

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

QUALCOMM INCORPORATED,
Patent Owner.

IPR2018-01250
Patent 8,447,132 B1

Before TREVOR M. JEFFERSON, DANIEL J. GALLIGAN, and
AARON W. MOORE, *Administrative Patent Judges*.

GALLIGAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, Apple Inc. (“Petitioner”) challenges the patentability of claims 1, 5–8, and 13 of U.S. Patent No. 8,447,132 B1 (“the ’132 patent,” Ex. 1001), which is assigned to Qualcomm Incorporated (“Patent Owner”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, we determine that Petitioner has proven by a preponderance of the evidence that claims 1, 5–8, and 13 of the ’132 patent are unpatentable. *See* 35 U.S.C. § 316(e) (“In an *inter partes* review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”).

A. Procedural History

On June 26, 2018, Petitioner requested *inter partes* review of claims 1, 5–8, and 13 of the ’132 patent on the following grounds:

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)
1, 5–7	102(b)	Needham ²
1, 5–7	103(a)	Needham, Nonaka ³
8	103(a)	Needham, Dvir ⁴
8	103(a)	Needham, Nonaka, Dvir

¹ The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. §§ 102 and 103 that became effective after the filing of the application for the ’132 patent. Therefore, we apply the pre-AIA versions of these sections.

² US 2002/0181801 A1, published Dec. 5, 2002 (Ex. 1004).

³ US 2008/0007634 A1, published Jan. 10, 2008 (Ex. 1005).

⁴ US 2008/0291287 A1, published Nov. 27, 2008 (Ex. 1007).

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)
13	103(a)	Needham, Gallagher ⁵
13	103(a)	Needham, Nonaka, Gallagher

Paper 2 (“Pet.”). Patent Owner did not file a Preliminary Response. We instituted trial on all grounds of unpatentability. Paper 6 (“Dec. on Inst.”), 9. In IPR2018-01251, Petitioner separately challenges claims 1, 5–8, 11, and 14 of the ’132 patent.

During the trial, Patent Owner filed a Response (Paper 23, “PO Resp.”), Petitioner filed a Reply (Paper 25, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 30, “PO Sur-reply”).

A combined oral hearing for this *inter partes* review and for IPR2018-01251 was held on October 10, 2019, a transcript of which appears in the record. Paper 36 (“Tr.”).

B. The ’132 Patent and Illustrative Claim

The ’132 patent generally relates to techniques for improving images. Ex. 1001, 1:19–39, 2:7–17. One example given in the ’132 patent is directed to improving the visibility of a face in an image. Ex. 1001, 2:7–17. The ’132 patent explains that, when a digital picture is taken of a person in a dark part of a room with a bright window in the background, “the image sensor may not be able to acquire both the details of the bright view coming through the window and the details of the person’s face.” Ex. 1001, 1:28–33. According to the ’132 patent, conventional methods for improving the image, such as adjusting the exposure time or using dynamic range compression/enhancement methods, “still tend to produce images that lack

⁵ US 6,891,977 B2, issued May 10, 2005 (Ex. 1006).

details which are important to the end user.” Ex. 1001, 1:35–39. To address this purported problem, the ’132 patent discloses the following:

[T]he technique introduced here includes a method and apparatus for dynamic range correction based on image content. Known prior techniques of dynamic range correction do not take into consideration or use the content of an image, at least to the extent such content has semantic significance (meaning) to a human viewer. For example, such methods do not consider or apply the principle that showing the details of certain types of objects depicted in an image often should have higher priority than the rest of the image. As a more specific example, in many instances showing the details of a person’s face in the foreground of an image should be given higher priority than showing the details of a view in the background of the image. The technique introduced here considers and applies this principle in performing dynamic range correction.

Ex. 1001, 2:36–50.

Of the challenged claims, claim 1 is the only independent claim and is reproduced below.

1. A method comprising:

determining whether a first portion of digital image data represents a physical object of a predetermined type;

determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type;

applying the determined correction to the first portion of the digital image data to enhance a visual characteristic of the first portion of the digital image data, by applying a first amount of the correction to the first portion of the digital image data; and

applying a second amount of the correction to a second portion of the digital image data, wherein the first amount differs from the second amount, and wherein the first amount corresponds to a physical object of the predetermined type.

Ex. 1001, 11:30–47.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner’s declarant, Dr. Alan Bovik,⁶ offers the following assessment as to the level of ordinary skill in the art:

A person of ordinary skill in the art as of the Critical Date⁷ (a “POSITA”) would have had a Bachelor of Science degree in computer science or a similar technical field together with 3-5 years of educational practicum or work experience in the field of computer vision and/or image processing.

Ex. 1003 ¶ 7. Citing the testimony of its declarant, Dr. John Villasenor, Patent Owner argues that the level of ordinary skill in the art would have been that of a person with “a Bachelor of Science degree in electrical engineering, computer science, or a related discipline, and 2-3 years of experience in image processing.” PO Resp. 9 (citing Ex. 2001 ¶¶ 30–32). Patent Owner also argues that, “[a]lthough this definition differs from that proposed by petitioner, the difference would not change the actions of this proceeding.” PO Resp. 9.

⁶ Petitioner submitted the declaration of Dr. Larry Davis with its Petition, but, due to Dr. Davis’s unavailability for deposition, Petitioner sought to enter a substitute declaration in the record. We held a call with the parties to discuss the issue. On the call, the parties agreed to a general framework for dealing with the situation. Paper 11. After the call, the parties met and conferred and emailed us with their proposed solution to allow Petitioner to serve and file a substitute declaration (Ex. 3001), and we authorized the parties to proceed as agreed (Paper 11). Petitioner filed Dr. Bovik’s declaration as Exhibit 1003 and moved unopposed to expunge Dr. Davis’s declaration. Paper 13. We granted Petitioner’s unopposed motion and expunged Dr. Davis’s declaration. Paper 20.

⁷ Dr. Bovik identifies the Critical Date as December 9, 2009, the date of filing of US Provisional Application 61/285,063, to which the ’132 patent purports to claim priority. Ex. 1003 ¶ 6.

Neither party explains in detail why its proposed level of ordinary skill in the art should be adopted. Although there are slight differences between the proposed levels of ordinary skill in the art, the parties' declarants agree that a person with a Bachelor of Science degree in a field such as computer science and professional experience in image processing would qualify as a person of ordinary skill in the art. Ex. 1003 ¶ 7; Ex. 2001 ¶ 30. Based on the evidence of record, including the testimony of the parties' declarants, the subject matter at issue, and the prior art of record, we determine that the skill level of a person of ordinary skill in the art would have been that of a person having a Bachelor of Science degree in electrical engineering, computer science, or a related discipline, and three years of experience in image processing. We apply this level of ordinary skill in the art in our analysis.

B. Claim Interpretation

In an *inter partes* review for a petition filed before November 13, 2018, a claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears. 37 C.F.R. § 42.100(b) (2018); *see* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018). The Petition was accorded a filing date of June 18, 2018, and, therefore, the broadest reasonable interpretation standard for claim interpretation applies. *See* Paper 5 (Notice of Filing Date Accorded to Petition).

In applying a broadest reasonable interpretation, claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *See In*

re Translogic Tech., Inc., 504 F.3d 1249, 1257 (Fed. Cir. 2007). This presumption may be rebutted when a patentee, acting as a lexicographer, sets forth an alternate definition of a term in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Furthermore, only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

1. Physical Object of a Predetermined Type

Petitioner proposes a construction for “physical object of a predetermined type.” Pet. 3–4. There is no dispute between the parties that the art teaches “determining whether a first portion of digital image data represents a physical object of a predetermined type,” and, therefore, we agree with Patent Owner that this term does not require express construction. *See* PO Resp. 7–8.

2. Gain

Patent Owner argues that “gain” is “an attribute that relates to brightening or darkening a region of an image.” PO Resp. 8 (citing Ex. 2001 ¶ 107). Petitioner does not dispute that Patent Owner’s construction is within the broadest reasonable interpretation of gain but instead argues that “gain” is not limited to brightening or darkening. Pet. Reply 1–3. Because, as explained below, the asserted prior art teaches “gain” under Patent Owner’s construction, we need not determine the full scope of the term “gain” to resolve the dispute before us. *See Nidec*, 868 F.3d at 1017. Rather, we apply Patent Owner’s proposed construction in our analysis below.

