

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.,

Petitioner,

v.

DENTAL MONITORING SAS,

Patent Owner.

Case No. IPR2024-00052

U.S. Patent No. 11,049,248

PATENT OWNER'S SUR-REPLY

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Patent Trial and Appeal Board
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PATENT OWNER'S UPDATED EXHIBIT LIST

Exhibit Number	Description
2001	Declaration of Joshua A. Krevitt in Support of Patent Owners' Motion for Pro Hac Vice Admission
2002	Declaration of Dr. John Mongan, dated January 30, 2024
2003	Curriculum Vitae of John T. Mongan, MD, PhD
2004	Declaration of Budi Kusnoto, D.D.S., M.S., dated January 30, 2024
2005	Curriculum Vitae of Budi Kusnoto, D.D.S., M.S.
2006	September 28, 2022 Press Release of Petitioner, Align Technology, Inc.
2007	Rui Zhao et al., <i>Changing Clear Aligners Every 10 Days or 14 Days? A Randomised Controlled Trial</i> , 39(1) Australasian Orthodontic J. (2023)
2008	May 7, 2020 Press Release of Petitioner, Align Technology, Inc.
2009	U.S. Pat. Pub. 2017/0325689 (Dental Monitoring's English Language Translation of the International Patent Application published as Salah (PCT Publication No. WO2016066651))
2010	J. Liu et al., <i>Machine learning in orthodontics: Challenges and perspectives</i> , 30(10) Advances in Clinical and Experimental Medicine 1065
2011	<i>Dental Monitoring SAS v. Align Technology, Inc.</i> , Case No. 22-cv-07335, Dkt. No. 59, Order Denying Second Motion to Dismiss (N.D. Cal., July 19, 2023)
2012	<i>Dental Monitoring SAS v. Align Technology, Inc.</i> , Case No. 22-cv-07335, Dkt. No. 97, Align's Notice of Pending Inter Partes Review Petition (N.D. Cal., Dec. 18, 2023)

Exhibit Number	Description
2013	<i>Dental Monitoring SAS v. Align Technology, Inc.</i> , Case No. 22-cv-07335, Dkt. No. 92, Order Re Updated Patent Showdown Deadlines (N.D. Cal., Oct. 26, 2023)
2014	Docket Navigator Report on Time to Trial in cases before Judge Alsup (Excluding Outliers)
2015	<i>Dental Monitoring SAS v. Align Technology, Inc.</i> , Case No. 22-cv-07335, Dkt. No. 56, Patent Showdown Scheduling Order (N.D. Cal., July 14, 2023)
2016	<i>Dental Monitoring SAS v. Align Technology, Inc.</i> , Case No. 22-cv-07335, Defendant’s Patent Local Rule 3-3 and 3-4 Initial Invalidity Contentions and Disclosures (N.D. Cal., Sept. 11, 2023)
2017	The PASCAL-Context Dataset (June 13, 2017 version available at https://web.archive.org/web/20170613074321/https://cs.stanford.edu/~roozbeh/pascal-context/)
2018	The PASCAL VOC 2010 Dataset (July 7, 2017 version available at https://web.archive.org/web/20170707024736/http://host.robots.ox.ac.uk/pascal/VOC/voc2010/#data)
2019	The Berkeley Segmentation Data Set (BSDS 500) (July 22, 2016 version available at https://web.archive.org/web/20160722194737/http://www.eecs.berkeley.edu/Research/Projects/CS/vision/grouping/resources.html)
2020	The PASCAL VOC 2012 Segmentation dataset (July 13, 2017 version available at https://web.archive.org/web/20170713000522/http://host.robots.ox.ac.uk/pascal/VOC/voc2012/#data)

Exhibit Number	Description
2021	The NYUD v2 Datasets (July 13, 2017 version available at https://web.archive.org/web/20170705142032/https://cs.nyu.edu/~silberman/datasets/nyu_depth_v2.html)
2022	Timothy T. Wheeler, <i>Orthodontic Clear Aligner Treatment</i> , 23(1) Seminars in Orthodontics 83 (2017)
2023	Emilia Taneva, Budi Kusnoto, Carla A. Evans, Chapter 9: 3D Scanning, Imaging, and Printing in Orthodontics, <i>Issues in Contemporary Orthodontics</i> (Farid Bourzgui 2015)
2024	Orhan Tuncay et al., <i>Effectiveness of a Compliance Indicator for Clear Aligners</i> , 43(4) J. Clin. Orthod. 263 (2009)
2025	Silvia Caruso, Sara Caruso, et al., <i>A Knowledge-Based Algorithm for Automatic Monitoring of Orthodontic Treatment: The Dental Monitoring System. Two Cases</i> , 21(5) Sensors (Basel) 1856 (2021)
2026	Barry J. Glaser, <i>The Insider's Guide to Invisalign Treatment</i> , (3L Publishing, 2017)
2027	Excerpt from Deposition Transcript of Dr. Maureen Valley in IPR-2019-000132
2028	Expert Declaration of Dr. John Mongan, M.D., Ph.D., in support of Dental Monitoring's Patent Owner's Response
2029	Updated Curriculum Vitae of John T. Mongan, M.D., Ph.D.
2030	Expert Declaration of Dr. Budi Kusnoto, D.D.S., M.S., in support of Dental Monitoring's Patent Owner's Response
2031	Updated Curriculum Vitae of Budi Kusnoto, D.D.S., M.S.
2032	American Association of Orthodontists, <i>2023 Economics of Orthodontics Analysis Reporting on 2022 Practice & Patient Statistics: Member Report</i> (Aug. 28, 2023)

