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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,435* .

PATENT UNDER REEXAMINATION *11314983* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

Order Granting Request For Ex Parte Reexamination	Control No. 90/019,435	Patent Under Reexamination 11314983	
	Examiner JOSEPH R POKRZYWA	Art Unit 3992	AIA (FITF) Status Yes

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

The request for *ex parte* reexamination filed 03/01/2024 has been considered and a determination has been made. An identification of the claims, the references relied upon, and the rationale supporting the determination are attached.

Attachments: a)☐ PTO-892, b)☑ PTO/SB/08, c)☐ Other: ____

1. ☑ The request for *ex parte* reexamination is GRANTED.

RESPONSE TIMES ARE SET AS FOLLOWS:

For Patent Owner's Statement (Optional): TWO MONTHS from the mailing date of this communication (37 CFR 1.530 (b)). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

For Requester's Reply (optional): TWO MONTHS from the **date of service** of any timely filed Patent Owner's Statement (37 CFR 1.535). **NO EXTENSION OF THIS TIME PERIOD IS PERMITTED.** If Patent Owner does not file a timely statement under 37 CFR 1.530(b), then no reply by requester is permitted.

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	/ERON J SORRELL/ Primary Examiner, Art Unit 3992	

cc:Requester (if third party requester)

DETAILED ACTION

Response to Request for ex parte Reexamination

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. Reexamination has been requested for claims 1-5 and 8-14 of U.S. Patent 11,314,983, issued to Salah *et al.* (hereafter "the '983 Patent").

3. A substantial new question affecting claims 1-5 and 8-14 of the '983 Patent is raised by the Third Party's request for *ex parte* reexamination.

4. The '983 Patent originally issued on April 26, 2022, with patented claims 1-14, being filed as U.S. Patent Application 16/031,125 (hereafter "the original '125 Application) on July 10, 2018. Here, the original '125 Application claims foreign priority to French patent application FR 1756953, filed on July 21, 2017.

Listing of Prior Art

5. In the current Request for Reexamination filed March 1, 2024, the Third Party Requester alleges that claims 1-5 and 8-14 of the '983 Patent are unpatentable over the following references:

a. U.S. Patent 9,152,767, with the inventor of Mah (noted as "Mah"), being issued on October 6, 2015;

b. U.S. Patent Application Publication 2018/0125610, with the inventor of Carrier, Jr. *et al.* (noted as "Carrier"), being published on May 10, 2018, filed November 3, 2017, based on a provisional application filed November 4, 2016;

c. U.S. Patent Application Publication 2018/0211380, with the inventor of Tandon *et al.* (noted as "Tandon"), being published on July 26, 2018, filed January 25, 2017;

d. U.S. Patent Application Publication 2018/0061054, with the inventor of Abraham *et al.* (noted as "Abraham"), being published on March 1, 2018, filed August 29, 2016;

e. Seiya Murata *et al.*, "Towards a Smart Dental Healthcare: An automated Assessment of Orthodontic Treatment Need", Second Int'l. Conf. on Informatics & Assistive Techs. For Health-Care, Med. Support & Wellbeing 35, Oct. 8, 2017 (noted as "Murata");

f. Chonho Lee *et al.*, "A Data Analytics Pipeline for Smart Healthcare Applications", Sustained Simulation Performance (presented at a conference in March 2017 and published August 26, 2017 (noted as "Lee"); and

g. U.S. Patent Application Publication 2018/0028294, with the inventor of Azernikov *et al.* (noted as "Azernikov"), being published on February 1, 2018, filed July 26, 2017, based on a provisional applications filed July 27, 2016 and May 10, 2017.

6. The Examiner notes that each of the references of Mah, Carrier, Tandon, Abraham, Murata, Lee, Azernikov were each not cited in the record, nor discussed in the original prosecution that matured into the '983 Patent. However, it is noted that a related the reference of the above noted reference of Mah was cited in the original prosecution, with this related reference being cited in an Information Disclosure Statement dated July 10, 2018. But here, this related reference of Mah was not particularly discussed, nor utilized in any rejection in the original prosecution. Thus, the reference of Mah, discussed in the Request for Reexamination, is being viewed in a new light.

Requester's Position

7. The Request indicates that the Third Party Requester alleges that:

SNQ#1. A substantial new question of ***claims 1-5 and 8-14*** of the '983 Patent is raised by the combination of Mah in view of Carrier and Tandon;

SNQ#2. A substantial new question of ***claims 1-5 and 8-14*** of the '983 Patent is raised by the combination of Mah in view of Carrier and Abraham;

SNQ#3. A substantial new question of ***claims 1-5 and 8-14*** of the '983 Patent is raised by the combination of Murata in view of Lee;

SNQ#4. A substantial new question of ***claims 1-5 and 8-14*** of the '983 Patent is raised by the reference of Azernikov; and

SNQ#5. A substanti997al new question of ***claims 1-5 and 8-14*** of the '983 Patent is raised by the combination of Azernikov in view of Carrier and Abraham.