3. *Gain Map*

Patent Owner argues that “gain map” is “a representation of a plurality of gain values corresponding to different locations of an image.” PO Resp. 8 (citing Ex. 2001 ¶ 107). Petitioner does not dispute that Patent Owner’s construction is within the broadest reasonable interpretation of “gain map”; rather, Petitioner’s dispute as to this term centers on the broadest reasonable interpretation of “gain,” discussed above. Pet. Reply 1–3. Because, as explained below, the asserted prior art teaches “gain map” under Patent Owner’s construction, we need not determine the full scope of the term “gain map” to resolve the dispute before us. *See Nidec*, 868 F.3d at 1017. Rather, we apply Patent Owner’s proposed construction in our analysis below.

4. *Matched*

Claim 1 recites “determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type.” Patent Owner argues that “in the context of the claims and specification of the ‘132 Patent,” the term “matched” “mean[s] that a correction is ‘predetermined or assigned to’ an object type.” PO Sur-reply 4. Patent Owner argues, therefore, “that the correction must be predetermined or assigned to a particular object type, and that ‘matched’ requires more than mere happenstance application of a correction to a particular object type (*e.g.*, when a correction is applied to an entire image regardless of the presence/absence of the object type).” PO Sur-reply 5.

Patent Owner’s argument suffers the very defect that Patent Owner alleges in Petitioner’s contentions, namely that it “effectively eliminate[s]

the plain meaning of the claim structure and language.” *See* PO Sur-reply 5. In particular, Patent Owner’s argument that “matched” means that a correction is “predetermined or assigned to” a particular object renders meaningless the recited step of “determining a correction to apply” based on determining that the object was detected. If the correction has already been determined—“predetermined”—why does it need to be determined again? Thus, we question Patent Owner’s proposed construction.

Although the term “matched” does not appear in the written description of the ’132 patent, Patent Owner cites various disclosures in the ’132 patent that it contends describe the matching required in claim 1. PO Sur-reply 4–7. Patent Owner argues the following:

As a further example of matching, the ‘132 Patent describes that “a single gain lookup table contains one or more values to be used for specified image content (e.g., faces) and separate values to be used for other image content, and the DRC [(dynamic range correction)] unit selects the appropriate value for a given input pixel from the lookup table according to whether that pixel is part of a specified type of object” and that, in another embodiment, “a particular gain lookup table is provided for specific image content (e.g., faces) and a separate gain look up table is provided for all other content.” APPLE-1001, 3:12-27. A set of gain values or specific gain table for specific image content, such as a set of gain values or specific gain table applied to all faces, is a correction that is applied to faces because they are faces, i.e., a correction that is matched to faces. *See* EX2001, ¶51.

Thus, the ‘132 Patent describes a process in which a set of gain values are in a gain lookup table are predetermined or assigned to a predetermined object type. *See* APPLE-1001, 3:12-22; EX2001, ¶51.

PO Sur-reply 6.

Patent Owner's discussion here is helpful in understanding the claim in light of the description in the Specification of the '132 patent. As Patent Owner acknowledges in the passage quoted above, the Specification of the '132 patent describes that dynamic range correction is applied to the whole image but that the gains applied in that correction operation depend on objects identified in the image. The '132 patent states that "the DRC unit selects the appropriate value for a given input pixel from the lookup table according to whether that pixel is part of a specified type of object" and that "the DRC unit uses a weighting factor (effectively, another game) to modify the gain obtained/calculated from the lookup table, according to whether the input pixel is part of a specified type of object." Ex. 1001, 3:12–22. Other passages of the '132 patent cited by Patent Owner (*see* PO Sur-reply 5) also confirm that dynamic range correction is applied but the amount of the correction depends on the object detected. Ex. 1001, 5:52–60 (describing Figure 7 as illustrating "an example of the effects of dynamic range correction, such as may be done by using the gain lookup table 207"), 5:65–67 (describing how DRC unit 117 uses a lookup table having gain values pertaining to pixels that are part of a detected object, such as a face, and pixels that are not part of that object).

For the reasons explained above, we question whether Patent Owner's proposed construction of "matched" as "predetermined or assigned to" is appropriate given that it appears to vitiate the step of "determining a correction to apply," but we agree with Patent Owner's characterization of the claimed invention as encompassing one in which a particular correction operation, such as dynamic range correction, is applied but the actual correction that occurs depends on the detection of "a physical object of a predetermined type" and the correction values associated with ("matched

to”) that predetermined type. Indeed, this is what the ’132 patent describes as its contribution to the field. Ex. 1001, 2:36–41 (“[T]he technique introduced here includes a method and apparatus for dynamic range correction based on image content. Known prior techniques of dynamic range correction do not take into consideration or use the content of an image, at least to the extent such content has semantic significance (meaning) to a human viewer.”); *see In re Smith Int’l, Inc.*, 871 F.3d 1375, 1383 (Fed. Cir. 2017) (stating that the broadest reasonable interpretation “is an interpretation that corresponds with what and how the inventor describes his invention in the specification, i.e., an interpretation that is consistent with the specification”) (internal quotations and citations omitted).

We apply this understanding of the claims in our analysis of the teachings of the prior art below.

C. Principles of Law

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Although the elements must be arranged or combined in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (citing *In re Bond*, 910 F.2d 831, 832–33 (Fed. Cir. 1990)).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying

factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations, if in evidence.⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*D. Anticipation by Needham
(Claims 1 and 5–7)*

Petitioner contends claims 1 and 5–7 of the ’132 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Needham. Pet. 2, 6–7, 10–16, 18, 20–22.

1. Needham

Needham is directed to image correction and enhancement and, like the ’132 patent, describes detecting objects, such as human faces in an image, and performing certain correction operations based on detecting the presence of the object in the image. Ex. 1004, code (57), ¶ 17.

2. Claim 1

a) First “determining” step

Independent method claim 1 is reproduced above and recites “determining whether a first portion of digital image data represents a physical object of a predetermined type.” Petitioner contends Needham’s disclosure of detecting types of image features in an image, such as a human face, describes this limitation. Pet. 11 (citing Ex. 1004 ¶¶ 1, 17, 26, 28–30, Figs. 2–5). We agree, and we find Needham describes this subject matter because it discloses that “automated feature detection unit 250 detects, from the input image 110, the types of image features that are specified by the

⁸ Patent Owner does not present any objective evidence of nonobviousness (i.e., secondary considerations) as to any of the challenged claims.

feature types 220” and also discloses that “a specified image feature may correspond to a human face, a building, an animal, etc.” Ex. 1004 ¶¶ 17, 26; *see also* Ex. 1001, 2:33–35 (“Techniques for detecting faces and other arbitrary objects and patterns in an image are known in the art and are therefore not described in detail herein.”).

b) Second “determining” step and the “applying” steps

The remaining limitations of claim 1 are as follows:

determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type.

applying the determined correction to the first portion of the digital image data to enhance a visual characteristic of the first portion of the digital image data, by applying a first amount of the correction to the first portion of the digital image data; and

applying a second amount of the correction to a second portion of the digital image data, wherein the first amount differs from the second amount, and wherein the first amount corresponds to a physical object of the predetermined type.

As discussed above in the section addressing claim construction, we agree with Patent Owner’s characterization of the claimed invention as encompassing one in which a particular correction operation, such as dynamic range correction, is applied but the actual correction that occurs depends on the detection of “a physical object of a predetermined type” and the correction values associated with (“matched to”) that predetermined type.

Petitioner contends Needham discloses that “feature-based image correction is performed based on configuration parameters that include feature type(s), feature weight(s), and correction parameter(s).” Pet. 12

(citing Ex. 1004 ¶ 22, Fig. 2). According to Petitioner, “[a] correction parameter defines the correction operation (e.g., maximize the intensity dynamic range (i.e., enhance the contrast)) and the operational parameter (e.g., specified dynamic range) used during the correction operation.”

Pet. 12–13 (citing Ex. 1004 ¶¶ 19–20, 24, 31–32, Fig. 7).

Needham discloses the following:

Different image features may also be considered with different importance. For example, human faces may be considered as more important than buildings in the input image 110. To accomplish this for example, weights may be assigned to different image features to specify their relative importance. Such weights may be used to control the correction parameter(s) during the correction. For instance, if the correction operation of maximizing intensity dynamic range is applied to both human faces and buildings and a human face feature has a higher weight than a building feature, the intensity dynamic range used for correcting human faces in an image may be larger (corresponding to higher contrast) than that used for correcting buildings in an image. In this way, the human faces may be corrected so that they become more visible than buildings.

Ex. 1004 ¶ 22. Thus, according to Petitioner,

Needham discloses applying a weight assigned to human face features (i.e., a first amount of the correction corresponding to the physical object of the predetermined type) when correcting the dynamic range of a human face, and applying a lower weight assigned to building features (i.e., a second, different amount of the correction) when correcting the dynamic range of buildings.

