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Paper No. 41
Entered: February 20, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.,
Petitioner,

v.

DENTAL MONITORING SAS,
Patent Owner.

IPR2024-00052 (Patent 11,049,248 B2)
IPR2024-00110 (Patent 11,109,945 B2)

Record of Oral Hearing
Held: January 29, 2025

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

APPEARANCES:

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The above-entitled matter came on for hearing on Wednesday, January 29, 2025, commencing at 1:00 p.m., via video teleconference.

P R O C E E D I N G S

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JUDGE SZPONDOWSKI: We have our hearing in IPR2024-00052 and IPR2024-00110. Let me introduce the panel. I'm Judge Szpondowski and joining me are Judge Homere and Judge Zecher. Let's get started with the parties' appearances first. Who do we have for Petitioner?

MR. ARGENTI: Good afternoon, Your Honor. Matt Argenti from Wilson Sonsini on behalf of Petitioner Align Technology. Also on the line we have my co-counsel Mike Rosato and Patrick Medley and on the public line we have some representatives from Align attending, including Martha Shane (phonetic sp.) and Dennis Chang.

JUDGE SZPONDOWSKI: Okay, thank you. And who do we have from Patent Owner?

MS. JACOBSEN: Good afternoon. This is Charlotte Jacobsen from Gibson Dunn on behalf of Patent Owner and joining me from Gibson Dunn are Allyson Parks and Andrew Blythe. And on the public line we also have representatives from Patent Owner Dental Monitoring.

JUDGE SZPONDOWSKI: All right, thank you. Well, welcome everyone. Obviously, our hearing today is over video. Given that, I just want to start off by clarifying a few items. First, if you encounter any technical difficulties that you feel fundamentally undermines your ability to adequately represent your client, please let us know immediately.

Second, when not speaking please mute yourself. And please identify yourself each time you speak in order -- so that the correct reporter can prepare an accurate transcript.

Fourth, we have the entire record including all of the demonstratives, so please refer to the demonstrative papers or exhibits clearly and explicitly by slide or page number, also to ensure the preparation of an accurate transcript. You're welcome to either share your demonstratives or, like I said, we have the whole record so you can just refer, whatever you prefer.

And finally, as you know, there is a public line so please be aware that members of the public may be listening as well.

We've set forth the procedure for today's hearing in our December 19th, 2024 order. As a reminder, each party will have a total of 80 minutes to present arguments. Petitioner has the burden of proof as to whether the challenged claims are unpatentable and will go first. Patent Owner will then present opposition arguments.

Then to the extent that Petitioner has reserved prime, Petitioner will present the rebuttal arguments. And then to the extent that Patent Owner has reserved time, Patent Owner will present sur-rebuttal arguments.

We remind the parties that they are not interrupt the other party while the other party is presenting its arguments and demonstratives. If a party believes that a demonstrative or argument presented by the other party is objectionable they should raise that objection or any arguments relating to that during your own time.

We saw that Petitioner filed objections to Patent Owner's demonstratives 33 through 38, 64, 65, 69 through 71, and 83 through 87. So, I would like the parties to address those objections and to hear Patent Owner's response during your time.

Are there any questions before we get started?

MR. ARGENTI: No, Your Honor.

MS. JACOBSEN: No. Thank you, Your Honor, none from Patent Owner.

JUDGE SZPONDOWSKI: Then I think we're ready to begin. Would Petitioner like to reserve time for rebuttal?

MR. ARGENTI: Yes, Your Honor, 20 minutes, please.

JUDGE SZPONDOWSKI: Okay. You reserve 20 minutes, and you can start whenever you're ready.

MR. ARGENTI: Thank you, Your Honor. So, I do plan to share my screen to have the demonstratives on the display. Let me do that right now. Hopefully, that will now work. Let me know if you don't see the demonstratives. It looks like we do. All right.

So, good afternoon, Your Honors. Again, my name is Matt Argenti on behalf of Petitioner Align. Today during my presentation I'll be referring to our demonstratives which have been submitted as Exhibit 1053 in both of the IPRs that we'll be discussing.

Your Honors, it's well-established that it is not patentable to take a routine, long-established practice and claim it as an invention performed on a computer, but that's what's happened here. For at least 14 years before the challenged patent, orthodontists assessed aligner

fit by looking at the separation between aligner and teeth. It's a very straightforward principle.

If the gap between the aligner and the teeth was too big that meant the aligner didn't fit properly, which was detrimental to treatment. The evidence of record shows this was a common aspect of the aligner treatment and the Patent Owner's dental experts agree.

The challenged claims recite nothing more than performing that routine assessment using a captured image and generic image processing software. That's not patentable. That's something that the District Court has already recognized when finding Claims 1 and 14 of the '248 ineligible under Section 101. And despite Dental Monitoring currently appealing that to the Federal Circuit, they are not challenging the ineligibility of Claim 1.

For similar reasons, the claims are obvious. The prior art demonstrates that there was nothing inventive about remote aligner treatment using cellphone images or using a computer to detect edges of objects in a dental image or analyzing the gap between an aligner and the teeth.

All of that is in the prior art and that's not in dispute. Putting those conventional concepts together doesn't make them any more inventive. All the Patent Owner is left with is a legally erroneous argument that relies on attacking the references individually.

But as the Board recognized in the institution decision, that did not revise a prima facie obviousness showing.

Now, turning to slide 2, in the grounds challenged for both IPRs are grounds involved with the Kim, Invisalign and Salah references.

Kim provides methods for remote aligner treatment services involving capturing the images with a patient's cellphone and transmitting them for (inaudible 0:48:29). Invisalign is an align clinical guide from 2003 describing consideration for monitoring aligner treatment.

Salah in Patent Owner's own PCP application describing image analysis methods for monitoring patient teeth during the dental treatment. Now, the IPR in the '248 patent also involves the Maninis reference which teaches state-of-the-art approaches for deep learning-based image analysis.

Turning to slide 3, as we see here on this slide the '248 patent relates to the field of image analysis, specifically dental arch image analysis. The patent explains an image of an alignment in a service position, that means worn on the teeth, is captured and analyzed.

The analysis involved what the patent calls a deep learning device which can be a neural network. The patent says neural networks were well-known to POSAs and provides the non-limiting list of them.

As we see here in the abstract, the analysis leads to a determination of a tooth attribute relating to a separation, the separation between the aligner and the teeth. So, what happens is you capture an image of a tooth, analyze it using any one of a number of known neural networks to determine something about the separation between the aligner and the teeth.

Now, turning to slide 4 and the '945 patent, which contains similar disclosure using some different terminology but getting at the same idea. It describes capturing at least one 2-dimensional image of

an aligner in the service position and then analyzing the image to compare outlines at the edges of the teeth and the aligner.

Turning to slide 5, the claims of the '248 patent broadly capture the basic elements we just saw in the disclosure. Looking at Claim 1 on this slide, it recites capturing a cellphone image of the aligner in a service position. That's the text in purple. Then generically analyzing the image on a computer using a known deep learning technique. That's the text in blue.

And as a result, determining a value relating to a separation between the teeth and the aligner. That's in red.

But as we will see, considering that separation was just a standard part of orthodontic treatment and there was nothing non-obvious about doing it with cellphone images and software, particularly when those tools were already used for dental treatment applications.

Turning to slide 6, Claim 1 of the '945 patent similarly involves acquiring an image of an aligner in a service position. It also encompasses capturing and analyzing a second image of just the teeth, but that's an alternative that we don't need to address in our ground. That's why the clause number two here is lined out on the slide. We show obviousness based on the first, third, and fourth clauses.

Compared to the '248 claim that we just saw, this claim does not require analysis by a deep learning device. It more broadly says you use image processing software. That's why the deep learning teachings of the Maninis reference are not at issue in the '945 IPR, only the '248.

Turning to slide 7 and claim construction, in the '248 Petition we propose constructions for four terms. The parties only dispute one issue, but Petitioner construes the tooth attribute term to mean an attribute of a tooth that may relate to the tooth separation from an aligner. Patent Owner agrees that a tooth attribute is an attribute of a tooth but then carves out positions or edges of teeth or aligners from that definition. There's no support for that.

The patent says the separation between the tooth and aligner can be a tooth attribute so it follows that the location of the tooth edge used to determine that separation can also be a tooth attribute.

Turning the slide 8, for the '945 patent we've proposed three constructions in the Petition. The Patent Owner Response did not respond to any of them so these are undisputed.

Now, turning to slide 9 and Patent Owner's constructions, in the '248 Response they proposed two constructions, but as we explained in our Reply neither impacts our ground of challenge and they don't just dispute in the Sur-reply.

Now, turning to slide 10 and the '945 patent, in the '945 IPR Patent Owner likewise proposed two constructions in their Response but neither one has any effect on the Petition ground and neither one of these constructions is in dispute.

Turning to slide 11 and the prior art cited in the ground. Kim is a public patent application describing a system for remote teeth alignment services. As we see in Figure 1 on the left of this slide, both the patient and the orthodontist have their own computer terminals in addition to terminals for the aligner manufacturer and the

operator of the server (phonetic sp.) in this figure. Kim explains that the patient takes pictures of their teeth using a smartphone and sends them to the orthodontist for analysis.

In addition to sending a picture of the teeth alone, Kim also describes sending the orthodontist a photo of the clear aligner currently worn by the patient. You see that in paragraph 66 on this slide.

JUDGE SZPONDOWSKI: Counsel, this is Judge Szpondowski. So, what does that mean, the clear aligner currently worn by the orthodontic patient, because I think there's some dispute over that?

MR. ARGENTI: It's pretty clear disclosure of sending a photo of the aligner in a service position, but Patent Owner does dispute that. Patent Owner disputes that Kim means what it says in that paragraph. Patent Owner argues that that's just a photo of the aligner, not an aligner on the teeth, so I think it's pretty clear that that is a photo of an aligner worn by the patient.

However, even if Patent Owner's position was the correct interpretation of Kim, which it isn't, there's no dispute that Kim discloses remote aligner treatment methods involving capturing photos of teeth to send to an orthodontist and photos of an aligner to send to an orthodontist.

Turning to slide 12 and the Invisalign guide, this reference describes considerations for aligner treatment. One of those issues that it talks about is aligner fit.

JUDGE HOMERE: Counselor, this is Judge Homere. In the second scenario that you give regarding paragraph 66 of Kim, so how would that meet the limitation in question here? So, all you have is picture of the aligner and picture of the teeth. How do you get you to the aligner (inaudible 40:59) is being worn by the patient?

MR. ARGENTI: Well, let me jump ahead then, Your Honor, just one moment and find where we address that. So, if we go to slide 20, one of the disputed issues is Patent Owner's argument that Kim doesn't teach taking a photo of an aligner worn on the teeth, and that has two big problems. As I mentioned, the first problem is that their position is at odds with the plain language of Kim, which is explicit about taking a photo of the clear aligner currently worn by the orthodontic patient. They can't rewrite the reference through unsupported testimony.