Discussion of the Prosecution History and Patentable Subject Matter

8. Initially, it is noted that of the requested claims 1-5 and 8-14 of the '983 Patent, claims 1 and 12 of the '983 Patent are independent. Thus, the prosecution history of these claims will be analyzed to determine the perceived original patentable features during the original prosecution of these claims. Here, independent claims 1 and 12 of the '983 Patent matured from the corresponding claims of the original '125 Application, being renumbered from the original claims 1 and 17 of the application.

9. With this, looking into the prosecution history of the original '125 Application, a Notice of Allowance was mailed on December 22, 2021. Here, in review of the Notice of Allowance, the original Examiner gave a statement as to the reasons for allowance, stating on page 3 that:

> Based on applicant's amendment, with respect to claim 1, representative of claim 17, the closest prior art of record (Kuo; Borovinskih and Kopelman), Kuo reference is directed to the field of orthodontics. More specifically, the present invention is related to methods and system for providing dynamic orthodontic assessment and treatment profiles. Borovinskih reference is directed to methods and systems for monitoring a dental patient's progress during a course of treatment. A three-dimensional model of the expected positions of the patient's teeth can be projected, in time, from a three-dimensional model of the patient's teeth prepared prior to beginning the treatment, and Kopelman reference is directed to the field of dentistry and, in particular, to a system and method for providing augmented reality enhancements for dental practitioners.

But, neither Kuo nor Borovinskih and Kopelman, teach or suggest, among other things, "acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient; submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image, steps: A) creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned; B) training of at least one deep learning device, by means of the learning base; C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone".

These key features in combination with the other features of the claimed invention are neither taught nor suggested by (Kuo; Borovinskih and Kopelman) prior art of record.

10. With this, looking further into the prosecution history of the original '125 Application, in a non-final Office action dated January 1, 2021, application claims 1 and 17, as well as application dependent claims 2 and 18 were indicated as being rejected as being unpatentable over Kuo (U.S. Pat. App. Pub. 2015/0132708) in view of Borovinskih *et al.* (U.S. Pat. App. Pub. 2017/0049311). Subsequently, the Applicant filed an amendment dated May 26, 2021, which amended independent claims 1 and 17 to include the limitations:

"comprising the following steps:

acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient;

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image."

11. In response to this amendment, a final Office action was mailed on July 14, 2021 that indicated that independent claims 1 and 17 stood rejected as being unpatentable over Kuo in view of Borovinskih *et al.*, and further in view of Kopelman *et al.* (U.S. Pat. App. Pub. 2018/0168780), but that dependent claims 2 and 18 now contained allowable subject matter in light of the amendment to the respective independent claims. This lead to the amendment filed October 12, 2021, which was noted in the Notice of Allowability, whereby the amendment filed on October 12, 2021 incorporated the features of application dependent claims 2 and 18 into independent application claims 1 and 17. Specifically, in the noted amendment filed on October 12, 2021, which was entered with the filing of a Request for Continued Examination after the final Office action dated July 14, 2021, independent claim 1 of the original '125 Application was amended with the added limitations that include:

> "said method also comprising the following steps:
>
> A) creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned;
>
> B) training of at least one deep learning device, by means of the learning base;
>
> C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone";
>
> D) determination, as a function of said probability, of the presence of a tooth at a position represented by said analysis tooth zone, and of the attribute value of said tooth."

12. Similarly, in the amendment filed on October 12, 2021, independent claim 17 of the original '125 Application was amended with the added limitations that include:

> said method also comprising the following steps:

1′) creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising an attribute value for at least one image attribute, or "image attribute value";

2′) training of at least one deep learning device, by means of the learning base;

3′) submission of the analysis image to the deep learning device for it to determine, for said analysis image, at least one probability relating to said image attribute value, and determination, as a function of said probability, of a value for said image attribute for the analysis image.

13. Therefore, the perceived allowable features in the prosecution of the original '125 Application of patented independent claim 1 and 12 of the '983 Patent appear to be found in the limitations that recite "acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient; submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image", in combination with the method steps that require "creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned; B) training of at least one deep learning device, by means of the learning base; C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone", as recited in claim 1, and similarly in claim 12.

Discussion of Substantial New Question of Patentability

14. MPEP 2240 [R-07.2015] states, in part:

> *37 C.F.R. 1.515 Determination of the request for ex parte reexamination.*
>
> (a) Within three months following the filing date of a request for an *ex parte* reexamination, an examiner will consider the request and determine whether or not a substantial new question of patentability **affecting any claim** of the patent is raised by the request and the prior art cited therein, with or without consideration of other patents or printed publications. A statement and any accompanying information submitted pursuant to § 1.501(a)(2) will not be considered by the examiner when making a determination on the request. The examiner's determination will be based on the claims in effect at the time of the determination, will become a part of the official file of the patent, and will be given or mailed to the patent owner at the address provided for in § 1.33(c) and to the person requesting reexamination. [Emphasis added].

