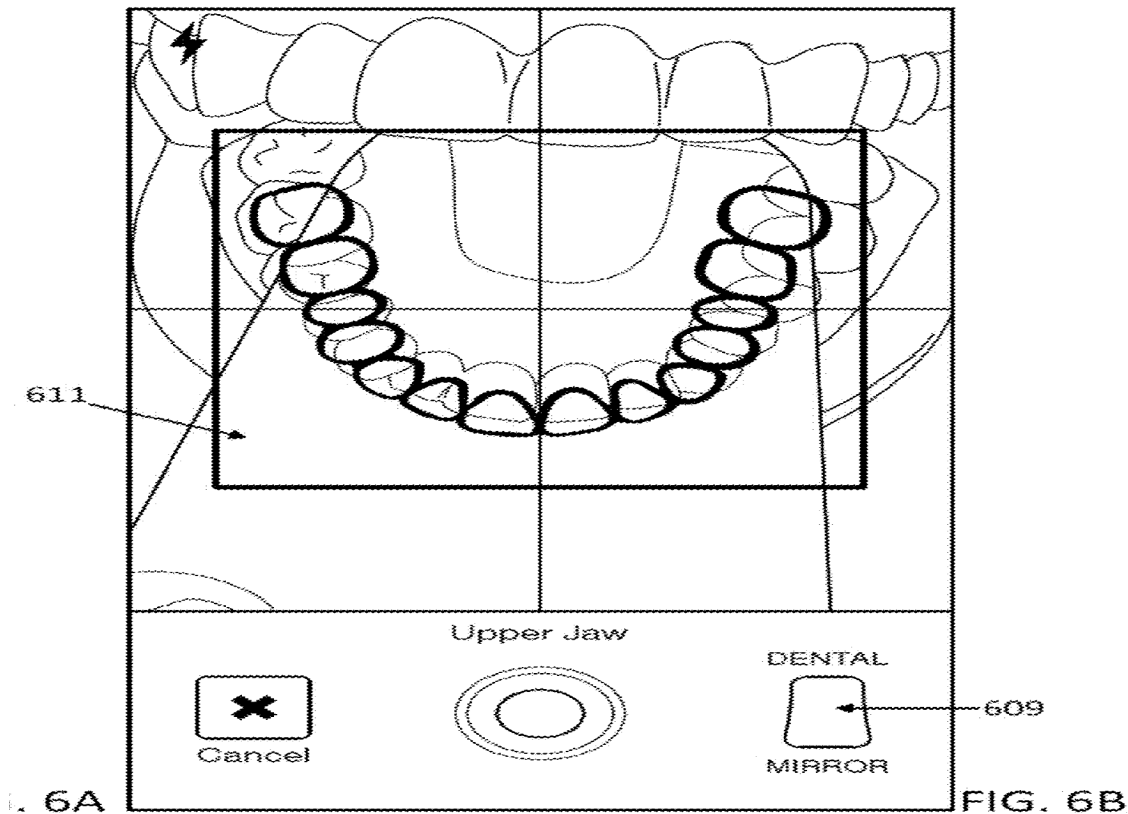


FIG. 6B above depicts an example of a poor quality image of the teeth. *Id.* ¶ 77.

The disclosed camera may also include an indicator, which is triggered when the overlay approximately matches with the patient's teeth. The trigger may be visual (including changing the color of the overlay, displaying or flashing an image/icon/color/symbol on the screen, etc.) and/or audible (emitting a ping, tone, etc.), and/or tactile (e.g., vibrating), etc. Ex. 1005 ¶¶ 68–70, 73. The telecommunications device may also include a machine learning feature recognition to assess the quality of the picture by estimating the quality of contour matching between the outline of the overlay and the teeth of the patient. *Id.* ¶¶ 111, 113. Carrier states that the

disclosed method is for “increasing the accuracy of the alignment of the camera lenses with teeth of the patient” to produce “[h]igh quality dental images.” *Id.* ¶ 102.

Upon uploading the images from the mobile telecommunications device to a remote location (e.g., a server), the images may be processed manually, automatically or semi-automatically to determine if the patient is a candidate for the orthodontic procedure. *Id.* ¶ 156.