The second problem, and this goes to your question, Your Honor, is that even if the Board was to credit their argument about the scope of Kim's disclosure, our Petition explains that capturing a cellphone image of an aligner in a service position would be obvious in view of the combination of Kim and Invisalign. The Board recognized in the institution decision that they can't rebut our obviousness showing by attacking the references individually, but they're still trying to do that.

Invisalign teaches assessing the separation between an aligner and the teeth and provides a photo to illustrate that. We see that here. So, Patent Owner is incorrect that our combination depends on Kim for this aspect of the claims. Applying Invisalign to Kim's method of

capturing teeth and aligner images for remote treatment purposes would lead a POSA to combine what Patent Owner says are two distinct images in Kim in order to perform the assessment taught by Invisalign.

So, whether Kim teaches separate photos of teeth and aligners or photos of aligners worn on the teeth, this element of the claims is taught or suggested by the combination.

JUDGE ZECHER: Mr. Argenti, this is Judge Zecher. How would you respond to Patent Owner's argument that this photo in Invisalign was actually just something perceived by orthodontists in that timeframe and it wasn't actually captured on a cellphone such that they could assess it remotely?

MR. ARGENTI: Well, a number of problems with that, Your Honor. The fact that it was -- it was clearly captured by a camera. They argue that it was a digital camera rather than a cellphone, but as we pointed out, this is a 2003 guide. The priority date is in 2017. Smartphones were incapable and probably performing better image capture with a cellphone in 2017 than this 2003 digital camera. So, that's one problem.

The other is that Kim teaches capturing the images of teeth and images of aligners with a cellphone and sending them for assessment. So again, they're attacking the references individually.

JUDGE ZECHER: Let me ask a follow-up question to that. How does this reliance on Frey in your Petition, kind of, play into that?

MR. ARGENTI: Well, I wouldn't say that we're relying on Frey. We provided it as corroboration of the motivation that you get from the references themselves, the prior art references. So, I think it's to stretch Patent Owner's position that we are relying on Frey. It's cited as helpful corroboration.

Beyond that, if I can jump ahead to slide 22 to discuss the Frey reference, the motivation to combine Kim and Invisalign to arrive at capturing images of aligners, it's clear from those two references themselves, as well as the testimony of both party's experts. However, Frey provides further collaboration. Frey is an orthodontics blog that predates the priority date and talks about recording video of a patient wearing an aligner and sending into an orthodontist for review.

While the Frey blog does compare this approach to the product that was offered by Dental Monitoring at the time, an earlier blog entry that they submitted as evidence, explained that, quote, "We routinely do this for international and out-of-state patients already," end quote.

So, you get the corroboration from Frey. You get the motivation from Kim and Invisalign themselves. Kim is telling people how to accomplish remote orthodontic treatment. Invisalign is telling people what are important considerations for orthodontic treatment.

They fit together well on their own and teach the motivation themselves. However, Frey just corroborates that this is something that was not only beneficial to do, it was already done.

JUDGE ZECHER: When you say that Frey corroborates then are you really just saying that it's just evidence of the general background knowledge in the art at that time?

MR. ARGENTI: I think that's one way of looking at it, yes, Your Honor, that it was just something that was not -- that people in the field were aware of. They were aware of the capabilities of cellphones for remote dental treatment. They were aware of the importance of certain aspects of aligner treatment, including considering the separation between the aligner and the teeth. And as Frey shows, the background state-of-the-art establishes that this, even the combination was something that was routinely done for out-of-area patients at the time.

Now, I'm going to go back into the slide. We were talking about Invisalign. I think I touched on just about everything that we needed to touch in our discussion there in response to your questions. I would just point out at the bottom of this slide that Invisalign not only provides the photographic image.

The teaching that it's important to assess, the separation between the aligner and the teeth, as well as the photographic example of that, but also it provides a particular threshold that they say orthodontists should look out for, 1 millimeter. So, the teachings of the reference are plain on their face.

Turning to slide 13 and the Salah reference. This is, again, Dental Monitoring's own PCP application. We spoke about this reference quite a bit during the hearing on the '409 patent last month.

Salah talks about capturing an image of the patient's teeth and applying computer image analysis to track treatment progress.

Among the types of information that Salah describes identifying in these images is contour information such as the edges of the teeth. And it's described as detecting objects within images. It lists a number of different image processing approaches, all of which were known at the time. These include simple methods of edge detection like the canny filter, as well as deep learning. And as we see on the slide, it provides an example in Figure 6 where a photograph of the teeth is analyzed to identify the edges of the teeth.

Turning to slide 14, finally, in the '248 ground but not in the '945 ground we apply the Maninis reference. As I explained in the last hearing, Maninis describes the use of deep learning neural networks for image analysis.

In particular, it provides a state-of-the-art detecting contours in an image, and it explains that this modular approach that -- excuse me -- that adding this modular approach, a well-known pipeline, provides improved results for, among other things, semantic segmentation and object detection. So you not only know where the object edges are in the image, you can classify what the objects are.

Turning to slide 15, these figures on this slide provide examples of the edge detection and object classification described In Maninis. On the left in Figure 10 Maninis illustrates object boundary detection, and on the right in Figure 16 Maninis shows how it improves object classification.

By combining classification results with COB boundary determinations, Maninis says that the results are improved in all cases.

Now, turning to slide 16 and the proposed combination. For both patents we rely on combining the teachings of Kim, Invisalign and Salah. Kim teaches an approach to remote monitoring for orthodontic aligner treatment involving capturing pictures of teeth and aligners with a cellphone and sending them to an orthodontist for analysis.

And Invisalign explains that a relevant consideration for an orthodontist monitoring aligner treatment is aligner fit and in particular assessing whether the separation between the aligner and the teeth more than 1 millimeter. And it provides a photographic example, as we've discussed. So, the combination of their teachings provides analyzing tooth aligner separation in a cellphone image relative to a threshold.

Salah provides detail on how to accomplish that using image processing techniques to identify the edges of teeth and aligner in an image. And for the '248, both Salah and Maninis teach applicable deep learning techniques with Maninis providing a state-of-the-art approach to the contour detection described in Salah.

Again, this is really nothing more than performing a longstanding aspect of aligner treatment using standard computing hardware and software techniques that were likewise well-known.

JUDGE ZECHER: Mr. Argenti, before you get into your next slide I do have a question about Maninis. And I believe there's a lot of arguments from Patent Owner that the so-called deep learning device

that's disclosed by Maninis cannot be trained a specific way that's required by the claims. Can you address that?

MR. ARGENTI: Yes, Your Honor. Their arguments are based on one particular example in Maninis. They argue that the learning base is binary only. It uses ones and zeroes to designate whether something is a contour or not a contour in an image.

Our Petition was in no way limited to that learning base example. We discussed this at length as noted in the '409 patent and really the arguments are the same here. They fail for the same reasons here. As I explained during the last hearing, our Petition was much broader in its citation to Maninis' teachings. They were not limited to a particular learning base that was capable of contour detection only. And I explained that Maninis itself would refutes their argument that the learning base is only for one purpose or another. Maninis provides examples, including the Pascal Context database and the VOC12 segmentation database, which are in the sections on the pages that we cited in our Petition where those learning bases are used for both what Maninis calls the low level and the high level application.

So, the learning bases in Maninis are not so limited as how Petitioner would argue deep learning and neural networks work as a matter of course. Maninis refutes that. We in no way limited ourselves to one particular example in one particular paragraph of Maninis. Our citations were much broader, as we've explained in our papers.

And even putting all that aside, Petitioner (sic) fails to respond and has never responded to our argument that we proposed in the

Petition a modified learning base that was suitable consistent with the teachings of all the combined references, that was suitable to the annotated for identification of teeth aligners and the gaps between them. That is, I believe, at page 38 of our '248 patent. It's a very similar argument to what we have in the '409 Petition.

So, we're hearing the same arguments again that we heard in the '409 and they fail for the same reasons here.

JUDGE ZECHER: Thanks for that explanation. Can we just take a step back from that just a little bit because Claim 1 in the '248 patent says, "Analysis of the analysis image by means of a deep learning device, trained by means of a learning base." What does it mean to be "trained by means of a learning base" with respect to the deep learning device? What's the scope of that?

MR. ARGENTI: I'm not sure the disputed issue has been framed as a scope issue, Your Honor, so --

JUDGE ZECHER: Well, I'm just trying to figure out the meaning of those words. You know, I understand your position and what you -- how you've mapped it to Maninis, but in light of the '248 patent what does it mean to be "trained by means of a learning base?"

MR. ARGENTI: The experts here on both sides are in agreement, at least the experts knowledgeable in neural network image analysis that neural networks that are used for image analysis are trained on a learning base where in this context it would be a correction of the images. And then it talks about a learning base database that has over 10,000 images in it and they've been annotated to identify some information that is consistent with and going to be

helpful for the information that you're trying to extract in your subsequent analysis.

JUDGE ZECHER: So, does "trained by a learning base" just mean basically inputting a bunch of images, a certain number or whatever it may be, a 1,000, 10,000, that may have annotations in them such that the trained learning device can take those and, kind of, create their system that they're going to use to analyze any future pictures that are inputted into it? Is that correct?

MR. ARGENTI: I think that's -- well, yeah. That sounds correct to me, Your Honor. That sounds consistent with the testimony that we have in this case.

JUDGE ZECHER: Okay, thank you.

MR. ARGENTI: So, turning to slide 17 and the rationale to combine, the references themselves provide it. Kim says that his methods of evaluating cellphone images reduce the time and cost of treatment and facilitate remote assessment.

Invisalign teaches that aligner fit evaluation, including the 1 millimeter separation threshold, is a useful consideration for aligner treatment. To accomplish that in the context of a cellphone-captured image POSAs would look to Salah's teachings of image processing techniques in that context, including detecting object edges in dental photos to provide accurate edges for the measurements that Invisalign teaches.

And for the '248, the further combination with Maninis provides state-of-the-art object detection and edge protection. Salah teaches deep learning as one possible approach to its image analysis

and consistent with that, Maninis provides an improved deep learning technique.

Now, turning to slide 1 --7 excuse me -- 18, and the disputed issues. First, Patent Owner argued that our expert Dr. Foroosh is not qualified to offer opinions on obviousness because he's not a dental practitioner. But regardless of which definition of the level of ordinary skill in the art is applied, Dr. Foroosh qualifies.

The parties agree that this would be someone trained in computer science or related fields, like Dr. Foroosh, and even under Patent Owner's definition, which they say is not materially different than ours. A POSA would be part of the team that included individuals familiar with medical imaging or dental imaging. Dr. Foroosh has experience with both.

