

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC. and AMAZON.COM SERVICES LLC,
Petitioner,

v.

NOKIA TECHNOLOGIES OY,
Patent Owner.

IPR2024-00604
Patent 10,536,714 B2

Before JAMESON LEE, STEVEN M. AMUNDSON, and
JASON M. REPKO, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

TERMINATION

Due to Settlement After Institution of Trial
35 U.S.C. § 317(a); 37 C.F.R. § 42.74

ORDER

Granting-In-Part and Denying-In-Part
Request to File Settlement Agreements
as Business Confidential Information
35 U.S.C. § 317(b); 37 C.F.R. § 42.74(c)

I. INTRODUCTION

On April 1, 2025, Petitioner and Patent Owner together filed a Joint Motion to Terminate this proceeding (Paper 24, “Motion to Terminate”) as well as a copy of their Settlement Agreement (Ex. 2023) and a copy of their Patent Agreement with exhibits (Ex. 2024). Also on April 1, 2025, the parties filed, under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c), a Joint Request to Treat Settlement Agreement and Patent Agreement as Business Confidential Information, specifically identifying Exhibits 2023 and 2024. Paper 25 (“Joint Request”).

II. DISCUSSION

We have not yet held oral hearing in this proceeding. Petitioner’s Reply has not yet been filed. We determine, therefore, that it is appropriate to terminate this proceeding both as to Petitioner and Patent Owner, and to treat Exhibits 2023 and 2024 as business confidential information under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

However, the Joint Request includes the following additional request: “Both parties also respectfully request that the Board inform us if anyone seeks production of the agreement and afford the parties an opportunity to address whether such request is supported by good cause.” Paper 25, 4. Neither 35 U.S.C. § 317(b) nor 37 C.F.R. § 42.74(c) provides for such notice to the parties, and such a request is also not in compliance with our authorizing email dated March 31, 2025, which states: “The request to file agreements should not make requests beyond that expressly provided by 37 C.F.R. § 42.74(c).” Ex. 3001. Accordingly, this additional request is denied.

III. ORDER

It is:

ORDERED that the Joint Motion to Terminate this proceeding is *granted*, and this proceeding is hereby terminated as to both Petitioner and Patent Owner;

FURTHER ORDERED that the Joint Request to treat Exhibits 2023 and 2024 as business confidential information under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) is *granted-in-part and denied-in-part*—all parts of the Joint Request is granted except for the request that the parties be informed if anyone seeks production of the agreement and that the parties be provided an opportunity to address whether there is good cause for such production;

FURTHER ORDERED that the Settlement Agreement (Ex. 2023) and Patent Agreement with exhibits (Ex. 2024) shall be kept separate from the file of Patent 10,536,714 B2;

FURTHER ORDERED that the Settlement Agreement (Ex. 2023) and the Patent Agreement with exhibits (Ex. 2024) shall, pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c), be made available only to Federal Government agencies on written request or to any other person upon written request and showing of good cause.

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Patent 10,536,714 B2

For PETITIONER:

Harper Batts
Chris Ponder
Jeffrey Liang
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
HBatts@sheppardmullin.com
CPonder@sheppardmullin.com
JLiang@sheppardmullin.com

For PATENT OWNER:

Scott W. Hejny
Eric S. Hansen
MCKOOL SMITH P.C.
shejny@McKoolSmith.com
ehansen@McKoolSmith.com

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III. ORDER

It is:

ORDERED that the Joint Motion to Terminate this proceeding is *granted*, and this proceeding is hereby terminated as to both Petitioner and Patent Owner;

FURTHER ORDERED that the Joint Request to treat Exhibits 2023 and 2024 as business confidential information under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) is *granted-in-part and denied-in-part*—all parts of the Joint Request is granted except for the request that the parties be informed if anyone seeks production of the agreement and that the parties be provided an opportunity to address whether there is good cause for such production;

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For Petitioner:

Harper Batts
Chris Ponder
Jeffrey Liang
Sheppard, Mullin, Richter & Hampton LLP
HBatts@sheppardmullin.com
CPonder@sheppardmullin.com
JLiang@sheppardmullin.com

For Patent Owner:

Scott W. Hejny
Eric S. Hansen
MCKOOL SMITH P.C.
shejny@McKoolSmith.com
ehansen@McKoolSmith.com

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LEE, *Administrative Patent Judge*.

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

I. INTRODUCTION

Amazon.com, Inc. and Amazon.com Services LLC (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–8, 15–22, and 29 (“challenged claims”) of U.S. Patent No. 10,536,714 B2 (Ex. 1001, “the ’714 patent”). Paper 3 (“Pet.”). Nokia Technologies Oy (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). Petitioner filed a Preliminary Reply. Paper 9 (“Prelim. Reply”). Patent Owner filed a Preliminary Sur-reply. Paper 10 (“Prelim. Sur-reply”).

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2024). An *inter partes* review may not be instituted unless the information presented in the Petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). The “reasonable likelihood” standard is “a higher standard than mere notice pleading” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

Upon consideration of the contentions and the evidence of record before us, we conclude Petitioner has shown a reasonable likelihood that it would prevail in establishing unpatentability of at least one challenged claim of the ’714 patent. Accordingly, we institute an *inter partes* review of all challenged claims of the ’714 patent on all grounds set forth in the Petition.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself as real party in interest. Pet. 89. Patent Owner identifies itself as real party in interest. Paper 5, 2.

B. *Related Matters*

The parties each identify the following litigations as related to the '714 patent:

Nokia Corp. et al. v. Amazon.com, Inc. et al., No. 1:23-cv-01232 (D. Del.);

Nokia Techs. Oy v. HP Inc., No. 1:23-cv-01237 (D. Del);

In the Matter of Certain Video Capable Electronic Devices, Including Computers, Streaming Devices, Televisions, and Components and Modules Thereof, Inv. No. 337-TA-1380 (USITC).

Pet. 89; Paper 5, 2.

Petitioner also has filed another petition against other claims in the '714 patent. IPR2024-00605, Paper 3.

C. *The '714 Patent*

The '714 patent issued from Application No. 16/356,733, filed March 18, 2019, which claims priority to Provisional Application No. 61/555,703, filed November 4, 2011. Ex. 1001, codes (21), (22), (60).

The '714 patent relates to encoding and decoding video information. Ex. 1001, code (57). Generally, video information may be encoded in two phases. *Id.* at 1:40–43. The '714 patent describes:

In the first phase, pixel values in a certain picture area or “block” are predicted. The pixel values can be predicted for example, by motion compensation mechanisms, which involve finding and indicating an area in one of the previously encoded video frames (or a later coded video frame) that corresponds closely to the block being coded. Additionally, pixel values can be predicted

by spatial mechanisms which involve finding and indicating a spatial region relationship, for example by using pixel values around the block to be coded in a specific manner.

Prediction approaches using image information from a previous (or a later) image can also be called as Inter prediction methods, and prediction approaches using image information within the same image can also be called as Intra prediction methods.

The second phase is one of coding the error between the predicted block of pixels and the original block of pixels.

Ex. 1001, 1:43–59. The decoder reconstructs the output video by applying a prediction mechanism similar to that used by the encoder and by applying prediction error decoding to recover the prediction error signal. *Id.* at 2:4–11. “After applying pixel prediction and error decoding processes the decoder combines the prediction and the prediction error signals (the pixel values) to form the output video frame.” *Id.* at 2:12–15.

The ’714 patent introduces a method for generating a motion vector prediction list for an image block. Ex. 1001, 4:18–19. The motion prediction candidate list is constructed in a way that reduces complexity of list construction. *Id.* at 2:19–22. The method performs only a limited number of motion information comparisons between candidate pairs to remove redundant candidates rather than perform a comparison for every available candidate pair, to construct the motion prediction candidate list. *Id.* at 2:19–25. “The decision of whether comparing two candidates may depend on the order of the candidates to be considered for the list and/or coding/prediction mode and/or location of the blocks associated with the candidates.” *Id.* at 4:26–30. By this method, a list of motion prediction candidates is created from which one of the candidates is to be signaled as

the motion information for the current coding or prediction unit. *Id.* at 4:30–34.

Figure 9 of the '714 patent is reproduced below:

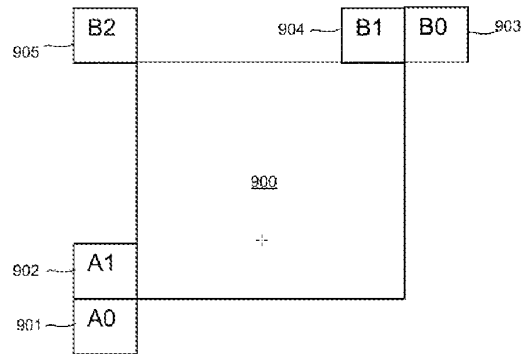


Fig. 9

Figure 9 illustrates an example of a coding unit and some neighboring blocks of the coding unit. Ex. 1001, 8:6–7. In this example the spatial motion prediction candidates are spatial neighboring blocks A0, A1, B0, B1, and B2. *Id.* at 14:64–65. These candidates for the current block being coded can be processed in a predetermined order, for example A1, B1, B0, A0, and B2. *Id.* at 15:15–16.

The '714 patent describes that a coding unit may be vertically split into two rectangular prediction units or horizontally split into two rectangular prediction units. Ex. 1001, 15:50–16:5. Figures 11a and 11b are reproduced below:

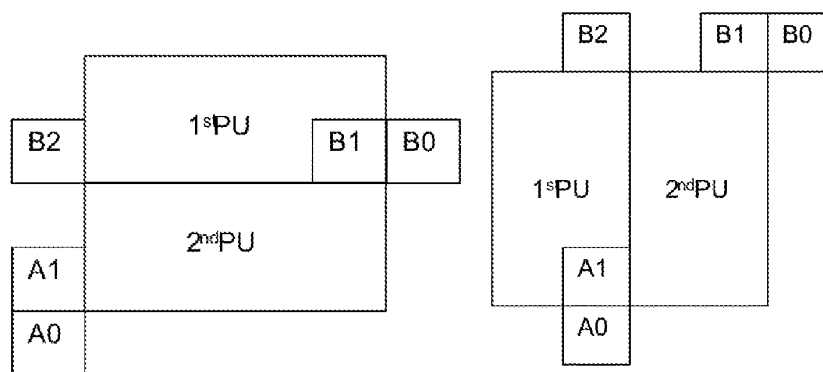


Fig. 11a

Fig. 11b

Figure 11a illustrates locations of five spatial neighbors A0, A1, B0, B1, and B2 for a prediction unit (PU) generated as the second prediction unit of a horizontally divided coding unit. Ex. 1001, 8:12–14. Figure 11b illustrates locations of five spatial neighbors for a prediction unit generated as the second prediction unit of a vertically divided coding unit. *Id.* at 8:15–17.

The '714 patent describes that if the current coding unit is horizontally split into two rectangular prediction units and the current prediction unit is the second prediction unit in the coding/decoding order, then A1 is compared only with B1, and if A1 has the same motion information as B1, then A1 would not be included in the list being constructed. Ex. 1001, 15:61–16:1. In contrast, if the comparison indicates A1 does not have the same motion information as B1, then A1 would be included in the list as a spatial motion prediction candidate, assuming that the list does not already contain a maximum number of spatial motion prediction candidates. *Id.* at 15:18–29, 16:5–7.

The '714 patent describes that if the current coding unit is horizontally split into two rectangular prediction units and the current prediction unit is the second prediction unit in the coding/decoding order, then B1 is not

included in the list being constructed. Ex. 1001, 16:11–16. If the current coding unit is not horizontally split into two rectangular prediction units and if block B1 has the same motion information as block A1, then B1 is not included in the list. *Id.* at 16:16–21. Otherwise, B1 is included in the list as a spatial motion prediction candidate, assuming that the list does not already contain a maximum number of spatial motion prediction candidates. *Id.* at 15:18–29, 16:21–23.

The '714 patent describes that if the spatial motion prediction candidate is block B0, then it is not included in the list if it has the same motion information as block B1. Ex. 1001, 16:24–27. The '714 patent describes that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block B0 is included in the list. *Id.* at 16:27–31.

The '714 patent describes that if the spatial motion prediction candidate is block A0, then it is not included in the list if it has the same motion information as block A1. Ex. 1001, 16:32–35. The '714 patent describes that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block A0 is included in the list. *Id.* at 16:27–31.