Pet. 16.

Patent Owner argues that Needham’s disclosure in paragraph 22 does not describe the claimed subject matter. PO Resp. 11–23. For example, Patent Owner argues that “Needham describes in paragraph 22 a goal for the dynamic range correction, but does not disclose in this example the actual corrections being applied to the face and the building to obtain the indicated

visibility.” PO Resp. 13. We disagree. Needham discloses a larger dynamic range correction for a face than for a building if the face has a higher weight (“considered as more important”) than a building, such that “the human faces may be corrected so that they become more visible than buildings.” Ex. 1004 ¶ 22. In a passage cited by Patent Owner in support of its claim interpretation, the ’132 patent states that “the DRC [(dynamic range correction)] unit uses a weighting factor . . . to modify the gain obtained/calculated from the lookup table, according to whether the input pixel is part of a specified type of object.” Ex. 1001, 3:19–22, *cited in* PO Sur-reply 4–7. Needham and the ’132 patent, therefore, both describe determining a dynamic range correction based on identifying a face in the image and finding associated weights to apply in the correction operation. Ex. 1004 ¶ 22; Ex. 1001, 3:12–27. Furthermore, Patent Owner’s statement that “weights themselves are not corrections” (PO Resp. 19) is correct insofar as the correction is dynamic range correction performed according to the weights in Needham. *See* Ex. 1004 ¶ 22. But this disclosure of Needham is precisely what the ’132 patent discloses in performing dynamic range correction based on gain and weight values pertaining to particular objects, and, as discussed extensively above, this is the subject matter that Patent Owner contends claim 1 encompasses. *See* Ex. 1001, 3:12–27; *see also* PO Sur-reply 4–6. Accordingly, Patent Owner’s arguments support the finding that Needham describes the subject matter of claim 1 of the ’132 patent.

Patent Owner argues that “Needham does not describe the cause-effect relationship that a determined type of physical object results in the particular correction that is applied to the objects of that type in the image” and that, “[t]o be ‘matched,’ a particular correction must be applied to a

particular physical object because it is that particular type.” PO Resp. 15 (citing Ex. 2001 ¶ 51). Paragraph 22 of Needham, however, expressly discloses applying dynamic range correction to human faces differently from buildings because “human faces may be considered as more important than buildings.” Ex. 1004 ¶ 22.

Patent Owner also argues the following in reference to Needham: “That correction parameters are specified for each feature is insufficient to demonstrate that the correction parameters are ‘matched’ to a particular object type.” PO Resp. 15 (citing Ex. 2001 ¶ 51). Yet, in characterizing the ’132 patent, Patent Owner argues the following: “A set of gain values or specific gain table for specific image content, such as a set of gain values or specific gain table applied to all faces, is a correction that is applied to faces because they are faces, i.e., a correction that is matched to faces.” PO Sur-reply 6 (citing Ex. 2001 ¶ 51). We fail to see a distinction between these two disclosures. Needham discloses that automated feature-based image correction mechanism 120 identifies “the set of specified image features” and that “a specified image feature may correspond to a human face, a building, an animal, etc.” Ex. 1004 ¶ 17. And, as Patent Owner acknowledges in the quote above (PO Resp. 15), Needham specifies correction parameters for each feature. *See also* Ex. 1004 ¶ 35 (“For each detected image feature, the corresponding correction parameters are retrieved 860.”). Thus, Needham’s disclosure of specifying correction parameters for feature types falls squarely within Patent Owner’s explanation of how the ’132 patent describes matching.

Patent Owner also cites testimony from Petitioner’s declarant, Dr. Bovik, stating that, in paragraph 22 of Needham, dynamic range correction would occur even in the absence of a face, and Patent Owner

argues that, “[i]f Needham’s correction happens even in the absence of an object, then that correction is not matched to the object.” PO Resp. 15–16 (citing Ex. 2004, 112:3–16, 112:18–20). Patent Owner’s argument, however, ignores Needham’s express disclosure, which describes an input image having a face. To the extent Patent Owner’s argument is that prior art cannot describe the claimed subject matter unless it expressly prohibits putting all image data through the same correction regardless of whether a physical object of a predetermined type is found, this argument is directly contrary to the disclosure in the ’132 patent. As shown in Figure 1 of the ’132 patent, all image data go through dynamic range correction (DRC) unit 117, and, in describing the operation of DRC unit 117, the ’132 patent states that “a particular gain lookup table is provided for specific image content (e.g., faces) and a separate gain look up table is provided for all other image content.” Ex. 1001, 3:24–27, Figure 1. Patent Owner cites this disclosure four times in explaining how claim 1 should be interpreted. PO Sur-reply 4–6 (citing Ex. 1001, 3:12–27). Thus, the ’132 patent describes performing dynamic range correction on an image but using different values depending on what objects are detected. *See* PO Sur-reply 6 (in describing ’132 patent’s DRC operation, Patent Owner stating that “[a] set of gain values or specific gain table for specific image content, such as a set of gain values or specific gain table applied to all faces, is a correction that is applied to faces because they are faces, i.e., a correction that is matched to faces”). Furthermore, claim 1 is not directed to processing that happens if a physical object of a predetermined type is *not* found in the image. Rather, claim 1 is directed to a method in which “a first portion of digital image data represents a physical object of a predetermined type,” and paragraph 22 of Needham discloses human faces and buildings in an image.

For the reasons discussed above, we find Needham's disclosure of applying a larger intensity dynamic range to a face than a building where a face is considered more important than a building describes determining a correction to apply "wherein the determined correction is matched to the predetermined type" because the larger intensity dynamic range is applied because the face is detected and has a higher importance than the building. Ex. 1004 ¶ 22. Thus, we find Needham's disclosure of applying different amounts of correction to a face and a building in an image describes the second "determining" step and the "applying" steps of claim 1.

Patent Owner also argues that Needham's paragraph 32 demonstrates a lack of the claimed matching. PO Resp. 12. Needham discloses the following:

For each defined correction operation, one or more operational parameters 720 may be specified. For example, to perform the correction operation of enhancing the brightness 730 of an image feature, an intensity upper bound 750 may be specified as an operational parameter so that the brightest intensity in the corrected image feature will not exceed the defined upper bound. Such upper bound may be specified, for example, as a function of statistical properties of one or more image features in the input image 110. As another example, to enhance the contrast 740 of an image feature, an intensity dynamic range 760 may be specified as an operational parameter so that the contrast in the detected image feature will be scaled to the specified dynamic range. Similarly, the specified dynamic range 760 may be defined as a function of statistical properties of one or more image features detected from the input image 110. *The operational parameter(s) may also specify that different occurrences of a same image feature type (e.g., different human faces) in an image receive a differing correction operation.* For example, the intensity dynamic range used for correcting a particular human face may be determined according to the size of the face detected. The larger the face (e.g., closer to the

camera), the larger the dynamic range that may be used (so that the face can be seen more clearly).

Ex. 1004 ¶ 32 (emphasis added).

Patent Owner argues that this disclosure shows “multiple objects of the same type receiving different corrections” (PO Resp. 12) and shows that “operational parameters can include different dynamic ranges that may be used for objects of the *same type*” (PO Sur-reply 8). Patent Owner further argues the following:

[T]he correction—enhancing the contrast 740—is not applied in a first amount to the predetermined object type (faces) and in a second amount to another portion of the image. Indeed, when a correction of “enhancing the contrast 740” is applied only to faces (*see* APPLE-1004, [0031] (operation mode 705 = individual features)), Needham’s paragraph [0032] does *not* disclose that “enhancing the contrast 740” is applied in a different amount to another portion of the image. APPLE-1001, Cl. 1. Likewise, when a correction of “enhancing the contrast 740” is applied to the entire image (*see* APPLE-1004, [0031] (operation mode 705=entire image)), Needham’s paragraph [0032] does *not* disclose that “enhancing the contrast 740” is selected based on the detection of the predetermined object type (face/s). APPLE-1001, Cl. 1.

PO Sur-reply 9–10.