In addition -- sorry, Your Honor. I'm now turning in the demonstratives to slide 18, which I'm addressing. In addition, as we've explained, Petitioner's own expert Dr. Mongan formed his opinions on these prior art references in a declaration for the preliminary response where he doesn't mention consultation with any dentist.

Turning to slide 19 --

JUDGE ZECHER: Mr. Argenti, can I ask a question about this? I know in related IPR2023-01369 you introduced the declaration of Dr. Valley to inform Dr. Foroosh's opinions in that case. You reference it here in the '248 one, in the '248 patent Petition, as well as the '945 patent Petition, but you never introduced the declaration of Dr. Valley in these two proceedings. Why is that?

MR. ARGENTI: We only referenced it to point out a repeated pattern of meritless attacks on Dr. Foroosh and to, again, point out that we had refuted it in the previous '409 IPR. We didn't introduce that declaration here because, as Patent Owner has noted, the prior art at issue in the other case and the disputed issues in the '409 are largely distinct from what's going on here, with the exception of some of the arguments about Maninis. So, it was really just to say, Your Honors, this has happened before and it's happening now. There was no big deal there and it has no merit here.

We didn't need any dental expert testimony in this case because, one, the references speak for themselves. They refute the argument. Two, when we're looking at something like Kim and a dispute about how to interpret Kim and the scope of its disclosure, we've explained that under either interpretation of Kim, they didn't respond to the obviousness case that we laid out in the Petition.

And then the other disputed issue, as I'll point out in a few slides, relates to whether an image was representative, whether the Invisalign image is representative. So, Dr. Foroosh applied his computer science expertise and said, well, the images that you now say are representative I was able to perform the exact same analysis on.

JUDGE HOMERE: Counsel, Judge Homere. Regarding the level of experts there are two components. There is the education component and the experience. What is it as far as Dr. Foroosh's experience qualifies him to be an expert under this definition here?

MR. ARGENTI: Because he has ample experience with computer vision, image processing and any other types of activities that are laid out in both definitions as would be required. Again, the POSA here is someone with a computer science image analysis background, which is undisputed that that's what Dr. Foroosh has.

If you go beyond that and you look at the component of the definition of that says -- talks about they could be or they would be part of a team, a multidisciplinary team where you have people from different backgrounds, even there he qualifies under that definition as being not only a computer science expert but someone familiar with and has ample experience with medical imaging, dental imaging. We pointed out the citations in our Petitioner's Reply to his CV, multiple pages of his CV establishing that he has that experience even under Patent Owner's definition.

JUDGE HOMERE: Okay. But as I reviewed his CV, I'm not sure that I saw anything pertaining to an experience relating to evaluating a dental apparatus in a patient's, you know, mouth (inaudible 0:20:39) Invisalign or something like that. So, how do you get to that particular qualification here if he is -- if Dr. Foroosh knows his particular experience in assessing this particular apparatus in a patient's mouth?

MR. ARGENTI: That knowledge is not a requirement of the POSA under either party's definition. Patent Owner's arguments are based on an assertion that the POSA has to be a dentist or an orthodontist or has to have knowledge of dentistry or orthodonture practice. That's just not true based on their own definition.

So one, it's not required. So, two -- which doesn't mean that the POSA can't understand these references or isn't qualified to understand these references. The references speaks for itself.

So, it's very clear when Invisalign talking about this is what you're looking for orthodontist, the separation -- a 1 millimeter separation between an aligner and the teeth. See? There's no dispute that that's not an accurate statement. There's no dispute that it should be interpreted a different way.

Their only argument is that the (inaudible 0:19:22) accompanying that test in Invisalign is not representative of what an orthodontist would see.

But they submitted with Dr. Kusnoto's testimony additional photos that they said are representative. And Dr. Foroosh showed that you can run the same analysis on those photos.

JUDGE HOMERE: Okay.

MR. ARGENTI: Very briefly at slide 19, Dr. Kusnoto during cross-examination admitted that Dr. Foroosh doesn't misunderstand any of the terminology in these references.

We've already addressed slide 20 very briefly. This refutes their argument that Kim doesn't teach remote assessments of an aligner on the teeth, nor does Invisalign. That doesn't respond to the combination of those two references.

Turning to slide 21, continuing their attack on Kim in isolation, they argue that Kim is entirely directed to tracking how teeth are moved during treatment, not tracking aligner fit. But as we just saw, Kim talks about assessing the aligner, not just tooth movement.

In addition, consistent with Invisalign's teachings, Patent Owner's dental expert admits that checking aligner fit was the routine aspect of aligner treatment. It was done at regular intervals along with assessing treatment progress based on tooth position. So, those are the two primary assessments throughout aligner treatment. You see that here.

Patent Owner's attack on Kim in isolation ignores the teachings of the Invisalign guide, which are representative of the undisputed fact that checking aligner fit was a crucial aspect of aligner treatment and that involves assessing the separation between the aligner and the teeth.

Turning to slide 22, we already discussed the Frey reference that corroborates motivation, including its assertion in the separate exhibit that Dental Monitoring themselves filed where Frey is saying, "We routinely do this for international and out-of-state patients already."

Turning to slide 23, Patent Owner also disputes the motivation to combine the teachings of the Salah with Kim and Invisalign where Salah describes image processing techniques, including edge detection and deep learning in the context of dental image analysis.

So, if a POSA for computer science or for someone similar is combining the teachings of Kim and Invisalign to provide a remote aligner treatment solution that includes the well-known approach of assessing separation between the aligner and the teeth, Salah demonstrates the image processing tools to do that.

Applying Salah's contour detection techniques allows the POSA to detect those teeth edges and make the threshold measurement value or the threshold value measurement described in (inaudible 0:16:07). This is right in the wheelhouse for someone knowledgeable in image processing, and Salah is telling the POSA that these techniques work on two edges.

Now, I've already alluded to this earlier, Patent Owner argues that even if Salah's techniques work for tooth edges they wouldn't work on aligner edges. They say Salah teaches away from low contrast images, and they say that's what images of aligners in a service position would be.

So, we asked Dr. Foroosh, as I mentioned, to run a basic edge detection algorithm on each of the so-called representative images that Patent Owner and their experts pointed to, and as you can see here, every one of them allowed for edge detection. And these are all using the canny filter example from Salah.

There are other image processing techniques described in Salah even more sophisticated than this one. There's no credible argument that the teachings of Salah are not supportive of the combination. And, of course, as we explain, Maninis would be expected to be even more effective, given its state-of-the-art teachings.

Turning to slide 25 and the Maninis reference, which as I mentioned is only relevant to the '248 IPR, as an initial matter Patent Owner also argues that Maninis is not prior art.

We discussed that during the hearing on the '409 patent and I don't want to repeat myself, but very briefly Maninis was submitted to

archive.org for publication months before the priority date, and the evidence establishes that it was published within four days after submission. That's confirmed not only by archive.org's policy at the time but also by our expert Dr. Foroosh's own personal experience as an archive.org user.

Turning to slide 26, Patent Owner also argues that our combination involving Maninis would be inoperable. That's again something that they raised in the IPR on the '409 patent that we discussed at length during the last hearing. The arguments failed here for the same reason as discussed in that earlier case.

They concoct something they call them Maninis COB neural network which they say is incapable of object classification, such as identifying teeth and aligners and the gap between them. But just as in the '409 IPR, our combination is not limited to Maninis' COB neural methods, which is a term that you won't find in our Petition or in Maninis itself.

Rather, the Petition proposed using Maninis' deep learning architecture for improved object detection and object classification, which is exactly what Maninis describes.

Turning to slide 27, Patent Owner also argues that a POSA would not have been motivated to assign Maninis' deep learning techniques. But recall that Salah lists deep learning as one of its image processing options and Maninis provides this state-of-the-art deep learning image processing approach. Contrast that to the '248 patent's (inaudible 0:12:55) disclosure of using known neural networks. It doesn't claim to provide an improved neural network. It

just says use a known technology for this application, which again, is equivalent to a visual assessment dental professionals have been making for years.

Turning to slide 28, also as in the '409 IPR Patent Owner argues here that the time and expense of training a neural network to analyze dental images would have weighed against motivation to combine. But as we explained in that earlier case, Patent Owner exaggerates the necessary cost. Dr. Kusnoto admits his opinions here are based on things that our combination doesn't require like anonymizing photos and adding unnecessary labels.

Dr. Foroosh explains that many of those steps would be easily automatically accomplished using software at low cost. And even if the alleged costs were real, Dr. Foroosh explains that a one-time investment would not deter a POSA. It's just the standard development cost for a tool like this.

Turning to slide 29, as to '945 patent, Patent Owner raises one argument that only applies to this patent and not the '248. They say that our combination cannot identify the edges of individual teeth or distinguish between the edges of teeth and aligners because the image processing in Salah is only capable of identifying contours in an image, not distinguishing between what objects those contours correspond to.

That misrepresents Salah and the ground in the Petition. Salah lists over 30 kinds of image processing techniques and there's no dispute that many of them were capable of detecting and

distinguishing between objects in an image. That would have been readily apparent to POSAs reading the reference.

And Salah itself is capable of recognizing the contours of the gum as opposed to the contours of the teeth. Patent Owner has presented no theory why a POSA would ignore these teachings or think them inapplicable to distinguishing between, for example, the edges of an aligner and the teeth, particularly when Invisalign says that's what you do as a routine matter of treatment.

Turning to slide 30 and then dependent claims in the suit in the '248 IPR, starting with Claims 7 and 14. As a reminder, Claim 14 is another claim that has been found ineligible by the District Court. These claims recite training the deep learning device using a learning base of images with historical tooth zones representing a tooth and a tooth attribute relating to separation between the tooth and the aligner.

We explain in the Petition that in our combination in view of the teachings of Maninis, the deep learning base would be trained on images labeled with pixel-wise annotation corresponding to the teeth, the aligner, and the gap in between. Those annotations provide the location of the edges of the teeth and the aligner, which define the separation between the two, as well as identify the separation itself with the gap labeling.

Each of those is an attribute relating to the separation.

Patent Owner --

JUDGE SZPONDOWSKI: Mr. Argenti? Sorry, counsel, this is Judge Szpondowski. What are you mapping the tooth attribute value to?

MR. ARGENTI: The tooth attribute value would be, as I was just mentioning, the labeling of the teeth, the aligner, and the gap in between. So, the value could be the individual -- collection of individual pixels that identify the edge of a tooth, the edge of the aligner, and the gap in between. It could also be a measurement of the distance which is consistent with the specification.

Any other questions on that issue or should I continue?

JUDGE SZPONDOWSKI: Well, I'm just looking at the petition. Patent Owner's argument is that you didn't map anything for the (inaudible 0:08:17) and I'm just -- it seems kind of vague. Maybe you can point me in the Petition, you know, where you did that?