Exhibit Number	Description
2033	American Board of Orthodontists, <i>Ideal Photographs and Radiographs</i>
2034	Institute of Medical Illustrators, <i>IMI National Guidelines: Orthodontic Photography</i> (Feb. 2008).
2035	Canon, <i>Canon Dental Photography Guide</i> (2015)
2036	Excerpts from Transcript of Deposition of Dr. Maureen A. Valley in IPR2019-00132 (Dec. 18, 2019)
2037	Excerpts from Declaration of Dr. Maureen A. Valley in <i>Dental Monitoring SAS v. Align Technology, Inc.</i> , 3:22-cv-07335-WHA (Dkt. 104-5)
2038	R. Kaplan, <i>Standardization for Serial Intraoral Photography</i> , The C.V. Mosby Co. 431 (1979)
2039	[RESERVED]
2040	S. Samawi, <i>Clinical Digital Photography in Orthodontics: Professional Photographic Records in Daily Practice</i> , 18 Jordan Dental J. 20 (2012)
2041	O. Russakovsky et al., <i>ImageNet Large Scale Visual Recognition Challenge</i> , https://arxiv.org/pdf/1409.0575
2042	S. Xie & Z. Tu, <i>Holistically-Nested Edge Detection</i> , https://arxiv.org/pdf/1504.06375
2043	[RESERVED]
2044	[RESERVED]
2045	B. Lang, <i>NVIDIA's Next-Gen Titan X Has 11 TFLOPS Performance, 12GB of Memory, and Costs 1 Arm and 1 Leg</i> , Road TOVR (July 21, 2016)

Exhibit Number	Description
2046	I. Ahmad, <i>Digital Dental Photography, Part 2: Purposes and Uses</i> , 206(9) British Dental J. 459 (May 2009)
2047	S. Finlay, <i>Photographic Analysis and Diagnosis: Step One</i> , 2(3) Inside Dentistry (Oct. 2009)
2048 ¹	Deposition Transcript of Dr. Hassan Foroosh, Ph.D., in IPR2023-01369 (May 17, 2024)
2049	[RESERVED]
2050	[RESERVED]
2051	[RESERVED]
2052	[RESERVED]
2053	Declaration of N. E. Frank-White (attaching S. Frey, <i>A Quick Look at Dental Monitoring, The Ortho Cosmos</i> , http://theorthocosmos.com/quick-look-dental-monitoring/ (Apr. 17, 2017)
2054 ²	Deposition Transcript of Dr. Hassan Foroosh, Ph.D., in IPR2024-00110 and IPR2024-00052 (June 28, 2024)

¹ Patent Owner is not yet in receipt of the witness's signature or the officer's certification and will coordinate with Petitioner to file an updated exhibit once complete. 42.53(f)(5)-(6).

² Patent Owner is not yet in receipt of the witness's signature or the officer's certification and will coordinate with Petitioner to file an updated exhibit once complete. 42.53(f)(5)-(6).

Exhibit Number	Description
2055	<i>Making Sure Your Invisalign Aligners Fit Correctly</i> , Morita Orthodontics (2016)
2056	Apple, <i>Apple Reinvents the Phone with iPhone</i> , Apple Newsroom (Jan. 9, 2007)
2057	[RESERVED]
2058	U.S. Pat. No. 11,109,945
2059	Declaration of H. Foroosh in support of Align’s petition for <i>inter partes</i> review of U.S. Pat. No. 11,10,945
2060	BusinessWire, <i>DentalMonitoring Sets New Standard In Orthodontic Remote Monitoring With De Novo Approval By the U.S. Food and Drug Administration (FDA)</i> , May 20, 2024 Press Release (https://www.businesswire.com/news/home/20240520240852/en/DentalMonitoring-Sets-New-Standard-In-Orthodontic-Remote-Monitoring-With-De-Novo-Approval-By-the-U.S.-Food-and-Drug-Administration-FDA-)
2061	[RESERVED]
2062	[RESERVED]
2063	N. Smith, <i>Clear aligner therapy: An esthetic approach to total patient care</i> , Dentistry IQ (Sept. 25, 2017)
2064	Provisional Patent Application No. 62/417,985 to Carrier et al.
2065	Deposition Transcript of Dr. Hassan Foroosh, Ph.D., in IPR2024-00110 and IPR2024-00052 (November 8, 2024)

I. Introduction

Petitioner's sole combination is inoperable. It cannot recognize whether an edge detected in an image is an aligner, tooth, lip, tongue, or something else. It thus cannot determine a "tooth attribute of an 'analysis tooth zone'...relating to a separation between the tooth...and the aligner," as required by the claims. On Reply, Petitioner does not contest that Maninis's COB neural network is incapable of producing the "semantic contours" required for Petitioner's obviousness combination. Petitioner instead suggests that its ground was never based on Maninis's COB neural network. Petitioner's assertions are demonstrably false—the only neural network architecture identified in the Petition is Maninis's COB neural network. Petitioner cannot avoid the consequences of its inoperable combination.

As to the remaining references, Petitioner advances a series of supposed motivations, premised on opinions from an unqualified expert lacking any dental or orthodontic experience. Petitioner's arguments fail and should be rejected.

II. Dr. Foroosh Lacks Requisite Skill in the Art

Petitioner's entire case rests on the opinions of one expert. Dr. Foroosh is not qualified as a POSA under either party's definition and, as a result, rendered unqualified and incorrect opinions regarding references indisputably in the dental field. POR, 4-5.

To try to excuse Dr. Foroosh's failings, Petitioner misconstrues Patent Owner's POSA definition, which provides for consultation with "individuals familiar with medical imaging, dental imaging, dentistry, and/or orthodontics." POR, 3-4; Reply, 2. So too does Petitioner's definition. POR, 4. Petitioner now says a POSA needs only experience in medical or dental imaging, and not dentistry or orthodontics. Reply, 2-4. But to interpret and apply art in the dental field, as opposed to the medical imaging field, consultation with a person experienced in dentistry or orthodontics is necessary under both POSA definitions.³ POR, 4-5.