Patent Owner’s arguments fail to appreciate the scope of independent claim 1. In particular, claim 1 recites “applying a second amount of the correction to a second portion of the digital image data, wherein the first amount differs from the second amount, and wherein the first amount corresponds to a physical object of the predetermined type.” Claim 1 does not preclude the “second portion of the digital image” from also representing a “physical object of the predetermined type.” By contrast, claim 7, which depends from claim 1, recites “determining that the second portion of the

digital image data does not represent a physical object of the predetermined type.” Needham’s paragraph 32 disclosure falls squarely within the scope of claim 1 because different portions of the image (represented by different human faces) receive differing corrections, specifically differing dynamic range corrections. In particular, Needham discloses that “different occurrences of a same image feature type (e.g., different human faces) in an image receive a differing correction operation” and that “the intensity dynamic range used for correcting a particular human face may be determined according to the size of the face detected,” such that “[t]he larger the face (e.g., closer to the camera), the larger the dynamic range that may be used (so that the face can be seen more clearly).” Ex. 1004 ¶ 32. Thus, in paragraph 32, Needham describes determining whether a first portion of an image represents a human face and determining and applying a correction to that portion based on the detection of a face, and it also describes applying a second, different amount of the correction, e.g., dynamic range correction, to a different portion of the image represented by a different human face. As such Needham’s paragraph 32 describes the subject matter of claim 1.

c) Determination of unpatentability of claim 1

For the reasons discussed above, we find Needham describes all of the limitations of claim 1. Having considered the full record developed during trial, we determine Petitioner has demonstrated by a preponderance of the evidence that claim 1 of the ’132 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Needham.

3. Claims 5 and 6

Claims 5 and 6 depend directly from claim 1. Petitioner presents persuasive arguments and evidence showing how Needham describes the subject matter recited in these claims. *See* Pet. 18 (claim 5), 20 (claim 6).

Claim 5 recites

wherein applying the determined correction to the first portion of the digital image data comprises applying a first amount of a parameter to the first portion to enhance the visual characteristic, wherein the first amount of the parameter is different from a second amount of the parameter applied to a second portion of the digital image data, resulting in a first portion of a digital image that corresponds to the first portion of digital image data being brighter than if the second amount of the parameter were applied to both the first portion and the second portion of the digital image data.

Petitioner contends Needham's disclosure of applying different weights to faces and buildings in maximizing intensity dynamic range to make faces more visible than buildings describes this subject matter. Pet. 18 (citing Ex. 1004 ¶¶ 19, 20, 22, 26, 27, 29–31, 35, Figs. 2, 6). As discussed above, Needham discloses assigning different weights “to different image features to specify their relative importance” so that,

if the correction operation of maximizing intensity dynamic range is applied to both human faces and buildings and a human face feature has a higher weight than a building feature, the intensity dynamic range used for correcting human faces in an image may be larger (corresponding to higher contrast) than that used for correcting buildings in an image. In this way, the human faces may be corrected so that they become more visible than buildings.

Ex. 1004 ¶ 22.

Claim 6 recites “wherein the predetermined type of physical object represents facial attributes.” Petitioner contends “Needham discloses that ‘a specified image feature may correspond to a human face.’” Pet. 20 (quoting Ex. 1004 ¶ 17).

Patent Owner refers to its arguments for claim 1 and does not separately address the additional limitations recited in claims 5 and 6. *See* PO Resp. 37.

Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claims 5 and 6 of the '132 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Needham.

4. Claim 7

Claim 7 recites that the method of claim 1 further comprises “determining that the second portion of the digital image data does not represent a physical object of the predetermined type; and determining a different amount of gain to apply to the second portion than an amount of gain determined for the first portion.”

As to the first “determining” step of claim 7, Petitioner contends “Needham describes an example (discussed above with respect to element [1c] of claim 1) where Needham's system determines that the first portion of the digital image data represents a human face (i.e., the claimed physical object of the predetermined type) and the second portion of the digital image data represents a building.” Pet. 21 (citing Ex. 1004 ¶¶ 17, 22). We agree with this contention, and we find Needham's disclosure of detecting, and processing differently, a human face and a building in an image describes “determining that the second portion of the digital image data does not represent a physical object of the predetermined type.” Ex. 1004 ¶ 22.

As to the second “determining” step of claim 7, Petitioner refers to its contentions with respect to claim 1 about applying different amounts of correction to the building than to the face. Pet. 22. Patent Owner argues

that “Needham does not disclose determining different amounts of gain (because weights are not gains)” and that “Needham merely discloses weighting different features and does not explicitly describe applying different amounts of gain to different portions of the same image.” PO Resp. 38–39. As an initial matter, we note that claim 7 does not require “applying” gain to the image but merely “determining” gain. By contrast, claim 1 recites two steps “applying” image corrections. Further, we disagree with Patent Owner that Needham does not describe determining different amounts of gain.

As discussed above, we apply Patent Owner’s definition of “gain” as “an attribute that relates to brightening or darkening a region of an image.” Petitioner argues that, under this interpretation, “Needham determines different amounts of gain for dynamic range correction of the face portion and the building portion of the image.” Pet. Reply 11 (citing Ex. 1022 ¶ 21). We agree. During the oral argument, counsel for Patent Owner explained that “[t]he dynamic range is the -- for a particular object -- in this case a face or a building -- the difference in brightness value between the darkest pixel and the lightest pixel.” Tr. 43:23–25. Thus, “an adjustment to dynamic range,” according to Patent Owner, “does relate to brightening and darkening.” Tr. 44:12–13. As discussed above, Needham discloses using a larger intensity dynamic range for correcting human faces than for correcting buildings in an image. Ex. 1004 ¶ 22. Patent Owner argues that “the amount of gain applied to two objects, even to reach two different dynamic intensity ranges, depends on the starting dynamic ranges of the respective objects ([Ex. 2001], ¶45), which is not given in Needham.” PO Sur-reply 15. Even so, Needham expressly discloses using a larger intensity dynamic range for correcting human faces than for correcting buildings in an

image (Ex. 1004 ¶ 22), and, as noted above, dynamic range adjustment relates to brightening and darkening. Thus, we find Needham discloses determining a different amount of gain for the building than for the face in an image. Ex. 1004 ¶ 22.

For these reasons, we find Needham describes the subject matter of claim 7. Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 7 of the '132 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Needham.

*E. Obviousness over Needham and Nonaka
(Claims 1 and 5–7)*

Petitioner contends claims 1 and 5–7 of the '132 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Nonaka. Pet. 2, 6–11, 12, 14–15, 16–17, 19–22.

1. Nonaka

Nonaka is directed to image processing and discloses that, when a face is detected in an image, an optimization processing section performs optimization processing of correcting the brightness and emphasizing the contrast of the face and the person. Ex. 1005 ¶ 64.

2. Claim 1

Petitioner relies on certain of Nonaka's teachings in combination with Needham to teach the claimed subject matter, and Petitioner argues a person of ordinary skill in the art would have had reason to combine the teachings of the references. Patent Owner argues that Nonaka does not teach a correction that is matched to a predetermined type of physical object, and Patent Owner also argues Petitioner has not established that a person of

ordinary skill in the art would have been motivated to combine the teachings or would have had a reasonable expectation of success in doing so.

PO Resp. 23–37; PO Sur-reply 16–21.

a) Correction matched to predetermined type of physical object

Claim 1 recites “determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type.”

As discussed above, Petitioner contends, and we agree, that Needham describes this subject matter. *See* Pet. 12–14. Petitioner also asserts the following:

When Nonaka’s system detects a face in a dark backlit region of the image, an optimization processing section 5b corrects the brightness of the face and emphasizes the contrast to improve visibility of the face in the dark backlit region. [Ex. 1005], [0029], [0050], [0058], [0064], Fig. 1. Nonaka’s system does not perform optimization processing when no face is detected. *Id.*, [0058]. Thus, Nonaka teaches determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type.

Pet. 14–15 (citing Ex. 1005 ¶¶ 29, 50, 58, 64, Fig. 1).

Patent Owner argues that, in Nonaka, the correction applied by optimization processing section 5b “is still applied when a face is not detected,” such as to brighten the dark part of an image when a face cannot be detected, and, therefore, “[i]f the brightening is performed regardless of whether the face is detected, then that brightening cannot be matched to the detection of a face object type.” PO Resp. 26–27 (citing Ex. 1005 ¶ 42; Ex. 2004, 152:22–153:1, 156:3–5). As Petitioner points out, however, the

processing described in Nonaka's paragraph 42, cited by Patent Owner, is the processing performed in order to detect a face. *See* Pet. Reply 12.

Nonaka discloses the following:

[W]hen the face is detected, the face detecting section 11 outputs a size and a position of the face in the screen to the MPU 1. In addition, in a case where the main subject is positioned at a dark part of the screen of the backlight scene or the like, the image is blackened, and a fine difference between the brightness and the darkness cannot be seen. *In this state, the face detecting section 11 cannot detect the face.* In such a backlight scene, to detect the face, the optimization processing section 5b and the exposure control section 12a perform processing and control so as to brighten the dark part as described later in detail.

Ex. 1005 ¶ 42 (emphasis added). Nonaka shows this processing in Figure 8, reproduced below.