3. Maninis (Ex. 1007)

Maninis relates to using “Convolutional Neural Networks (CNNs)” to “produce[] multiscale oriented contours and region hierarchies starting from generic image classification.” Ex. 1007, Abstract. Maninis indicates that the “latest wave of contour detectors takes advantage of deep learning to obtain state-of-the-art results,” and provides “an end-to-end deep framework to boost the efficiency and accuracy of contour detection, using convolutional feature maps and a novel loss function.” *Id.* at 2. Figure 2 of Maninis, reproduced below, further illustrates using a deep learning device for performing contour and edge detection in images. *Id.* at 3.

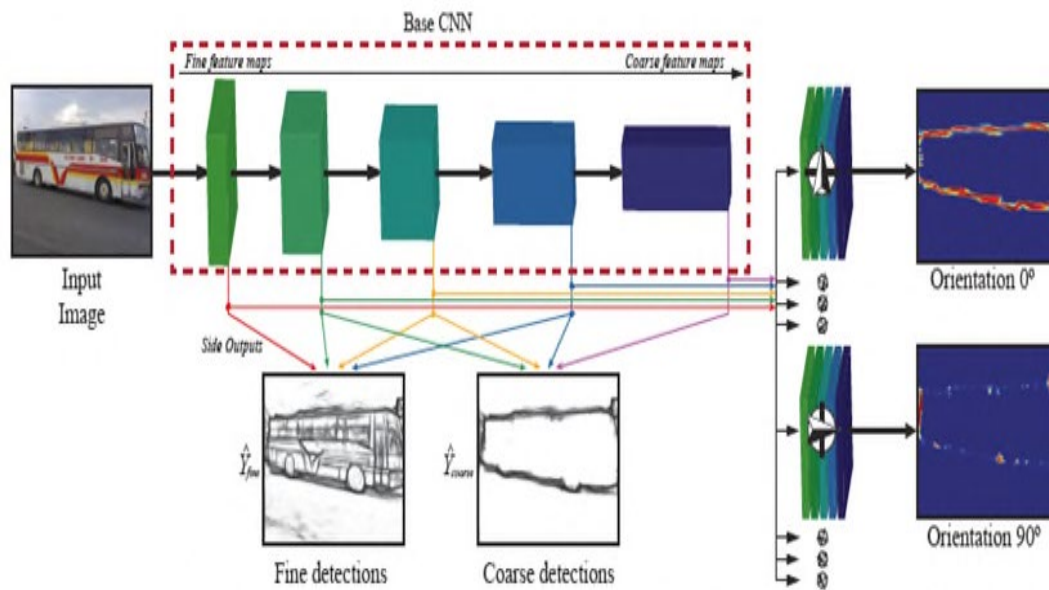


Figure 2 above illustrates a deep learning architecture depicting connections between different stages used to generate the multiscale contours using multiple feature map layers in a CNN to detect image contents at different scales (fine and coarse detections) as well as different orientations. *Id.*

Maninis uses a training dataset of 10,103 images with “localized pixel-wise semantic annotations,” meaning pixel-by-pixel indications of each object’s location in each image. *Id.* at 5–6. For training and optimization purposes, Maninis divides these images into “train, validation, and test sets” to train and validate the deep learning device. *Id.*

E. Asserted Obviousness Based on Salah, Carrier, and Maninis

Petitioner argues that claims 1–15 are rendered obviousness based on the combined teachings of Salah, Carrier, and Maninis. Pet. 18–70. In support of its showing, Petitioner relies upon the Foroosh Declaration. *Id.* (citing Ex. 1002). We have reviewed Petitioner’s assertions and supporting evidence. For the reasons discussed below, and based on the record before us, we are persuaded that Petitioner demonstrates a reasonable likelihood of prevailing in showing that at least one challenged claim would have been obvious in view of the combination of Salah, Carrier, and Maninis.

1. The Preamble

Independent claim 1 recites “[a] method for acquiring an image of a dental arch of a patient, said method comprising the following steps.” Ex. 1001, 32:13–14.

Petitioner argues that, to the extent the preamble is limiting, Salah teaches these limitations. Pet. 24–25 (citing Ex. 1008, Abstr., 12:20–24) (asserting “Salah teaches acquiring images of patients’ dental arches”). Further, Petitioner argues that Carrier likewise teaches these limitations. *Id.* (citing Ex. 1005 ¶ 9; Ex. 1006 ¶ 7) (asserting that Carrier “teaches methods of obtaining images of patients’ teeth ‘for therapeutic use.’”). According to Petitioner, “both references teach using a mobile device that guides users to acquire dental images.” *Id.* (citing Ex. 1008, 27:21–28:2, Figs. 5A–D; Ex. 1006 ¶¶ 59, 96, Figs. 2A–3B, 5C–7C; Ex. 1005 ¶¶ 104, 173, Figs. 2A–3B, 5C–7C; Ex. 1002 ¶¶ 89–93).