SNQ#1

15. With respect to the Third Party Requester's proposed SNQ#1, noted above, the Requester alleges that a substantial new question of claims 1-5 and 8-14 of the '983 Patent is raised by the combination of Mah in view of Carrier and Tandon. It is agreed that the combination of Mah in view of Carrier and Tandon raises a substantial new question of patentability as to at least independent claim 1 of the '983 Patent.

16. In this regard, he reference of Mah discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract; also see col. 1, line 39-col. 2, line 16; also see col. 9, line 10-col. 10, line 27], comprising the following steps:

acquisition, …, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see Fig. 1; also see col. 2, line 17-col. 3, line 37, wherein "A method can include transmitting, receiving or otherwise communicating data, such as patient data, treatment data or other data, through or via a website, which can include transmitting, receiving or otherwise communicating data to and/or from a server or other computer(s), directly, indirectly or otherwise."; also see col. 4, lines 26-49; also see col. 5, lines 37-52];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see Abstract; also see col. 5, lines 6-52, wherein "Upon providing the server 8 with the patient data, e.g., patient photographs 2, study models 4, radiographs 6, and/or combinations thereof, a user may instruct the server 8 to conduct an automated diagnosis. The automated diagnosis will be based upon the patient data, the information derived from scientific textbooks and literature 16, and dynamic results from ongoing and previously completed orthodontic studies 18. The server 8 will preferably employ the use of logic-based rules and decision trees 20 to diagnose an orthodontic condition based on all of such information. The invention provides that the server 8 will preferably express the diagnosis by identifying one or more orthodontic conditions, along with a probability value for each orthodontic condition. According to such embodiments, the probability value would represent the relative probability that the diagnosis is accurate."; also see col. 7, lines 4-63; also see col. 11, lines 12-67].

17. Here, however, Mah does not expressly disclose of "acquisition, **with a cellphone**, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient".

18. But the reference of Carrier discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract; also see Figs. 8A-8B], comprising the following steps:

acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see paragraph 0006, wherein "In general, the methods and apparatuses described herein may obtain an image of a patient's teeth for therapeutic use, which may include viewing the patient's teeth, for example, on a screen of a mobile telecommunications device (such as a mobile phone or other hand-held personal computing device, e.g., smartwatch, pad, laptop, etc.)."; also see paragraph 0099, wherein "For example, the methods and apparatuses described herein may use a user's own handheld electronics apparatus having a camera (e.g., smartphone) and adapt it so that the user's device guides the user in taking high-quality images (e.g., at the correct aspect ratio/sizing, magnification, lighting, focus, etc.) of a predetermined sequence of orientations."; also see paragraph 0052; also see paragraphs 0132-0133; also see paragraphs 0171-0173; also see Figs. 5A-7C; also see steps 801-815 in Fig. 8A];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see paragraphs 0134-0135, wherein "The method can further comprise transmitting the captured image to a remote server as in step 810 and/or evaluating the captured image for medical treatment by using

the set of images collected 809. The captured dental images can be transferred to server part for performing more precise estimation of treatment progress and/or for pre-screening a patient."; also see steps 810 and 809 in Fig. 8A; also see step 859 in Fig. 8B],

19. With this, it would have been obvious to one of ordinary skill in the art to have the functionality described in Carrier utilized in the teachings of Mah, so as to have Mah perform the function requiring the "acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient".

20. Further, Mah discloses said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, **or** "historical images", each historical image comprising one or more zones each representing a tooth, **or** "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned [see col. 1, lines 39-67, wherein "A method for diagnosing and identifying a treatment for an orthodontic condition can include receiving patient data regarding an orthodontic condition, accessing a database, such as a database that comprises or has access to information derived from one or more patient treatments, and generating or otherwise building a model of an orthodontic condition, which can include defining one or more anatomic features of a set of teeth. A method can include analyzing patient data, identifying at least one diagnosis of an orthodontic condition, such as based on information derived from patient treatments, and executing one or more algorithms, such as an artificial intelligence algorithm, based on an input, which can include one or more inputs derived from information derived from a patient treatment. … A method can include tagging or otherwise designating one or more anatomic features of

teeth with an electronic identifier, such as an identifier generated by an algorithm, an identifier defined by a user, a combination thereof, or another identifier. An anatomic feature of a tooth can include any of incisal edges, cusp tips, occlusal fossa, points of maximum crown convexity, marginal ridges, interproximal contact points, interocclusal contact points, interdental papilla heights, marginal gingival lines, zones of attached gingiva and combinations thereof."; also see col. 6, lines 36-col. 7, line 3; also see col. 13, lines 4-43];