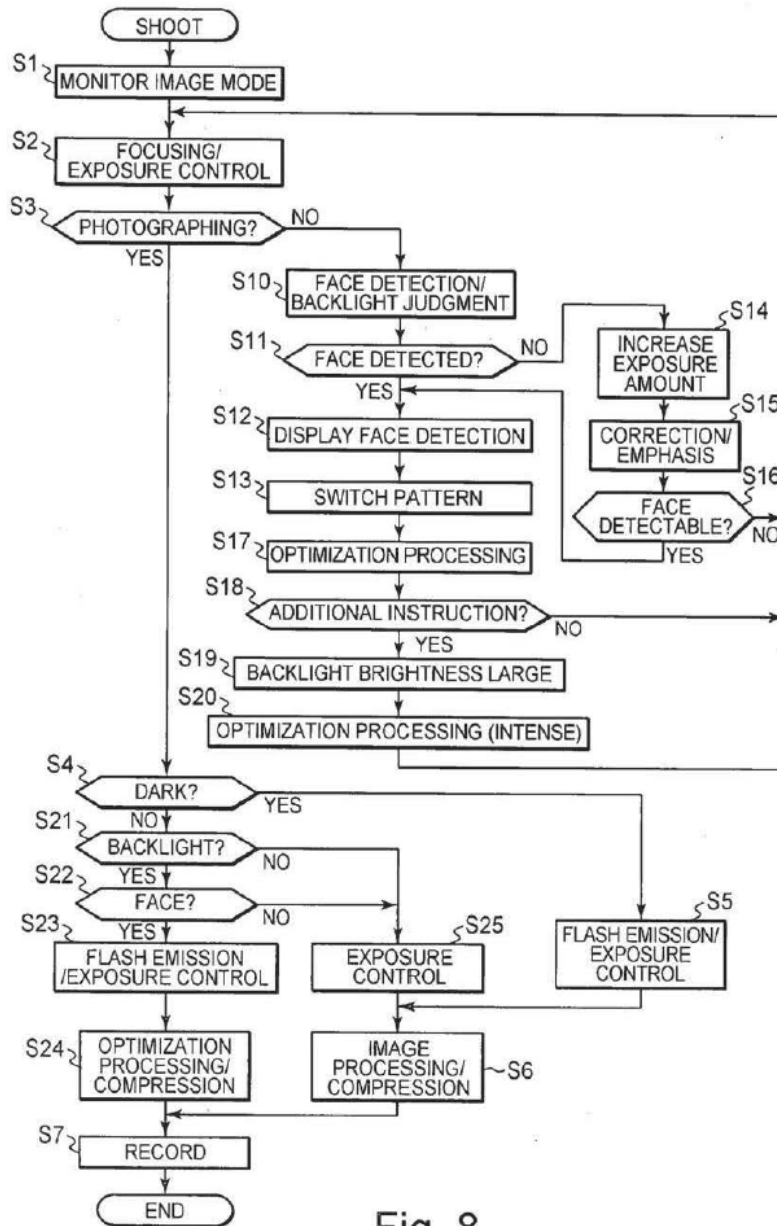


Fig. 8

Nonaka's Figure 8, reproduced above, "is a flow chart showing a procedure of control processing during the photographing when the optimization processing is mainly performed." Ex. 1005 ¶ 61. As shown in Figure 8 and described in Nonaka, when a face cannot be detected in step S11, the "NO" path leads to corrections in steps S14 and S15 to attempt to detect a face. Ex. 1005 ¶¶ 67–68. If a face can be detected, the "YES" path is followed, as shown in Figure 8.

Petitioner relies on the “optimization processing” of step S17. *See* Pet. Reply 12–13. Patent Owner argues that Petitioner “improperly proffers a new theory of mapping Nonaka to claim 1” in the Reply because “Petitioner’s previous mapping relied solely on paragraphs [0048]-[0050] of Nonaka as allegedly mapping to claim element [1c].” PO Sur-reply 16. Patent Owner argues that Petitioner’s reliance on Figure 8 and paragraphs 58, 63, 64, and 67–70 of Nonaka “is untimely and should be rejected.” We disagree. Petitioner’s contention at pages 14–15 of the Petition identifies, among others, paragraphs 58 and 64 of Nonaka, and Petitioner argues that, “[w]hen Nonaka’s system detects a face in a dark backlit region of the image, an optimization processing section 5b corrects the brightness of the face and emphasizes the contrast to improve visibility of the face in the dark backlit region” and that “Nonaka’s system does not perform optimization processing when no face is detected.” Pet. 14 (citing Ex. 1005 ¶¶ 29, 50, 58, 64, Fig. 1). Nonaka discloses that, “when the face is detected (step S11 YES), as shown in FIG. 4A, the optimization processing section 5b subjects the face part and the person to the optimization processing of correcting the brightness of the part and emphasizing the contrast (step S17).” Ex. 1005 ¶ 64. This language tracks Petitioner’s contention at page 14 of the Petition. Thus, we do not find Petitioner’s reliance on this disclosure in Nonaka untimely or improper.

Patent Owner also argues that the correction performed at step S17 may be performed at other times as well when a specific object is not detected and, therefore, the correction is not matched to the object. PO Sur-reply 17–18. We disagree because Nonaka discloses that “the optimization processing section 5b subjects the face part and the person to the optimization processing of correcting the brightness of the part and

emphasizing the contrast (step S17)” “when the face is detected (step S11 YES).” Ex. 1005 ¶ 64. That similar processing may occur under different circumstances does not take away from Nonaka’s express disclosure of performing it when a face is detected. Indeed, this is the “cause-effect relationship” Patent Owner argues the claim encompasses. *See* PO Resp. 26. Patent Owner also suggests that Nonaka does not teach the claimed matching because it discloses optimization processing of the “face part ***and the person,***” as opposed to merely the face part. PO Sur-reply 17 (citing Ex. 1005 ¶ 64). Performing the same processing on the body as well as the face does not take away from Nonaka’s teaching that the processing is performed as a result of detecting the face and is, therefore, “matched” to the face. Ex. 1005 ¶ 64.

For the foregoing reasons, we are persuaded Petitioner has shown Nonaka teaches “determining a correction to apply to the first portion of the digital image data, based on a determination that the first portion of the digital image data represents a physical object of the predetermined type, wherein the determined correction is matched to the predetermined type.”

b) Reason to combine and reasonable expectation of success

Petitioner argues combining Nonaka’s teachings with those of Needham would improve Needham “by providing functionality for improving visibility of a person in a backlit scene.” Pet. 8–9 (citing Ex. 1005 ¶¶ 3, 5, 8, 9, 43, 44; Ex. 1003 ¶¶ 61–62). Petitioner argues a person of ordinary skill in the art “would have been led by Nonaka to modify Needham to apply amplifying correction and contrast emphasis (i.e., dynamic range correction), enabling both the person and landscape portions of an image to be more easily distinguished and perceived.” Pet. 9 (citing Ex. 1003 ¶¶ 61–62). Petitioner further asserts that a person of ordinary skill

in the art “would have found it desirable to process image data at high speed and to improve visibility while the user is shooting the image, and Nonaka describes well-known components and techniques for doing so.” Pet. 9–10 (citing Ex. 1003 ¶ 63).

Patent Owner argues that “Needham already provides dynamic range correction” and “Needham’s algorithm already maximizes the dynamic range” and, therefore, that “there is no reason for a [person of ordinary skill in the art] to modify Needham’s dynamic range correction (DRC) with Nonaka’s DRC.” PO Resp. 29 (citing Ex. 1004 ¶ 19; Ex. 2001 ¶ 77).

Although Needham discloses a “correction operation of maximizing intensity dynamic range” (Ex. 1004 ¶ 22 (emphasis added)), we do not see this as disqualifying additional image processing prior art from being considered by a person of ordinary skill in the art addressing the problem of making certain portions of an image stand out based on their content. Petitioner argues that Nonaka’s teachings would benefit Needham by “improving visibility of a person in a backlit scene.” Pet. 8–9 (citing Ex. 1005 ¶¶ 3, 5, 8–9, 43–44; Ex. 1003 ¶¶ 61–62).