Patent Owner does not specifically respond to these arguments. *See generally* Prelim. Resp. Nonetheless, the burden of persuasion remains on

Petitioner to demonstrate unpatentability. *See Dynamic Drinkware, LLC*, 800 F.3d at 1378. However, we address herein Patent Owner’s pertinent arguments raised throughout the Preliminary Response, to the extent they are relevant to our discussion of the preamble. In one instance, Patent Owner argues that “Salah does not require or relate to the acquisition of highly accurate, high quality dental images, as is claimed by the ’409 [p]atent.” Prelim. Resp. 8 (citing Ex. 2002 ¶¶ 53–58), *id.* at 17 (citing Ex. 1008, 2:22–27). According to Patent Owner, Salah is instead concerned with an image acquisition method for providing real-time guidance to a patient (or someone close to the patient) and real-time analysis during actual image acquisition. *Id.* (citing Ex. 1008, 10:22–26, 31:23–24, 54:12–15). Further, Patent Owner argues that Carrier is likewise concerned with providing real-time guidance to a patient (or someone close to the patient) during actual image acquisition. *Id.* at 11–12 (citing Ex. 1005 ¶¶ 7, 19; Ex. 2002 ¶¶ 59–64) *cf id.* at 11 (citing Ex. 1006 ¶¶ 6, 51, 57; Ex. 2002 ¶¶ 59–64) (asserting Carrier provisional discloses a method for allowing dental professionals using a mobile phone to capture “high quality dental images.”)

Patent Owner’s arguments are not persuasive because they do not have any basis in the claim. Although the ’409 patent generally discusses a method for guiding a patient or an operator to use a mobile phone to capture high-quality dental images, such characterization of the dental images is not particularly recited in the claim. “[T]he name of the game is the claim.” *In re Hiniker Co.*, 150 F.3d 1367, 1369 (Fed. Cir. 1998); *see generally* Ex. 1001. Accordingly, Patent Owner’s statement that “the purpose of Salah’s disclosed invention is not an improved method for acquiring dental images, *as is claimed by the ’409 [p]atent*” is unsupported on the record before us.

Prelim Resp. 7 (emphasis added). That is, the claim does not require acquiring a high-quality image of a dental arch. And, even if Salah and Carrier describe real-time guidance in image acquisition, they nevertheless describe dental image acquisition, which is what is claimed in the preamble. Further, we note that Carrier discusses the importance of allowing a patient using a mobile phone to capture high quality dental images. Ex. 1005 ¶ 102.

Based on our review and consideration of the current record, and without determining whether the preamble is limiting, we determine that Petitioner has sufficiently shown that Salah, Carrier (and, thus, the combination of Salah with Carrier, and Maninis) teaches the subject matter of the preamble.

2. *Step 1a') activation of an image acquisition apparatus*

Independent claim 1 further recites “activation of an image acquisition apparatus so as to acquire an image, called ‘analysis image’, of said arch.” Ex. 1001, 32:15–16.

Petitioner argues that Salah teaches these limitations. Pet. 25 (citing Ex. 1008, 27:11–13, 31:4–7; Ex. 1002 ¶ 94) (asserting “Salah teaches that a user . . . may acquire dentition images using . . . a cellphone . . . that includes a viewfinder or screen to aid in alignment” “to acquire images displayed on a viewfinder or screen when aligning the apparatus constitutes the recited ‘activation’ to acquire an ‘analysis image.’”). Further, Petitioner argues that Carrier likewise teaches these limitations. Pet. 25–27 (citing Ex. 1002 ¶¶ 95–97; Ex. 1005 ¶¶ 8, 104, 107, 108, 171, Figs. 3A–B, Fig. 7B; Ex. 1006 ¶¶ 7, 59, 62, 63, 94, Figs. 3A–B, Fig. 7B) (asserting that Carrier teaches a mobile device (e.g., a smart phone) for acquiring images of a patient’s teeth

when they are aligned with an outline of teeth in an overlay displayed on the screen of the mobile device). According to Petitioner, both Salah and Carrier teach a mobile phone to acquire an image of a dental arch displayed on the screen during alignment. *Id.* at 27 (citing Ex. 1002 ¶¶ 98).

Patent Owner does not specifically respond to these arguments. *See generally* Prelim. Resp.