B) training of at least one deep learning device, by means of the learning base [see col. 8, lines 39-56, wherein "The invention provides that, under this approach, a decision tree may be "learned" vis-à-vis splitting a source set into subsets, based on an attribute value test. The invention provides that this process may be repeated on each derived subset in a recursive manner, which is completed when the subset (at a node) has the same value of the target variable, or when splitting no longer adds value to predictions. According to this embodiment, decision trees are used for relatively simpler functions as decision-tree learners create over-complex trees (overfitting), although pruning may, optionally, be performed to minimize this problem. In addition, concepts that are relatively more difficult to learn are not easily expressed by decision trees—and, in such case, more advanced algorithms will be implemented in the systems and methods described herein."];

C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone" [see col. 10, line 46-col. 11, line 45, wherein "Using one or more artificial intelligence algorithms, such as the algorithms described herein (or combinations thereof), as well as (i) information derived from textbooks and scientific literature and (ii) dynamic results derived from

ongoing and completed patient treatments, the server calculates one or more diagnoses for the patient, along with an associated probability value (which is indicative of the relative accuracy of each diagnosis). Three diagnoses, and associated probability values, for this Example are listed below. Diagnosis One: Class II Malocclusion (85%) Diagnosis Two: Class I Malocclusion (14%) Diagnosis Three: Class III Malocclusion (1%).”; also see col. 5, lines 37-64].

21. Here, while Mah can be interpreted as disclosing that the method includes “A) creation of a learning base comprising more than 1000 images of dental arches, **or** “historical images”, each historical image comprising one or more zones each representing a tooth, **or** “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned”, the reference is not clear of utilizing a learning base comprising more than 1000 images of dental arches [also called] “historical images”, each historical image comprising one or more zones each representing a tooth, [also called] “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned.

22. But the reference of Tandon discloses discloses a method for analyzing an image, called “analysis image”, of a dental arch of a patient [see Abstract]

said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, or “historical images”, each historical image comprising one or more zones each representing a tooth, or “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned [see paragraphs 0214-0215, wherein “he total number of samples used for each cell type and/or condition may be chosen to ensure that the model is trained to a level of

reliability required for application (e.g., the model correctly classifies to within 0.9 of the gold standard). Depending on the task, the training set may have about 500-80,000 images per set. In certain embodiments, blob identification/nucleation tagging tasks require about 500-1000 images. In certain embodiments, for entire body classification (e.g., detecting a cell independent of nucleation features) about 20,000 to 80,000 images may be required."]".

23. With this, it would have been obvious to one of ordinary skill in the art to have the functionality described in Tandon utilized in the teachings of Mah, so as to have Mah perform the function requiring the "A) creation of a learning base comprising **more than 1000 images** of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned".

24. With this, as noted above, independent claim 12 of the '983 Patent includes similar perceived patentable features as that of independent claim 1. Thus, with respect to independent claims 1 and 12 of the '983 Patent, the combination of Mah, Carrier, and Tandon appear to describe the features that were deemed to be the patentable features in the original prosecution of the original '125 Application that matured into independent claims 1 and 12 of the '983 Patent. Thus, the combination of Mah, Carrier, and Tandon is seen to raise a substantial new question of patentability as to at least claims 1 and 12 of the '983 Patent, which question was not present in a previous examination of the '983 Patent. The combination of Mah, Carrier, and Tandon was not utilized in any rejection, nor was the reference discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the

teachings of the combination of Mah, Carrier, and Tandon important in deciding whether or not at least independent claims 1 and 12 are patentable. Therefore, the combination of Mah, Carrier, and Tandon is seen to raise a substantial new question of patentability as to at least independent claims 1 and 12 of the '983 Patent, as suggested in SNQ #1. Further, because dependent claims carry all of the limitations of the claims for which they depend on, for the same reasons as discussed above with respect to independent claim 1, the combination of Mah, Carrier, and Tandon is also seen to raise a substantial new question of patentability as to dependent claims 2-5, 8-11, 13, and 14, as further suggested in SNQ #1.

SNQ#2

25. With respect to the Third Party Requester's proposed SNQ#2, noted above, the Requester alleges that a substantial new question of claims 1-5 and 8-14 of the '983 Patent is raised by the combination of Mah in view of Carrier and Abraham. It is agreed that the combination of Mah in view of Carrier and Abraham raises a substantial new question of patentability as to at least independent claim 1 of the '983 Patent.

26. In this regard, he reference of Mah discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract; also see col. 1, line 39-col. 2, line 16; also see col. 9, line 10-col. 10, line 27], comprising the following steps:

acquisition, ..., by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see Fig. 1; also see col. 2, line 17-col. 3, line 37, wherein "A method can include transmitting, receiving or otherwise communicating

data, such as patient data, treatment data or other data, through or via a website, which can include transmitting, receiving or otherwise communicating data to and/or from a server or other computer(s), directly, indirectly or otherwise."; also see col. 4, lines 26-49; also see col. 5, lines 37-52];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see Abstract; also see col. 5, lines 6-52, wherein "Upon providing the server 8 with the patient data, e.g., patient photographs 2, study models 4, radiographs 6, and/or combinations thereof, a user may instruct the server 8 to conduct an automated diagnosis. The automated diagnosis will be based upon the patient data, the information derived from scientific textbooks and literature 16, and dynamic results from ongoing and previously completed orthodontic studies 18. The server 8 will preferably employ the use of logic-based rules and decision trees 20 to diagnose an orthodontic condition based on all of such information. The invention provides that the server 8 will preferably express the diagnosis by identifying one or more orthodontic conditions, along with a probability value for each orthodontic condition. According to such embodiments, the probability value would represent the relative probability that the diagnosis is accurate."; also see col. 7, lines 4-63; also see col. 11, lines 12-67].