MR. ARGENTI: So, in the Petition, if we look at the discussion of, for example Claim 7, I believe the most relevant portion is going to be at pages 46 and 47. This is where we discussed that by applying those pixel-wise annotations designating something as tooth, aligner, or gap, or identifying an individual tooth, tooth one, tooth two, tooth three, the collections of those pixels corresponding to a particular contour become the tooth attribute.

If the tooth attribute can be a measurement of the separation, maximal mean separation, that disclosure in the specification, then it follows that, of course, the location, identification of the location of the boundary, which is the basis of that calculation, can also be a tooth attribute.

Where is the tooth edge located in this image? Where is the aligner edge located in this image? Those are the tooth attributes that we're referring to.

JUDGE SZPONDOWSKI: Thank you.

MR. ARGENTI: So, as I just mentioned, the annotation that we propose provides the locations of the edges of the tooth and the aligner, which define the separation between the two, as well as identification of the separation itself. Each of those is an attribute relating to the separation as required by the claim.

Patent Owner argues that this conflates a tooth attribute with a tooth zone, but the zone merely represents a tooth. It isn't recited as consisting of a tooth or defining a tooth. So, the zone can be more than just the tooth and even include the aligner, as we pointed out in our Petition.

Therefore, the location of the tooth outline is not the same thing as the zone. Their argument is not mentioned (phonetic sp.) with the scope of the claims. And even if the zone is coextensive with the tooth, we explain that our identified tooth attribute can just be the portion of the tooth edge corresponding to the respective aligner edge, not the entire tooth outline. So, our combination is not conflating the tooth attribute at the tooth zone.

Beyond that, Patent Owner argues that the pixel annotations in our combination can't serve as attributes of tooth. The specification makes clear that an attribute value can be a collection of values, which their own expert conceded, so there's no issue with relying on a collection of pixel values. So, what we have is a collection of pixel annotation that collectively establish the location of the teeth and the aligner edge in the image, which in turn define the separation between the two.

So, of course, those are attributes relating to a separation, not to mention our combination also involves labeling the separation itself as a gap, which unquestionably relates to the separation.

Turning to slide 31 and Claim 8. Whereas Claim 7 said the historical image included a tooth attribute value or values, here the claim says that the historical image has an image attribute value, which the specification says can be a collection of tooth attribute values. Patent Owner's arguments here largely roll down to a proposition that it's because, they say, we have failed to show tooth attribute value for Claim 7, we've also failed to show image attribute values to this claim, which can be rejected for the reasons that we just discussed for Claim 7.

We also explained that labeling any pixels in the image as an aligner or a gap would serve to provide the image attribute value that an aligner or gap is present in the image. Patent Owner argues that that would just be pixel-wise annotations, not image attribute values, but they haven't explained how anything in the claim, excludes pixel-wise labeling from (inaudible 0:03:47) image attribute values.

Patent Owner does not contest that an indication of a presence of an aligner gap image would satisfies this claim element, and that's exactly what our combination provides.

Now, unless Your Honors have any questions, I'm happy to reserve the remainder of my time for rebuttal. As you noted, we do have objections to Patent Owner's demonstratives. The basis for that is set forth in our objection, and I'm happy to discuss that now or during my rebuttal time, whatever you think is appropriate.

JUDGE SZPONDOWSKI: I think you should address it now, if you could just touch on your objection?

MR. ARGENTI: Of course.

JUDGE SZPONDOWSKI: That way we can hear from Patent Owner.

MR. ARGENTI: Of course. So, we noted the specific slides. You noted them at the beginning of the hearing. There are quite a few of them. The issue boils down to that all of those slides contain new argument primarily in the form of graphics and images that are found nowhere in the record.

When we look at those slides, in the initial slides in the 30 to 40 range that we objected to, they contain images, things like a cat and a flower.

We have no idea where those came from. They're not in the record and therefore any arguments about what those images represent or how they would be understood by a POSA are new arguments. It appears that all of the flow charts and surrounding graphics are new argument based on these new images.

We met and conferred. Patent Owner agreed, acknowledged that this was new content created specifically for the oral argument. Declined to remove those slides. They did provide alternative slides at the end of their slide deck, which I think are intended to address the same issue, but they swapped in images from Maninis as opposed to the new images, but the graphics remain, the surrounding graphics remain.

And they created new problems. If you look at the alternative slides, they're making arguments that we never heard during the proceeding but pointing to images in Maninis that are described in reference as being analyzed and they're arguing that those are the learning base basis, but in the input that they have annotations.

So, they're essentially taking the output of Maninis and moving it back even before the input to the learning base page. It's inconsistent with the reference and, most importantly, we don't know what they're going to argue about those. But these are graphics and figures that are found nowhere in the record.

Thank you, Your Honor.

JUDGE SZPONDOWSKI: Okay. Okay, thank you.

Okay. We will turn to Patent Owner. I'd like you to start with your response to Petitioner's objections to the demonstrative because, you know, I do have to agree that it seems like a lot of these pictures you've used in these slides really aren't found anywhere in the record.

I looked at all the citations that were cited on the pages of the demonstratives and didn't see that. So, I'd like to hear your response.

Would you like to reserve any time for sur-rebuttal?

MS. JACOBSEN: Yes. I will reserve 15 minutes, please, Your Honor.

JUDGE SZPONDOWSKI: Okay, thank you. Okay. You may begin whenever you're ready.

MS. JACOBSEN: Thank you, Your Honor. As you requested, I'll start by addressing the slides that have objections to them. I don't plan to cover all of those slides with the argument today in this

presentation, but really the explanation for why these are not new argument is almost the same for all of them.

And particularly with respect to slides 33 to 38, they are based on the explanation from Dr. Mongan, Patent Owner's expert in deep learning, and he provides a background discussion of deep learning where he explains that how a neural network functions is determined by its structure and by its training. And that's in paragraph 61 to 67, and particularly in paragraph 62.

And then in our discussion of Maninis we explain how there are two fundamentally different types of neural network in Maninis. One of those is a deep learning device that is trained to recognize generic contours. The other one is a deep learning device or a neural network that is designed to -- and able to recognize semantic contours. And those two things are trained fundamentally differently. They're designed fundamentally differently and they output a different output.

And that is, you know, the exact same argument that we make with respect to Maninis and, indeed, _Patent Owner -- I'm sorry -- Petitioner doesn't object to any of Patent Owner's slides with the same flow chart for Maninis. So, all we did was in order to provide some background on deep learning, the fact that they have to be trained to do a specific task, that they are designed to do a particular task, that the function of a deep learning device is to (inaudible 1:01:20), all of which is supported by Dr. Mongan.

We just used some generic images to illustrate the point. And the image that we chose is an image of a cat because all through Dr. Foroosh's deposition when we were talking about how a deep learning

device works, what it can recognize, how you train it, that it's trained in a different way, what it would understand, that was with reference to an image of cat. You know, can a different deep learning device look at an image and recognize a cat?

And so that is the basis for that kind of image and that explanation, and if I could just pause there and go into it in further detail when I address Maninis and I can point you exactly to the record where we make these arguments, where we explain it, and what the basis is.

JUDGE SZPONDOWSKI: Well, I think we need to figure out if we can even allow these slides before we get there. I mean, I think there's the issue. And I, you know, like I said, I went through all the citations here and I kind of agree with Petitioner that this does seem like a new argument on these slides.

MS. JACOBSEN: Well, if we look at --

JUDGE ZECHER: Counselor, this is Judge Zecher. Can you tell us where these paragraphs from Dr. Mongan are actually developed in your papers and presented because I'd like to see where that is.

MS. JACOBSEN: Right. So, in Patent Owner's Response, which is Paper 20 at page 9, we discuss Dr. Mongan's testimony on the background a deep learning device. And that is paragraphs 61 to 67 of Exhibit 2028. And what we explain there is that it was known that each neural network trained for an image recognition (inaudible 0:59:27) is unique to the annotated images on which it is trained and

its success improves on the quality of the training and the challenges of the attributes the neural network itself is recognizing.

And so that is the discussion in Exhibit, for example, in 2028, paragraph 62, where Dr. Mongan provides more details on that point. And --

JUDGE ZECHER: Where's the reference to images of cats, though?

MS. JACOBSEN: Okay. So that was in, for example, discussed at the Patent Owner's Response at page 43 where we talk about how Dr. Foroosh misunderstood the teaching Maninis. And he understood Maninis to be talking about the COB neural network able to look at an image of a cat and say this is an image of a cat.

And what Dr. Mongan explains is, no, that's not right. That's not what the COB neural network in Maninis does. Instead, the COB neural network in Maninis can look at an image and all it can detect is generic contours. Where are the boundaries? Where are the lines? If I trace over all of the lines in that image then that's the output from COB.

And so we used an image of a cat, which is what we discussed at length with Dr. Foroosh in his deposition, to say, well, Dr. Foroosh is saying it's a deep learning device in Maninis that gives you what's called semantic contour. This is an image of a cat and it's labeled as a cat, whereas, in fact, what Maninis' COB neural network can do is only show you the generic contours, outline of the cat or outline the sheep as in Maninis, but it can't tell you what is in that image. All it does is draw the lines in the image, and that's the only output.

And that's really important here to understand that different types of neural networks perform different tasks. They have a different structure that determines what input they can receive and what output they can generate. And what the problem with Petitioner's case here is that they take a learning base and to train a deep learning device that is fundamentally incapable of being trained on that learning base, and it says that that deep learning device in Maninis' COB is going to output something, which it cannot do.

So if we look at, for example, slide 40 in Patent Owner's slide deck --

JUDGE ZECHER: Well, before we get down the road of you presenting this slide deck, I think we need to decide whether or not you should present these slides in the first instance. So, I mean we don't want you to get off kilter on what you're going to present to us by basically jumping right into this because I'm sure you had something you wanted to start with versus something you want to, kind of, lead us into.

But just a moment.

MS. JACOBSEN: Sorry, Your Honor. Slide 40 isn't actually objected to. So, you know, I can do this with reference -- I can try and do this with reference to only the slides that have not been objected and perhaps, you know, if there's additional time at the end we can talk a little bit more about these objections.

But the flow charts which explain how you start with an untrained neural network, you then train it with a learning base so that you get a trained neural network, and then you present it with a new

image to get a specific output for that deep learning device, that's all explained in Dr. Mongan's report and where he distinguishes between different types of deep learning device.

JUDGE ZECHER: Counselor, just give us a second. We're consulting behind the scenes. Hold on.

MS. JACOBSEN: Understood.

(Whereupon, the proceeding was paused for Judges to confer.)

JUDGE SZPONDOWSKI: We are going to sustain Petitioner's objections to these slides. So, you may continue, but just avoid the slides that were objected to.