Someone with experience only in "medical and dental imaging" (Reply, 2) does not automatically have the requisite dental or orthodontic experience. Indeed, Dr. Foroosh has no experience with dentistry or orthodontics, and he has never

³ Petitioner's quibble with the relevant field is irrelevant. Reply, 4. Both "aligner treatment" and "dental arch image analysis" require a working knowledge of dentistry or orthodontics, which Dr. Foroosh lacks. POR, 5. Petitioner's reliance on Kim and Invisalign belies what it now calls the "field." Invisalign and Kim concern "aligner treatment," not "image analysis." Petition, 6-8; EX2028, ¶¶68-96.

assessed aligner fit. POR, 5; EX2065, 46:22-47:7, 49:6-12.⁴ Thus, he is unqualified to opine alone on the alleged obviousness of a new “method for assessing the shape of an orthodontic aligner,” as claimed. POR, 3-5, 15-16. Dr. Foroosh simply does not know how aligner fit was assessed prior to the ’248 patent and was unable to fully understand the references describing it, and therefore, is not able to opine on whether a POSA would have designed the claimed aligner fit assessment method that can be performed remotely. *Id.*

Petitioner oversells Dr. Kusnoto’s testimony, saying he “admit[ed] that Dr. Foroosh correctly understood the terms used.” Reply, 3. But Dr. Kusnoto was asked only about “terms” and “terminology.” *Id.* Patent Owner’s critique is not that Dr. Foroosh used incorrect vocabulary, but that he misunderstood the references as a whole. *E.g.*, POR, 47-48 (“Petitioner and its expert misinterpret Kim as assessing aligner fit from an image”), 49-51 (Dr. Foroosh did not know

⁴ While Dr. Kusnoto rightly testified that someone experienced in medical imaging “who has work[ed] a lot in” the dental field “can certainly know the relevan[ce] of the aligner’s treatment,” it does not follow that all such individuals would. Reply, 3 (quoting EX1052, 27:7-28:6). Dr. Foroosh has worked on one project that involved dental—not aligner—images. EX1002, ¶6. That cannot possibly qualify as “work[ing] a lot in the field.” POR, 5.

“what operations a dentist should perform” and disregarded teaching that “Invisalign describes methods for assessing aligner fit that can only be performed in person”). It is manifest that Dr. Foroosh’s lack of dental experience and failure to consult with any other individual pervades his opinions, and his opinions should be given no weight. *Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n*, 22 F.4th 1369, 1376-77 (Fed. Cir. 2022) (“To offer expert testimony from the perspective of a skilled artisan...a witness must at least have ordinary skill in the art. Without that skill, the witness’ opinions are neither relevant nor reliable.”).

Recognizing its expert’s failings, Petitioner also seeks to rely on Dr. Maureen Valley’s declaration in a different IPR, involving a different patent and ground references. Reply, 3 (citing IPR2023-01369, Paper 23 and EX1035). That is both improper and inapposite. *Unified Patents Inc. v. Sound View Innovations, LLC*, IPR2018-00599, Paper 50, at 50-51 (P.T.A.B. Sept. 9, 2019) (excluding declaration from different IPR as hearsay). Dr. Foroosh did not consult Dr. Valley here. EX2065, 11:20-12:3; EX2054, 124:16-19. Besides, Dr. Valley’s declaration cannot save Petitioner—it does not even address Kim and Invisalign.

III. Petitioner’s Construction of “Tooth Attribute” Is Flawed

The claims require a “tooth attribute relating to a separation between the tooth...and the aligner.” *E.g.*, EX1001, cl. 1. The specification is clear that the tooth attribute is an attribute of a tooth, such as a tooth number or type. EX1001,

7:64-8:7; EX2028, ¶145. In contrast, Petitioner’s proposed combination can only detect contours associated with outlines of objects, not their characteristics. Petitioner thus proposes a distorted construction under which the “tooth attribute” can be the “respective positions or edges” of a tooth or aligner. POR, 13-14.

Petitioner’s construction is incorrect because it conflates the “tooth attribute” and the “tooth zone.” POR, 14. Petitioner argues the “zone is an area, an outline is a line” (Reply, 6), but this statement elides the fact that the area must be defined by an outline. Moreover, what Petitioner points to in the prior art as being a “tooth attribute” is not even an outline, but rather a grid of pixelwise labels indicating whether each pixel might be part of a contour, as discussed in detail in Section VIII.A. That bitmap image provides no information that is an “attribute of a tooth,” or even an “attribute related to a tooth” as Petitioner says is required. Reply, 5; EX2028, ¶¶212-213. In other words, knowing that a pixel is from a contour, or even where that contour is within the image, is not a value that says anything “related to a tooth.” *Id.*

It is not Patent Owner’s categorical position that “attributes specifying the relative positions of the tooth or aligner cannot be tooth attributes” (Reply, 5)—but mere contours of the tooth and aligner are not. It does not follow that because “maximal” and “mean separation” between a tooth and aligner can be a tooth attribute according to the specification, then the tooth contour used to determine

those separations must also be a tooth attribute. Reply, 6. There is no specification support for Petitioner’s definition of “tooth attribute” and it is appropriate to read the claims as excluding tooth and aligner edges. *E.g., Wang Lab’ys, Inc. v. Am. Online, Inc.*, 197 F.3d 1377, 1383 (Fed. Cir. 1999) (proper to limit claims to character-based protocol and exclude bit-mapped protocol where “[t]he only embodiment described...is the character-based protocol”); POR, 14.

IV. Petitioner Has Not Shown Maninis Is Prior Art

Petitioner has the burden to show Maninis is prior art. *E.g., Louisiana Pac. Group v. Huber Engineered Woods LLC*, IPR2020-00600, Paper 14, 14 (P.T.A.B. Aug. 20, 2020). Petitioner cites only speculation and anecdote. POR, 40-42. None of its reply arguments prove publication.

First, Petitioner disputes that the discussion of arXiv.org’s alleged policies is speculative hearsay. Reply, 7-8. But an archived webpage with no custodian to authenticate or explain it is not “extensive uncontroverted evidence of business practice.” *Cf. Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1568-69 (Fed. Cir. 1988). Petitioner has no evidence from anyone with knowledge whether, and if so, how these alleged policies were applied to Maninis, including which alleged arXiv.org policy applied at the time of Maninis’s April 2017 submission. EX1023 (purported July 2017 version); EX1026 (purported September 2016 version). Many questions about Maninis’s publication remain unanswered.

Petitioner acknowledges publication was not automatic; Dr. Foroosh testified that Maninis would have been subject to “review” before publication, but the duration of such review is unknown. EX2048, 231:17-232:15. The purported July 2017 policy even indicates that publication can be paused indefinitely in some circumstances. EX1023 (“Edits made during the same day...**will irrevocably delay announcement.**” (emphasis in original)). As such, Petitioner has not shown that Maninis was published within three months of its submission and is prior art.

Second, Petitioner faults Patent Owner for not addressing a snapshot of the arXiv.org search page (EX1025), but Patent Owner already did so in substance: the “download link” therein is the same as that on the Maninis authors’ website and it is undisputed that this link would have pointed to the earlier version of Maninis on which Petitioner does not rely. POR, 41 (addressing EX1024); EX2048, 235:5-236:8.