27. Here, however, Mah does not expressly disclose of "acquisition, **with a cellphone**, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient".

28. But the reference of Carrier discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract; also see Figs. 8A-8B], comprising the following steps:

acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see paragraph 0006, wherein "In general, the methods and apparatuses described herein may obtain an image of a patient's teeth for therapeutic use, which may include viewing the patient's teeth, for example, on a screen of a mobile telecommunications device (such as a mobile phone or other hand-held personal computing device, e.g., smartwatch, pad, laptop, etc.)."; also see paragraph 0099, wherein "For example, the methods and apparatuses described herein may use a user's own handheld electronics apparatus having a camera (e.g., smartphone) and adapt it so that the user's device guides the user in taking high-quality images (e.g., at the correct aspect ratio/sizing, magnification, lighting, focus, etc.) of a predetermined sequence of orientations."; also see paragraph 0052; also see paragraphs 0132-0133; also see paragraphs 0171-0173; also see Figs. 5A-7C; also see steps 801-815 in Fig. 8A];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see paragraphs 0134-0135, wherein "The method can further comprise transmitting the captured image to a remote server as in step 810 and/or evaluating the captured image for medical treatment by using the set of images collected 809. The captured dental images can be transferred to server part for performing more precise estimation of treatment progress and/or for pre-screening a patient."; also see steps 810 and 809 in Fig. 8A; also see step 859 in Fig. 8B],

29. With this, it would have been obvious to one of ordinary skill in the art to have the functionality described in Carrier utilized in the teachings of Mah, so as to have Mah perform the function requiring the "acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient".

30. Further, Mah discloses said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, **or** "historical images", each historical image comprising one or more zones each representing a tooth, **or** "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned [see col. 1, lines 39-67, wherein "A method for diagnosing and identifying a treatment for an orthodontic condition can include receiving patient data regarding an orthodontic condition, accessing a database, such as a database that comprises or has access to information derived from one or more patient treatments, and generating or otherwise building a model of an orthodontic condition, which can include defining one or more anatomic features of a set of teeth. A method can include analyzing patient data, identifying at least one diagnosis of an orthodontic condition, such as based on information derived from patient treatments, and executing one or more algorithms, such as an artificial intelligence algorithm, based on an input, which can include one or more inputs derived from information derived from a patient treatment. … A method can include tagging or otherwise designating one or more anatomic features of teeth with an electronic identifier, such as an identifier generated by an algorithm, an identifier defined by a user, a combination thereof, or another identifier. An anatomic feature of a tooth can include any of incisal edges, cusp tips, occlusal fossa, points of maximum crown convexity, marginal ridges, interproximal contact points, interocclusal contact points, interdental papilla

heights, marginal gingival lines, zones of attached gingiva and combinations thereof."; also see col. 6, lines 36-col. 7, line 3; also see col. 13, lines 4-43];

B) training of at least one deep learning device, by means of the learning base [see col. 8, lines 39-56, wherein "The invention provides that, under this approach, a decision tree may be "learned" vis-à-vis splitting a source set into subsets, based on an attribute value test. The invention provides that this process may be repeated on each derived subset in a recursive manner, which is completed when the subset (at a node) has the same value of the target variable, or when splitting no longer adds value to predictions. According to this embodiment, decision trees are used for relatively simpler functions as decision-tree learners create over-complex trees (overfitting), although pruning may, optionally, be performed to minimize this problem. In addition, concepts that are relatively more difficult to learn are not easily expressed by decision trees—and, in such case, more advanced algorithms will be implemented in the systems and methods described herein."];

C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone" [see col. 10, line 46-col. 11, line 45, wherein "Using one or more artificial intelligence algorithms, such as the algorithms described herein (or combinations thereof), as well as (i) information derived from textbooks and scientific literature and (ii) dynamic results derived from ongoing and completed patient treatments, the server calculates one or more diagnoses for the patient, along with an associated probability value (which is indicative of the relative accuracy of each diagnosis). Three diagnoses, and associated probability values, for this Example are listed

below. Diagnosis One: Class II Malocclusion (85%) Diagnosis Two: Class I Malocclusion (14%) Diagnosis Three: Class III Malocclusion (1%).”; also see col. 5, lines 37-64].

31. Here, while Mah can be interpreted as disclosing that the method includes “A) creation of a learning base comprising more than 1000 images of dental arches, **or** “historical images”, each historical image comprising one or more zones each representing a tooth, **or** “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned”, the reference is not clear of utilizing a learning base comprising more than 1000 images of dental arches, [also called] “historical images”, each historical image comprising one or more zones each representing a tooth, [also called] “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned.