MS. JACOBSEN: Understood, Your Honor. So with that, perhaps we can take a step back and start this presentation by talking about the state-of-the-art. Now as Your Honors know, both of the challenged patents are directed to new methods for assessing the fit of a clear aligner. So, a clear aligner and the piece of plastic. It's transparent, it's molded, and it's designed to go into the patient's mouth and go on to the teeth and exert gentle pressure on the patient's teeth to bring about a desired movement of those teeth.

And patients when they're being treated with clear aligners receive a series of clear aligners over the course of that treatment, maybe 10 or 15, and they're changed every one to two weeks depending on the treatment plan from the orthodontist.

And I propose to start with a discussion of the state-of-the-art with respect to how the progress of that clear aligner treatment was assessed because it was notably absent from the Petition that there was any discussion of the state-of-the-art in 2017 with respect to

assessing clear aligner treatment. And that's significant because the state-of-the-art is the background against which we assess the teaching in, the prior art and it's the way in which we avoid falling into a hindsight bias which we all know is improper.

So, there are several points relating to the state-of-the-art that are addressed by Patent Owner's declaration from Dr. Kusnoto. So, Your Honors noted that in this case Petitioners have no evidence from a dental expert or an orthodontist. (Inaudible 0:52:17) dental treatment occurred in the prior art.

Dr. Kusnoto does know. He has 25 years of experience as an orthodontist and he explains the state-of-the-art.

And so if you turn to slide 4 from Patent Owner's deck, there you have an explanation that Dr. Kusnoto provided which is undisputed, and that is about how aligner treatment was assessed in 2017 before the '248 and the '945 patent. And what Dr. Kusnoto explains is that the progress of that aligner treatment was assessed in person at that time. So, the patient would go to their orthodontist's office and the orthodontist would do a series of different examinations on the patient in order to see how the treatment is progressing.

One thing that the orthodontist would do is look at the position of the patient's teeth, note how that compared with where they were supposed to be at that stage of treatment. The orthodontist would also look at things like, well, how are the attachments for the aligner on the patient's teeth, and then they would look at the aligner fit.

They would assess the aligner fit, and that would involve the patient putting on their clear aligner, the one corresponding to the

stage of treatment they're at at that time and probably the one before and the one after as well. And the orthodontist would do a visual inspection of how that clear aligner looks, but importantly they would also do a manual manipulation of the clear aligner on the patient's teeth. You know, does it lock?

And that was an important part of the clear aligner assessment, and there's no suggestion that aligner fit could be assessed simply by looking at an image. I mean, they're designed to exert pressure and you can't see pressure in an image and so that's why the orthodontist would also manually manipulate the patient's teeth.

And if we go to slide 5 then, this is evidence from Dr. Kusnoto again explaining how clear aligner treatment was not assessed in 2017. And what he explains is that at that time orthodontists were not using images to assess aligner fit, and they weren't doing any kind of quantitative measurement of the separation between the clear aligner and the patient's teeth.

And indeed at that time, there was no way to do that. And as we explain on slide 6, that was at least in part because in order to take high quality dental images, and this is just images of a patient's teeth leaving aside an aligner of the teeth at the moment, you needed training. You needed specialized equipment and training. And that's understood and that's actually confirmed by Petitioner's expert Dr. Valley when she gave evidence in other proceedings and in the District Court. In this case it didn't -- in relation to images of teeth.

And while there were some dentists who had tried to take images of teeth, not aligners but teeth just with a cellphone, what they

found was that was fraught with difficulty because if you got close enough so that the image had high quality then the image was often distorted or blurred. And if you went too far away then you couldn't actually capture the image you wanted.

And so at that time in 2017 it was not standard to use images of a patient's teeth to assess their treatment at all, and there's no suggestion in the record that anybody at that time was using an image of an aligner on a patient's teeth to assess aligner fit or do any kind of quantitative analysis of a separation between the teeth and the aligner.

JUDGE ZECHER: Ms. Jacobsen, this is Judge Zecher. How would you balance that against what I understood Petitioner to argue, which was that the prior references speak for themselves. We have Kim. We have Salah. They both talk about taking pictures of patient's teeth and , subsequently, having a dental professional analyze them.

MS. JACOBSEN: Right. So a couple of things on that. One simply is they're saying that the references speak for themselves. That's not a substitute for having a qualified expert give testimony about how a person of ordinary skill in the art would read those references and (inaudible 0:47:30) a substitute for understanding them in the context of the state-of-the-art so as to avoid any kind of hindsight bias in your analysis of those images.

And when you look at the images that are discussed in either the Kim reference or in Salah, those references are of the teeth only. Those are the bare teeth. There is nothing in those references that suggest you should take an image of an aligner on the patient's teeth.

In fact, Salah doesn't mention aligners anywhere in the entire reference, and it doesn't suggest that you can just use an image of an aligner on a patient's teeth to assess how the aligner fits and the progress of the patient's treatment.

JUDGE ZECHER: Ms. Jacobsen, but I thought we were focused on just whether or not we had the capability in that timeframe of taking a picture of a patient's teeth and providing it to a dental professional to assess. I don't think we've quite got to the minutiae of putting an aligner on the teeth. I'm just trying to -- I think -- it seems like we're conflating those two things, so I --

MS. JACOBSEN: Right.

JUDGE ZECHER: -- was hoping to focus on the first one.

MS. JACOBSEN: Right. So there's two different things we're talking about here is one is the state-of-the-art and how did people at that time assess aligner fit or assess the treatment of a patient with a clear aligner. And at that time it was not standard to use images for that kind of assessment.

Now, Petitioner has been able to find one or two isolated references that propose a new approach. They were filed very close to the '248 and the '945 patents. They had no other -- there is no evidence that they had been adopted into the state-of-the-art or successfully implemented by the time the '248 or the '945 patent was filed.

And so you need to read those references against the backdrop of the state-of-the-art and they're very clear that they are only proposing a new way to look at teeth, not to assess aligner fit.

JUDGE HOMERE: Counselor, this is Judge Homere. The reference (inaudible 0:45:16) Invisalign. Invisalign is actually prior art and (inaudible 0:45:07). And the picture taken with the (inaudible 0:44:59). So is it your position that given that that image (inaudible 0:44:59) the gap between the aligner and the edges of the teeth? Is that your position?

MS. JACOBSEN: Yes. So, our position with respect to Invisalign is that it is very clearly a guide that was intended to be given to dental professionals and orthodontists so that they could understand how to assess a patient in person.

If you go to slide 16 of Patent Owner's slides, we have there a quote from Dr. Foroosh when he talks about how Invisalign is not a remote treatment disclosure. And so he himself admits that there's no suggestion in Invisalign that you should be taking images of a patient's teeth with the aligner on and using them to access aligner fit.

Instead, Invisalign is completely consistent with the state-of-the-art in describing an in-person analysis that requires a combination of steps to assess how the patient's treatment is going forward. And there's no suggestion that you could do away with any aspect of that treatment or that you could move that treatment to move analysis. So, if you --

JUDGE HOMERE: Well, Counsel, my question was regarding the depiction in Invisalign where you have a patient with the aligner, a picture of a patient with the aligner on their teeth. So in that case -- so once that picture captured because I know that (inaudible 0:43:13) around this time and the ability to take a picture of anything unless,

you know, including a patient's teeth was, you know, that was part of the state-of-the-prior-art. So, the question then, so would we have been able to utilize a camera to produce a picture as depicted in Invisalign?

MS. JACOBSEN: Well, Your Honor, the question is whether a person of ordinary skill in the art would have been motivated to do that. They had to have a reason to do that, and here --

JUDGE HOMERE: So, that's not the question that I asked. So, I asked -- the question I'm asking is prior to the invention if cameras, you know, cellphone cameras were available would one skilled in the art be able to take a picture as what is depicted in the Invisalign reference?

MS. JACOBSEN: Well, Your Honor, there's no --

JUDGE HOMERE: That's a simple question. That's a yes or no question.

MS. JACOBSEN: Your Honor, there's no evidence that the cellphone cameras in 2017 were able to take a sufficiently high quality image of a patient's teeth with an aligner on in order to do an inspection. The only way that the '248 patent is able to do that and to recommend that is because it combines the image with a very sophisticated deep learning device that has been trained a specific way in order to conduct that analysis.

And so, no, Your Honor, there's no prior art that suggests that you could do that and discloses that you could take an image with a cellphone and that it would be sufficiently high quality. Counsel for Petitioner --

JUDGE HOMERE: (Inaudible 0:41:31).

MS. JACOBSEN: -- admitted that all of these images that it relies on, none of them were taken with a cellphone, so there's no example of a cellphone image in the prior art that a person of ordinary skill in the art could look to and conclude that I can get a good enough image here in order to combine with deep learning and make an adjustment to aligner fit.

JUDGE HOMERE: Okay. So assuming arguendo that around that time the picture that you have that is depicted in Invisalign, assuming that you had the capability of capture -- of producing a picture like that, now if that picture is produced or provided to a professional they wouldn't be able to assess the separation of the gap between the patient's teeth and the aligner?

MS. JACOBSEN: Well, no, Your Honor, because at that time there was no way to quantitatively assess separation between the teeth and the aligner, and there's no suggestion and the prior art that you can just look at an image and say, okay, well, that gap is 0.9 millimeters, that's fine. Or that gap is 1.1 millimeters, that's too bad. That's not how a dental professional worked in those days.

They had to do a combination of, one, looking at how they choose the aligner was sitting on the teeth but also manually manipulating it so they can see where it's exerting pressure, whether it's rocking on the patient's teeth. And that's a critical part of the evaluation that Petitioner ignores completely because it has no expert that knows anything about how clear aligner treatment was assessed in 2017.

And it's really important when you look at, for example, Patent Owner's slide 17, and there we have the image that Petitioner relies on. That's Image A from Invisalign. And this is the image that they seize upon, I think recognizing that Kim doesn't actually disclose taking any images with an aligner on the patient's teeth. And we can talk about why that is, but they realized that they have to rely on Invisalign and they have to say that Invisalign provides the motivation to take an image of a patient's teeth with an aligner on and do an assessment from that image and do a quantitative measurement of the separation between the edge of the teeth and (inaudible 0:38:52) in the Petition and in Dr. Foroosh.

And they say this is what shows that separation is visually distinguishable, and this is what they say provides the motivation here to assess aligner fit. Well, this image is not representative of anything that an orthodontist would have seen in the clinic in 2017.

And if Your Honors turn to slide 18, you see some testimony from Dr. Foroosh. And even though Dr. Foroosh looked at Invisalign and said, oh, you know, that image A shows a visual separation, that's what somebody's going to see in the clinic. That's what you're going to use to assess the treatment progress. He has no idea if that is representative of what somebody would see in the clinic, and he admitted to having no idea if that particular situation ever happened in real life.