Based on our review and consideration of the current record, we determine that Petitioner has sufficiently shown that Salah, Carrier (and, thus, the combination of Salah with Carrier, and Maninis) teaches the limitations in step 1a’.

3. *Step 1b’) analysis of the analysis image*

Independent claim 1 further recites “analysis of the analysis image by means of a deep learning device trained by means of a learning base.” Ex. 1001, 32:17–18 (emphasis added).

Petitioner argues that the combination of Salah, Carrier and Maninis teaches these limitations. Pet. 27–31. In particular, Petitioner argues that Salah’s disclosure of an acquisition apparatus that includes a verification means to guide a user (1) in positioning the camera to acquire an image of a patient’s dental arch, (2) in determining whether the image is acceptable, and (3) in subsequently employing deep learning to analyze the captured image to detect the contour of teeth teaches “the analysis of the image.” *Id.* at 27–28 (citing Ex. 1002 ¶¶ 99–101; Ex. 1008, 27:21–28:2, 34:5–36:14, Figs 6b). Further, Petitioner argues that Carrier’s disclosure of using contour/object detection to assess image alignment and to guide users to acquire an image of a patient’s dental arch such that all teeth are visible to detect the positions of tooth edges relative to an overlay teaches analyzing an acquired image.

Id. at 28 (citing Ex. 1002 ¶¶ 102, 103; Ex. 1005 ¶¶ 108, 128; Ex. 1006 ¶¶ 63, 81).

Furthermore, Petitioner argues that, “[a]lthough Carrier does not expressly disclose that its image analysis techniques employ ‘a deep learning device trained by [a] means of a learning base,’ Carrier invites use of ‘any appropriate technique[s] (e.g., edge detection image processing, etc.),’ and Salah expressly identifies deep learning as an option for detecting tooth contours.” *Id.* at 28–29 (citing Ex. 1002 ¶ 104; Ex. 1005 ¶ 108; Ex. 1006 ¶ 63; Ex. 1008, 34:5–36:14).

Additionally, Petitioner proposes to modify Salah-Carrier’s system to use Maninis’s deep learning techniques for detecting contours/edges to perform image analysis, a process referred to as “Convolutional Oriented Boundaries (COB).” *Id.* at 29 (citing Ex. 1002 ¶ 105; Ex. 1007, Abstr., 3–5, Figures 3–5). According to Petitioner, Maninis’s disclosure of using a deep learning convolutional neural network to perform image analysis would enable both “detection of tooth edges and recognition of individual teeth as taught by Carrier.” *Id.* at 30 (citing Ex. 1002 ¶ 106). “Thus, Salah, Carrier, and Maninis teach ‘analysis of the analysis image’ (to determine values for tooth presence and edges, as taught by Carrier) ‘by means of a deep learning device trained by means of a learning base’ (a device comprising a deep learning neural network trained with a learning base, as taught by Salah and Maninis).” *Id.* at 31 (citing Ex. 1002 ¶ 109).

Patent Owner argues that the proposed combination of Salah, Carrier, and Maninis is deficient because, absent the disclosure of the ’409 patent, a person of ordinary skill in the art (“POSITA”) would not have been motivated to combine Salah and/or Carrier with the specific neural network

of Maninis. Prelim. Resp. 16–17. First, Patent Owner argues that Petitioner fails to identify any problem or shortcoming with the prior art methods disclosed in Carrier and Salah that the POSITA would have been motivated to address. *Id.* at 16. According to Patent Owner, Carrier’s methodology was specifically designed to use “traditionally handheld consumer electronics” (e.g., a smartphone), as opposed to “expensive and bulky” equipment (e.g., single-lens reflex cameras), to achieve the desired “high quality dental images.” *Id.* at 16–17 (citing Ex. 1006 ¶¶ 51, 52, 54). Whereas, Patent Owner argues, Salah expressly requires using a cell phone to acquire simple images of patient’s teeth without requiring precise positioning of the camera relative to the teeth. *Id.* at 17 (citing Ex. 1008, 2:22–27; Ex. 2002 ¶¶ 53–58, 73). Patent Owner therefore argues that, contrary to Petitioner’s assertion (Pet. 23), Maninis does not provide any “specific functionalities” that a POSITA would have believed were missing from Salah and Carrier. *Id.* (citing Ex. 2002 ¶ 73).