32. But the reference of Abraham discloses a method for analyzing an image, called “analysis image”, of a dental arch of a patient [see Abstract]

said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, or “historical images”, each historical image comprising one or more zones each representing a tooth, or “historical tooth zones”, to each of which, for at least one tooth attribute, a tooth attribute value is assigned [see paragraphs 0043-0046, wherein “In addition, CNN Training Module 1202 is coupled to a data store 1206 containing a large plurality of pre-stored images relevant to the cephalometric image of interest. For example, the data store 1206 may comprise a digital storage unit holding hundreds, thousands or more prior-taken cephalometric images. The prior-taken images can be all of a same anatomy (e.g., head, face, jaw, teeth, or other portions of

patients' bodies), or may comprise different categories of groups of images representing different anatomical structures."].

33. With this, it would have been obvious to one of ordinary skill in the art to have the functionality described in Abraham utilized in the teachings of Mah, so as to have Mah perform the function requiring the "A) creation of a learning base comprising **more than 1000 images** of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned".

34. With this, as noted above, independent claim 12 of the '983 Patent includes similar perceived patentable features as that of independent claim 1. Thus, with respect to independent claims 1 and 12 of the '983 Patent, the combination of Mah, Carrier, and Abraham appear to describe the features that were deemed to be the patentable features in the original prosecution of the original '125 Application that matured into independent claims 1 and 12 of the '983 Patent. Thus, the combination of Mah, Carrier, and Abraham is seen to raise a substantial new question of patentability as to at least claims 1 and 12 of the '983 Patent, which question was not present in a previous examination of the '983 Patent. The combination of Mah, Carrier, and Abraham was not utilized in any rejection, nor was the reference discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of the combination of Mah, Carrier, and Abraham important in deciding whether or not at least independent claims 1 and 12 are patentable. Therefore, the combination of Mah, Carrier, and Abraham is seen to raise a substantial new question of patentability as to at least

independent claims 1 and 12 of the '983 Patent, as suggested in SNQ #2. Further, because dependent claims carry all of the limitations of the claims for which they depend on, for the same reasons as discussed above with respect to independent claim 1, the combination of Mah, Carrier, and Abraham is also seen to raise a substantial new question of patentability as to dependent claims 2-5, 8-11, 13, and 14, as further suggested in SNQ #2.

SNQ#3

35. With respect to the Third Party Requester's proposed SNQ#3, noted above, the Requester alleges that a substantial new question of claims 1-5 and 8-14 of the '983 Patent is raised by the combination of Murata in view of Lee. It is agreed that the combination of Murata and Lee raises a substantial new question of patentability as to at least independent claim 1 of the '983 Patent.

36. Initially, it is noted that both references of Murata and Lee were published before the filling date of the original '125 Application of July 10, 2018, but after the foreign priority date of the French patent application FR 1756953, which is July 21, 2017. Thus, these cited references of Murata and of Lee are intervening references. Here, in the original prosecution of the original '125 Application, certified copies of the French Patent Application FR 1756953 were submitted, but there was not an English language translation of these certified priority documents. With this, the Third Party Requester points to areas in the original '125 Application that allegedly

include matter not described in the French patent application, some of which is claimed subject matter, whereby the features would thus not be granted the earlier foreign priority date.

37. With this, the reference of Murata discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract], comprising the following steps:

acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see page 35, col. 2, wherein "Here, we consider the automation of IOTN assessment, which brings several benefits as follows. ...What's mor, it benefits people who are able to take their oral photo using a smartphone or mobile device, and periodically perform self-assessment at remote without visiting clinics."];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see page 35, col. 1, wherein "The recent breakthrough in image recognition technology using deep convolutional neural network (CNN) model ..."; also see page 36, cols. 1 and 2, and page 37, cols. 1 and 2; also see Figure 3 on page 37],

Here, however, Murata discloses that the CNN model is utilized to check "the degree of malocclusion and jaw abnormality from oral and facial images", therein not being clear of disclosing the method steps that require "submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image".

But Lee discloses a similar method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract on page 181; also see Section 3 on pages 187-190],

comprising:

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see page 190, wherein "We consider a landmark as an image patch, i.e., a sub-image of the whole cephalometric image, which includes the landmark. Collecting a bunch of patches for several landmarks from different patients, we train a CNN-based model to recognize whether given sub-images (i.e., regions) include the landmarks."; also see Fig. 2 on page 187 and Fig. 3 on page 189; here, the "landmarks" are seen to include a patient's "tooth", such that the system determines "at least a value of a tooth attribute relating to a tooth"].

38. With this, it would have been obvious to one of ordinary skill in the art to have the functionality described in Lee utilized in the teachings of Murata, so as to have Murata perform the function requiring the "acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient".