The '714 patent describes that if the spatial motion prediction candidate is block B2, then it is not included in the list if it has the same motion information as block A1. Ex. 1001, 16:45–49. The '714 patent indicates that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block B2 is included in the list. *See id.* at 15:22–29, 15:46–49.

Claims 1, 15, and 29 are independent and reproduced below:¹

1. [pre] A method comprising:

[a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

[b] determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

[c] comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates;

[d] determining to include or exclude the first spatial vector prediction candidate in the motion vector prediction list based on the comparing; and

[e] causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

Ex. 1001, 31:21–50.

15. [pre] An apparatus comprising a processor and a memory including computer program code, the memory and the

¹ The bracketed headings correspond to those used by Petitioner to reference the claim elements. *See* Pet. 28–45, 62–63. We use the same headings here for ease of reference, understanding, and consistency.

computer program code configured to, with the processor, cause the apparatus to:

[a] select a first spatial motion vector candidate from a set of spatial motion vector prediction candidate from a set of spatial vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list composes motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

[b] determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

[c] compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

[d] determine to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on comparison of the motion information of the first spatial motion vector candidate with motion information of the spatial motion vector prediction candidate; and

[e] cause information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

Id. at 35:10–48.

29. [pre] A non-transitory computer readable medium having stored thereon stored on a computer executable program code for use by an encoder, said program codes comprising instructions for:

- [a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;
- [b] determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;
- [c] comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;
- [d] determining to include or exclude the first spatial vector prediction candidate in the motion vector prediction list based on the comparing; and
- [e] causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

Id. at 39:22–40:9.

D. The Applied Prior Art and Declarations

Petitioner relies on the following evidence:

Name	Patent Document/Publication	Exhibit
Rusert ²	US Pat. Pub. No. 2011/0194609	1004
Karczewicz ³	US Pat. Pub. No. 2011/0249721	1005
Lin ⁴	US Pat. Pub. No. 2014/0092981	1006
Nakamura Document ⁵	Nakamura et al., “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1007
Nakamura WD Description ⁶	Nakamura et al., “WD Description of JCTVC-F419 Proposal 1” for “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1008
Nakamura Presentation ⁷	Nakamura et al., “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1009
WD4	Bross et al., “WD4: Working Draft 4 of High-Efficiency Video Coding,” Joint Collaborative Team on Video Coding (JCT-VC) of ITC-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting: Torino, IT, Jul. 14–22, 2011 (Document JCTVC-F803).	1010

² Published August 11, 2011. Ex. 1004, code (43).

³ Published October 13, 2011. Ex. 1005, code (43).

⁴ Issued from Application No. 14/123,200, which claims priority to Provisional Application No. 61/500,903, filed June 24, 2011. Ex. 1006, codes (21), (60). Patent Owner does not dispute this priority date of Lin.

⁵ Published July 2011.

⁶ Published July 2011.

⁷ Published July 2011.

Petitioner also relies on the Declaration of Charles D. Creusere, Ph.D. Ex. 1003. With regard to the status of Nakamura and WD4 as prior art printed publications, Petitioner additionally relies on the Declarations of Vivienne Sze, Ph.D. (Ex. 1014) and Clifford Reader, Ph.D. (Ex. 1050).⁸ Patent Owner relies on the Declaration of Iain E. Richardson, Ph.D. (Ex. 2001).

E. The Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims of the '714 patent are unpatentable based on the following grounds (Pet. 16):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 5–8, 15–17, 19–22, 29	103(a) ⁹	Rusert, Karczewicz
1–8, 15–22, 29	103(a)	Rusert, Karczewicz, Lin
1–8, 15–22, 29	103(a)	Nakamura, ¹⁰ WD4

⁸ Patent Owner disputes that WD4 constitutes prior art as of the effective filing date of the '714 patent. Prelim. Resp. 59–64. However, we need not reach the issue because, as discussed below, the alleged ground of unpatentability based on Nakamura and WD4 lacks sufficient substantive merit.

⁹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the '714 patent claims priority to an application filed before March 16, 2013 (the effective date of the amendments), the pre-AIA version of § 103 applies.

¹⁰ Petitioner uses the name “Nakamura” to refer to a collection of three files, i.e., the “Nakamura Document” (Ex. 1007), the “Nakamura WD Description” (Ex. 1008), and the “Nakamura Presentation” (Ex. 1009). Pet. 65. Petitioner asserts that “they were jointly presented in a single proposal, by the same author, packaged together in a single zip, and meant to be read together, teaching related aspects of Nakamura’s proposal.” *Id.*

III. ANALYSIS

A. *Legal Standards*

A claim is unpatentable under 35 U.S.C. § 103(a) “if the differences between the subject matter sought to be patented 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.” 35 U.S.C. § 103(a); *see KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations of nonobviousness.¹¹ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. *Level of Ordinary Skill in the Art*

Citing testimony from Dr. Creusere, Petitioner asserts a person of ordinary skill in the art (hereinafter “POSITA”) “would have had (1) a bachelor’s degree in electrical engineering, computer engineering, computer science, or a comparable field of study such as physics, and (2) approximately two to three years of practical experience with video encoding/decoding.” Pet. 22 (citing Ex. 1003 ¶¶ 57–59).

Patent Owner states that it “has applied Petitioner’s POSITA for the sake of this Response.” Prelim. Resp. 31.

On this record, we adopt Petitioner’s statement of the level of ordinary skill in the art. It is supported by the testimony of Dr. Creusere and not

¹¹ The record does not include any evidence of secondary considerations of nonobviousness.

disputed by Patent Owner. Further, it appears consistent with what is reflected by the content of the applied prior art. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill).

C. *Claim Interpretation*

We use the same claim construction standard that would be used to construe a claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). The claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) is applicable.

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Phillips*, 415 F.3d at 1316. “There are only two exceptions to this general rule:

- 1) when a patentee sets out a definition and acts as his own lexicographer, or
- 2) when the patentee disavows the full scope of a claim term either in the

specification or during prosecution.” *Thorner v. Sony Comput. Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal, if any, can be effectuated by language in the specification or the prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. “temporal motion vector prediction candidate”

Petitioner construes the term “temporal motion vector prediction candidate” in claims 7 and 21 to mean “a candidate motion vector obtained from a previously-encoded frame.” Pet. 23. Patent Owner states that its Response does not depend on a resolution of the meaning of this term and does not express a position with respect thereto. Prelim. Resp. 32. Because no dispute hinges on the meaning of this term, we do not find it necessary to construe this term expressly.

2. “subset of . . . candidates”

Petitioner construes the term “subset of . . . candidates” in limitation [1b] to mean a subset of one or more [spatial motion vector prediction] candidates. Pet. 24. Patent Owner does present any contrary position or

argument. Because no dispute hinges on the meaning of this term, we do not find it necessary to construe this term expressly.

3. “*the block*”

Petitioner asserts:

Limitation [1b] recites “the block,” which could be interpreted to refer to either (a) the “block of pixels” introduced in [1a], or (b) the block from which the first spatial motion vector candidate is obtained. During prosecution of the parent ’833 patent, the Examiner applied the first interpretation, with “the” block as the “current block” (Ex-1015, 000168), which the Applicant did not dispute (Ex-1015, 000241-244). For purposes of this IPR, Petitioner applies the Examiner’s interpretation, where “the block” finds antecedent basis in the “block of pixels” in [1a]. Ex-1003, ¶ 66.

Pet. 23.

Notably, Petitioner recognizes that there are two potential choices of what is referred to by “the block” in limitation [1b], one being the block of pixels recited in limitation [1a], i.e., the current block being processed, and the other being a block, not previously recited in the claim, but from which the first spatial motion vector candidate is obtained. Overlooked by Petitioner is that the words “the block” are a part of the bigger term “the block *associated with* the first spatial motion vector prediction candidate.” Ex. 1001, 31:35–37 (emphasis added).

That specific claim language of association indicates a relationship between “the block” and the first spatial motion vector prediction candidate, that is more than how every single prediction candidate broadly may be regarded in general as related to the current block being processed, the block for which a motion vector prediction list is being generated. The modifier “associated with the first spatial motion vector prediction candidate” clearly modifies “the block” at issue here and cannot be discarded or ignored.

Further, if “the block” refers to the block recited in limitation [1a], i.e., the current block being processed, then the modifying phrase “associated with the first spatial motion vector prediction candidate” would be superfluous and have no meaning, because “the block,” without the modifying phrase, would already derive its antecedent basis from “a block of pixels” recited in limitation [1a]. We decline to adopt a construction that reads out “associated with the first spatial motion vector prediction candidate.” Construing the claim according to what the claim language actually states, without excluding any part of the claim language recited, is more appropriate.

The Specification of the ’714 patent is consistent with the plain reading of “the block associated with the first spatial motion vector prediction candidate.” Each selected first candidate to evaluate for inclusion in a prediction list for the current block is compared with a subset of candidates associated with the first selected candidate. Ex. 1001, 15:18–29, 15:46–49, 16:1–49. Patent Owner correctly notes:

The ’714 patent makes clear that the candidate motion vectors for the current frame use either “one or more . . . neighbor blocks . . . of the current block in the same frame and/or co-located blocks . . . of the current block in one or more other frames[,]” i.e., *these are motion vectors associated with other blocks, rather than the current block*, to define a list of suitable motion vector candidates for the current block, as would be understood by a POSITA [person of ordinary skill in the art]. Ex-1001 at 12:51–56; Ex-2001 at 38.

Prelim. Resp. 50 (emphasis added, alterations by Patent Owner). Patent Owner further correctly notes that if Petitioner’s proposed construction is adopted, that would mean the “determining a subset” recitation of limitation [1b] is satisfied regardless of whether the location of the block is associated

with a first spatial motion vector candidate, directly contrary to the recitation of limitation [1b]. We agree with Patent Owner that Petitioner's proposed construction improperly reads out the claim language "associated with the first spatial motion vector prediction candidate." Prelim. Resp. 51.

The reason Petitioner provided for its construction is that an Examiner had taken that interpretation during prosecution of a parent application of the '714 patent. Pet. 23. However, Petitioner does not provide claim language that was construed in the parent application. Nor does Petitioner specifically compare that claim language with the claim language here. Even if the claim language is the same, that an Examiner had construed the language that way does not make it a proper construction if the Applicant did not dispute that construction during prosecution of the parent application. The Applicant might not have needed to present arguments in that regard to obtain allowance of its claims.

Claim construction is a question of law, and we are not bound by an earlier construction of an Examiner who applied a different standard for claim construction in a parent application for a similar claim term.

For the foregoing reasons, we disagree with Petitioner's proposed construction of "the block" to mean "the block of pixels" in limitation [1a]. Rather, "the block" in limitation [1b] means "the block associated with the first spatial motion vector prediction candidate," as limitation [1b] states.

D. Alleged Obviousness of Claims 1–3, 5–8, 15–17, 19–22, and 29 over Rusert and Karczewicz

1. Overview of Rusert (Exhibit 1004)

Rusert's disclosure relates to a method of selecting predicted motion vector (PMV) candidates, a video coding apparatus, a video decoding apparatus, and a computer-readable medium. Ex. 1004 ¶ 1.

Figure 1 of Rusert is reproduced below:

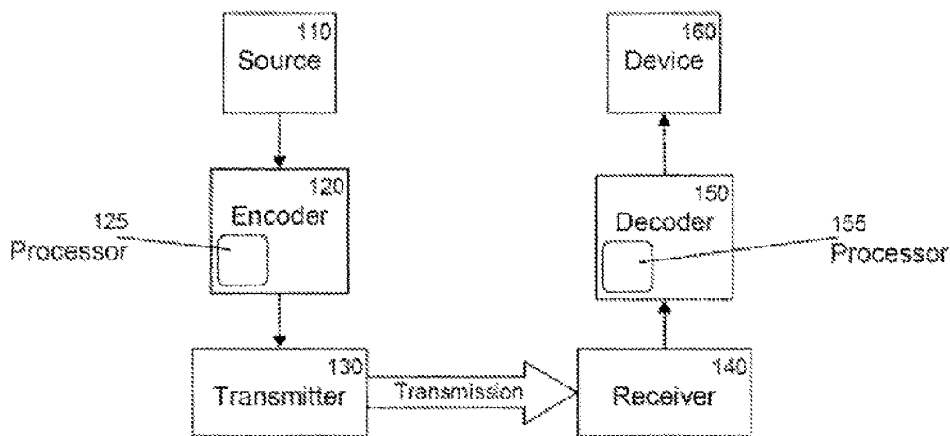


Fig. 1

Figure 1 illustrates a video coding and transmission system according to Rusert. Ex. 1004 ¶ 27.