Patent Owner also argues that Nonaka teaches two processing paths—one for the displayed image and another for the captured image—and that a person of ordinary skill in the art would not modify Needham’s single path, post-capture processing architecture with a two-path architecture. PO Resp. 29–30 (citing Ex. 1005 ¶ 8; Ex. 2001 ¶¶ 65–66, 68, 71–76; Ex. 2004, 135:23–25). Patent Owner argues that “[t]hese two techniques require different implementations in a digital image processing system, and thus a [person of ordinary skill in the art] would not have combined these references.” PO Resp. 31 (citing Ex. 2001 ¶¶ 68–73). In a similar vein, Patent Owner argues that a person of ordinary skill in the art would not have

had a reasonable expectation of success in combining the teachings of Needham and Nonaka to arrive at the claimed subject matter based on the differences in the systems. PO Resp. 32–33. For example, Patent Owner argues that a person of ordinary skill in the art “would not expect success from combining the corrections and architectures of these two different dynamic range correction systems.” PO Resp. 33 (citing Ex. 2001 ¶¶ 65–76). Patent Owner also argues that Petitioner does not explain how the weights of Needham would be modified in view of Nonaka’s gain values to enhance the image. PO Resp. 32 (citing Ex. 2001 ¶¶ 74–77).

These arguments imply that Petitioner’s contentions fail for not setting forth a specific system design “combining the corrections and architectures of” Needham and Nonaka (PO Resp. 33). However, the Court of Appeals for the Federal Circuit has

consistently held . . . that “[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”

MCM Portfolio LLC v. Hewlett-Packard Co., 812 F.3d 1284, 1294 (Fed. Cir. 2015) (quoting *In re Keller*, 642 F.2d 413, 425 (CCPA 1981)).

Furthermore, whether Nonaka discloses processing live digital image data in the display or digital image data in a captured image is irrelevant because both scenarios encompass processing digital image data, which is what the claims require. See *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016) (“The reasonable expectation of success requirement refers to the likelihood of success in combining

references *to meet the limitations of the claimed invention.*” (emphasis added)). Thus, we find these arguments unavailing.

We are persuaded Petitioner has set forth sufficient articulated reasoning with rational underpinning to show that a person of ordinary skill in the art would have combined the teachings of Needham and Nonaka. In particular, Petitioner’s assertions that Nonaka’s teachings would have improved visibility of a person in a backlit scene (Pet. 8–9) are supported by Nonaka’s disclosure, which is directed to “cop[ing] with photographing of a scene such as a backlight scene having a large luminance difference.”

Ex. 1005 ¶ 3. Nonaka’s disclosure of optimization processing on the image based on detecting a face to improve facial visibility further supports Petitioner’s reasoning. *See* Ex. 1005 ¶ 64.

c) Determination of unpatentability of claim 1

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 1 of the ’132 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Nonaka.

3. Claims 5–7

As discussed above, we find Needham describes the subject matter of claims 5–7 and, therefore, anticipated these claims. Petitioner also contends these claims would have been obvious over the combined teachings of Needham and Nonaka, arguing that Nonaka teaches the limitations of these claims. Pet. 19–22.

As to claims 5 and 7, Petitioner argues Nonaka’s disclosure of applying different amounts of gain to the landscape and to the person in the image teaches different amounts of a “parameter” in claim 5 and different

amounts of “gain” in claim 7. Pet. 19–20 (citing Ex. 1005 ¶¶ 48–50, Fig. 4A; Ex. 1003 ¶ 57), 22 (citing Ex. 1005 ¶¶ 49–50, Fig. 4A). We are persuaded because Nonaka discloses applying a “gain 1” to landscape 30a and “perform[ing] the correction processing of the person 30b with a gain 2 as a correction value larger than that of the gain 1 to raise the luminance curve from F0 to F2.” Ex. 1005 ¶¶ 48–50.

As to claim 6, Petitioner argues Nonaka discloses determining whether a face is in the image and, therefore, teaches “wherein the predetermined type of physical object represents facial attributes.” Pet. 20 (citing Ex. 1005 ¶¶ 36, 42, 59, 63, Figs. 1, 7A, 7B, 8). We are persuaded because, as discussed above, Nonaka discloses detecting a face in an image. *See* Ex. 1005 ¶ 42 (“The face detecting section 11 detects, by use of the image data, whether or not a human face exists in the subject.”).

Patent Owner refers to its arguments against the combination of Needham and Nonaka for claim 1 and does not separately address Petitioner’s contentions that Nonaka teaches the subject matter recited in claims 5–7. *See* PO Resp. 37, 39.

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claims 5–7 of the ’132 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Nonaka.

*F. Obviousness over the Combinations of Needham and Dvir
and Needham, Nonaka, and Dvir
(Claim 8)*

Petitioner contends claim 8 of the ’132 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and

Dvir and over the combined teachings of Needham, Nonaka, and Dvir.
Pet. 2, 22–27.

1. Dvir

Dvir, titled “Dynamic Range Compensation by Filter Cascade,” discloses using a cascade of filters in image processing and determining the number of filters based on image content. Ex. 1007, codes (54), (57). Dvir discloses that “the local contrast may be controlled by selectively using various sections in cascade” and that “[v]arious spatial measurements may be used to characterize the image content. These measurements, which can be taken together with user preference for the amount of local contrast needed, can be used to adaptively determine which and how many sections will be used.” Ex. 1007 ¶¶ 33–34.

2. Claim 8

Claim 8 depends from claim 7 and recites “wherein determining the amount of gain to apply to the first portion of the digital image data comprises: determining the amount of gain to apply to the first portion of the digital image data so as to maintain local contrast of the first portion of the digital image data.”

a) Maintaining local contrast

Petitioner argues the following:

Dvir describes a dynamic range compensation (DRC) unit that includes cascaded two-dimensional low-pass filters. APPLE-1007, [0005]-[0006], [0012]-[0013], [0019]-[0026], Figs. 3, 4. Dvir discloses that the number of cascaded stages of the filters can be adaptively selected depending on the image content to control local contrast of the image. *Id.*, [0033]-[0036]. Dvir also discloses that user preference for the amount of local contrast can also be used to adaptively determine the number of cascaded stages of the filters. *Id.*, [0034].”

Pet. 27.

Dvir discloses the following:

The general embodiment of FIGS. 3 and 4 can include 2 or more cascaded stages. The particular number of active sections in the cascade can be adaptively selected using measurements from the whole image or from sub image block, so that a number sections ranging from one to all of the available sections are applied to the image. In the exemplary embodiments, each section contains a linear filter whose window support length increases with the section number; that is, again referring to FIG. 4, the LPF of section $n+1$ has larger support than LPF of section n . Since a narrow support filter can track changes more locally than a filter with wider support, *the local contrast may be controlled by selectively using various sections in cascade.*

Various spatial measurements may be used to characterize the image content. These measurements, which can be taken together with user preference for the amount of local contrast needed, can be used to adaptively determine which and how many sections will be used.

Ex. 1007 ¶¶ 33–34 (emphasis added).

Patent Owner attempts to distinguish the disclosure of Dvir by arguing that Dvir “does not disclose determining gains, let alone determining gains that maintain a local contrast as required by claim 8.” PO Resp. 41. Patent Owner also argues “the disclosure in Dvir that ‘the local contrast may be controlled’ refers to the local contrast at the output of the processing” but, “[b]y contrast, to ‘maintain’ local contrast requires specific consideration of the contrast before the processing as well as affirmative steps to ensure a similar output contrast—something that is not discussed in Dvir.” PO Resp. 41 (citing Ex. 1007 ¶ 33; Ex. 2001 ¶ 96).

We fail to see a distinction between the relied-upon disclosure of Dvir and the claimed subject matter given the similarity of disclosure between

Dvir and the '132 patent. The written description of the '132 patent does not use the word “maintain,” but it discloses that “local contrast may be controlled by selectively using various sections in cascade.” Ex. 1001, 9:32–35. This disclosure appears in a passage of the '132 patent that is nearly identical to the relied-upon disclosure of Dvir. *Compare* Ex. 1001, 9:23–53, *with* Ex. 1007 ¶¶ 33–36. The '132 patent elsewhere mentions “improv[ing] local contrast” (Ex. 1001, 3:28–32), not maintaining local contrast. This disclosure appears in a passage that is also nearly identical to disclosure in Dvir. *Compare* Ex. 1001, 3:28–34, *with* Ex. 1007 ¶ 12.