Further, Patent Owner argues that Petitioner fails to provide any reasoned basis as to why a POSITA would have been aware of Maninis or selected it from the wealth of computer vision art, given that Maninis’s disclosed deep learning architecture does not pertain to any medical application, let alone for dental and aligner images. Prelim. Resp. 17–18. Accordingly, Patent Owner asserts that Petitioner’s proposed combination is a product of impermissible hindsight. *Id.* at 18.

Additionally, Patent Owner argues that Petitioner’s reliance on vague “image analysis trends” to provide motivation for the proposed combination of reference is further evidence of hindsight bias. *Id.* at 18–19. More particularly, Patent Owner argues that “[b]road references to ‘edge detection

image processing’ or ‘image recognition algorithms’ in Carrier and the Carrier Provisional would not have motivated a POSA to specifically select deep learning technology for image acquisition, particularly when no prior art references cited by Petitioner suggest such use.” *Id.* at 19.

Furthermore, Patent Owner argues that, likewise, Salah’s mentioning of deep learning once out of a list of almost 40 potential and non-preferred methods for post image acquisition updating of a 3D tooth contour map would not have motivated a POSITA to combine the references because Petitioner fails to explain why the POSITA would have zeroed in on deep learning instead of the other cited methods. *Id.* at 20 (citing Ex. 1008, 34:5–36:14). More particularly, Patent Owner asserts:

Moreover, Petitioner[] admit[s] that deep learning technology represented a “new class of computer vision” and it worked in a fundamentally different way from traditional image processing software. *See, e.g.*, Pet. 3-4. Deep learning methods take in “raw image data and directly learn to accomplish a vision task,” including high-level object classification and localization. *Id.* They were thus computationally intensive, as well as expensive and time-consuming to develop. EX2002, ¶75. The specific deep learning architecture of Maninis was also not suited for use on mobile devices, such as smartphones, or for real-time object recognition on such devices. EX2002, ¶75.

In contrast to Maninis, however, both Salah and Carrier describe methods and apparatuses for providing real-time guidance during actual image acquisition using software running on a mobile device. *See* Sections V.A–B. Petitioner’s obviousness arguments fail because a POSA would not have been motivated to combine Salah or Carrier with Maninis, which was neither suited for use on a mobile device nor providing real-time object recognition on one.

Id. at 21 (citing Ex. 2002 ¶¶ 73–76).

Therefore, Patent Owner submits that, because Petitioner has not identified a deep learning device for acquiring an image of a dental arch as recited in claim 1 of the '409 patent, Petitioner's motivation to combine the references should be rejected as it is premised upon impermissible hindsight. *Id.* at 22.

Next, Patent Owner argues that a POSITA would have not had a reasonable expectation of success in combining Salah, Carrier, and Maninis in the manner proposed by Petitioner. Prelim. Resp. 22. Patent Owner reiterates that none of the references teaches using a deep learning device for image acquisition, let alone for acquiring dental and aligner images. *Id.* According to Patent Owner, Salah and Carrier pertain to using traditional image processing software on an image acquisition device (e.g., a cell phone) to provide real-time guidance during image acquisition. *Id.* at 22–23 (citing Ex. 1005 ¶ 7). Whereas Salah and Maninis disclose using deep learning techniques in the context of image analysis post acquisition. *Id.* at 23 (citing Ex. 2002 ¶ 77). More particularly, Patent Owner argues that Petitioner provides no further explanation how Maninis's incompatible power-hungry parallel processors could be used for image acquisition in Salah or Carrier's portable devices. *Id.* at 23–24 (citing Ex. 2002 ¶ 72). Therefore, Patent Owner submits that the Petition should be denied for lack of reasonable expectation of success in combining the references. *Id.* at 24.

Based on the preliminary record, we are persuaded that Petitioner has presented sufficient evidence that would support a finding that the combined teachings of Salah, Carrier, and Maninis account for step 1b'). As an initial matter, we note that the claim recites in step 1a') "an image acquisition

apparatus” and in step 1b’) “a deep learning device”. Although Patent Owner argues that the image acquisition apparatus pertains to a mobile device, Patent Owner has not accounted for the “deep learning device” besides the indication that the latter device pertains to a neural network trained by a learning base to assist the image acquisition apparatus in assessing the analysis image. Prelim. Resp. 22–23, Ex. 1001, 3:13–17, 18:56–59, 23:7–10. The record before us is devoid of any evidence to substantiate Patent Owner’s inference that the “deep learning device” recited in the claim is somehow integrated in the mobile device. Accordingly, on this record, we find insufficient evidence to corroborate Patent Owner’s argument that the claimed “deep learning device” is somehow different from the one disclosed in Maninis.