In the illustrated coding system of Figure 1, a video signal from source 110 is ultimately delivered to device 160. Ex. 1004 ¶ 34. The video signal from source 110 is passed through encoder 120 containing processor 125. *Id.* Encoder 120 applies an encoding process to the video signal to create an encoded video stream, which is sent to transmitter 130. *Id.* Receiver 140 receives the transmitted encoded stream and passes it to decoder 150. *Id.* Decoder 150 contains processor 155 which is used to decode the encoded video stream. *Id.* The decoder outputs a decoded video stream to device 160.

Rusert describes:

The methods disclosed herein are performed in the encoder during encoding, and also in the decoder during decoding. This is achieved even though the generation of the signaling bits is done in the encoder. During decoding the decoder parses the bits and mimics of the encoder in order to achieve encoder/decoder synchronization. Because the encoder and decoder follow the same rules for creating and modifying the set of PMV candidates, the respective lists of PMV candidates stored in the encoder and decoder maintain synchronization[.] Still, explicit signaling of PMV candidate lists may be performed under certain circumstances.

The described method assume coding of a motion vector (MV) 210 using predictive coding techniques, where a predicted motion vector (PMV) 220 is used to predict a MV 210, and the prediction error or difference (DMV) 230 is found according to $DMV = MV - PMV$. DMV 230 is signaled from the encoder 120 to the decoder 150. Additionally, a code “index” 250 is sent to select a particular PMV candidate, in this case 242 from a list of PMV candidates, PMV_CANDS 240 as shown in FIG. 2a. The index 250 may be sent once together with each transmitted motion vector MV 210, i.e., per sub-block (e.g. 8x8 pixel block). Likewise, the index may be sent for groups of motion vectors, e.g. per macroblock (16x16 block).

Ex. 1004 ¶¶ 35–36. The list PMV_CANDS 240 is identically available at both the encoder and decoder. *Id.* ¶ 37. “Using the transmitted index, the decoder 150 can determine the PMV 220 as used in the encoder as shown in FIG. 2b, and thus may reconstruct $MV = DMV + PMV$.” *Id.*

Rusert describes a method of selecting PMV candidates, wherein each PMV candidate corresponds to a motion vector used for coding of a previous block within an allowed distance from the current block. Ex. 1004 ¶ 11. The method comprises selecting a set of PMV candidates as a subset

of the previously coded motion vectors that were used for previous blocks having an allowed distance from the current block. *Id.*

Rusert further describes:

A PMV candidate list is created by selecting a subset of the motion vectors previously used for previous blocks. Restricting the previous blocks that are considered reduces the number of previous motion vectors that must be considered meaning that less computation is needed, improving the processor efficiency of the coding.

Identifying allowed distance values means that certain distance values may not be allowed. These not allowed distance values result in skipped layers of blocks. The size of the PMV candidate list is limited because a very large list would require long code words to identify which PMV candidate to use[.] Skipping layers can provide increased coding efficiency by ensuring that not only the nearest neighbor previous blocks are considered, but also previous blocks. This allows a candidate list to be produced using motion vectors from a wide range of previous blocks, but that is not excessively long.

Ex. 1004 ¶¶ 12–13.

Rusert additionally describes:

The PMV_CANDS list used for coding a motion vector associated with a current motion compensation block can be dynamically generated specifically for the current motion compensation block, i.e. without consideration of the PMV_CANDS lists used for coding of MVs associated with motion compensation blocks previously coded. In that case, before a block is processed, a PMV_CANDS list is initialized and then updated with a number of previously coded or predefined motion vectors.

Ex. 1004 ¶ 41.

Rusert also describes a way to reduce the number of candidates in the PMV_CANDS list:

One measure for reducing the number of candidates is to avoid duplicate occurrences of the same motion vector in a given PMV_CANDS list. This can be done, when updating the list, by comparing the candidates already in the list with the new vector that could be added, and if a duplicate is found, either removing the duplicate vector or skipping the new vector. It is preferable to skip the new vector, otherwise a subsequent duplicate from a distant block may cause a candidate high in the order of the list to be put at the end of the list.

Ex. 1004 ¶ 71.

2. *Overview of Karczewicz (Exhibit 1005)*

Karczewicz discloses video coding techniques applicable to a coded block pattern of a coding unit (CU) of video data. Ex. 1005 ¶ 31.

Karczewicz refers to a developing coding standard H.265 as follows:

Efforts are currently in progress to develop a new video coding standard, currently referred to as High Efficiency Video Coding (HEVC). The emerging HEVC standard may sometimes be referred to as ITU-T H.265. The standardization efforts are based on a model of a video coding device referred to as the HEVC Test Model (HM).

Id. ¶ 32. Karczewicz states that “HM refers to a block of video data as a coding unit (CU).” *Id.* ¶ 33.

Karczewicz describes that a CU has a similar purpose as a macroblock in previous standard H.264, “except that a CU does not have the same size limitations associated with macroblocks.” Ex. 1005 ¶ 33. Karczewicz also describes that “[s]yntax data within a bitstream may define a largest coding unit (LCU), which is a largest coding unit in terms of the number of pixels.” *Id.*

Karczewicz describes that a CU may be split into sub-CUs, and that “[i]n general, references in this disclosure to a CU may refer to a LCU of a picture or a sub-CU of an LCU.” Ex. 1005 ¶ 33. An LCU may be split into

sub-CUs, and each sub-CU may be split into sub-CUs. *Id.* Karczewicz describes that a bitstream may also define a smallest coding unit (SCU). *Id.*

According to Karczewicz, a CU may be partitioned into one or more prediction units (PUs). Ex. 1005 ¶¶ 33, 35. “[A] CU may be broken into blocks, e.g., sub-CU and/or one or more PU or TU.” *Id.* ¶ 41. In general, a PU represents all or a portion of the corresponding CU, and includes data for retrieving a reference sample for the PU. *Id.* ¶ 35. Karczewicz describes that “[d]ata for the CU defining the PU(s) may also describe, for example, partitioning of the CU into one or more PUs.” *Id.*

Karczewicz describes that “prediction operations may be performed using a PU based on a block size of PU.” Ex. 1005 ¶ 46. Further, Karczewicz describes that it uses the term “block” to refer to any one of LCU, SCU, CU, PU, or transform unit (TU). *Id.* ¶ 33.

3. *Claim 1*

a. *Preamble recitation 1[pre]*

The preamble recites: “A method comprising:” Ex. 1001, 31:31:21. Petitioner asserts that Rusert discloses a method. Pet. 28 (citing Ex. 1001, code (57)). Patent Owner does not dispute the assertion. Petitioner sufficiently accounts for the preamble of claim 1, even assuming that the preamble is limiting.

b. *Limitation 1[a]*

Limitation 1[a] recites:

selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector

prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

Ex. 1001, 31:22–33. According to Petitioner, Rusert teaches all of limitation 1[a]. Pet. 29.

To account for “selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels,” Petitioner explains: Rusert teaches “selecting PMV [prediction motion vector] candidates” for a current block from a “set of previously coded motion vectors that were used for previous blocks.” Pet. 29 (citing Ex. 1004 ¶¶ 11–12, 15, 24–25, 39, 44, 51–66, 113, Fig. 6).

Petitioner further explains: “As Rusert iterates through blocks of pixels in a frame, each block will have its own unique set of previously-coded motion vectors from which to select a PMV candidate because after a block is encoded/decoded, the set of previously-coded motion vectors increases.” Pet. 29 (citing Ex. 1004 ¶¶ 11–12, 36, 59, Fig. 3; Ex. 1003 ¶¶ 102, 104). Petitioner further explains: “Rusert’s PMV candidates (Ex-1004, ¶3) comprise spatial motion vector prediction candidates obtained from previously-encoded blocks in the current frame,” include spatially neighboring motion vectors, and are included in “PMV_CANDS, which ‘comprise[s] spatial . . . neighbors of the current block’ in the current frame.” *Id.* at 30 (citing Ex. 1004 ¶¶ 4–6, 67; Ex. 1003 ¶ 103) (alterations by Petitioner, emphasis omitted).

Patent Owner does not dispute these assertions. Petitioner’s assertions are supported by the cited evidence. Petitioner sufficiently accounts for this portion of limitation 1[a]: “selecting a first spatial motion vector prediction

candidate from set of spatial motion vector prediction candidates for a block of pixels.”

Regarding the portion of limitation 1[a] that states “[selecting a first . . . candidate . . .] as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels,” Petitioner explains that Rusert teaches search patterns for an outwards going scan around the current block for “selecting PMV candidates to potentially be included in PMV_CANDS.” Pet. 30 (citing Ex. 1004 ¶¶ 44, 51–56, Figs. 3a–3n (“showing numerical scan order around current block ‘.’ from block 1 onwards”)). *Id.* Petitioner presents on page 31 of the Petition the following annotated Figure 3n of Rusert:

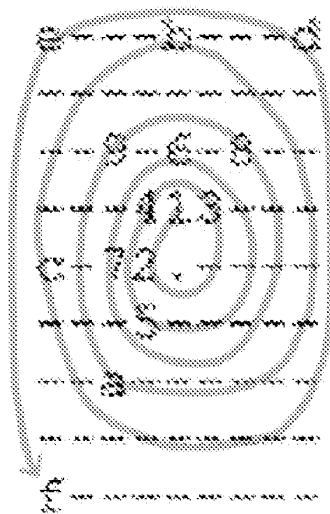


Fig. 3n

Annotated Figure 3n illustrates a possible scan pattern and distance measurements for a plurality of blocks surrounding a current block, to which Petitioner has added directional scanning order in red. Pet. 31; Ex. 1004 ¶ 30.

Petitioner explains that following the search pattern sequences, of which Figure 3n is an example, Rusert visits a previously coded block and selects the motion vector for that block as a candidate for potential inclusion in PMV_CANDS. Pet. 31 (citing Ex. 1004 ¶¶ 44, 51–56; Ex. 1003 ¶ 107). Petitioner further explains:

PMV_CANDS is a **motion vector prediction list for a prediction unit of the block of pixels**. It is a list of predicted motion vectors “used for coding a motion vector associated with a current . . . block.” Ex-1004, ¶41, ¶4, ¶¶39–42. PMV_CANDS is “dynamically generated specifically for the current . . . block[.]” EX-1004, ¶41. “[B]efore a block is processed, a PMV_CANDS list is initialized and then updated with . . . motion vectors.” *Id.* When PMV_CANDS is updated, i.e., when “one or more motion vectors are added” (Ex-1004, ¶39), it comprises a subset of the set of previously-coded motion vectors that have been included in PMV_CANDS to that point. Ex-1004, ¶¶4-5, ¶¶36–39, ¶¶43–44, ¶¶51–66. When PMV_CANDS is complete, a PMV that “is used to predict a [motion vector] . . . is signaled” using an index “to select a particular PMV candidate . . . from PMV_CANDS[.]” Ex-1004, ¶36; Ex-1003, ¶108.

The prediction unit of Rusert’s block of pixels is the block itself because that is the unit for which a motion vector is assigned for motion prediction. Ex-1004, ¶¶2–4, ¶43. Rusert provides a motion vector for each “8X8 pixel block,” also called a “sub-block” because it is a portion of a “macroblock.” Ex-1004, ¶36. Rusert scans neighboring blocks because motion vectors are assigned based on blocks, which are the PUs in Rusert’s teachings. *See* Ex-1004, ¶¶50–67, Figs. 3a-3n; Ex-1003, ¶109.

Pet. 31–32 (emphasis added, alterations by Petitioner).

Patent Owner does not dispute these assertions. Petitioner’s assertions are supported by the cited evidence. Petitioner sufficiently accounts for this portion of limitation 1[a]: “[selecting a first . . . candidate . . .] as a potential

spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels.”