Third, Dr. Foroosh’s anecdotal experience as an occasional submitter to arXiv.org is equally speculative and insufficient. Reply, 8. Unlike the attorney in *Cooler Masters Co. v. Aavid Thermalloy LLC*, IPR2019-00337, Paper 49, Dr. Foroosh has no expert knowledge regarding the practices of arXiv.org. EX2048, 231:14-234:24. Dr. Foroosh’s interpretation of “metadata,” which is not of record in this proceeding, is likewise pure speculation. Reply, 8; EX1002, ¶57.

V. Petitioner Cannot Avoid the Consequences of Its Inoperable Combination

Petitioner's Reply argues that Patent Owner's Response was limited to the Maninis COB neural network, whereas the Petition relied on Maninis more broadly. Reply, 9-12. That is not accurate.

A. The Inoperability of Maninis COB Is Dispositive

Patent Owner's Response demonstrated that Petitioner's reliance on Maninis's COB neural network as the "deep learning device trained by means of a learning base" dooms its obviousness ground. POR, 42-46. In Petitioner's combination, the deep learning device analyzes images to identify teeth and aligners by detecting their contours and identifying the objects within each contour. *Id.*, 42. To do so, the deep learning device must produce "semantic contours" that distinguish between teeth and aligner. *Id.*, 43-44. Accordingly, Petitioner proposes to train the deep learning device using historical images with pixelwise labels identifying teeth and aligners. *Id.*, 42-46. But the COB neural network on which Petitioner relies is neither capable of generating semantic contours nor being trained on them, making the proposed combination inoperable. *Id.*; EX2028, ¶¶126-136, 178-183. A POSA would thus not have been motivated to combine Maninis with Salah, as Petitioner proposes, with a reasonable expectation of success. POR, 42-46, 60-61.

In Reply, Petitioner does not dispute Patent Owner’s explanation of the COB neural network and does not contest its inoperability for training on or producing semantic contours. Reply, 9-12; EX1048, ¶¶11-17. The Petition fails as to every challenged claim on this basis alone.

B. Petitioner Cannot Reasonably Dispute Reliance on COB

Petitioner now argues that the Petition does not rely exclusively on the COB neural network in the Petition. Reply, 9-12. Not so.

The Petition does not identify any other neural network that is used alone or with the COB neural network in Petitioner’s combination. Instead, Petitioner repeatedly refers to Maninis’s COB neural network as “Maninis’s technique.” Petition, 25, 39. The Petition indicates that it views Maninis’s technique as the one depicted in Figures 9 and 10 of Maninis, which use only the COB neural network. *Id.*, 39; EX2028, ¶130. Petitioner then illustrates “Maninis’s ‘deep learning architecture’” by reproducing Figure 2, showing the COB neural network. Petition, 36⁵; EX1002, ¶¶97-99. For claim 13, adding only the limitation that “the deep

⁵ “VGGNet and ResNet” referenced in the Petition relate to the “Base CNN,” a component of the COB neural network in Figure 2—not separate neural networks. EX1007, 2, Fig. 2; EX2028, ¶173 n.7; EX1037, 147:13-149:24.

learning device is a neural network,” the Petition again cites Figure 2 and not Section 6 of Maninis on which Petitioner now relies. Petition, 53-54⁶; Reply, 9-10.

The architecture of Figure 2 produces only generic contours. EX2028, ¶¶127-130. Petitioner does not suggest—nor could it—that this architecture encompasses the distinct neural networks mentioned later in Maninis as capable of generating semantic results. EX2028, ¶¶131-134. Importantly, despite Maninis’s reference to ***other neural networks***, Petitioner never once proposed a combination employing multiple neural networks. Petitioner also does not articulate what such a combination would entail even on Reply.

Likewise, the Petition relies exclusively on Maninis’s description of training the COB neural network as satisfying the “trained by means of a learning base” limitation. Petition, 37 (citing EX1007, 3, 5-6); EX1002, ¶100 (same). Petitioner does not suggest that other neural networks mentioned in Maninis could be trained to generate semantic results using the same learning base on which the COB neural network is trained to generate generic contours—they could not. EX2028, ¶135.

⁶ The Petition’s discussion of claim 13 cites Maninis page 13, but the five lines of Section 6 that extend onto this page do not provide any substantive teachings of neural networks for semantic segmentation.

Petitioner’s alleged motivation to combine and expectation of success also depend on the COB neural network. Petitioner relies on Maninis’s description of COB as an “improvement[]” over the state of the art and the speed of COB as the alleged desirable characteristic leading to a motivation to use its methods with Salah. Petition, 25, 36; EX1002, ¶¶77, 100; EX2028, ¶136. Petitioner also relies on Maninis’s description of COB as “flexible” and “modular.” Petition, 25; EX1037, 116:3-117:6, 147:16-149:24. “Based on” this “flexibility and prospect to improve performance,” Petitioner argues “a POSA would have been motivated to analyze images using...Maninis to improve” Salah and Kim. Petition, 26.

Having identified no other structure beyond the COB neural network as satisfying Step 1(b"), nor any reason a POSA would have been motivated to select another neural network and expect success, Petitioner cannot reasonably dispute its sole reliance on the COB neural network.⁷

On Reply, Petitioner points to its citations to sections of Maninis that mention semantic contours and object detection. *E.g.*, Reply, 9-12; EX1048, ¶¶13-17. Petitioner’s new-found understanding of Maninis cannot be reconciled with

⁷ Petitioner’s focus on Dr. Mongan’s use (for clarity) of the phrase “COB **neural network**” is a red herring—COB is undeniably a neural network. Reply, 9; EX1037, 108:4-112:17.

the prior record in which Petitioner clearly misattributes Maninis’s semantic results to the COB neural network alone. For example, the Petition cites to Maninis Figures 9 and 10 as allegedly supporting semantic recognition of “a particular tooth, aligner surface, or gap between them” even though the Maninis COB neural network used in those figures cannot produce semantic results. Petition, 39; EX2028, ¶130. Dr. Foroosh likewise testified—incorrectly—that the COB neural network produces “a contour of a cat, ...labeled as a cat.” EX2048, 211:20-212:15. Tellingly, Dr. Foroosh does not address this testimony or dispute Patent Owner’s characterization of it. EX1048. Petitioner’s attorney argument cannot explain away Petitioner’s clear misunderstanding of Maninis.⁸ Reply, 11-12; POR, 43-44.