Further, as set forth above, in its contentions for this limitation, Petitioner relies on Salah for teaching using an image acquisition apparatus including a verification means to guide a user in positioning, capturing an image of a patient’s dental arch, and subsequently using deep learning to analyze the captured image to detect edges and contours therein. Pet. 27–28. Petitioner then proposes modifying Salah’s system with Carrier’s teaching of using contour/object detection to assess image alignment and to guide users to acquire an image of a patient’s dental arch such that all teeth are visible to detect the positions of tooth edges relative to an overlay. *Id.* at 28. Additionally, Petitioner proposes modifying the Salah-Carrier system by using Maninis’s deep learning techniques for detecting contours/edges to perform image analysis. *Id.* at 29. Because Petitioner relies upon the combination of Salah and Carrier with Maninis’s teachings, Patent Owner’s argument regarding Maninis not being related to a medical application is

tantamount to separate attacks against the references individually, and not as the combination proposed by Petitioner. One cannot show non-obviousness by attacking the references individually where the proposed rejection or challenge is based on combinations of references. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

Based on the preliminary record, we are persuaded by Petitioner's argument that the proposed combination of Salah, Carrier, and Maninis is no more than a simple arrangement of old elements with each performing the same function it had been known to perform, yielding no more than what one would expect from such an arrangement. Pet. 21, 24; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Because the proposed combination involves known elements performing their ordinary functions to produce a predictable result, Petitioner has sufficiently established for purposes of institution that a POSITA would have appreciated that the proposed combination is proper.⁴ Pet. 24 (citing Ex. 1002 ¶¶ 87–88; Ex. 1007 ¶ 2). Patent Owner's assertion of hindsight is therefore a conclusion unsupported

⁴ It has been held that where the claimed subject matter involves more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness *must* be based on “an apparent reason to combine the known elements in the fashion claimed.” *KSR*, 550 U.S. at 417–18. That is, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id.* at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Such reasoning can be based on interrelated teachings of multiple patents, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art. *Id.* at 417–18.

by objective evidence. *See Cheese Sys., Inc. v. Tetra Pak Cheese & Powder Sys., Inc.*, 725 F.3d 1341, 1352 (Fed. Cir. 2013) (“In this regard, objective evidence operates as a beneficial check on hindsight.”).

Based on our review and consideration of the current record, for purposes of institution, we determine that Petitioner has sufficiently shown that the combination of Salah, Carrier, and Maninis teaches the limitations in step 1b’.

Rationale to Combine with Reasonable Expectation of Success

Based on the preliminary record, we are persuaded that Petitioner has presented a sufficient rationale to combine the teachings of Salah, Carrier, and Maninis with a reasonable expectation of success. Petitioner contends that Salah and Carrier are in the same field of endeavor, in that they disclose similar techniques of using deep learning for dental imaging (e.g., assessing alignment, using the assessment to guide users, obtaining dentition images with the user’s mobile phones), with Carrier providing specific details to effectively assess alignment based on the appearance of the patient’s teeth to capture high-quality dentition images. Pet. 21. Further, Petitioner submits the following:

The resulting combination would use each reference’s teachings to perform substantially the same function as they provide alone, with Carrier’s techniques for assessing alignment used to determine the feedback to users when guiding them to acquire dental images as taught by Salah. POSAs would thus have had a reasonable expectation of success, as the combination would be one of complementary techniques, applied in understood ways, to produce a predictable outcome.

Id. (citing Ex. 1002 ¶ 82).

Furthermore, Petitioner contends that, although Maninis is not related to dental imaging it describes broadly applicable techniques (e.g., deep learning) for image classification and contour detection, which would have complemented the contour/edge detection discussed in Salah and Carrier. *Id.* at 22 (citing Ex. 1002 ¶ 84). Thus, Salah, Carrier, and Maninis are at least reasonably pertinent to this contour/edge detection problem in object imaging. *Id.* (citing Ex. 1005 ¶¶ 108, 128; Ex. 1006 ¶¶ 63, 81; Ex. 1008, 34:5–36:14). More particularly, Petitioner asserts:

Maninis motivates employing deep learning techniques for object and contour detection. Maninis teaches that the “latest wave of contour detectors takes advantage of deep learning to obtain state-of-the-art results.” EX1007, 2. Maninis provides a flexible, “modular” technique and “can incorporate and benefit from future improvements in the base CNN.” *Id.* Maninis also achieves improvements relative to “recent approaches to contour detection using deep learning.” EX1007, 3, 9 (“Overall, comparing to previous state-of-the-art, we get a significant improvement at a fraction of the computation time (24.37 to 0.79 seconds).”), 11-12 (improved object identification); EX1002, ¶85.