Alternatively, Petitioner relies on Karczewicz to account for a “prediction unit.” Pet. 32–33. Petitioner explains:

Additionally, Ground 1 combines Rusert’s “block” teaching (following H.264 terminology) to PUs (in H.265 terminology). Supra §VI.A.1; Ex-1004, 116. As Karczewicz explains, H.265 introduced terminology for a type of block called “prediction unit[s.]” Ex-1005, ¶¶33-36; *supra* §I. “In general, a CU has a similar purpose to a macroblock of H.264” (Ex-1005, ¶33), which in its simplest case is commensurate with a PU but may also be divided into multiple PUs. Ex-1005, ¶35. “[T]he PU may include data defining a motion vector for the PU” that is used for “prediction using a PU[.]” Ex-1005, ¶¶35-36, ¶66; Ex-1003, ¶¶110-111. In short, Karczewicz explains that H.265 assigned motion vectors based on a type of block called a PU. Ex-1005, ¶¶33-36, ¶64. Rusert explained its teachings based on the blocks for which motion vectors were assigned (Ex-1004, ¶¶2-5, ¶36, ¶43). Therefore, it was obvious to apply Rusert’s teachings to PUs, with PMV_CANDS being a motion vector prediction list for a PU of the block of pixels. Ex-1005, ¶¶33-36, ¶66; Ex-1003, ¶110-112.

Id. (alterations by Petitioner). These assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding motivation to combine the teachings of Rusert and Karczewicz, and reasonable expectation of success, Petitioner presents cogent reasoning on pages 24–27 of the Petition.

Petitioner asserts that in light of Karczewicz’s teachings about H.265, “[a] POSITA would have been motivated to apply Rusert’s teachings to H.265 PUs.” Pet. 24. Petitioner explains:

Rusert does not use H.265 terminology. Nonetheless, Rusert explains that, while its examples were “given in the context of H.264/AVC, the principles disclosed herein can also

be applied to . . . other coding standard[s], and indeed any coding system which uses predicted motion vectors.” Ex-1004, ¶116. Karczewicz teaches the concept of PUs in H.265, which was emerging as the successor standard to H.264—both were drafted by ITU-T—sharing the same concepts of block-based video encoding with predicted motion vectors. Ex-1005, ¶32, ¶¶35-37, ¶66, ¶71; Ex-1006, ¶5. Karczewicz teaches H.265 concepts including PUs. Therefore, the art provides express motivation to apply Rusert’s teachings to other standards including H.265, as taught by Karczewicz. Ex-1003, ¶¶71-74.

This would have combined prior art elements according to known methods to yield predictable results, e.g., combining Rusert’s teachings for generating/de-duplicating MVP candidate lists with H.265 concepts, including PUs and related information for motion vectors. In Rusert’s H.264 examples, motion vectors and motion prediction operate on blocks. Ex-1004, ¶¶2-5, ¶36, ¶43. As Karczewicz explains, for H.265 drafts, motion vectors and motion prediction operated on blocks called PUs. Ex-1005, ¶¶33-36, ¶¶64-66. Karczewicz also teaches types of information conveyed by motion vectors. Ex-1005, ¶35. A POSITA would have been motivated to apply Rusert’s known techniques for selecting PMV candidates to PUs, to improve the similar draft H.265 standard in the same way that Rusert explained for H.264. This application would have been a simple substitution of Karczewicz’s PU teachings for Rusert’s block teachings, which would have yielded several advantages, including improved coding efficiency as taught by both references. Ex-1004, ¶7; Ex-1005, ¶6; Ex-1003, ¶¶75-79.

Pet. 24–26 (alterations by Petitioner).

Regarding predictable results, Petitioner asserts:

The combination would have had predictable results. Rusert already applies its teachings to block-based encoding/decoding. Ex-1004, ¶2, ¶11. A PU is a type of block. Ex-1005, ¶35. Rusert’s concepts were readily applicable to PUs, and the combination would have had the predictable result of selecting PMV candidates (as Rusert teaches) for PUs (as Karczewicz teaches). Ex-1004, ¶116; Ex-1003, ¶83. Therefore, the combination would not have changed the principle of

operation for Rusert or Karczewicz because it applies their teachings in the manner taught by each. Applying H.265 teachings to Rusert, and vice versa, was consistent with Rusert's statement that its principles are applicable to other standards. Ex-1004, ¶116; Ex-1003, ¶84.

Pet. 27.

Regarding reasonable expectation of success, Petitioner asserts:

A POSITA would have had a reasonable expectation of success combining Rusert and Karczewicz. The combination applies teachings according to their known purposes, in a conventional manner. The teachings are complementary aspects of block-based video encoding from H.264 and H.265. Ex-1004, ¶116. Karczewicz complements Rusert by teaching H.265 terminology and concepts. Ex-1005, ¶32. Ground 1 does not modify Rusert or Karczewicz in a way that would render either inoperative. To the contrary, the similarities of the architectures would have given a POSITA a reasonable expectation of success in combining their teachings. Ex-1004, ¶11; Ex-1005, ¶2; Ex-1003, ¶¶85-86.

Pet. 27–28.

Petitioner's assertions regarding motivation to combine, predictable results, and reasonable expectation of success are supported by the cited evidence and not disputed by patent Owner. We are sufficiently persuaded that the teachings of Rusert and Karczewicz properly may be combined in the manner proposed by Petitioner.

Regarding the portion of limitation 1[a] that states “where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit,” Petitioner accounts for it by the

discussion appearing on pages 33–35 of the Petition. Pet. 33–35.

Petitioner’s assertions are supported by the cited evidence and not disputed by patent Owner. Petitioner sufficiently accounts for this portion of limitation 1[a]: “where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit.”

For the foregoing reasons, Petitioner sufficiently has shown that Rusert discloses limitation 1[a] and that Rusert and Karczewicz reasonably would have suggested limitation 1[a].

c. Limitation 1[b]

Limitation 1[b] recites: “determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 31:34–37.

Petitioner asserts that Rusert selects a set of PMV candidates as a “subset” of the set of previously coded motion vectors that were used for previous blocks, and that the subset members have an allowed distance from the current block and an allowed position. Pet. 35 (citing Ex. 1004 ¶¶ 11–12, 15, 24–25, 37, Figs. 2a–2b; Ex. 1003 ¶¶ 120–121).

Regarding “determining a subset of spatial motion vector prediction candidates,” Petitioner explains:

Rusert implements the subset of PMV candidates using an outward scan of blocks having previously-coded motion vectors, starting from the current block and staying within an allowed distance. Ex-1004, ¶¶ 4-5, ¶¶ 36-39, ¶¶ 43-44, ¶¶ 51-66. As the scan progresses outwards, the subset includes the previously-coded PMV candidates obtained from blocks in previous

locations of Rusert's scan. Ex-1004, ¶¶44, ¶¶51-66, Figs. 3a-3n. For example when the selected first spatial motion vector prediction candidate is obtained from the third block in Rusert's scan sequence, the subset of spatial motion vector prediction candidates comprises the candidates from previous scan locations (the first and second blocks). *Id.*

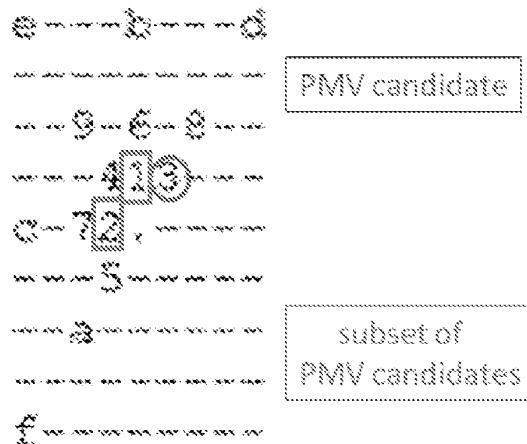


Fig. 3n

[The figure is an annotated version of Rusert's Figure 3n (a scan pattern around the current block), in which the subset of PMV candidates is identified in red and the selected first PMV candidate is identified in blue]

Ex-1003, ¶¶121-122.

Pet. 36. Petitioner further explains:

Additionally, Rusert terminates the scan “as soon as a predefined number of unique PMV candidates have been found.” Ex-1004, ¶48. Even PMV candidates that are within “a certain distance” and part of “a predetermined scan pattern” are not considered if the “pre-defined number of unique PMV candidates have been found.” Ex-1004, ¶¶44-49. Rusert improves coding efficiency by using subsets. Ex-1004, ¶¶12-13. Therefore, Rusert's scan of previously-coded motion vectors is further cabined into a subset because it is limited to this predefined number of PMV candidates.

Id. at 37. Petitioner asserts: “As the scan progresses outwards and the subset of PMV candidates is updated, the subset is stored as a list of PMV candidates called PMV_CANDS. *Id.* (citing Ex. 1004 ¶¶ 37–41, 44–49, 51–66).

Regarding the “based on a location of the block associated with the first spatial motion vector prediction candidate” requirement of limitation 1[b], Petitioner explains:

Here, “the block” refers to the “block of pixels” in [1a] and therefore refers to the current block for which candidates are being analyzed. *Supra* §V.C. Because the subset of PMV candidates is based on “an outwards going scan . . . around the current block” (Ex-1004, ¶¶43-44), the subset of blocks that are scanned and the corresponding subset of spatial motion vector prediction candidates from those blocks are based on the location of the current block.

Furthermore, the subset of PMV candidates is based on “an allowed distance from the current block and an allowed position.” Ex-1004, ¶15, ¶¶11-13, ¶17, ¶¶24-25, ¶113, Fig. 6. The distance and position are relative to and therefore based on the location of the current block. Ex-1004, ¶¶11-17, ¶¶24-25, ¶¶43-44, ¶¶51-56, Figs. 3a-3n.

Pet. 37–38 (alterations by Petitioner). Petitioner further explains: “Only candidates from blocks with allowed positions relative to the current block are included. Ex-1004, ¶¶15-16, ¶59 (excluding ‘blocks to the right and below the current block’), ¶65; Ex-1003, ¶¶127-129.” *Id.* at 38.

The above-quoted explanations of Petitioner on why Rusert discloses the “based on a location of the block associated with the first spatial motion vector prediction candidate” requirement of limitation 1[b] are unpersuasive because, as we determined above, “the block associated with the first spatial motion vector prediction candidate” language does not refer to the current

block as Petitioner contends. Rather, it refers to the block with which the first selected spatial motion vector prediction candidate is associated, which in the example provided by Petitioner would be block 3.

However, Petitioner presents an alternative contention, in case we disagree with its primary position noted above. Pet. 39. The alternative contention is as follows:

Even if “the” block was the block from which the selected first candidate is obtained, Rusert also teaches this. §V.C. A “position” of a block of a PMV candidate is represented as (xpos, ypos), i.e., a location of the block associated with the first spatial motion vector prediction candidate. Ex-1004, ¶¶51-52. Based on the block’s location, the subset of PMV candidates with which the PMV candidate is compared includes the candidates of blocks located in the scan pattern up to the PMV candidate. Ex-1004, ¶44. For example, in Fig. 3n, the PMV candidate for block “3” is compared with a subset of PMV candidates for blocks “1” and “2.” Ex-1004, ¶44, ¶¶65-66, Fig. 3n:

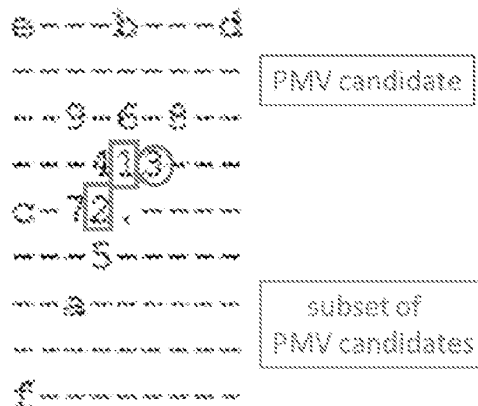


Fig. 3n

[The figure is an annotated version of Rusert’s Figure 3n (a scan pattern around the current block), in which the subset of PMV candidates is identified in red and the selected first PMV candidate is identified in blue]

Ex-1003, ¶ 130.

Notwithstanding Patent Owner's argument to the contrary (Prelim. Resp. 51–52), we are persuaded by Petitioner's alternative contention. Patent Owner argues:

But, unlike the '714 Patent, the subset (subset of PMV candidates for blocks “1” and “2”) does not actually depend in any way on the location of the first candidate (PMV candidate for block “3”). Under Rusert's method, the list of candidates (1, 2, 3, 4, etc.) is always constructed according to the same rules and the same order. Ex-1004. For example, when candidate 3 is reached, it will always be compared with 1 and 2, regardless of the location of the first candidate. Ex-2001 at 39-40.