39. Further, Murata additionally teaches that said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth

attribute value is assigned [see page 37, col. 1, wherein "We collected 300 patients' images (i.e., 1,500 images in total), and we intentionally assigned each image with one of two labels,..."];

B) training of at least one deep learning device, by means of the learning base [see page 38, col. 1, wherein "For this experiment, we use a machine of Windows10 with Intel® Xeon® CPU...The proposed model is trained with GeForce GTX TI-TAN x 12GB."];

C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone" [see page 37, col. 1, wherein "...Softmax layer converts feature vectors into class probabilities. It normalizes the vector of scores.... Then, the model is trained (i.e., updates their weights) in such a way that the class label with the highest probability becomes a true label. Note that multi-layer perception (MLP) usually indicates the neural network consisting of fully connected layers and a softmax layer."].

40. With this, as noted above, independent claim 12 of the '983 Patent includes similar perceived patentable features as that of independent claim 1. Thus, with respect to independent claims 1 and 12 of the '983 Patent, the combination of Murata and Lee appear to describe the features that were deemed to be the patentable features in the original prosecution of the original '125 Application that matured into independent claims 1 and 12 of the '983 Patent. Thus, the combination of Murata and Lee is seen to raise a substantial new question of patentability as to at least claims 1 and 12 of the '983 Patent, which question was not present in a previous examination of the '983 Patent. The combination of Murata and Lee was not utilized in any

rejection, nor was the reference discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of the combination of Murata and Lee important in deciding whether or not at least independent claims 1 and 12 are patentable. Therefore, the combination of Murata and Lee is seen to raise a substantial new question of patentability as to at least independent claims 1 and 12 of the '983 Patent, as suggested in SNQ #3. Further, because dependent claims carry all of the limitations of the claims for which they depend on, for the same reasons as discussed above with respect to independent claim 1, the combination of Murata and Lee is also seen to raise a substantial new question of patentability as to dependent claims 2-5, 8-11, 13, and 14, as further suggested in SNQ #3.

SNQ#4

41. With respect to the Third Party Requester's proposed SNQ#4, noted above, the Requester alleges that a substantial new question of claims 1-5 and 8-14 of the '983 Patent is raised by Azernikov. It is agreed that Azernikov raises a substantial new question of patentability as to at least independent claim 1 of the '983 Patent.

42. In this regard, the reference of Azernikov discloses a method for analyzing an image, called "analysis image", of a dental arch of a patient [see Abstract; also see paragraphs 0007-0008; also see Figs. 1-18], comprising the following steps:

acquisition, with a cellphone, by the patient, the analysis image being a photograph or an image taken from a film, and representing the dental arch of the patient [see paragraphs 0055; also see paragraphs 0069-0072, wherein "Client device 107 can be an electronic device used by a human client 175 to perform functions such as receiving and/or reviewing scan dental models from scanner 109, submitting new dental restoration requests including dental models to dental restoration server 101 for design and/or fabrication, receiving and/or reviewing finished dental restoration model design from dental restoration server 101 through network 105, or receiving and/or checking identified dental information of the dental models. For example, client device 107 may be a smart phone, or a tablet, notebook, or desktop computer. Client device 107 can include and/or interfaces with a display device on which human client 175 may view the dental models, review the identified dental information of the dental models, or review complete dental restoration design."; also see paragraphs 0055-0056; also see paragraphs 0111-0112];

submission of the analysis image to a neural network, in order to determine at least a value of a tooth attribute relating to a tooth represented on the analysis image [see paragraphs 0065-0067, wherein "In some embodiments, training module 123 may pre-train one or more deep neural networks using training data sets from database 133. In this way, restoration server 101 can readily use one or more pre-trained deep neural networks to recognize/identify, locate, and characterize many different dental information such as, but not limited to, upper and lower jaws, prepared and opposing jaws, tooth numbers, restoration types such as crown, inlay, bridge and implant, etc. Additional examples of dental information may include dental features (e.g., buccal and lingual cusps, occlusal surface, buccal and lingual arcs, etc.), margin lines, etc."; also see paragraphs 0085-0087; also see paragraphs 0096-0099],

said method also comprising the following steps:

A) creation of a learning base comprising more than 1000 images of dental arches, **or** "historical images", each historical image comprising one or more zones each representing a tooth, **or** "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned [see paragraphs 0065-0068; also see paragraphs 0126-0128, wherein "Training module 123 can also train one or more deep neural networks to predict the shape and size of a missing tooth based on the unsupervised learning of hundreds or thousands of sample dentition data sets. By learning the attributes of various dental features in thousands of training data sets, the neural network can predict the shape and size of various dental restorations such as crowns or dental implants."; also see paragraphs 0152-0153];