Now, unlike Dr. Foroosh, Dr. Kusnoto does know. And what Dr. Kusnoto explained is that image A that Petitioner relies on is not an aligner in the service position. It is an artificially created image

where the aligner has been pulled away from the teeth in order to illustrate a gap for the purposes of the taking a photo and including it in the clinical guide.

And the way that Kusnoto knows that and he explains that in paragraph 61 of his declaration -- that's Exhibit 2030 -- is because the separation is almost even across all of the teeth. And that's not what we see in real life. In real life what we see is much smaller separation between the teeth and the aligner, even in an aligner that is fitting really poorly, that is fitting poorly.

And we have two examples on slide 18 of Patent Owner's demonstratives.

Slide B you can barely -- I'm sorry, image B -- you can barely even see there is an aligner there. And even the other image A, which is shown on Patent Owner's demonstrative 18, even that one is a much smaller gap than in the image that Petitioner relied on in support of its case.

So, this is important for a couple of reasons. One, Petitioner chose to hang their entire case on image A. They said this is the image that shows a poorly fitting aligner with a clearly visually distinguishable gap that would have motivated somebody to take an image of an aligner in the service position, measure the separation, and assess clear aligner treatment in that way.

And Dr. Foroosh has shown, and I don't think it's disputed now, but it can't be. They have no evidence from anyone that knows about aligner treatment that this isn't representative. It's not a representative image and so it can't provide that motivation.

Now, the fact that after the fact in rebuttal Dr. Foroosh was able to run some image analysis in 2024 using 2024 technology on other images doesn't show that a person of ordinary skill in the art faced with aligner fit like the examples on slide 18 would have been motivated to try and take an image and use those types of images that reflect actually what we see in the clinic in order to try and assess aligner fit from an image.

A skilled person wouldn't. There's no evidence that these images, the real-life images, the ones that a person of ordinary skill might actually see would be sufficient to allow somebody to have a motivation to do that.

The other point I want to make is that, you know, Petitioner says, oh, well, you can use the same analysis to do image A as these other images. Well, Dr. Foroosh admitted during his deposition that he couldn't do that. You have to change the parameters on his image analysis, 2024 image analysis technology, in order to be able to make it work. And so it's not as simple as Petitioner suggests that all images could be equally analyzed in order to assess aligner fit.

Now, I'd like to go back to Kim unless Your Honors have any other questions on Invisalign and just to address that next.

No? All right. So if we turn to slide 13 in Patent Owner's demonstratives, Petitioner's combination starts with Kim. And what Kim is is a reference with a new way of assessing clear aligner treatment. And what Dr. Kusnoto explains is that aligner fit and tooth alignment are fundamentally different analyses.

A tooth alignment involves looking at the position of each of the individual teeth in an image and seeing how they compare with the intended position of the teeth. Assessing clear aligner, which is what is in the '248 and the '945 involves at the time the 2017 looking at and assessing how the aligner was sitting in the teeth and whether it was the appropriate shape to exert the right pressure on the teeth to bring around the desired motion of the teeth into the desired position.

And as I've explained, it's a combination of not just looking at the aligner on the teeth but also being able to manipulate them to ensure it's exerting the right pressure.

Now, to assess teeth alignment, Kim uses what it calls teeth alignment information. Now, that can include images of teeth without the aligner and we have examples shown on slide 13, and Kim goes into great detail explaining the types of images you would need to (inaudible 0:32:05), what views. It explains how to do that. It provides guidance for the patient how to do that.

And then Kim is very clear that it is that teeth alignment information that can include images of the bare teeth that is used for diagnosis, and it's that information that's used for treatment of the patient. And all of the benefits of Kim that Petitioner points to relate to the reduced diagnosis time and the cost come from the use of the teeth alignment information.

Now, if you turn -- Your Honors turn to slide 14 from Patent Owner's, we have the paragraph 66, which is the part of Kim that Petitioner zeroes in on. And a little bit like Invisalign, Petitioners

point to just one tiny part of the reference ignoring the larger context of each of those references.

And what Petitioners says is that this paragraph 66, which confirms the clear aligner information, teaches taking an image of an aligner in a service position, and that's not right. As Dr. Kusnoto explains, the way that that would be understood by somebody with knowledge in the field is that that is an image of the bare alignment, and the analysis that Kim proposes is to check that it's normal, which is things like is it broken? Is it distorted? And does it correspond -- the clear aligner correspond to the appropriate step?

So, we're in step six. Is the patient wearing aligner number six? When in step seven is the patient wearing aligner number seven?

And Petitioner says okay, but it says currently worn, and counsel said it's pretty clear that that means or the claim language means that that is on the patient's teeth. Well, there's several reasons why that's not right.

The first is that Kim discusses teeth alignment information and clear aligner information separate. Those are two different things in the context of Kim. They're collected differently. They're processed differently and they are used differently. It is the teeth alignment information in Kim that is used for diagnosis and treatment, and it is the clear aligner information and it's just used to check if the clear aligner is normal and that the patient is using the right number aligner.

JUDGE ZECHER: Ms. Jacobsen, this is Judge Zecher.

MS. JACOBSEN: Yes.

JUDGE ZECHER: I'm going to just cut to the heart of the issue. Let's just say for a second we agree with you that the clear aligner currently worn by the orthodontic patient, which I believe is the exact wording in paragraph 66 of Kim, it's just the aligner itself. It's not the aligner on the teeth.

MS. JACOBSEN: Yes.

JUDGE ZECHER: It seems to me that the Petitioner does have an alternative argument in its Petition. I'm looking at the Petition at page 21 in the IPR2024-00052 case addressing the '248 patent where he says, look, to the extent you're going to argue that Kim doesn't sufficiently describe the aligner currently worn in an image is in the service position on the patient's teeth, taking such an image would have been readily apparent in view of Invisalign. Can you address that specifically because let's just say, like I said we agree with you that it's just the aligner itself, but it seems to be that he's buttressing it with Invisalign.

MS. JACOBSEN: Yes, Your Honor. So, I think that's right. Petitioner is buttressing it with Invisalign recognizing that Kim doesn't disclose taking an aligner image. The problem with the Petitioner is --

JUDGE ZECHER: Well, just to be clear, I think there's two arguments. I think he's saying that Kim does teach a picture with the aligner on the teeth. We can, of course, assess Kim ourselves and decide and make that finding, but I think the alternative one is if it doesn't then you need to also consider it in the context of what Invisalign is teaching.

MS. JACOBSEN: Right. And what Invisalign is teaching, if we go to slide 16, is a method for conducting an assessment of aligner treatment progress in person. There's nothing in Invisalign itself that suggests that you can take an image of an aligner on a patient's teeth and use it to assess treatment.

JUDGE ZECHER: But why is this in-person aspect of it so important?

MS. JACOBSEN: Because it --

JUDGE ZECHER: I mean, we do have a picture with an aligner on the teeth in there. Now, whether or not it's taken in person or remotely, why does that matter?

MS. JACOBSEN: Well, it's not about whether the image is taken in person or remotely. It's about how is the aligner assessed? And the aligner is assessed in person because the orthodontist needs to be able to feel the patient's teeth and feel it on the patient. There's nothing in Invisalign that says you can just look at the aligner on the patient's teeth in an image and make an assessment of the treatment progress because the clear aligner is intended to exert pressure on the patient's teeth to move them. And so you need to be able to manipulate the aligner on the patient's teeth in order to be able to see if it's fitting correctly. And that's what Invisalign is talking about.

I mean, Dr. Foroosh, he suggests --

JUDGE ZECHER: But Ms. Jacobsen, I'm struggling with that aspect.

MS. JACOBSEN: Yeah.

JUDGE ZECHER: You keeps saying that the orthodontist needs to feel the aligner, you know, be in person, but yet that's not what your claim requires. There's no touching of the aligner, anything like that that would help the orthodontist to remember he is putting an Invisalign on, determine whether it fits properly other than simply looking at the picture. So, why is that such a critical aspect of this?

MS. JACOBSEN: Well, Your Honor, that's because it's a critical aspect because that's what the prior art teaches and that's how it was been done in the prior art. And we can't consider the innovation and the '248, the brand new method in the '248 and then hindsight to see if we can find a basis for the innovation in the '248 in the prior art.

And it's only because the '248 patent combines an image of an aligner in the service position with a deep learning device designed and trained to do a particular analysis to detect a tooth attribute value for an analysis (inaudible 0:25:115) relating to separation. That then you can (inaudible 0:25:10) you still get those two innovations in order to come up with the new method of assessing aligner fit that's in the '248 patent.

And so without the innovation in the '248 patent, (inaudible 0:24:57) the deep learning device to do a particular type of analysis, without that insight there's nothing in Invisalign that suggest to you that you can use an image of an aligner to assess aligner fit. Instead, Invisalign is talking about assessing a patient's treatment in person. There's nothing there about any analysis, any taking of images, any

known human analysis of images, and it provides no method to assess separation from an image. And that's what's really important.

JUDGE ZECHER: Okay, thank you.

MS. JACOBSEN: And, Your Honors, I'd like to just briefly touch on Salah because Salah is important as well. And this we discussed at slide 22. So, Salah is about again assessing tooth positions and how it assesses the tooth positions and the movement of teeth is by comparing (inaudible 0:23:50) in 3-D scans of the teeth. I would say that's the treatment.

And so what Salah is about is tracking the movement of teeth and not any accelerated (inaudible 0:23:37). Salah doesn't suggest remotely accessing aligner fit. It doesn't suggest taking images of aligners in the service position. It doesn't suggest analyzing any images of an aligner in a service position.

And indeed, if we turn to slide 23, actually Salah teaches away from doing any kind of contour analysis on an image of an aligner in the service position. This is what Salah says is, okay, there's one way in which you can analyze an image is to get contour. This is just any contour within the image. It picks up, you know, the contour of the tooth, the contour of the cone, the contour of the gum, whatever it might be. It's not looking at individual parts of an image.

And it says, well, where there's a little (inaudible 0:22:45) contour we're going to get a low quality contour and that's going to be unreliable. And so it recommends that you filter that out and you don't use the unreliable contour in your analysis.

And so when it comes to aligners, they are by definition intended to delete contours, to visually blend with the patient's teeth. And so they are intended to create contours of low contrast and the kind of thing that Salah says you should not rely on if you are doing image analysis because it can result in a false positive.

The Salah is the reference that Petitioner has that suggests doing any known human analysis of any image from the dental field, and it teaches away from using its contour analysis with low contrast, and that's what we would have with an aligner image.

So, Your Honors, perhaps we can transition to Maninis next unless Your Honors have any questions on Kim, Invisalign, or Salah?

And here we can start with slide 39, which Petitioner objected to the slide. And sorry (inaudible 0:21:03). And when it comes to deep learning devices, and as Your Honors know, the claims require a deep learning device trained by means of a learning base so as to analyze an image and determine a tooth attribute value related to separation for an analysis (inaudible 0:20:41). That's what the claim requires.