Prelim. Resp. 51–52. Patent Owner asserts:

[A]t the time that neighboring block 2 has finished being considered, the content of PMV_CANDS for block 3 is already known: it will be the set of candidates 1 and 2 (assuming that 1 and 2 are dissimilar). The location of, and indeed any information related to, block 3 is irrelevant to the contents of PMV_CANDS at the time that block 3 is under consideration. Ex-2001 at 45.

Id. at 57–58. Patent Owner further asserts:

[R]ather than being based on the location of a PMV candidate under consideration, the set of PMV candidates used for comparison in Rusert is determined based on the value of each PMV candidate that has already been considered and added to the list. Ex-1004. If candidate 3 is compared to candidates 1 and 2, this is not because candidate 3 is located in the top right, but because candidates 1 and 2 are dissimilar and thus neither is excluded from being added to PMV_CANDS. *See* Rusert ¶¶ 70-72; Ex-2001 at 45.

Id. at 58.

Patent Owner's argument is misplaced and misunderstands Petitioner's position. The first selected spatial motion vector prediction candidate is not restricted to the third block in the scanning sequence. It can be any block along the outwardly expanding spiraling path.

Petitioner is correct that the determined subset does depend on the location of the first selected spatial motion vector prediction candidate. For example, if the first selected candidate is at the location of block 5, then the subset would be the four members 1, 2, 3, and 4, and if the first selected candidate is at the location of block 3, then the subset would be the two members 1 and 2. The members of the determined subset depend on the location of the block associated with the first selected spatial motion vector prediction candidate as Petitioner contends.

For the foregoing reasons, Petitioner sufficiently has shown that Rusert discloses limitation 1[b].

d. Limitation 1[c]

Limitation 1[c] recites:

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates;

Ex. 1001, 31:38–43.

Petitioner identifies three such comparisons disclosed by Rusert. Pet. 40–41. Petitioner explains:

First, Rusert compares whether “the PMV candidate is a duplicate of *another* PMV candidate” in the subset of PMV candidates, which is stored as a list in PMV_CANDS. Ex-1004, ¶21, ¶71. “This ca[n] be done, when updating the list, by comparing the candidates already in the list with the new vector that could be added, and if a duplicate is found. . . skip the new vector” thereby “reducing the number of candidates[.]” Ex-1004, ¶71, ¶62. A potential PMV candidate is selected and compared with each PMV candidate in the subset of preceding PMV candidates in Rusert’s scan sequence, which are stored in

PMV_CANDS. Supra §VI.A.2[1b]. If the x and y components of two motion vectors are the same, they are duplicates and the potential candidate is excluded. *Id.*; Ex-1003, ¶134.

Second, Rusert compares whether “the PMV candidate is . . . within a threshold distance of an existing PMV candidate” in the subset of candidates, e.g., using “a similarity measure” such as Euclidean distance to calculate whether the difference between the x and y components of their motion vectors is “smaller than a pre-defined threshold”; if so, the potential candidate is removed/skipped. Ex-1004, ¶21, ¶72, ¶87. The distance between duplicate PMV candidates is zero. Ex-1003, ¶¶135-136, ¶135n.5.

Third, Rusert compares whether “at least one alternative PMV candidate will allow motion vectors to be coded using fewer bits” (Ex-1004, ¶21) thereby “removing PMV candidates” that “will never be used” because another PMV candidate in the subset facilitates “a bit sequence that is shorter or of the same length compared for all possible motion vectors.” Ex-1004, ¶¶90-94. When the x and y values of an existing candidate’s motion vector can be added to the x and y values of a difference motion vector (“DMV”) to yield the x and y values of the selected candidate while using fewer overall bits, Rusert excludes the selected candidate. Ex-1004, ¶95 (teaching exemplary PMV/DMV combinations requiring fewer bits); Ex-1003, ¶136.

Id. (footnote omitted) (alterations by Petitioner). Petitioner further explains:

All three teachings compare a potential candidate with a subset of preceding candidates in Rusert’s scan. Since preceding candidates have smaller index values, they would be signaled more efficiently than later duplicates, and Rusert improves efficiency by determining this subset and comparing potential new candidates to the subset. Ex-1004, ¶¶88-98; Ex. 1003, ¶137.

Id. at 42.

Petitioner’s assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently accounts for limitation 1[c].

e. Limitation 1[d]

Limitation 1[d] reads: “determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing.” Ex. 1001, 31:44–46.

Petitioner explains:

As explained above, Rusert determines whether to include or exclude the selected first PMV candidate in PMV_CANDS, which stores the subset of PMV candidates based on each of the three comparisons explained for [1c]. Rusert removes “unnecessary PMV candidates” to “ensure[] the length of the [PMV_CANDS] list is not unnecessarily long[.]” Ex-1004, ¶¶20–21. Rusert explains that “[a] PMV candidate may be determined to be unnecessary” and be therefore excluded if at least one of the three comparisons is fulfilled. Ex-1004, ¶21; supra § VI.A.2[1c]. A shorter PMV_CANDS list “allows the remaining PMV candidates to be signaled using shorter codes and so fewer bits[.]” Ex-1004, ¶22, ¶90; Ex-1003, ¶¶145-146.

Rusert excludes unnecessary candidates when deciding whether to add a new candidate to the subset of PMV candidates stored in PMV_CANDS. Ex-1004, ¶21, ¶¶71-72; supra § VI.A.2[1c]. As part of the “update” process whereby new candidates are added, Rusert determines whether a selected PMV candidate should be included or skipped, meaning it is excluded based on any of the three comparisons from [1c]. Ex-1004, ¶¶71-72. Additionally, this would have been obvious because Rusert teaches the advantages of reducing the number of candidates in PMV_CANDS using the three comparisons from [1c] (Ex-1004, ¶12, ¶21, ¶70, ¶84, ¶90), and the natural time to perform the comparisons would have been when evaluating whether or not to add a candidate to the subset of PMV candidates stored in PMV_CANDS. As Rusert teaches, performing this check when PMV_CANDS is updated will prevent “unnecessary” candidates from being added, “because it may happen that some candidates . . . will never be used[.]” Ex-1004, ¶90; Ex-1003, ¶¶147-148.

Pet. 44–45 (alterations by Petitioner).

These assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently has shown that Rusert discloses limitation 1[d].

f. Limitation 1[e]

Limitation 1[e] recites: “causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.” Ex. 1001, 31:47–50.

Petitioner asserts that Rusert discloses causing an index identifying one spatial motion vector prediction candidate from PMV_CANDS to be stored and transmitted to a decoder. Pet. 45 (citing Ex. 1004 ¶¶ 35, 150). Petitioner explains that the index identifies and signals one PMV candidate from PMV_CANDS. *Id.* at 45–46 (citing Ex. 1004 ¶¶ 35–37, 75, 91–92, Figs. 2a–2b). Petitioner asserts that Rusert teaches exemplary binary codes for the index used for transmission and storage. *Id.* at 46 (citing Ex. 1004 ¶¶ 88–102, Table 1).

These assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently has shown that Rusert discloses limitation 1[e].

g. Patent Owner’s Assertion that Petitioner Improperly Equates Prediction List and Subset

Patent Owner asserts that Petitioner improperly “relies on the same evidence in Rusert to show both the ‘motion vector prediction list’ limitation and the ‘subset’ limitation” recited in claim 1. Prelim. Resp. 47. Patent Owner explains its argument as follows:

In order to show the limitation “motion vector prediction list,” Petitioner relies on the “PMV_CANDS” list of Rusert, asserting that “Rusert’s PMV_CANDS is the claimed ‘motion vector prediction list.’” Pet. 31. At the same time, however,

Petitioner relies on Rusert's "PMV_CANDS" in order to show the "subset" limitation. *Id.* at 37. Petitioner further contends that "the subset is stored as a list of PMV candidates called PMV_CANDS." Pet. at 37; Ex-2001 at 36-37.

Id. at 47–48. According to Patent Owner, Petitioner's meeting both the "motion vector prediction list" and the "subset of spatial motion vector prediction candidates" by the same structure PMV_CANDS "renders these distinct claim elements functionally meaningless." *Id.* at 48–49. In essence, Patent Owner's argument is that the "subset" corresponds to motion vector prediction candidates with which a selected candidate is compared to determine whether the selected candidate should be included in the prediction list, and thus the subset and the prediction list cannot be the same. *See id.* at 49 ("The subset cannot, therefore, be the distinct 'motion vector prediction list' being constructed").

Patent Owner's argument has facial appeal but does not withstand closer scrutiny. It is misplaced in the context of Rusert's parameter PMV_CANDS.

PMV_CANDS is a name for a variable and its content changes dynamically during the prediction list building process, as explained by Petitioner in the context of various limitations of claim 1 as discussed above. At the end of the dynamic process for constructing a prediction list, PMV_CANDS holds the complete prediction list. During the list building process, PMV_CANDS holds those candidates which have been determined to be included, thus far, in the prediction list, and those members constitute the subset with which a selected candidate being evaluated for inclusion in the prediction list is compared. The subset gets larger, incrementally, as more candidates are determined for inclusion in the prediction list.

There is no conflict or inconsistency in Petitioner's referring to PMV_CANDS as the "subset" and also as the "prediction list," given the dynamic process of constructing a prediction list by comparing a candidate being evaluated with candidates which have already been determined as good for inclusion in the list. At the end of the list construction process, PMV_CANDS holds all members of the prediction list. Prior to the end of the list construction process, PMV_CANDS holds the claimed subset.

h. Preliminary Conclusion for Claim 1

For the foregoing reasons, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 over Rusert and Karczewicz.

4. Dependent Claims 2, 3, and 5–8

Claims 2, 3, and 5–8 each depend, directly or indirectly, from claim 1. Ex. 1001, 31:51–61, 32:1–33:16. Petitioner addresses claims 2, 3, and 5–8 on pages 47 to 50 and on pages 54–62 of the Petition. Pet. 47–50, 54–62. Petitioner's assertions are supported by the cited evidence and also not disputed by Patent Owner. We have already addressed, above, Patent Owner's argument directed to Petitioner's alternative argument regarding limitation 1[b].

Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 2, 3, and 5–8 over Rusert and Karczewicz.

5. Independent Claims 15 and 29

Petitioner asserts:

Beyond the preambles, claims 15 and 29 are nearly identical to claim 1, with limitations [15a]-[15e]/[29a]-[29e] having only minor differences with [1a]-[1e], respectively.

Limitations [15c]/[29c] recite “each possible candidate pair” where [1c] recites “each pair” and is taught by Ground 1 because not comparing each pair satisfies not comparing each possible candidate pair. Ex-1003, ¶234, ¶256. Ground 1 teaches [15a]-[15e]/[29a]-[29e] for the same reasons provided for [1a]-[1e]. *Supra* §VI.A.2[1a]-[1e]; Ex-1003, ¶¶225-241, ¶¶252-258.

Pet. 62. Petitioner further asserts: “Ground 1 teaches [15pre] and [29pre]. Rusert teaches a video encoding/decoding ‘apparatus’ (Ex-1004, ¶1, ¶¶24-27, ¶114, ¶116, claims 17-18) comprising ‘a processor’ and ‘a computer-readable medium, carrying instructions, which when executed[,]. . . causes [the processor] to carry out any of the methods disclosed herein.’ Ex-1004, ¶¶24-26, ¶1; Ex-1003, ¶¶222-224, ¶¶249-251.” *Id.* at 62–63 (alterations by Petitioner).

Petitioner’s assertions regarding the preambles of claims 15 and 29 and regarding the limitations of claims 15 and 29 as compared to the limitations of claim 1 are supported by the cited evidence and not disputed by Patent Owner. Based on our reasoning discussed above for claim 1, we determine that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 15 and 29 over Rusert and Karczewicz.