Patent Owner and Dr. Villasenor state that “to ‘maintain’ local contrast requires specific consideration of the contrast before the processing as well as affirmative steps to ensure a similar output contrast—something that is not discussed in Dvir.” PO Resp. 41; Ex. 2001 ¶ 96. Yet, as noted above, the '132 patent does not use the word “maintain,” and we see nothing in the '132 patent’s disclosure about controlling local contrast that provides the description Patent Owner and Dr. Villasenor say is required of the claim and, therefore, of the prior art. Patent Owner argues that “the ‘132 Patent at 9:28-53 discusses use of predetermined object types, in addition to the spatial measurements disclosed in Dvir at [0033]-[0036]” and that “Petitioner is incorrect that the cited portions of the ‘132 Patent are substantially the same as the cited portions of Dvir and is incorrect that Dvir includes all the teachings of local contrast that the ‘132 Patent contains.” PO Sur-reply 22. Although Patent Owner is correct that the '132 patent mentions “predetermined types of objects,” Petitioner relies on Needham’s disclosure of determining a gain for a first portion. *See* Pet. 26. Furthermore, the relied-upon disclosure of Dvir is in a section titled “Adaptively Selecting the Number of Stages Cascaded *Dependent on Image*

Content.” Ex. 1007 ¶ 32 (emphasis added). Importantly, the ’132 patent does not provide detail about what it means to “maintain local contrast” in addition to what is described in Dvir, and it does not explain “specific consideration of the contrast before the processing as well as affirmative steps to ensure a similar output contrast,” as allegedly required. *See* PO Resp. 41; Ex. 2001 ¶ 96.

Patent Owner also argues Dvir “does not convey anything specific about gain, or a relationship between determining a gain and maintaining local contrast.” PO Resp. 41 (citing Ex. 1007 ¶ 33). Patent Owner also argues that, “[w]hile Dvir discusses local contrast and gain calculation separately, Dvir does not disclose a link between the two.” PO Sur-reply 21 (citing Pet. 26–27; Ex. 2001 ¶¶ 95–96). We disagree. Dvir discloses “us[ing] a cascade of nonlinear edge preserving filters, and nonlinear pixel point operations, to calculate the pixel gain,” and the “cascade” of filters is what Dvir uses to control local contrast. Ex. 1007 ¶¶ 12, 33; *see* Pet. 27 (citing, *inter alia*, Ex. 1007 ¶¶ 12, 33).

Thus, we are persuaded that Dvir teaches determining the amount of gain to apply so as to maintain local contrast, and we are persuaded that this teaching, in combination with Needham’s and Nonaka’s disclosures of identifying portions of an image that correspond with particular image features (e.g., face and building) and processing sections with different features differently, teaches the subject matter of claim 8.

b) Reason to combine and reasonable expectation of success

Petitioner argues a person of ordinary skill in the art “would have found it desirable to refine the estimate of the enhancement gain for a pixel in order to achieve superior image quality, and Dvir describes well-known components and techniques for doing so.” Pet. 25 (citing Ex. 1007 ¶ 5;

Ex. 1003 ¶ 74). Petitioner also argues a person of ordinary skill in the art would have combined Dvir’s teachings with those of Needham and Nonaka “to determine the gain for dynamic range correction using a cascade of nonlinear edge preserving filters and nonlinear pixel point operations in order to achieve superior image quality.” Pet. 24 (citing Ex. 1003 ¶¶ 71–72).

Patent Owner argues that a person of ordinary skill in the art would not have combined the teachings of Needham and Dvir. PO Resp. 41–43; PO Sur-reply 21–23. For example, Patent Owner argues that combining Dvir’s teachings of filters “would add complexity to the hardware and/or software implementing Needham’s processing and the parameters needed to implement those filters” and that “edge-preserving filters, such as those in Dvir, can result in degradation to the image being processed with the filters because of the difficulties in localizing edges in the image.” PO Resp. 42 (citing Ex. 2001 ¶¶ 85–86).

As the U.S. Court of Appeals for the Federal Circuit has stated, “a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). “Instead, the benefits, both lost and gained, should be weighed against one another.” *Id.* (quoting *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000)). Here, the benefits of “superior image quality” are not in dispute. Patent Owner states that “Dvir employs the nonlinear edge preserving filters in an attempt to ‘achieve superior image quality as compared to previous image dynamic range compensation approaches, while preserving edge detail.’” PO Resp. 40 (quoting Ex. 1007 ¶ 5). Dvir explains that “[t]he described methods and corresponding apparatus provide ways to

achieve superior image quality as compared to previous image dynamic range compensation approaches.” Ex. 1007 ¶ 5; *see* Pet. 25 (citing Dvir paragraph 5 in support of contention that a person of ordinary skill in the art “would have found it desirable to refine the estimate of the enhancement gain for a pixel in order to achieve superior image quality, and Dvir describes well-known components and techniques for doing so”). Thus, although there may be disadvantages to relying on Dvir’s teachings in terms of some additional complexity, Dvir expressly states that its disclosure helps “achieve superior image quality as compared to previous image dynamic range compensation approaches” (Ex. 1007 ¶ 5), which we find would have motivated a person of ordinary skill in the art to use Dvir’s teachings despite the possible additional complexity.

Patent Owner also argues that “Dvir has no awareness of objects within the image and thus applies its filters indiscriminately of the locations of objects.” PO Resp. 43 (citing Ex. 2001 ¶¶ 99–100). Dr. Villasenor testifies that

the combination of Dvir with Needham alone or Needham in view of Nonaka would result in the system of cascaded filters disclosed in Dvir being applied in ways that would mix the processing of objects and non-objects in a way that would undermine the image recognition aspect that is a core feature of claim 1 and all claims that depend from it.

Ex. 2001 ¶ 100. As noted above, however, Dvir discloses using cascaded filters to control local contrast in a section titled “Adaptively Selecting the Number of Stages Cascaded *Dependent on Image Content*.” Ex. 1007 ¶ 32 (emphasis added). Dvir discloses that “[v]arious spatial measurements may be used to characterize the image content.” Ex. 1007 ¶ 34. Thus, Dvir discloses adapting the number of filter sections to be used based on image

content. Ex. 1007 ¶¶ 33–36. Petitioner contends that a person of ordinary skill in the art “would have been motivated to adaptively select the number of cascaded stages of the filters based on the image content and user preference so as to maintain local contrast of *the first portion of the digital image data*.” Pet. 27 (emphasis added) (citing Ex. 1003 ¶ 71). Thus, Petitioner’s contention is that a person of ordinary skill in the art would have combined Dvir’s teachings of selecting the number of cascaded filters based on image content with Needham’s disclosures of identifying portions of an image that correspond with particular image features (e.g., face and building) and processing sections with different features differently, as discussed above in detail. Thus, Patent Owner’s argument about indiscriminate application of filters and Dr. Villasenor’s testimony about mixing processing of objects and non-objects are not responsive to the contentions of obviousness.

Patent Owner also argues that “Petitioner does not provide an explanation for how Needham determines gains. Without an explanation as to how Needham determines gains, Petitioner cannot demonstrate that a modification of Needham would be operable, would result in predictable results, or would result in maintaining local contrast as required by claim 8.”

PO Resp. 43 (citing Ex. 2001 ¶¶ 88–98). Patent Owner also argues that

the reengineering necessary to modify the edge-preserving filters that work on a neighborhood of pixels around a certain pixel as in Dvir to instead work on detected objects, and the uncertainty of such a modification would have clearly discouraged a [person of ordinary skill in the art] from the combination.

PO Sur-reply 23 (citing PO Resp. 41–43; Ex. 2001 ¶¶ 84–101).

We do not agree that any alleged difficulty in adapting from operations on pixels to operations on objects would have been an

impediment to combining the teachings of Needham and Dvir because the objects in the image are made up of pixels. Thus, operations that are applied to objects in an image are applied to pixels within the object. Detecting objects in an image was known in the prior art, which is why the '132 patent states that it does not describe such techniques. Ex. 1001, 2:33–35; *see also* Ex. 1004 ¶ 26 (Needham disclosing that “feature detection may be performed using any technique or algorithm for detecting features in an image as should be known to those skilled in the art”). As discussed above, Needham discloses performing dynamic range correction on certain objects in an image when those objects are detected, and, thus, it discloses operating on the pixels of which those objects are composed. Thus, we credit Dr. Bovik’s testimony that “[c]ombining Dvir’s dynamic range correction technique with Needham, alone and/or in combination with Nonaka, produces no more than expected results and is within the capability of a” person of ordinary skill in the art. Ex. 1003 ¶ 74.

We are persuaded that Petitioner has set forth articulated reasoning with rational underpinning to show why a person of ordinary skill in the art would have combined these teachings and that Petitioner has shown that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings to arrive at the claimed subject matter. *See* Pet. 24–26; Ex. 1003 ¶¶ 69–74. In particular, Dvir itself explains that its disclosed processing “achieve[s] superior image quality as compared to previous image dynamic range compensation approaches,” which is an express disclosure of the prior art showing a benefit to pursuing the combination. Ex. 1007 ¶ 5.

c) Determination of unpatentability of claim 8

Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 8 of the '132 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Dvir and over the combined teachings of Needham, Nonaka, and Dvir.