And actually before we do this, perhaps we should just start with Petitioner's combination, which is at slide 26 of Patent Owner's deck. And there we have '248 Claim B double prime and there's the claim limitation that I just discussed. And the way that Petitioner maps the prior art to this claim (inaudible 0:20:05) is by saying a person of ordinary skill in the art would have used a deep learning device in Maninis, and you can see in that purple box there that says that Petitioner says he used the deep learning architecture of Maninis.

And as we've shown in our papers, Petitioner referred to the deep learning architecture in Maninis is talking about COB, which is in the Figure 2, which is a particular neural network that was developed by the author Maninis and that is the subject of the vast majority of the paper, the sole subject of the vast majority of that paper.

Petitioner then proposes that that deep learning device would be trained according to Maninis and it cites Exhibit 1007 at page 3. That is the only training that Petitioner advances. And then it says it's going to train COB according to Maninis using an "appropriately annotated training set."

And so what it says there is is images of teeth with an aligner in the service position that have been labeled as with the teeth, the aligners, and the gap between them. And that is what our expert explains and is now perceived as what's called semantic contours.

And then according to Petitioner, you're going to use the COB neural network trained according to Maninis on a database of images labeled with semantic contours in order to protect the boundaries of the teeth and the aligner and the regions defined within those boundaries being labeled as teeth or aligner. So that's semantic contours.

And so that's important to understand here that that is how the Petition says the claims are satisfied by the prior art. And in the following slides 27, 28, 29, and 30 we explain where that's the case.

JUDGE ZECHER: Ms. Jacobsen, this is Judge Zecher. I took a note when Mr. Argenti was presenting and he said, I quote, "The

combination is not limited to Maninis' COB neural network." That's a term that you coined and brought up in the Patent Owner Response. Can you respond to that argument?

MS. JACOBSEN: So, Your Honor, Maninis discusses COB throughout his paper, and that is a neural network, a singular neural network that is shown in Figure 2 of Maninis. And so purely for (inaudible 0:17:18) is what it discusses the whole way through its paper.

And if you look in the Petition in the discussion of element 1B, and we explain this in our papers, the discussion of element 1B in the Petition, the only thing that Petitioner points to is disclosure in Maninis relating to COB. So, whether you call it COB or COB neural network to make clear it is a neural network because there's no dispute that's what it is, it doesn't matter. That's all they relied on to satisfy element 1B, and that's shown in our slides, as well as (inaudible 0:16:39) and in the Sur-reply.

JUDGE ZECHER: So I am looking at page 36 of the Petition and I do see the reference to COB. I also see some references to the CNN convolution neural networks “plural.”

MS. JACOBSEN: Right. And, Your Honor, as we explain in our papers those are part of the COB neural network. That's what COB was built on. That is not a separate and distinct neural network and I can provide you with the cite for that.

JUDGE ZECHER: Okay, thank you. I apologize. I believe that I interrupted my colleague. Judge Szpondowski, did you have a follow-up question?

JUDGE SZPONDOWSKI: I did. I'm looking at toward the bottom of page 37 of the Petition where Petitioner relies on pages 11 and 12 of the discussion of the semantics, boundaries and semantic segmentation. But I mean, it does seem that they're relying on more than what you're asserting.

MS. JACOBSEN: Well, yes, Your Honor, but as in view of what actually is the deep learning device they only point to COB. And that's significant because they rely on COB as the deep learning device and they say it's going to do an analysis, which is object recognition or semantic segmentation. But COB is incapable of doing this, and that's -- I think perhaps if I can take a step back and just explain neural networks a little bit more then we can make that point more clearly.

And if we can turn to slide 31? And so it's important to understand that a deep learning device is not generic. It's not interchangeable. Each deep learning device has its own structure architecture, and that determines the inputs that it can receive and the outputs that it can generate. And so you have to select a deep learning device with your task in mind.

So if I wanted to detect colors using a deep learning device I pick one that can do that. I can't use a deep learning device that just is able to recognize black and white. And so if we turn to slide 32 then, what's undisputed between the technical experts is that a deep learning device is useless in and of itself. It has to be trained to do its particular task. And the way that a deep learning device is trained is by using a dataset, and that data set in this context assesses images

annotated with the thing that you want your deep learning device to be able to learn to recognize.

And so that training process is essentially giving the deep learning device a question, you know, what's in this image? And the answer in this image are teeth so that it can learn to recognize the teeth or the aligner. And then when it's presented with a new question, a new image, it can output what it's been learned to recognize.

But they have trained to do a specific task. They're not interchangeable. You can't plug and play. And what's undisputed is in 2017 no prior art -- there was no deep learning device that existed that could be purchased off the shelf that could already detect dental images or detect teeth or detect aligners.

Instead, what has to happen is you have to take a deep learning architecture and then as the patent describes you would have to train it in order to do the particular analysis.

JUDGE HOMERE: Counsel, this is Judge Homere. Isn't it true that part of the underlying problem itself describes the type of deep learning device that you use, for example, could be a conditional (phonetic sp.) neural network as one of the tasks the (inaudible 0:12:37) that can be used for that specific purpose?

MS. JACOBSEN: Right. That is a deep learning device with the correct architecture, but in order to use it in any of the claims it would have to be trained on a learning base of images appropriately annotated in order to do any of the analyses that are described in the patent and claimed in the patent. And so you can't just select, you

know, any of those deep learning devices. This is not a generic analysis here.

No. You actually have to take the deep learning device and train it and create something new in order to use it in the methods in this patent.

JUDGE HOMERE: That is correct. And one of the examples of a suitable deep learning device is provided in the patent (inaudible 0:11:46) the conditional neural network. Is that correct?

MS. JACOBSEN: That is correct. You could --

JUDGE HOMERE: Is it not (inaudible 0:11:38) directed to such a deep learning device you can actually part of the Maninis reference is directed to using a conditional (inaudible 0:11:26) neural network, which is a type, a suitable type described in the patent?

MS. JACOBSEN: Well, Your Honor, CNN is a class of neural networks and architectures and Maninis is concerned with a particular individual neural network in that class which is COB. And if you turn to slide 39, it describes what COB is.

And so COB is a neural network that has been designed to take, you know, designed to be able to be trained to recognize only generic contours. And what that means is it can only detect boundaries within an image. It can't detect what is in an image. So even though in slide 39 we see an outline of a sheep, the neural network does not know what is in that image. COB cannot identify that this is a sheep or a tooth or anything. Instead --

JUDGE HOMERE: Well, Counsel, my question is not regarding COB. It's regarding CNN that is described in the patent as a

suitable example of a neural network that is able to perform the (inaudible 0:10:07) and to perform the (inaudible 0:10:08).

MS. JACOBSEN: And, Your Honor, what I'm saying is that's a class of neural network and members of that class can be trained to do the analysis, but simply because that was a known class it doesn't mean that Maninis can be trained or describes the way to train a neural network to do what is in the patent.

JUDGE HOMERE: No, but are we talking about the same -- we're talking about the same neural network. We're talking about CNN that is provided in the patent. So, I'm not exactly sure because I know that the claim (inaudible 0:09:27) does not articulate or recite a particular neural network. The patent doesn't recite how to train that neural network so all that we have (inaudible (inaudible 0:09:15) what kind of example of neural network can be trained for what's in the patent.

And one example is the CNN, which is also described in Maninis. So, I'm not exactly sure how you are trying to, you know, parse this here.

MS. JACOBSEN: Well, Your Honor, because (inaudible 0:08:52) is only designed to be able to train on generic contours and it is only able to output generic contours. It is mathematically incapable of training on semantic contours as Petitioner proposes, and it cannot output what Petitioner proposes it would do if used according to the claim.

CNN is a broad category of neural networks. COB is a special individual neural network that was designed by the author, Maninis,

but they say it's an advance on the technology and that they have created to do a very specific thing. And as we've discussed, a neural network can only do the task it has been trained to do. In Maninis the training algorithm and the images on which it's trained are only generic contours. It can't do anything else, and that's what we've illustrated.

If we go to slide 31, what Maninis actually describes is the COB neural network, which is a neural network designed to recognize generic contours and output generic contours. That is the vast majority of Maninis. In any sections of Maninis, what Maninis says is actually you can use a different neural network altogether, the dilated network or the PSP net neural network to start detect semantic contours.

And then Maninis says, okay, well, you can snap the output of those two neural networks together and you can use COB to improve the outlines of the output from the other neural network. But Maninis doesn't talk about how to train those other neural networks and it doesn't talk about what learning base to use for those other neural networks. And that's the problem.

It says when you go to Petitioner's combination, and that's 43 --

JUDGE ZECHER: Ms. Jacobsen, this is Judge Zecher. I think we understand your argument. I think you're effectively saying that Maninis' neural network can't be trained the way that your claimed neural network is required and therefore Petitioner's proposed combination is inoperable. We've heard a lot of arguments in the

other case as well, but I just wanted to flag this for you because you only have a few minutes left --

MS. JACOBSEN: Yes.

JUDGE ZECHER: -- before you start eating into your sur-rebuttal. So if there's other issues you want to address I think you should move forward.

MS. JACOBSEN: Yes. Thank you, Your Honor. So just touching on slide 64, which is discussing the dependent claims in the '248 patent, this is a slide that was objected to by Petitioner, but the basis was that the images are not in the Petition set, or I'm sorry, in the Patent Owner's Response. That's incorrect. All of these images come from Dr. Kusnoto's declaration.

And so I don't think that there's a problem that me talking about this slide, and I don't need to do it with reference to any particular images, but the point that I would like to make here is the patent discloses two very different types of analysis, a detailed image analysis and a global image analysis.

And in the detailed image analysis you have to select a deep learning device that can be trained on tooth attribute values and then it will output tooth attribute values. And in the global image analysis you have to train on image attribute values and output image attribute values. And the problem for Petitioner is that those two are fundamentally different deep learning devices. There's no deep learning device identified that could do both of those. Either you're trained on tooth attribute values and output tooth attribute values or you're trained on global attributes in your output global attributes.

But Petitioner relies on the exact same combination to do both things. It's like, yeah, and that's just it doesn't work like that with deep learning devices. That is a fundamental misunderstanding of this technology here.

The other problem with Petitioner's case in Claims 7 and 14 is that they say the tooth attribute value is the pixels that represent the edge of the tooth or the pixels that represent the edge of the aligner, and those are not. It's simply taking an image and saying this pixel is an edge, this pixel is an edge, this pixel is an edge. It's not telling you anything about the actual tooth itself. It's simply identifying where in the image the tooth is, but that's not an attribute of the tooth. It's not something like the number of the tooth, the condition of the tooth, or anything like that, and that's all its combination says that it outputs.