6. *Dependent Claims 16, 17, and 19–22*

Claims 16, 17, and 19–22 each depend, directly or indirectly, from claim 15. Ex. 1001, 35:49–60, 36:1–37:19. Petitioner asserts that other than the preambles, “claims 16-22 are identical to claims 2-8.” Pet. 63. Petitioner asserts that the preambles are accounted for by reference to the discussion of the preamble of claim 15. *Id.* For the rest of claims 16–22, Petitioner relies on the same arguments and evidence submitted for claims 2–8. *Id.*

We have already addressed Petitioner's accounting for claims 2–8 and claim 15. For substantially the same reasons as we have provided for claims 2–8 and 15, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 16, 17, and 19–22 over Rusert and Karczewicz.

E. Alleged Obviousness of Claims 1–8, 15–22, and 29 over Rusert, Karczewicz, and Lin

1. Overview of Lin (Exhibit 1006)

As background, Lin describes:

In video coding systems, spatial and temporal redundancy is exploited using spatial and temporal prediction to reduce the information to be transmitted. The spatial and temporal prediction utilizes decoded pixels from the same picture and reference pictures respectively to form prediction for current pixels to be coded. In a conventional coding system, side information associated with spatial and temporal prediction may have to be transmitted, which will take up some bandwidth of the compressed video data. The transmission of motion vectors for temporal prediction may require a noticeable portion of the compressed video data, particularly in low-bitrate applications. Accordingly, motion vector prediction has been widely used in the field to reduce bitrate corresponding to the motion vector coding.

High-Efficiency Video Coding (HEVC) is a new international video coding standard that is being developed by the Joint Collaborative Team on Video Coding (JCT-VC). HEVC is based on the hybrid blockp-based motion-compensated DCT-like transform coding architecture. The basic unit for compression, termed Coding Unit (CU), is a $2N \times 2N$ square block, and each CU can be recursively split into four smaller CUs until a predetermined minimum size is reached. Each CU contains one or multiple Prediction Units (PUs). The PU sizes can be $2N \times 2N$, $2N \times N$, $2N \times nU$, $2N \times nD$, $N \times 2N$, $nL \times 2N$, $nR \times 2N$, or $N \times N$, where $2N \times N$, $2N \times nU$, $2N \times nD$ and $N \times 2N$, $nL \times 2N$, $nR \times 2N$ correspond to horizontal and vertical partition of a

2Nx2N PU with symmetric or asymmetric PU size division respectively.

Ex. 1006 ¶¶ 3–4. Lin further describes: “When a PU is coded in either Skip or Merge mode, no motion information is transmitted except for the index of the selected candidate.” *Id.* ¶ 7.

Lin discloses a method and apparatus of deriving a motion vector predictor (MVP) for a current block in an Inter, Merge, or Skip mode.

Ex. 1006 ¶ 25. The method determines redundant MVP candidates according to a non-MV-value based criterion. *Id.* The redundant MVP candidates are then removed from the MVP candidate set. *Id.*

Lin describes an embodiment which identifies and removes redundant MVP candidates to avoid “imitation of Merge,” a scenario in which multiple partitioned PUs from an original PU are merged back to form the original PU. Ex. 1006 ¶ 44. “Consequently, the MVP candidates of a current PU that may cause the current PU to be merged with other PUs to cause imitation of Merge is considered redundant and can be removed without comparing the MV values.” *Id.*

2. *Claims 1–3, 5–8, 15–17, 19–22, and 29*

Petitioner relies on Lin only to account for features added in claims 4 and 18. Pet. 50, 62. For claims 1–3, 5–8, 15–17, 19–22, and 29, Petitioner’s analysis is the same as its analysis for these same claims as unpatentable over Rusert and Karczewicz. *Id.* at 28–63.

Accordingly, for the same reasons we discussed above why Petitioner has made an adequate showing for claims 1–3, 5–8, 15–17, 19–22, and 29, as obvious over Rusert and Karczewicz, Petitioner has shown a reasonable likelihood that it would prevail in establishing the alleged obviousness of

claims 1–3, 5–8, 15–17, 19–22, and 29, as obvious over Rusert, Karczewicz, and Lin, with no teaching stemming from Lin.

3. *Dependent Claims 4 and 18*

Claim 4 depends from claim 1 and further recites: “examining whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector candidate from the motion vector prediction list if the prediction unit is the second prediction unit.” Ex. 1001, 31:62–67.

Claim 18 depends from claim 15 and further recites: “wherein the apparatus is further caused to examine whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector candidate from the motion vector prediction list if the prediction unit is the second prediction unit.” Ex. 1001, 35:61–67.

The added features of claims 4 and 18, relative to the independent claims from which they each depend, are essentially the same, with claim 4 reciting a function performed as a method step and claim 18 reciting the function as performed by the claimed apparatus.

Petitioner relies on the disclosure of Lin for the added features of claims 4 and 18. Pet. 50–52, 63. Petitioner explains:

Lin examines whether a block of pixels is divided. Lin teaches that, in H.265/HEVC, “[t]he basic unit for compression, termed Coding Unit (CU), is a 2Nx2N square block, and . . . [e]ach CU contains one or multiple Prediction Units (PUs)” with divisions “correspond[ing] to horizontal and vertical partition[s.]” Ex-1006, ¶4; Ex-103, 000007, 000017. Horizontally-divided CUs have PUs of size 2NxN; vertically-divided CUs have Nx2N PUs. Id. Lin explains that a block of pixels can be divided into a first PU (“PU1”) and second PU (“PU2”). Ex-1006, ¶25, ¶44, Figs. 7A-7D; Ex-1013, 000007, 000010, 000017; Ex-1003, ¶170.

Id. at 50 (alterations by Petitioner). Petitioner further explains:

Lin examines whether the block is divided into two PUs horizontally (having $2N \times N$ PUs) or vertically ($N \times 2N$). Lin “identifies and removes redundant candidates” by examining the CU for “scenario[s] that . . . may cause the current PU to be . . . considered redundant and can be removed[,] including where “for the second $2N \times N$, . . . $N \times 2N$. . . PU, one or more of the MVP candidates are redundant and removed if said one or more of the MVP candidates [are] located within the previous (first) $2N \times N$, . . . $N \times 2N$. . . PU.” Ex-1006, ¶25, ¶44; Ex-1013, 000009-11, 000017; Ex-1003, ¶171.

Id. at 51 (alterations by Petitioner). Petitioner additionally explains: “Lin examines whether (i) the current block is divided into two PUs and (ii) the spatial motion vector prediction candidate is from the other PU; if so, Lin excludes the candidate from the MVP list because it is redundant. Ex-1006, ¶44, ¶25, Figs. 7A-7D; Ex-1013, 000010, 000017.” *Id.* at 52.

The above assertions of Petitioner are supported by the cited evidence and not disputed by Patent Owner.

Regarding motivation to combine, Petitioner explains:

[A] CU comprises one PU when it has uniform motion and is only divided if different parts are moving in different directions, as Karczewicz explains. *See* Ex-1006, ¶4; Ex-1013, 000007; Ex-1005, ¶35. Therefore, for a divided block, the motion vector for one PU is not a good predictor for the other. Lin teaches what Karczewicz suggests, that the motion vector from one half can be removed as a candidate for the other, thereby reducing the number of candidates. Ex-1006, ¶25, ¶44; Ex-1013, 000010; Ex-1003, ¶¶174-175. This would have had the predictable result of excluding such candidates, consistent with the reason why a block was divided to begin with. Ex-1013, ¶94.

Accordingly, a POSITA would have been motivated to apply Lin’s teachings to the Ruser/Karczewicz combination because Lin provides a straightforward teaching for reducing redundant candidates when blocks are divided. This would have

furthered Rusert's goal of "reduc[ing] the number of previous motion vectors that must be considered[.]" Ex-1004, ¶12, ¶7; Ex-1003, ¶¶88-89. Ground [2] combines Lin's known technique to improve similar H.265 PU-based methods in the same way, which were ready for improvement to reduce the number of previous motion vectors that must be considered. Ex-1004, ¶12; Ex-1003, ¶¶90-91.

Pet. 53 (second and third alterations by Petitioner). Petitioner further explains: "The combination would not have changed the principle of operation for any reference, in the manner taught by each reference. Ex-1006, ¶44; Ex-1013, 000010. Ground 2 simply applies Lin's exclusion of PUs in certain scenarios. Ex-1003, ¶95." *Id.* at 54.

Regarding a reasonable expectation of success in applying the teachings of Lin to the combination of Rusert and Karczewicz, Petitioner asserts:

As with Ground 1, all references teach aspects of block-based video encoding for H.264/H.265 to reduce PMV candidates. Ex-1004, ¶25, ¶39, ¶¶42-44; Ex-1005, ¶3, ¶5, ¶38; Ex-1006, ¶4, ¶25; Ex-1013, 000009-11. The combination does not modify Rusert, Karczewicz, or Lin in a way that would render any reference inoperative. Indeed, many of the same reasons explained for Ground 1 likewise apply to Ground 2. Ex-1003, ¶¶96-98.

Pet. 54.

The above assertions of Petitioner are supported by the cited evidence and not disputed by Patent Owner.

Petitioner has shown a reasonable likelihood that it would establish obviousness of claims 4 and 18 over Rusert, Karczewicz, and Lin.

F. Alleged Obviousness of Claims 1–8, 15–22, and 29 over Nakamura and WD4

1. Overview of Nakamura (Exhibits 1007, 1008, and 1009)

As noted above, Petitioner Uses the name “Nakamura” to refer to a collection of three files, i.e., the “Nakamura Document” (Ex. 1007), the “Nakamura WD Description” (Ex. 1008), and the “Nakamura Presentation” (Ex. 1009). Pet. 65. Petitioner asserts that “they were jointly presented in a single proposal, by the same author, packaged together in a single zip, and meant to be read together, teaching related aspects of Nakamura’s proposal.” *Id.* Here, we focus on the Nakamura document (Ex. 1007).

In its introduction paragraph, the Nakamura document states: “This proposal is for the improvement of derivation method of the candidates for merge mode and motion vector predictor (MVP).” Ex. 1007 § 1. It unifies the location of spatial neighbors for merge mode and MVP by proposing that “the positions of the spatial neighbors that can be used as merging candidates are as same as the positions of the spatial MVP candidates.” *Id.* It also proposes to unify the derivation process for merge mode and for MVP. *Id.* The proposal “tries to reduce the number of candidates in the spatial derivation process to reduce the number of times of comparison in the removal process.” *Id.* at Abstr. It states: “The proposed techniques simplify the derivation process for merge mode and MVP.” *Id.* § 2.2.

Section 2.2.1 of the Nakamura document describes its proposed technique for merge mode and is reproduced below:

2.2.1 Proposal 1: Proposed technique for merge mode

Changes of our proposal for merge modes from HM3.0 are as follows:

- The positions of the spatial neighbors that can be used for merging candidates are as same as the positions of

the spatial MVP candidates. That is unification of the location of spatial neighbor for merge mode and MVP.

- Two spatial merging candidates are derived in the spatial derivation process.
- The merging candidate list is constructed of two spatial merging candidates and a temporal merging candidate.

Figures 2 (a) and (b) illustrate the position of the spatial neighbors A, B, C, D and E relative to the current prediction unit in the HM3.0 and the proposed technique, respectively.

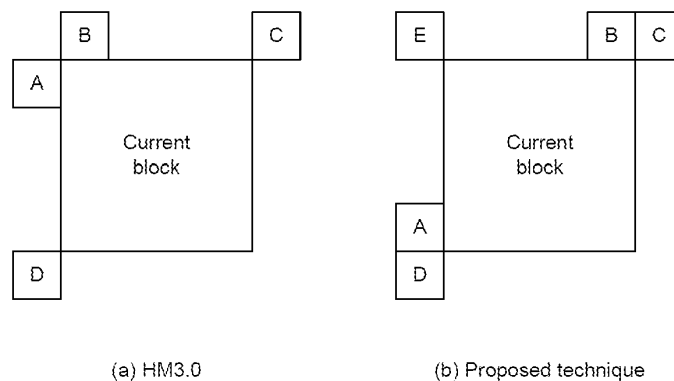


Figure 2 Spatial neighbors that can be used as merging candidates.

[Figure 2(a) shows spatial neighbors that can be used as merging candidates in existing HM3.0, and Figure 2(b) shows spatial neighbors that can be used as merging candidates in Nakamura's proposed technique]

In this proposal, two spatial candidates and a temporal candidate are derived. The number of candidates is reduced in the spatial derivation process to reduce the number of times of comparison in the removal process. Table 1 presents the number of times of comparison in the removal process in each the number of candidates. The number of times of comparison in the removal process in HM3.0 is ten times. On the other hand, the number of times of comparison in the removal process in the proposed technique is three times.