B) training of at least one deep learning device, by means of the learning base [see paragraphs 0065-0067, wherein "Training data sets can be specifically designed to train one or more deep neural networks of training module **123** to identify certain dentition features, surface tooth anatomy, dental restorations, etc. … In this way, restoration server **101** can readily use one or more pre-trained deep neural networks to recognize/identify, locate, and characterize many different dental information such as, but not limited to, upper and lower jaws, prepared and opposing jaws, tooth numbers, restoration types such as crown, inlay, bridge and implant, etc. Additional examples of dental information may include dental features (e.g., buccal and lingual cusps, occlusal surface, buccal and lingual arcs, etc.), margin lines, etc."];

C) submission of the analysis image to said at least one deep learning device for it to determine at least one probability relating to an attribute value of at least one tooth represented on a zone representing, at least partially, said tooth in the analysis image, or "analysis tooth zone" [see paragraphs 0016, wherein "Embodiments of the method further include segmenting,

by one or more computing devices, the dental model into different portions of the patient's dentition that represents different categories prior to recognizing the dental information associated with the dental model."; also see paragraph 0110, wherein "For example, the scan recognition module 125 may generate one or more depth maps and/or spherical distance maps representing different portions of the patient's dentition, e.g., different jaws, individual teeth, prepared tooth, etc. In one embodiment, scan recognition module 125 may also preprocess the scan data by segmenting the scan data into sub-images representing different portions, e.g., different jaws, individual teeth, prepared tooth, etc."; also see paragraphs 0096-0102].

43. With this, as noted above, independent claim 12 of the '983 Patent includes similar perceived patentable features as that of independent claim 1. Thus, with respect to independent claims 1 and 12 of the '983 Patent, the reference of Azernikov appears to describe the features that were deemed to be the patentable features in the original prosecution of the original '125 Application that matured into independent claims 1 and 12 of the '983 Patent. Thus, the reference of Azernikov is seen to raise a substantial new question of patentability as to at least claims 1 and 12 of the '983 Patent, which question was not present in a previous examination of the '983 Patent. The reference of Azernikov was not utilized in any rejection, nor was the reference discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of Azernikov important in deciding whether or not at least independent claims 1 and 12 are patentable. Therefore, the reference of Azernikov is seen to raise a substantial new question of patentability as to at least independent claims 1 and 12 of the '983 Patent, as suggested in SNQ #4. Further, because dependent claims carry all of the limitations of the claims for which they depend on, for

the same reasons as discussed above with respect to independent claim 1, the reference of Azernikov is also seen to raise a substantial new question of patentability as to dependent claims 2-5, 8-11, 13, and 14, as suggested in SNQ #4.

SNQ#5

44. With respect to the Third Party Requester's proposed SNQ#5, noted above, the Requester alleges that a substantial new question of claims 1-5 and 8-14 of the '983 Patent is raised by the combination of Azernikov in view of Carrier and Abraham. It is agreed that the combination of Azernikov in view of Carrier and Abraham raises a substantial new question of patentability as to at least independent claim 1 of the '983 Patent.

45. Here, as discussed above in SNQ#4, the reference of Azernikov, alone, is seen to raise a substantial new question of patentability with respect to independent claims 1 and 12. Thus, for the same reasons discussed above with respect to Azernikov, alone, with respect to independent claims 1 and 12 of the '983 Patent, the reference of Azernikov appears to describe the features that were deemed to be the patentable features in the original prosecution of the original '125 Application that matured into independent claims 1 and 12 of the '983 Patent.

46. Thus, the combination of Azernikov in view of Carrier and Abraham is seen to raise a substantial new question of patentability as to at least claims 1 and 12 of the '983 Patent, which question was not present in a previous examination of the '983 Patent. The combination of

Azernikov in view of Carrier and Abraham was not utilized in any rejection, nor was the reference discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of Azernikov, Carrier, and Abraham important in deciding whether or not at least independent claims 1 and 12 are patentable. Therefore, the combination of Azernikov in view of Carrier and Abraham is seen to raise a substantial new question of patentability as to at least independent claims 1 and 12 of the '983 Patent, as suggested in SNQ #5. Further, because dependent claims carry all of the limitations of the claims for which they depend on, for the same reasons as discussed above with respect to independent claim 1, the combination of Azernikov in view of Carrier and Abraham is also seen to raise a substantial new question of patentability as to dependent claims 2-5, 8-11, 13, and 14, as suggested in SNQ #5.

35 U.S.C. 325(d)

47. A review of any post grant challenges for the '983 Patent indicates the patent has not been the subject of any prior *inter partes* reviews or post grant proceedings. With this, there has not been any discretionary denial under 35 U.S.C. §314(a), and additionally, there has not been any prior denial under 35 USC §325(d). Thus, based on the particular facts and circumstances in this instance, there is no basis to reject the request under 35 USC §325(d).

Conclusion

48. A substantial new question of patentability affecting claims 1-5 and 8-14 of U.S. Patent Number 11,314,983 is raised by the Request for *ex parte* reexamination. Thus, **claims 1-5 and 8-14** of U.S. Patent Number 11,314,983 are subject to reexamination and will be reexamined in response to the Request.

49. Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that *ex parte* reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extension of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

50. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving

U.S. Patent 11,314,983 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

51. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

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