Petitioner does not dispute that the COB neural network must be run *in parallel* with another neural network that can produce semantic contours. EX2028, ¶131. However, the Petition never described the necessary coupling or how any system of multiple neural networks satisfies the claim limitations, including which is the “deep learning device,” how it is “trained” and by which “learning base,” and which performs what “analysis” to obtain a “value” as claimed. POR, 45. That failure is significant because a neural network’s training determines its

⁸ Dr. Mongan confirmed that the contours depicted in the bottom right frame of Maninis Figure 10 were not “detected as” sheep. Reply, 12; EX1037, 130:1-136:21.

functionality, and COB and the other neural networks mentioned in Maninis cannot be trained on the same learning base and cannot perform the same tasks. *E.g.*, EX2048, 201:20-205:10; EX2028, ¶179.

C. Any Reliance On Other Neural Networks Is New and Improper

To the extent Petitioner seeks to newly rely on different neural networks from Maninis—which Petitioner does not explicitly do on reply—that goes beyond the scope of proper reply and should be disregarded. 37 C.F.R. §42.23(b); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367-68 (Fed. Cir. 2015) (upholding “Board’s rejection of...previously unidentified portions of a prior-art reference to make a meaningfully distinct contention”).

Regardless, as explained in Patent Owner’s Response, Petitioner’s combination fails even if other neural networks are used with COB to produce semantic contours. POR, 58-62.

VI. Petitioner’s Supposed Motivations to Combine Are Erroneous

The Reply compounds the Petition’s misinterpretations of the references to suggest inaccurate motivations to combine.

A. There Was No Motivation to Combine Kim with Invisalign or Salah

The Petition finds motivation to combine Invisalign with Kim “[i]n view of Kim’s disclosure of orthodontic checking of a photo or video of an aligner currently

worn by the patient.”⁹ Petition, 22. Kim does not disclose an image of a seated aligner. Rather, Petitioner takes one paragraph of Kim—relating to “clear aligner information”—out of context and applies it to the distinct “teeth alignment information.” POR, 47-48. To be clear, the teeth alignment information of Kim relates to assessing teeth alignment of bare teeth, not aligner fit. EX2030, ¶¶71-73. Petitioner does not, and cannot, justify its conflation of these two distinct aspects of Kim.

Petitioner instead doubles down on this single paragraph. Based on mere attorney argument and the word of an expert who has **never** assessed aligner fit, Petitioner says that “the clear aligner currently worn” refers to an aligner on teeth. Reply, 13; EX2065, 46:22-47:7, 49:6-12. In contrast, Patent Owner’s experts explain why this paragraph discloses only images of aligners on their own, each citing numerous other statements in Kim supporting their interpretation. EX2030;

⁹ Petitioner’s combination begins with Kim. Petition, 20-21. As an initial matter, Kim is not a prior art patent or printed publication under 35 U.S.C. § 311(b) because it was not published before the priority date and never issued as a patent. Thus, it cannot be used as a ground reference. *See Lynk Labs, Inc. v. Samsung Electronics Co., Ltd.*, No. 2023-2346 (Fed. Cir.). Even if Kim can be considered, it does not support Petitioner’s case here.

¶¶71-79; EX2028, ¶¶73-82. Dr. Kusnoto reached his opinion using his undisputed orthodontics expertise, and Dr. Mongan’s view is based on Kim’s disclosures of distinct computer architectures. *E.g.*, EX2030, ¶74; EX2028, ¶¶74-76; EX1051, 31:2-15. Dr. Mongan then consulted with Dr. Kusnoto to confirm his understanding. EX2028, ¶80.

Petitioner suggests the images of Kim must show seated aligners because “PO points to no evidence...that photos of aligners on their own provided dental practitioners with meaningful information during treatment.” Reply, 13. However, Invisalign discusses visual examination steps to assess the aligner off the teeth, including “read[ing] the imprint on Aligner” to ensure the patient is using the correct aligner and checking for “Staining or discoloration” or “Holes or bubbles,” which would be equally important in Kim’s remote methods. EX1006, 6, 36-37.

Even if Petitioner were correct that Kim teaches images of aligners on teeth—it does not—Petitioner’s expert confirmed Kim itself provides no basis for determining whether the aligner is “fitting well” from an image alone. EX2054, 22:6-19. Thus, even under Petitioner’s view, Kim cannot provide the motivation or expectation of success to assess aligner fit from an image, and no other ground reference alone or in combination suggests analyzing images of aligners on teeth at all. POR, 25-26, 29-30.

Next, the Petition erred in its supposed motivation to combine Kim and Salah, stating that Kim “teaches application of computer image analysis to dental images.” Petition, 24. In reply, Petitioner reframes this argument, suggesting that Kim somehow teaches “analysis of images on a computer” akin to Salah’s computer-aided image analysis. Reply, 14-15. Either way, Petitioner’s expert disclaimed this motivation. POR, 48 (citing EX2054, 30:12-15). Kim—at best—teaches visual inspection of images displayed on a computer. Reply, 15 (quoting EX1005, ¶66 (“the orthodontist checks [the] photo or video”)); EX2030, ¶78. Moreover, an orthodontist “check[ing]” an image is far afield from the computer-implemented image analysis of Salah. Importantly, as Kim discloses only cellphone images taken by untrained persons using 2017 technology, there is no teaching or suggestion that these images would be suitable for computer-implemented analysis at all. POR, 21; EX2028, ¶92. Additionally, although Salah depicts a bonded expander, a POSA would recognize significant differences exist between this appliance and a clear aligner, and that Salah is not attempting to assess the shape of the appliance at all. POR, 54-55; EX2028, ¶123.

B. Petitioner’s Expert Disregarded Key Portions of Invisalign and His Opinions on Motivation Are Thus Unreliable

Petitioner tries to sidestep the fact that Dr. Foroosh was unable to understand and therefore disregarded Invisalign’s teachings regarding in-office examinations.