G. Obviousness over the Combinations of Needham and Gallagher and Needham, Nonaka, and Gallagher (Claim 13)

Petitioner contends claim 13 of the '132 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Gallagher and over the combined teachings of Needham, Nonaka, and Gallagher. Pet. 2, 28–33.

1. Gallagher

Gallagher relates to digital image processing and discloses generating a gain map indicating gain to apply pixel-by-pixel or region-by-region to an image based on semantic labels indicating the type of content in an image, such as flesh or sky. Ex. 1006, 6:25–37.

2. Claim 13

Claim 13 recites:

A method as recited in claim 7, wherein determining the amount of gain to apply to the first portion of the digital image data comprises:

modifying a gain map based on the determination that the first portion of the digital image data represents a physical object of the predetermined type; and

wherein applying the determined amount of gain to apply to the first portion of the digital image data comprises obtaining

the amount of gain to apply to the first portion of the digital image data from the gain map.

With respect to claim 7, discussed above, we find Needham describes, and the combination of Needham and Nonaka teaches, determining a different amount of gain for two different portions of an image. Claim 13 additionally recites the use of a “gain map,” which encompasses “a representation of a plurality of gain values corresponding to different locations of an image.” Our findings as to claim 7 already show how Needham describes, and the combination of Needham and Nonaka teaches, “a plurality of gain values corresponding to different locations of an image.” Thus, under Patent Owner’s proposed interpretation, claim 13’s recitation of a “gain map” adds the requirement of modifying and using some “representation” of those values in determining and applying gain.

Gallagher provides such a “representation” by disclosing a gain map as follows:

[T]he image $i(x,y)$ is passed into the gain map generator 2. The purpose of the gain map generator 2 is to create a map indicating the gain of the sharpening operation on a pixel-by-pixel or region-by-region basis based on semantic labels derived from pattern recognition. The gain map is a control signal used to determine the level of sharpening to apply on a pixel-by-pixel basis.

Ex. 1006, 6:25–31. Gallagher explains that “the term semantic refers to the meaning that would be assigned to a region by an observer. For example, the semantic content of a region may be an object such as a human face, a building, a cloud, or the sky.” Ex. 1006, 3:45–48. Thus, Gallagher discloses a gain map that provides gain values for parts of an image based on the content of the image.

Petitioner contends it would have been obvious to combine Gallagher's gain map teachings with those of Needham and Nonaka and provides several reasons that a person of ordinary skill in the art would have done so. *See* Pet. 29–31. For example, Petitioner argues that “Gallagher's teachings further improve[] Needham (and thus, the Needham-Nonaka combination) by providing functionality for applying a correction operation on a pixel-by-pixel or region-by-region basis based on semantic information in the image.” Pet. 29 (citing Ex. 1006, 6:25–30; Ex. 1003 ¶¶ 80–81). Petitioner also argues that “[c]ombining Gallagher's image correction technique with Needham and/or Needham-Nonaka produces no more than expected results and is within the capability of a [a person of ordinary skill in the art], and so would have been obvious to a [a person of ordinary skill in the art].” Pet. 30–31 (citing Ex. 1003 ¶ 83).

Patent Owner argues that Gallagher's gain map has values for gain that relate to sharpening on a pixel-by-pixel basis, which does not fit within Patent Owner's construction of gain as “an attribute that relates to brightening or darkening a region of an image,” which we apply as discussed above. PO Resp. 46 (citing Ex. 2001 ¶¶ 107–110; Ex. 1006, 6:26–31). Thus, Patent Owner's argument is two-fold: first, an operation that is performed pixel-by-pixel does not teach performance by “region”; second, sharpening does not teach brightening or darkening.

Patent Owner's first point ignores Gallagher's disclosure that “[t]he purpose of the gain map generator 2 is to create a map indicating the gain of the sharpening operation on a pixel-by-pixel or *region-by-region* basis based on semantic labels derived from pattern recognition.” Ex. 1006, 6:26–29 (emphasis added). Thus, Patent Owner's attempted distinction based on pixels versus regions fails.

Patent Owner's second point is unavailing for two reasons. First, when asked about sharpness adjustment, Patent Owner's declarant, Dr. Villasenor, testified as follows: "Well, generally if you were going to enhance an edge, for example, you would have to change the pixel intensity value in order to achieve that goal." Ex. 1021, 130:5–15. Thus, adjusting sharpness at least "relates to brightening or darkening." Second, even if Gallagher's "gain" does not teach the claimed "gain," Needham describes, and the combination of Needham and Nonaka teaches, this subject matter, as discussed with respect to claim 7. As discussed above, under Patent Owner's proposed interpretation, claim 13's recitation of a "gain map" adds the requirement of modifying and using some "representation" of gain values in determining and applying gain. Petitioner relies on Gallagher for its teaching of such a "representation," namely its gain map. *See* Pet. Reply 22 ("[Petitioner] did not propose to modify Needham with Gallagher's gain map for determining the level of sharpening, but rather relied on Gallagher for its general teaching of generating a gain map that indicates an amount of correction to be applied to image pixels and using the gain map to correct the image.").

Patent Owner also argues that a person of ordinary skill in the art would not have combined the teachings of Gallagher with those of Needham and Nonaka. PO Resp. 47–48; PO Sur-reply 24–25. Patent Owner argues that "Petitioner has not taken into consideration design incentives that would lead a [person of ordinary skill in the art] away from combining Gallagher with Needham and/or Needham-Nonaka" and that "the goals of Gallagher are sharpening an image rather than feature-based enhancement of dynamic range contrast as in Needham." PO Resp. 47 (citing Ex. 2001 ¶¶ 101–103, 108). We disagree with Patent Owner. We find Gallagher's disclosure of

generating a gain map that indicates gains for areas of an image based on the semantic content (e.g., “a human face, a building, a cloud, or the sky” (Ex. 1006, 3:47–48)) of those areas fits neatly with Needham’s disclosures of performing correction operations based on the presence of certain features in an image, such as a face and a building (Ex. 1004 ¶ 22). Although Gallagher’s correction—a sharpening operation—may be different from Needham’s, Petitioner is not relying on Gallagher’s particular operation to teach the subject matter recited in claim 13. *See* Pet. 29 (asserting that a person of ordinary skill in the art “would have been led by Gallagher to modify Needham and/or the Needham-Nonaka combination to generate a gain map for dynamic range correction and using the gain map to correct the image as suggested by Gallagher”).

We find Needham’s and Nonaka’s disclosures of determining and applying gains, in combination with Gallagher’s disclosure of creating and using a gain map to apply gain, teach the subject matter recited in claim 13. We find Gallagher’s disclosure of using a gain map to control application of a correction operation (Ex. 1006, 6:25–31) would have provided improved functionality that would have motivated a person of ordinary skill in the art to use combine the teachings of Needham, Nonaka, and Gallagher to arrive at the claimed subject matter. *See* Ex. 1003 ¶ 81 (testifying that “Gallagher’s teachings further improves the Needham’s system (and thus, the combination of Needham and Nonaka) by providing functionality for applying a correction operation on a pixel-by-pixel or region-by-region basis based on semantic information in the image”).

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 13 of

the '132 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Needham and Gallagher and over the combined teachings of Needham, Nonaka, and Gallagher.

III. CONCLUSION⁹

For the reasons discussed above, we determine Petitioner has proven, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

Claim(s)	35 U.S.C. §	Reference(s)	Claim(s) Shown Unpatentable	Claims Not shown Unpatentable
1, 5–7	102(b)	Needham	1, 5–7	
1, 5–7	103(a)	Needham, Nonaka	1, 5–7	
8	103(a)	Needham, Dvir	8	
8	103(a)	Needham, Nonaka, Dvir	8	
13	103(a)	Needham, Gallagher	13	
13	103(a)	Needham, Nonaka, Gallagher	13	
Overall Outcome			1, 5–8, 13	

⁹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

In consideration of the foregoing, it is:

ORDERED that claims 1, 5–8, and 13 of the '132 patent have been shown to be unpatentable; and

FURTHERED ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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FOR PETITIONER:

Walter Karl Renner
Timothy W. Riffe
Thomas A. Rozyłowicz
Kim Leung
FISH & RICHARDSON P.C.
axf-ptab@fr.com
riffe@fr.com
rozyłowicz@fr.com
leung@fr.com

FOR PATENT OWNER:

Eagle Robinson
R. Ross Viguet
NORTON ROSE FULBRIGHT US LLP
eagle.robinson@nortonrosefulbright.com
ross.viguet@nortonrosefulbright.com