And so with respect to Claims 7 and 14, even if you agree that Maninis, you know, can somehow do the analysis that they say it can do, they don't identify any tooth attribute value. All they say is you're identifying the pixels that correspond to the edge with a deep learning device, and that's not a tooth attribute value.

And then just a few moments with respect to the '945 patent, all of the same arguments relate to that element 11 in the '945 because that claim element, again, requires the taking of an image of an aligner in the service position for the purposes of assessing aligner fit. And Kim does not support that you can assess the lines of an image. Invisalign does not seem suggest that you can assess aligner fit from an image, and Salah does not suggest that you can assess aligner fit from an image.

And so even taking all of the prior art together, there's nothing that would have motivated a person of ordinary skill in the art to capture these images and use them in the method that is claimed in either the '945 or the '248.

Now, the additional reason, and this is on slide 77, why Petitioner's ground fails with respect to the '945 is that there's really no dispute that the claim requires use of image processing software so as to identify not just contours, but whether the contour belongs to a tooth or it belongs to the aligner. And that is necessary so as to be able to measure the distance between them and compare the position of those two outlines.

And Petitioner's only reference that it relies on with respect to image analysis software is Salah and what Salah is talking about is just simply identifying the contours. Salah doesn't teach a skilled person how to identify what the contour belongs to, and that is a necessary step for the '945 patent.

And Petitioner, sort of, generally waved his hands and said, oh, there's lots of different image processing software discussed in Salah and, you know, one of them would work, but the Petition doesn't actually identify any image processing software in Salah that could actually do what is in the '945.

There is no identified way of doing it in the Petition, and they have to identify a specific image processing software that would be able to do that task.

And so unless Your Honors have any questions on that, I'll save the remainder of my time for rebuttal and sur-reply.

JUDGE SZPONDOWSKI: Okay, thank you.

So we will turn back to Petitioner's counsel for rebuttal. And I have found that you have 29 minutes.

MR. ARGENTI: I do want to respond to a few things that we heard from Patent Owner's counsel. At one point, Patent Owner argued that there's no evidence in the record that a cellphone in 2017 could take a suitable picture of an aligner on teeth and perform the claimed analysis without their special deep learning approach. My response to that is what about the '945 patent where the claims do not recite deep learning and yet are still performing the same analysis?

Beyond that, look at Kim itself which is talking in 2017 about taking cellphone images and sending them for assessment of aligner treatment. Look at Dr. Foroosh's analysis about the ability to perform known image processing analysis on what they are saying are representative images.

As to that particular issue counsel argues that Dr. Foroosh was applying 2024 technology for that analysis. That's not true. He explained that he was using the canny filter, which is disclosed in Salah. It was a prior art approach and, in fact, as Dr. Foroosh explained, it was one of the less sophisticated image processing approaches even in 2017. It's simply not true that he was using 2024 technology to make his point.

Counsel also argued that the manual manipulation is an essential aspect of assessing aligner fit as described in the Invisalign guide. The problem there is that they're arguing that for that reason you wouldn't have done this remotely. You can't do the assessment,

the manual assessment remotely. But with (inaudible 0:12:23) by their own argument Kim is addressing tracking tooth movement, which is one aspect of aligner treatment, but it's not tracking aligner fit. That's what they argue. So, even they themselves characterized Kim as splitting up part of aligner treatment, breaking it out, doing it remotely. They have no reason why you wouldn't do that for the spatial assessment that the Invisalign guide plainly discloses.

They argue that that's not enough to assess aligner fit. Invisalign says that if you have a gap greater than 1 millimeter that's an indication of a poor fit. There is no reason that can't be performed remotely, and they haven't identified one.

I believe --

JUDGE ZECHER: Mr. Argenti, sorry to interrupt. I think somebody's got an open mic on here so I just want to make sure if you're not speaking to mute it. Thank you.

MS. JACOBSEN: My apologies. That was me.

MR. ARGENTI: I believe at one point counsel also argued that we haven't shown that the distance measurement of 1 millimeter or any other distance between the aligner and teeth couldn't have been performed with the technology that we're citing. I would direct Your Honors to paragraph 113 of Dr. Foroosh's first declaration in Exhibit 1002 for example the '248 case where he does address that, how that would be accomplished.

He explains that measurements like that in the context of image processing can be done on a pixel-by-pixel basis so we are talking much smaller than 1 millimeter. So when you look at those

representative images that they themselves introduced into the case through Dr. Kusnoto's testimony, and Dr. Foroosh said, "No problem. I can show you I can use the canny filter to identify the edges in these images." He also has the testimony explaining how he would then use those images and those identified edges to calculate the distance consistent with the teachings of the Invisalign guide.

As to Maninis, we've talked about it at great length. I don't want to belabor the point, but I will again reiterate that we've relied on the full teachings of the Maninis paper which describes using its improved boundary detection technique to accomplish both contour detection and object classification. There's really no dispute that Maninis describes that.

Patent Owner has not pointed to anything in their claim scope in the '248 patent that would preclude using Maninis' full scope of its techniques that we've cited to satisfy the claims.

As to their argument that Maninis doesn't talk about what learning base to use for its other CNN besides the other CNN, I believe she was referring to the CNN discussed in Section 6, the high level analysis of Maninis, I already mentioned this during my first portion of the discussion that we cited Maninis' disclosures of using the same learning base, the same databases in both the low level and high level analysis, for example, that's discussed at pages 5 and 6 as well as 11 of Maninis cited in our papers where Maninis discusses using both the Pascal context and the VOC12 segmentation databases for high and low level applications. They are misrepresenting both the reference as well as our arguments in this case.

Now, we also heard Patent Owner rely heavily on the so-called standard of care in 2017 citing Dr. Kusnoto's testimony. Patent Owner argues that alignment fit was assessed in-person and they say that digital dental photographs were taken by trained dentists with expensive cameras. They say that their claimed invention was not the standard of care.

What you're not hearing from them and where that fits in the obviousness, because it doesn't. They're essentially trying to say that their claims aren't obvious because that's not how it was done, but that's conflates obviousness with anticipation. Their standard of care argument doesn't respond to the actual teachings that the prior art references at issue. And referring to their standard care argument as the state-of-the-art can't erase the prior art, which is also state-of-the-art.

It doesn't fit in proper gram (phonetic sp.) analysis considering the scope and content of the prior art and the differences, if any, between those teachings in the scope of the claims, let alone address what would have been obvious to a POSA.

A POSA that remember is a trained computer scientist. The prior art teaches remote analysis of cellphone-captured dental images. The prior art teaches assessing aligner fit based on the separation between an aligner and the teeth. The prior art teaches ways of detecting edges of teeth and aligners in the dental image. Our reasons to combine those well-known teachings are largely undisputed as is the reasonable expectation of success.

Whether remote assessment of aligner fit was a widely adopted practice in dental offices in 2017 is of no moment and attacking the references individually does not rebut our obviousness case.

Thank you.

MS. JACOBSEN: Your Honor, I cannot hear you. May I plan to start?

JUDGE SZPONDOWSKI: Got it, yes. I'm sorry. I am unmuted now. Thank you, Mr. Argenti.

Ms. Jacobsen, you may start whenever you're ready. You have 15 minutes.

MS. JACOBSEN: Thank you, Your Honor. I'll just address a couple of points and that is that Petitioner tried to suggest that the state-of-the-art is irrelevant to the obviousness analysis. That's plainly incorrect. That case law that we cited to it says that it is important to (inaudible 0:06:10) to avoid claim bias.

It's also important in this case because what Petitioner is proposing is that a skilled person would do away with any -- with an important aspect of assessing aligner fit, but it would separate out the visual analysis from the manual manipulation. And even when there is no teaching anywhere in the prior art that suggests that simply by looking at an image of an aligner on a patient's teeth you can assess how that aligner is fitting, and that's what the case -- the claims require here.

And so there's nothing in Petitioner's references that would have motivated a skilled person to make that change to the standard operation because Kim does not suggest it can be done. Invisalign

doesn't suggest it can be done and neither does Salah. And those are the three references that are directed to dental professionals and that teach only about looking at tooth position and not anything about how you can remotely assess aligner fit.

With respect to Dr. Foroosh's (inaudible 0:04:49) the Petitioner said that that was not using 2024 technology. Well, that was using images that are not captured on a cellphone but instead high quality images, and as Dr. Foroosh admitted, he could not analyze them in the same way. He had to make changes even to the technology that he was using and that technology is not what is recited in the '248 patent.

With respect to the full teachings of Maninis, essentially what Petitioner is now saying is that applying the full teaching of Maninis means that you would use two different neural networks in order to carry out this claim. You would use the Maninis COB neural network, which is undisputed, that can only detect generic contours, and you would use that in combination as Maninis did with a different neural network that's not described in any detail in Maninis to achieve the analysis that he is discussing.

The problem for Petitioner with advancing their case is, one, it's not what was in the Petition. The Petition consistently said that the deep learning device they would be using would be the COB. (Inaudible 0:03:17) look at neural networks cannot be trained in the same way using the same learning base to perform any kind of analysis.

And so if Petitioner wanted to rely on two different neural networks to satisfy the deep learning device limitation, they would

have had to have identified two different learning databases. They only identify one. They would have had to identify two different training algorithms. They only identify one.

And they would have had to explain how we would combine the two outputs of those different neural networks in order to satisfy the claim elements. And Petitioner has never done that anywhere in its papers and that's because in truth what Petitioner claim was was that you would use Maninis' COB. You would train it according to Maninis on images labeled with semantic contours to detect semantic contours, but as we pointed out in our reply, oh, I'm sorry, in Patent Owner's Response and then our Sur-reply, it is now undisputed that it doesn't work in that way. And if the deep learning device -- the COB is non-functioning there is no motivation to use something that is nonfunctional and no reasonable expectation of success with using COB as proposed by Petitioner.

If on the other hand now Petitioner is trying to say, well, actually it's really relying on those neural networks that actually produce the semantic contours and it doesn't matter that COB doesn't work at all in its combination, then it has no motivation. Everything that it pointed to for the motivation, everything that it was excited about in Maninis is specific to Maninis' COB neural network. That was the innovation that it produced, the speed, the flexibility, the modular nature of it. That is all specific to COB and COB cannot be trained in the way that Petitioner says to do anything.

So, if COB is there it's not doing anything in that combination. It can't contribute anything and so it has no motivation to use the other neural networks.

And so unless Your Honors have any other questions, that completes our presentation.

JUDGE SZPONDOWSKI: Great, thank you. Any further questions from Judge Homere or Judge Zecher?

JUDGE ZECHER: Nothing for me.

JUDGE SZPONDOWSKI: Okay. This concludes our hearing in IPR2024-00052 and IPR2024-00110. If the parties could stay on the line in case the court reporter has any questions, we would appreciate. So, thank you to both parties, and we are adjourned.

(Whereupon, the proceedings at 3:16 p.m. were concluded.)

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