POR, 49-50. Incredibly, Petitioner contends it was permissible for Dr. Foroosh to “focus[] on measurements that can be performed remotely on images” and ignore the rest of Invisalign. Reply, 16. But Dr. Foroosh’s opinion that “Invisalign’s teachings of how to evaluate aligner fit” can be replaced with “analyz[ing] images of the teeth of a patient wearing an aligner in a service position” (EX1002, ¶72) lacks credibility. How can Dr. Foroosh know that Invisalign’s alleged “measurements [] can be performed remotely on images” (Reply, 16) when he does not understand how aligner fit was assessed in-person or whether and how any measurements were performed? EX2054, 45:17-19, 58:24-59:7, 74:9-14 (that understanding was “out of the scope of [his] expertise”). Dr. Foroosh cannot. Rather, as Dr. Kusnoto explained, aligner fit was not assessed by making measurements; it required a combination of in-person visual and manual assessments. EX2030, ¶¶58-59, 66. The prior art did not suggest that this holistic assessment could be replaced by a remote measurement on a cellphone image. POR, 52-54.

C. Petitioner Cannot Reconcile Salah’s Need for “Contrast” with Its Use for Clear Aligners

Petitioner argues that Salah does not teach away from using its image analysis techniques on low-contrast areas, such as those showing clear aligners on teeth. Reply, 17. Not so. Salah does not “merely observe[] that higher-contrast

areas can produce higher-contrast contours” (*id.*); Salah teaches removal of low-contrast contours from the analysis altogether because they are unreliable. EX1008, 61:2-3; EX2028, ¶191.

Petitioner—unable to dodge the fact that Dr. Foroosh based his opinions on an unrealistic aligner image from Invisalign—says it was “straightforward” to analyze more representative images. Reply, 16-17. However, more representative images would have lower contrast, and the Petition was based on Dr. Foroosh’s assertion that Figure A of Invisalign could be readily analyzed using the techniques of Salah and Maninis. Petition, 38-39; POR, 54-55. Indeed, Dr. Foroosh tried to duplicate his analysis of Invisalign’s Figure A on other images, and had to adjust the scale of his Canny algorithm to account for contrast and sharpness, presumably because the parameters selected for his original analysis were unsuitable for these other images. EX1048, ¶20; EX2065, 12:25-13:13, 14:10-19, 16:22-17:5. Regardless, the question is not whether Dr. Foroosh can detect low-contrast contours, but whether a POSA upon reading Salah would have tried to do so with a reasonable expectation of success. They would not. EX2028, ¶191.

Lastly, Petitioner’s argument that Maninis could be combined with Salah to perform image analysis on a range of contrasts is both brand-new and unavailing. Reply, 17. Salah teaches that a “low-contrast area” produces low-quality contours that cannot be identified with high probability. EX1008, 60:17-61:3; EX2028,

¶191. At best, “Maninis teaches how to **use** differences in contour strength.” Reply, 17. There is no evidence that Maninis is better able to detect low-strength contours or otherwise solve the problem identified in Salah. Thus, Maninis does not undermine the clear teaching in Salah that low-contrast contours are not reliable and should not be used. EX2028, ¶124.

D. Petitioner Shows No Motivation to Use Semantic Contours

Petitioner’s combination further fails because it provides no motivation or reasonable expectation of success in combining Maninis and Salah to achieve semantic contours. Petitioner does not dispute that Salah discloses only generic contours, and thus, seeks to rely on Maninis also.¹⁰ Reply, 21-22. Petitioner argues that “Maninis would be providing functions taught in Salah for contour and object detection” and so “the improvements realized in Maninis” provide motivation. Reply, 22. However, the supposed improvements Petitioner identifies from Maninis all relate to the COB neural network, which cannot determine semantic contours. *Supra*, §V.B. Petitioner has not explained why benefits attributable to generic contours would have provided the motivation for semantic contours here.

¹⁰ Dr. Mongan did not “narrow[] the scope of” Maninis or presume a POSA would not have considered it. Reply, 21-22. Dr. Mongan’s declaration addresses Maninis in extensive detail. EX2028, ¶¶125-140, 171-183, 196-197, 200-206.

They would not given the differences in speed and efficiency across various neural networks. EX2028, ¶¶201-203.

E. Petitioner Fails to Address Resource Constraints and Costs

Petitioner argues that the undisputed resource constraints to implement deep learning are insignificant because the technique could be implemented on Kim's computer instead of a cellphone. Reply, 20-21. But Petition never suggested that the image should be sent to an external computer for analysis. This new theory is improper and should be rejected. *See Wells Fargo Bank, N.A. v. United Servs. Auto. Ass'n*, No. IPR2019-01082, 2020 WL 6937381, at *10-16 (P.T.A.B. Nov. 24, 2020) (refusing to consider reply proposal to perform image processing step on mobile phone instead of remote server where Petition failed to identify such an embodiment).

As to the clear disincentives to pursue Petitioner's combination, Petitioner does not deny there was no suitable prior art learning base or that creating one adds time, cost, and complexity. POR, 62-63. Petitioner simply asserts that "economic arguments cannot rebut the petition's showing of obviousness." Reply, 22 (citing *Orthopedic Equip. Co. v. United States*, 702 F.2d 1005, 1013 (Fed. Cir. 1983)). *Orthopedic* provides no such *per se* prohibition. To the contrary, it is appropriate to weigh the costs against the possible benefits. *E.g., Andersen Corp. v. Pella Corp.*, 300 F. App'x 893, 898 (Fed. Cir. 2008) ("a significant difference in cost

could discourage [a combination]”); *see also In re Schweickert*, 676 F. App’x 988, 995-96 (Fed. Cir. 2017).

The undisputed costs and complexity of generating a brand-new learning base weigh strongly against any proposed motivation to combine. *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1331-32 (Fed. Cir. 2016). Dr. Foroosh confirmed a POSA would expect the learning base to have “far more than 1000 images.” EX1002, ¶¶122-123. The only expert with personal experience, Dr. Kusnoto, explained that such a learning base “would have been expected to be costly and complicated.” EX2030, ¶¶88-90. And Dr. Kusnoto confirmed that, even if no redactions are required, other steps must be taken to anonymize the image. EX1038, 81:20-82:24; *cf.* Reply, 23.