Based on Maninis’s flexibility and prospect to improve performance, a POSA would have been motivated to analyze images using a deep learning device as taught by Maninis to improve an image acquisition apparatus as taught by Salah and Carrier. For example, a POSA would have been motivated to adapt Salah and Carrier’s image acquisition device to employ a deep learning architecture as taught by Maninis, trained on images relevant to Salah’s and Carrier’s dental imaging applications. Maninis’s deep learning architecture would provide specific functionalities required by Salah and Carrier, including the ability to identify objects (such as the required teeth Carrier proposes using image recognition software to identify) and to detect contours (such as the tooth edges Carrier

uses to assess alignments), to aid in guiding image acquisition, as taught by Salah.

Id. at 23–24 (citing Ex. 1002 ¶ 86).

Petitioner shows sufficiently for institution that a POSITA would have been motivated to incorporate Maninis’s teaching of using deep learning to identify edges/contours in images into the Salah-Carrier’s image capturing process to enhance the overall quality of images of a patient’s dental arch as they are being captured. *Id.*

For purposes of institution, we find that Petitioner’s rationale, which is supported by the testimony of Dr. Foroosh, is a sufficient demonstration, at this stage, of a motivation to combine the references with a reasonable expectation of success. *KSR*, 550 U.S. at 417–18.

4. *Step 1c') determination of a value for an image attribute*

Independent claim 1 recites “determination, for the analysis image, as a function of the results of the analysis in the preceding step, of a value for an image attribute.” Ex. 1001, 32:19–21.

Petitioner argues that the combination of Salah, Carrier, and Maninis teaches these limitations. Pet. 31–36. In particular, Petitioner argues that Salah teaches an acquisition apparatus capable of providing feedback regarding whether a captured image is acceptable and properly positioned. *Id.* at 31 (citing Ex. 1008, 27:21–28:2). According to Petitioner, while Salah does not expressly teach determining the value for an image attribute, a POSITA would have recognized such a step naturally flows from Salah’s determination of whether the image is acceptable as it would merely require routine skill. *Id.* at 31–32 (citing Ex. 1002 ¶¶ 110–111).

Petitioner further argues that Carrier provides examples that illustrate such routine image analysis. Pet. 32–33 (citing Ex. 1002 ¶¶ 112–115; Ex. 1005 ¶¶ 108, 114, 128; Ex. 1006 ¶¶ 63, 68, 81) (asserting that Carrier teaches analyzing an image to determine whether detected tooth edges are aligned with those in an overlay by assessing the distance therebetween, and alternatively, using image algorithms to ensure that all required teeth are visible Carrier). Petitioner asserts that a POSITA would have understood that Carrier’s measured distance teaches the image attribute values because they indicate the presence or absence of required teeth in the image as a whole. *Id.* at 33 (citing Ex. 1002 ¶ 121.)

Additionally, Petitioner argues that Maninis further complements the Salah-Carrier combination to teach this limitation. *Id.* at 33–36 (citing Ex. 1002 ¶¶ 117–120, 122; Ex. 1006, FIG. 6B; Ex. 1007, Abstr., 1–2, 5, 11–12; Ex. 1008, FIG. 4d, 54:23–26) (asserting that a POSITA would have been motivated to use Maninis’s deep-learning based contour detection techniques to identify and classify objects, thereby enabling users of the Salah-Carrier system to identify individual teeth in the image being captured).

Patent Owner does not specifically respond to these arguments. *See generally* Prelim. Resp.

Based on our review and consideration of the current record, we determine that Petitioner has sufficiently shown that Salah, Carrier (and, thus, the combination of Salah with Carrier, and Maninis) teaches the limitations in step 1c’.

5. *Step 1d') comparison of said image attribute value with a setpoint*

Independent claim 1 recites “comparison of said image attribute value with a setpoint.” Ex. 1001, 32:22–23.

Petitioner argues that the combination of Salah, Carrier, and Maninis teaches these limitations. Pet. 36–37. In particular, Petitioner argues that Salah teaches an acquisition apparatus capable of assessing whether a captured image is acceptable and properly positioned. *Id.* at 36 (citing Ex. 1008, 27:21–28:2). According to Petitioner, while Salah does not expressly teach comparing an image attribute thereof to a setpoint, a POSITA would have recognized such a step as a “routine option” as exemplified by Carrier’s teachings discussed above. *Id.* at 36–37 (citing Ex. 002 ¶¶ 123–127) (asserting that a “POSA would naturally have applied Carrier’s teaching by determining whether every required tooth was visible or not by comparing a value (the required teeth’s visibility or non-visibility) to a setpoint (they must be visible)”).