Table 1 The number of comparison in the removal process

The number of candidates in the spatial and temporal derivation process	The number of times of comparison in the removal process	Notes
3 (=2+1)	3 {times}	Proposed technique
4 (=3+1)	6 {times}	-
5 (=4+1)	10 {times}	HM3.0
6 (=5+1)	15 {times}	-

[Table 1 shows the number of comparisons in the removal process]

Table 2 presents the comparison between HM3.0 and proposed technique for merge mode:

Table 2 Comparison between HM3.0 and proposed technique for merge mode

	HM3.0	Proposal 1
The number of spatial candidates	4 in 4 {positions}	2 in 5 {positions}
Spatial derivation order	A, B, C, D	A, B, C, D, E
The number of times of comparison of redundant candidates in the spatial derivation process	0 {time}	0 {time}
The number of temporal candidates	1	1
Merging candidate list order	A, B, Col, C, D	S ₀ , S ₁ , Col
The number of times of comparison in the removal process	10 {times} (A vs B, Col, C, D, B vs Col, C, D, Col vs C, D, and C vs D)	3 {times} (S ₀ vs S ₁ , S ₀ vs Col, and S ₁ vs Col)

[Table 2 shows the comparison between HM3.0 and proposed technique for merge mode]

Notes:

S₀: The first spatial candidate found in the spatial derivation process.

S₁: The second spatial candidate found in the spatial derivation process.

Ex. 1007, 2–4.

2. *WD4 (Exhibit 1010)*

WD4 is a 222-page document titled “WD4: Working Draft 4 of High-Efficiency Video Coding.” Ex. 1010, i. It bears the following header on its title page:

Joint Collaborative Team on Video Coding (JCT-VC)
of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11
6th Meeting: Torino, IT, 14-22 July, 2011

Id.

WD4 defines a merge index, *merge_idx*, that “specifies the merging candidate index of the merging candidate list.” Ex. 1010 § 7.4.7. This merge index appears in “Prediction unit syntax” corresponding to information encoded for a prediction unit. *Id.* § 7.3.7.

3. *Claims 1, 15, and 29*

a. *Claim 1*

At the outset, Petitioner notes:

Nakamura satisfies claim 1 with independently sufficient teachings for H.265 merge mode (optimal for areas of uniform motion) and MVP mode (more versatile but requiring more bits). Generally, merge mode saved bits by utilizing PMVs without signaling DMVs and other information used by MVP mode. The granular differences are not relevant here because the claims do not require one mode or the other.

Pet. 65–66. Patent Owner does not present any counter argument based on differences between the merge mode and MVP mode disclosures of Nakamura.

(1) *Preamble [1pre]*

With regard to the preamble “A method,” Petitioner asserts: “Ground 3 teaches [1pre], e.g., an ‘improvement of derivation method of the candidates for merge mode and motion vector predictor (MVP)’ comprising

the below-described steps. Ex-1007, §1, Abstract, §2.1, Fig. 1; Ex-1010, §8.4.2.1.2, §8.4.2.1.8; *infra* §VI.B.2[1pre]-[1e]. Ex-1003, ¶¶274-277.”
Pet. 66. These assertions are supported by the cited evidence and not disputed by Patent Owner.

(2) *Limitation 1[a]*

Limitation 1[a] recites:

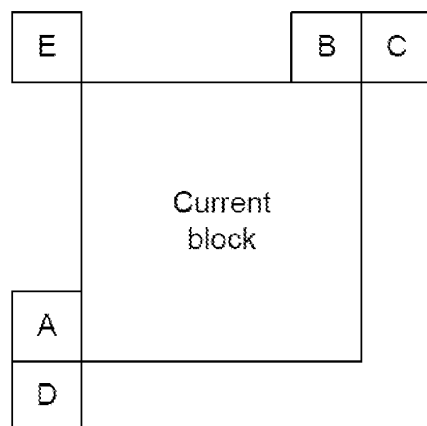
selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

Ex. 1001, 31:22–33.

Regarding “selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels,” Petitioner asserts:

For merge mode, Nakamura teaches identifying two spatial motion vector prediction candidates for a merge list, i.e., “spatial candidate[s]” S_0 and S_1 , from “the position[s] of the spatial neighbors A, B, C, D and E relative to the current prediction unit” which “can be used for . . . candidates[.]” Ex-1007, §2.2.1, Abstract, §1, Tables 2, 4, Fig. 1; Ex-1009, 000008, 000010, 000012-14. The selection of a candidate from a spatial neighbor for S_1 satisfies the claimed step for selecting a first spatial motion vector prediction candidate. Ex-1003, ¶¶279-280.

S_0 and S_1 are spatial motion vector prediction candidates because each is a candidate motion vector obtained from one or more previously-encoded blocks in the current frame (A-E). *Supra* §V.A; Ex-1007, §2.2.1, Fig. 2(b):



(b) Proposed technique

[The figure shows spatial neighbors that can be used as merging candidates in Nakamura’s proposed technique. Ex. 1007, 3]

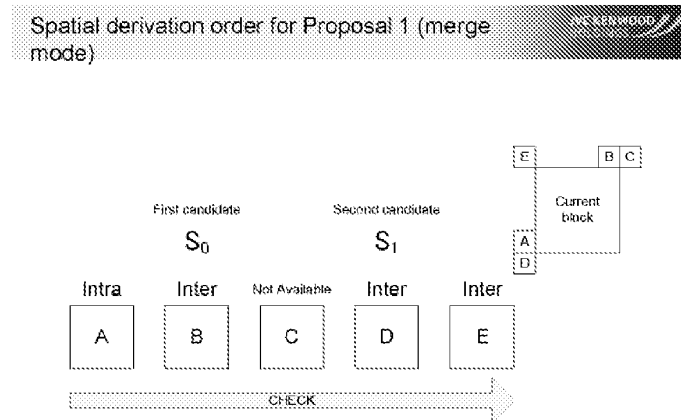
Ex-1003, ¶¶281-283.

Pet. 66–67 (alterations by Petitioner) (footnote omitted).

These assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding selection of that first candidate “as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list,” Petitioner explains:

Nakamura teaches a “merging candidate list is constructed of two spatial merging candidates” (S_0 and S_1) selected in a “[s]patial derivation order” from the five spatial neighbor candidates “relative to the current prediction unit[.]” Ex-1007, §2.2.1, Tables 2-4; Ex-1008, 8.4.2.1.1; Ex-1009, 000008, 000010, 000012-14. Following the spatial derivation order, Nakamura steps through blocks A-E until two spatial candidates (S_0 and S_1) are selected for potential inclusion in the merging candidate list. Ex-1009, 000008; Ex-1007, §2.2.1, Table 2; Ex-1003, ¶¶284-286.



[The illustration shows “Spatial derivation order for Proposal 1 (merge mode)”]

Pet. 68 (alteration by Petitioner). The above assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding the prediction list being for “a prediction unit of the block of pixels,” Petitioner explains:

Nakamura teaches “[t]he merging candidate list, mergeCandList,” (Ex-1008, §8.4.2.1.1; Ex-1010, §8.4.2.1.1) comprises “spatial merging candidates” found from “the position[s] of the spatial neighbors. . . relative to the current prediction unit” of the current block, with one assigned as the motion vector predictor for the current prediction unit. Ex-1007, §2.2.1, Tables 2, 4, Fig. 2(b); Ex-1008, §8.4.2.1.1; Ex-1010, §7.4.7, §8.4.2.1.1, 000049, 000174; Ex-1003, ¶¶287-288.

Pet. 68–69 (alterations by Petitioner). The assertions are supported by the cited evidence and not disputed by Patent Owner.

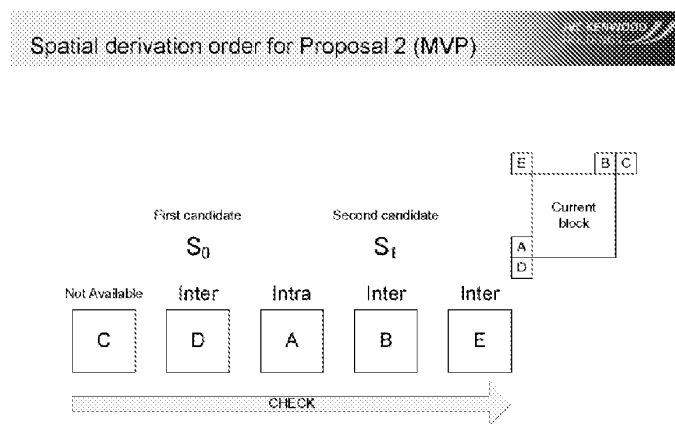
Regarding the prediction list comprising “motion information of the spatial motion vector prediction candidates,” Petitioner asserts: “The ‘merging candidate list is constructed of’ spatial candidates (Ex-1007, §2.2.1) and includes information of those candidates in the list, including ‘availability flags. . . reference indices. . . prediction list utilizing flags. . .’”

and ‘motion vectors[.]’ Ex-1008, §8.4.2.1.2; Ex-1010, §8.4.2.1.2; Ex-1003, ¶283, ¶289.” Pet. 69 (alterations by Petitioner). The assertion is supported by the cited evidence and not disputed by Patent Owner.

Regarding the prediction list being “utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit,” Petitioner asserts:

“The merging candidate list is constructed of two spatial . . . candidates” (Ex-1007, §2.2.1, Tables 2, 4) of which one is signaled by an index, mergeIdx, as the motion information for the current PU and includes reference indices, prediction list utilization flags, and motion vectors. Ex-1007, §8.4.2.1.1; Ex-1003, ¶290.

Ground 3’s MVP Mode teachings satisfy [1a] in a similar manner but with an “MVP list” instead of a merge list, mvp_idx_1X instead of mergeIdx, and a different spatial derivation order for selecting S_0 and S_1 . Ex-1007, Abstract, §8.4.2.1.10, 000049-50, 000174; Ex-1009, 000005, 000008, 000011-14:



[The illustration shows “Spatial derivation order for Proposal 2 (MVP)”]

Ex-1003, ¶¶292-301.

Pet. 69–71 (alteration by Petitioner) (footnotes omitted).

Petitioner's assertions are supported by the cited evidence and not disputed by Patent Owner.

(3) *Limitation 1[b]*

Limitation 1[b] recites: “determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 31:34–37.

Regarding “determining a subset of spatial motion vector prediction candidates,” Petitioner explains:

For merge mode, Nakamura teaches “[t]wo spatial merging candidates” (S_0 and S_1) “are derived in the spatial derivation process[]” from five “spatial neighbors A, B, C, D and E relative to the current prediction unit[.]” Ex-1007, §2.2.1, Tables 1, 4; Ex-1009, 000010, 000014; Ex-1007, Table 2; Ex-1009, 000008; *supra* §V.D. For S_1 , Nakamura teaches a subset (S_0) with which S_1 is compared to determine whether to include or exclude S_1 . Ex-1007, Tables 2, 4; Ex-1008, §8.4.2.1.1; Ex-1009, 000010, 13; Ex-1010, §8.4.2.1.1; Ex-1003, ¶¶304-306.

Pet. 71 (alterations by Petitioner).

Regarding determining a subset of spatial motion vector prediction candidates “*based on a location of the block associated with the first spatial motion vector prediction candidate*,” Petitioner explains:

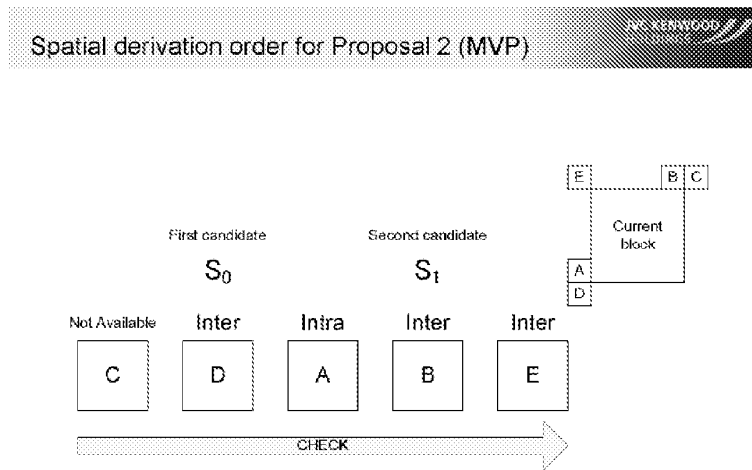
The subset is determined from a set of “spatial neighbors A, B, C, D and E relative to the current prediction unit” for the current block. Ex-1007, §2.2.1, Fig. 2(b); Ex-1009, 000008. The subset (S_0) is based on the location of S_1 following Nakamura's spatial derivation order, which is relative to the current block. Ex-1007, §2.2.1, Fig. 2; Ex-1008, §8.4.2.1.2, Fig. 8-3; Ex-1009, 000008, 000010; *supra* §V.C.; Ex-1003, ¶¶307-310.