Lastly, Petitioner brings in new references and argument to allege that “various cost-saving measures were well-known.” Reply, 23. However, Petitioner makes only a conclusory statement without tying the alleged “cost-saving measures” to a motivation to combine. Reply, 24. That is too little, too late.

F. Petitioner’s Hindsight Biases the Analysis

Dr. Foroosh’s hindsight-driven approach is clear. POR, 58-60. For another patent not requiring “deep learning,” he selected a “preferred” method of Salah. EX2058, cl. 1; EX2059, ¶83. For the ’248 patent claims requiring “deep learning,” he selected a “not preferred” method. EX1001, cl. 1; EX1002, ¶96. Dr. Foroosh

applied the same POSA definition to each patent, despite reaching different results. EX2059, ¶51; EX1002, ¶61. And he provided no explanation for why that same POSA would have allegedly chosen a “not preferred” method to achieve the ’248 patent claims, other than the claims requiring deep learning. That is “fraught with hindsight” and should be afforded little weight. *ActiveVideo Networks, Inc. v. Verizon Commc’ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012).

VII. Frey Is Not Prior Art

Frey says that the disclosures relied upon in the Petition came from Patent Owner. EX1009, 17-18, 26; Petition, 24, 31. Petitioner does not dispute that the ’248 patent inventors were Patent Owner’s employees. It therefore follows by necessity that any disclosure obtained from Patent Owner was obtained “directly or indirectly” from the inventors, as required by both §102(b)(1) exceptions. Because the disclosures of Frey relating to the subject matter of the ’248 patent were derived from the inventors, Frey is not prior art.

Frey cannot be considered if it is not prior art. Petitioner relies on Frey to assert that images of seated aligners were “known to be a useful practice for assessment of a patient’s orthodontic treatment status” in 2017. Petition, 24, 31. Frey is the **only** reference to suggest the use of such images and is therefore not merely confirmatory of other references. *Cf. Yeda Rsch. v. Mylan Pharms. Inc.*, 906 F.3d 1031, 1041 (Fed. Cir. 2018) (post-priority date evidence allowed where

opinion also supported by other prior art). Moreover, Frey is not probative of motivation because its teachings come from the same source as the '248 patent, *i.e.*, Patent Owner. *Otsuka Pharm. Co. v. Sandoz, Inc.*, 678 F.3d 1280, 1296 (Fed. Cir. 2012) (“The inventor’s own path itself never leads to a conclusion of obviousness.”).

Petitioner also now points to an earlier Frey post—cited in Patent Owner’s Response, not the Petition—describing Dr. Frey’s personal practice. Reply, 18-19 (citing EX2053, 7). It does not disclose that Dr. Frey was remotely analyzing images of seated aligners on teeth. Dr. Frey’s vague hearsay that “[w]e routinely do this for international and out-of-state patients already” does not specify if the word “this” refers to photo monitoring for clear aligner patients or for patients using braces or other orthodontic applications. EX2053, 7. Indeed, the **only** image in this post shows photographs of braces, and not clear aligners. *Id.*, 6. There is simply no way of knowing what Dr. Frey meant when he claimed to already “do this.”

VIII. Semantic Contours Cannot Be Tooth Attributes (Claims 7 and 14)

Petitioner repeats its mistaken theory that a contour can be a “tooth attribute value” in claims 7 and 14. Petitioner relies on three such contours: (1) “the locations of the edges of each tooth,” (2) “each corresponding edge of the aligner,”

or (3) “the gaps between the teeth and the corresponding edges of the aligner.”

Reply, 24. None is a “tooth attribute value.”

The COB neural network of Maninis must be trained with historical images having pixelwise labels, as illustrated by the following demonstrative example using a 2,500-pixel “historical image” depicting a tooth and aligner¹¹ (EX2028, ¶¶220-221):

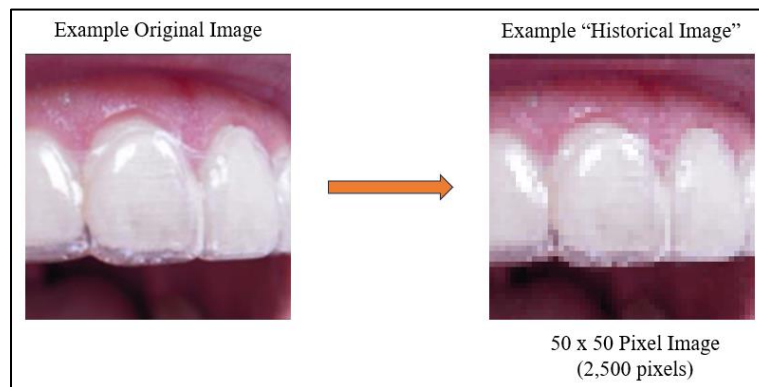


Figure A.

Under Petitioner’s view, this neural network would be trained with pixelwise annotations on historical images indicating whether each pixel is part of a contour, and the trained neural network would then produce on “analysis images” generic pixelwise annotations of whether each pixel is a contour (*id.*, ¶¶131-133):

¹¹ The “Original Image” was cited by Dr. Kusnoto. EX2030, ¶62 (citing EX2055, 2).

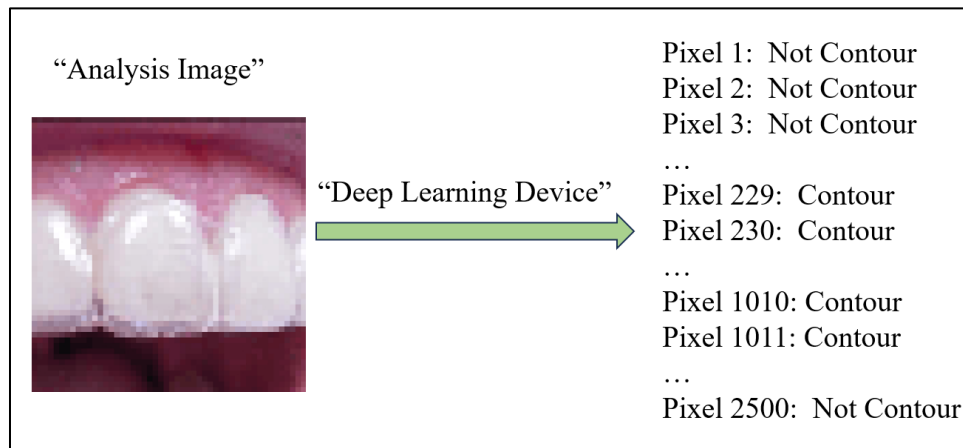


Figure B.