Patent Owner does not specifically respond to these arguments. *See generally* Prelim. Resp.

Based on our review and consideration of the current record, we determine that Petitioner has sufficiently shown that Salah, Carrier (and, thus, the combination of Salah with Carrier, and Maninis) teaches the limitations in step 1d’.

6. *Step 1e') sending of an information message as a function of said comparison*

Independent claim 1 recites:

sending of an information message as a function of said comparison, the information message being related to the quality of the image acquired or to the position of the acquisition apparatus in relation to said arch or to the setting of the acquisition apparatus or to the opening of the mouth or to the wearing of a dental appliance, or to a combination thereof, to check whether the analysis image respects the setpoint and, if it does not respect the setpoint, to guide the operator in order for him or her to acquire a new analysis image

Ex. 1001, 32:24–33.

Petitioner argues that the combination of Salah, Carrier, and Maninis teaches these limitations. Pet. 37–41. In particular, Petitioner argues that Salah teaches an acquisition apparatus capable of providing written and voice prompts to guide acquisition of an image, to assess the image, to position the image, as well as to take another photo, as needed. *Id.* at 37–38 (citing Ex. 1008, 27:21–28:2; Ex. 1002 ¶¶ 128–29). Accordingly, Petitioner asserts that Salah teaches sending information messages. *Id.* at 38.

Petitioner further argues that Carrier likewise teaches these limitations. Pet. 38–41 (citing Ex. 1002 ¶¶ 130–139; Ex. 1005 ¶¶ 108, 112–116, 120; Ex. 1006 ¶¶ 63, 67–70) (asserting that Carrier teaches visual, audible and/or tactile indications when the image and the overlay are aligned). Petitioner asserts that a POSITA would be motivated to send messages to guide users in capturing an acceptable image of the patient’s dental arch or otherwise to adjust or redo the photo. *Id.* at 40–41.

Patent Owner does not specifically respond to these arguments. *See generally* Prelim. Resp.

Based on our review and consideration of the current record, we determine that Petitioner has sufficiently shown that Salah, Carrier (and,

thus, the combination of Salah with Carrier, and Maninis) teaches the limitations in step 1e’.

Conclusion Regarding Independent Claim 1

For the foregoing reasons, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that independent claim 1 would have been obvious in view of the combination of Salah, Carrier, and Maninis.

9. Dependent claims 2–15

Petitioner also contends that claims 2–15, which depend directly or indirectly from independent claim 1, would have been obvious over the combination of Salah, Carrier, and Maninis. Pet. 41–70. We have reviewed Petitioner’s initial showing as to the additional limitations of these dependent claims, and find that Petitioner has sufficiently shown that the combination of Salah, Carrier, and Maninis teaches each of the limitations of these claims at this stage of the proceeding. *Id.* We further note that Patent Owner does not separately address the patentability of these claims beyond its arguments as to independent claim 1, addressed above. *See* Prelim. Resp. We determine, on the current record and for purposes of institution, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner would prevail in its obviousness contentions regarding claims 2–15.

As we preliminarily conclude that Petitioner demonstrates a reasonable likelihood of prevailing with respect to its obviousness challenge to independent claim 1 as rendered obvious by Salah, Carrier, and Maninis, we institute review on all challenged claims on all grounds set forth in the

Petition, including Petitioner’s challenge to claims 2–15 as rendered obvious by Salah, Carrier, and Maninis. *See* 37 C.F.R. § 42.108(a) (2023).

IV. CONCLUSION

For the foregoing reasons, we determine that the information presented shows a reasonable likelihood that Petitioner would prevail in showing that at least one challenged claim of the ’409 patent is unpatentable. At this preliminary stage, we have not made a final determination with respect to the patentability of the challenged claims or any underlying factual and legal issues. *See TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (noting that “there is a significant difference between a petitioner’s burden to establish a ‘reasonable likelihood of success’ at institution, and actually proving invalidity by a preponderance of the evidence at trial”).

V. ORDER

Accordingly, it is:

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–15 of the ’409 patent is instituted with respect to the grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

IPR2023-01369
Patent 10,755,409 B2

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