Knowing whether a pixel or a series of pixels is a contour, or not, is not a tooth attribute because it does not identify a characteristic or attribute of a tooth.

Even under Petitioner's mistaken view that its proposed combination produces semantic contours (it does not), the result is the same. A neural network trained using *semantic* pixelwise annotations on "historical images" would produce *semantic* pixelwise annotations on "analysis images" (*id.*):

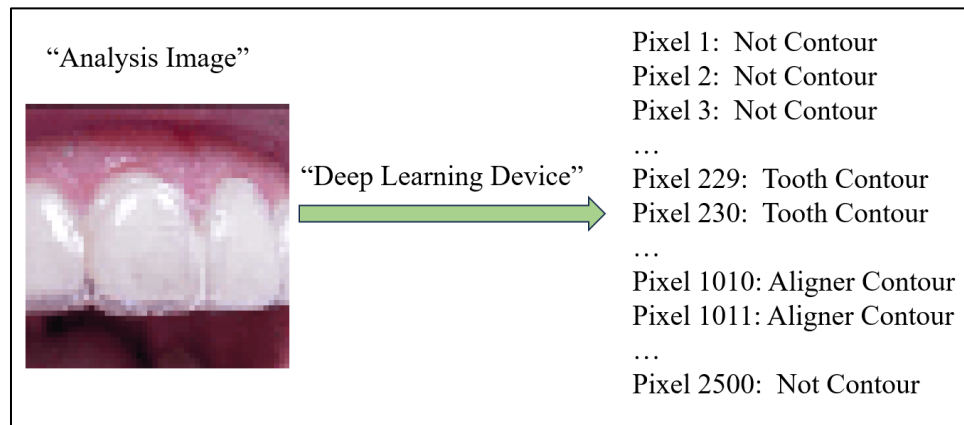


Figure C.

Again, knowing whether a pixel or series of pixels is a tooth contour or an aligner contour is not a tooth attribute because it provides no information related to a tooth. POR, 64-66; *supra*, §III. Instead, further analysis—missing from Petitioner’s combination—would be required to generate a tooth attribute value, such as maximal or mean separation.¹²

Thus, Petitioner’s combination discloses no tooth attribute value, as required by elements 7(1), 7(3), 14(1), and 14(3).

IX. Petitioner Points to No Neural Network Trained on “Image Attributes” (Claim 8)

Claim 8 depends directly from claim 1. Patent Owner’s argument as to claim 8 is not premised on claims 7 and 14 at all. *Cf.* Reply, 25. Instead, Petitioner’s

¹² Petitioner is incorrect that Patent Owner wrongly “equat[es] edges of teeth or aligners with the outline of zones.” Reply, 24; *supra*, §III.

combination fails to disclose a neural network that can be trained on and output image attribute values, as required by the claim. POR, 66-67.

The Petition identifies just three possible image attributes that can be outputted: (1) “the presence of an aligner;” (2) “the presence of...a gap”; and (3) “the distance between the teeth’s edge and the corresponding edges of the aligner.” Petition, 53. But the Maninis COB neural network on which Petitioner relies, as well as the other neural networks with which the COB neural network is combined—**must** be trained on pixelwise labels; they cannot accept any other input. POR, 68; EX1028, ¶¶219-224. None of the proposed image attributes comprise pixelwise labels, and they are therefore unsuitable for use in a learning base in Petitioner’s combination.

By contrast, a neural network trained using an “image attribute value” would arrive directly at an image attribute value from its analysis (EX1001, 26:15-20):

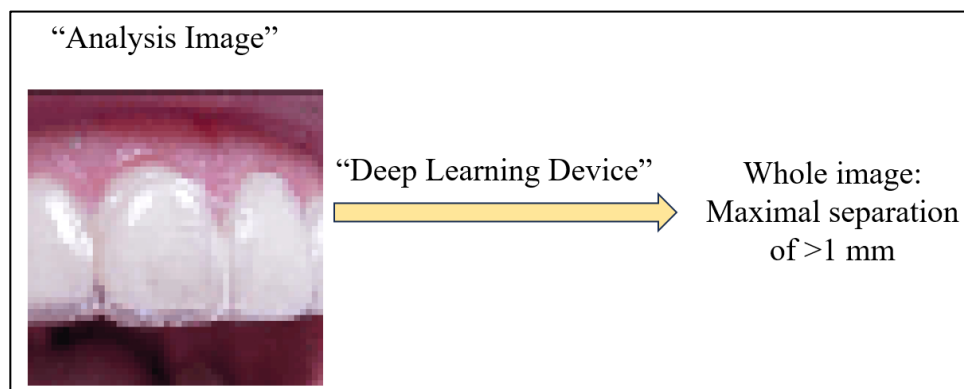


Figure D.

Just because an “image attribute” can be “determined as a function of” a “tooth attribute,” does not make them interchangeable. EX1001, 26:3-4; EX2028, ¶¶215, 225. As illustrated above, there is a substantive difference between training on attributes that “relate to” regions of pixels (or “tooth zones”) and attributes that “relate to” the whole image. Petitioner’s combination fails because it identifies no neural network that can be trained on and output image attributes, as required by claim 8.

X. Conclusion

Patent Owner respectfully submits that the Board should find all the challenged claims are patentable over the ground raised in the Petition.

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Certificate of Word Count

The undersigned hereby certifies that the portions of the above-captioned **DENTAL MONITORING SAS'S PATENT OWNER'S SUR-REPLY** has 5,582 words in compliance with the 5,600-word limit set forth in 37 C.F.R. §42.24. This word count was prepared using Microsoft® Word for Microsoft 365 MSO.

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Certificate of Service

Pursuant to 37 C.F.R. §42.6(e), the undersigned certifies that on November 15, 2024, a complete copy of **DENTAL MONITORING SAS'S PATENT OWNER'S SUR-REPLY** was served via electronic mail on the following counsel of record for Petitioner at the email addresses: mrosato@wsgr.com, margenti@wsgr.com, and pmedley@wsgr.com, as indicated in the Petition for electronic service to the following Petitioner counsel:

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