Pet. 72.

Petitioner further asserts:

Ground 3's MVP mode teachings satisfy [1b] in a similar manner but with an “MVP list” instead of a merge list and a

different spatial derivation order. Ex-1007, Abstract, §2.2.2, Tables 1, 3, 4, Fig. 3(b); Ex-1009, 000005, 000008, 000010-14, 000020.



[The illustration shows “Spatial derivation order for Proposal 2 (MVP)”]

Ex-1003, ¶¶311-318.

Pet. 72–73.

Petitioner’s explanation is unpersuasive. There is inadequate explanation as to why S_0 is determined on the basis of the location of S_1 , where S_0 and S_1 are selected in a “spatial derivation order” from the five spatial neighbor candidates relative to the current prediction unit. Ex. 1007, §2.2.1; Ex. 1009, 000008, 00001. As Patent Owner notes, S_0 is already selected regardless of what the selection of S_1 thereafter might be. Prelim. Resp. 71. The subset S_0 does not change depending on the later choice of S_1 .

On this record, the subset S_0 has not been sufficiently shown as based on a location of the block associated with the first spatial motion vector prediction candidate, S_1 . As we explained above in Section III.C.3, “the block associated with the first spatial motion vector prediction candidate” does not refer to the current block, but refers to “the block associated with

the first spatial motion vector prediction candidate.” Petitioner has not adequately shown the satisfaction of limitation 1[b].

(4) *Motivation to Combine Nakamura and WD4*

The deficiency discussed above relating to limitation 1[b] and the disclosure of Nakamura already alone undermines the alleged unpatentability of claim 1 over Nakamura and WD4. Additionally, we have concerns regarding Petitioner’s stated motivation for one of ordinary skill in the art to combine the teachings of Nakamura with the teachings of WD4.

With regard to motivation to combine the teachings of Nakamura and WD4, Petitioner explains:

Nakamura is an H.265 proposal for “reduc[ing] the number of candidates in the spatial derivation process to reduce the number of. . . comparison[s] in the removal process.” Ex-1007, Abstract. When applied to WD4, Nakamura’s teachings satisfy the challenged claims. Ex-1003, ¶260.

A POSITA would have been motivated to apply Nakamura’s teachings to the draft H.265 standard because that was its express purpose. Nakamura was proposed at the 6th JCT-VC meeting for inclusion into the standard. WD4 was the output of that meeting, reflecting the state of the draft H.265 standard at that time. Nakamura proposed “simplifications” and “improvement[s]” to H.265. Ex-1007, 000001, §6. WD4 “[i]ncorporated spatial merge candidate positions unification” from Nakamura. Ex-1010, Abstract. There was clear motivation to apply Nakamura to WD4. Ex-1004, ¶¶260-262. This was a combination of prior art elements according to known methods to yield predictable results. Ex-1003, ¶264.

Ground 3 applies Nakamura’s known techniques to a known method (WD4) ready for improvement to yield predictable results. Nakamura teaches its “proposed technique is implemented into” the H.265 model software. Ex-1007, §2.3.1. Nakamura measured actual improvements from the combination. Ex-1007, §3; Ex-1003, ¶¶262-263, ¶267.

A POSITA would have been motivated by the references' striking similarities and common purpose. Both are directed to H.265. Both derive motion vector prediction candidates, while seeking to reduce the number of candidates, for block-based inter prediction. Ex-1010, §0.1, §0.6, §§8.4.2.1.1-8.4.2.1.3; Ex-1007, Abstract. WD4 provides context for Nakamura's teachings. Ex-1010, ¶3, §8; Ex-1003, ¶¶265-267.

Pet. 63–64 (alterations by Petitioner).

On motivation to combine, Petitioner does not address the particular teachings sought to be combined. Rather, according to Petitioner, anything in Nakamura properly can be combined with anything in WD4 simply because Nakamura is a proposal for the next draft version of new standard H.265, i.e., version 4, and WD4 is the resulting draft version 4 of H.265 after all the proposals had been considered. Pet. 63–64. Petitioner's reasoning is flawed and based on mere speculation.

Nakamura is not a proposal to revise or modify WD4. WD4 did not yet exist at the time the Nakamura proposal was made. Even if some suggestions of Nakamura made it into WD4, as Petitioner asserts (Pet. 63–64), i.e., spatial merge candidate positions unification, that does not mean one of ordinary skill in the art would have had reason to combine other teachings of Nakamura with particular disclosures of WD4. Even assuming Nakamura and WD4 have striking similarities in some way and also a common purpose to some general extent, that still does not mean everything in one is combinable with everything in the other, without specific consideration of what are proposed to be combined and in what manner.

(5) *Preliminary Conclusion for Claim 1*

For the foregoing reasons, Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 of Nakamura and WD4.

b. *Independent Claims 15 and 29*

Claims 15 and 29 are largely the same as claim 1 except for their preambles. Claim 15 is directed to an apparatus comprising a processor and a memory including computer program code, where the processor, memory, and computer program code are configured to cause the apparatus to perform functions essentially corresponding to the steps in claim 1. Ex. 1001, 35:10–48. Claim 29 is directed to a non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, where the “program codes comprising instructions for” actions largely corresponding to the steps in claim 1. *Id.* at 39:22–40:9.

Similar to claim 1, claim 15 includes the limitation “determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 35:27–30. Similar to claim 1, claim 29 includes the limitation “determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” *Id.* at 39:38–41.

The same deficiency discussed above regarding Petitioner’s showing for claim 1’s “determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate” applies to claims 15 and 29. Additionally, we also have the same concerns regarding Petitioner’s stated

motivation to combine the teachings of Nakamura and WD4, as discussed above in the context of claim 1.

Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 15 and 29 over Nakamura and WD4.

4. *Dependent Claims 2–8 and 16–22*

Claims 2–8 each depend, directly or indirectly, from claim 1.

Ex. 1001, 31:51–33:16. Claims 16–22 each depend, directly or indirectly, from claim 15. *Id.* at 35:49–37:19.

The deficiency of Petitioner’s accounting for claim 1 equally applies to claims 2–8. The deficiency of Petitioner’s accounting for claim 15 equally applies to claims 16–22.

Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 2–8 and 16–22 over Nakamura and WD4.

G. *Discretionary Denial Under 35 U.S.C. § 325(d)*

Patent Owner contends that we should exercise discretion to deny institution under 35 U.S.C. § 325(d) based on the framework set forth in *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (precedential). Prelim. Resp. 32.

1. *Analytical Framework*

Section 325(d) provides that “[i]n determining whether to institute” an *inter partes* review, “the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. § 325(d).

When deciding whether to exercise our discretion under § 325(d), we follow the two-part framework set forth in *Advanced Bionics*. Specifically, we must first determine “whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office.” *Advanced Bionics*, Paper 6 at 8. That determination involves “two separate issues”:

- (1) “whether the petition presents to the Office the same or substantially the same art previously presented to the Office”; and
- (2) “whether the petition presents to the Office the same or substantially the same arguments previously presented to the Office.”

Id. at 7. “Previously presented art includes art made of record by the Examiner, and art provided to the Office by an applicant,” e.g., with an information-disclosure statement. *Id.* at 7–8.

If “either condition of first part of the framework is satisfied,” we must then determine “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” *Advanced Bionics*, Paper 6 at 8. “An example of a material error may include misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims.” *Id.* at 8 n.9.

When deciding whether to exercise our discretion under § 325(d) in view of the *Advanced Bionics* framework, we weigh the following nonexclusive factors:

- (a) the similarities and material differences between the asserted references and the prior art involved during prosecution;

- (b) the cumulative nature of the asserted references and the prior art evaluated during prosecution;
- (c) the extent to which the asserted references were evaluated during prosecution, including whether a rejection rested on any reference;
- (d) the extent of overlap between the arguments made during prosecution and Petitioner's reliance on the asserted references or Patent Owner's contentions concerning them;
- (e) whether Petitioner has pointed out sufficiently how the Examiner erred in analyzing the asserted references; and
- (f) the extent to which additional evidence and facts presented in the petition warrant reconsideration of the asserted references or arguments.

See *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph) (“*Becton*”).

Under the *Advanced Bionics* framework, *Becton* factors (a), (b), and (d) relate to “whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office.” *Advanced Bionics*, IPR2019-01469, Paper 6 at 8, 10. *Becton* factors (c), (e), and (f) relate to “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” See *id.* at 7–8, 10.

2. Analysis

It is not in dispute that neither Rusert nor Karczewicz was in the prosecution record of the application which issued as the '714 patent. However, Patent Owner asserts that Rusert is cumulative of three references which were in the prosecution record of the '714 patent: (1) Han

(Ex. 2006);¹² (2) Tai (Ex. 2007);¹³ and (3) Huang (Ex. 2008).¹⁴ Patent Owner explains:

Even though Rusert was not cited during prosecution of the application that resulted in the '714 patent, PO disputes that this arrangement satisfies the claims, because Rusert is largely cumulative of Han, Tai, and Huang. *See* Ex-2006–Ex-2008. Both Rusert and Han disclose a hierarchy of block unit representation, while both Rusert and Tai disclose a correlation between the current block position and neighboring blocks to reduce the number of PMV predictors to be evaluated, and both Rusert and Huang disclose constructing a candidate list based on motion information. *Id.*; Ex-2001 at 31.

Prelim. Resp. 37.

Based on the foregoing arguments, which lack specifics and do not sufficiently map the particular teachings from Rusert relied on by Petitioner to the disclosures of Han, Tai, and Huang, we do not find Rusert to be cumulative of these references. Further, even if all of Rusert's teachings relied on by Petitioner can be found in Han, Tai, and Huang as a collection of separate partial teachings from each, that still does not demonstrate Rusert as a cumulative reference. The quality of disclosure simply is not the same if three references have to be combined to yield what Rusert itself discloses.

¹² Han, Woo-Jin, et al., *Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools*, 20 IEEE Transactions on Circuits and Systems for Video Technology 1709 (2010).

¹³ Tai, Shen-Chuan, et al., *A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications*, 4 Journal of Display Technology 188 (2008).

¹⁴ Huang, Ai-Mei, et al., *A Multistage Motion Vector Processing Method for Motion-Compensated Frame Interpolation*, 17 IEEE Transactions on Image Processing 694 (2008).

Patent Owner also does not explain how it combines Han, Tai, and Huang to provide the same teachings relied on from Rusert by Petitioner.¹⁵

Patent Owner additionally asserts that Rusert was considered in an application (“the ’156 Application”) continuing from that which issued as the ’714 patent and itself issuing as U.S. Patent No. 11,570,467 (“the ’467 patent”), by the same Examiner who examined the application that issued as the ’714 patent, and that the ’467 patent has similar claims as the ’714 patent. Prelim. Resp. 34, 38–40. This argument also is unpersuasive, for several reasons.

First, the ’156 application is a continuing application and not a part of the prosecution history of the ’714 patent. The ’714 patent issued on January 14, 2020 (Ex. 1001, code (45)), and the Information Disclosure Statement including Rusert was filed in the ’156 application on June 7, 2021 (Ex. 2004, 147–53). Second, the claims in the ’467 patent issuing from the ’156 application do not include this limitation in claim 1 of the ’714 patent: “without making a comparison of each pair from the set of spatial motion vector prediction candidates,” or this limitation in claims 15 and 29 of the ’714 patent: “without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates.”

¹⁵ In its Sur-reply, Patent Owner argues that Rusert is cumulative of Tai. Paper 10, 3. Any argument that Tai alone includes all the teachings from Rusert that Petitioner has relied on should have been presented in the Preliminary Response. In any event, the Sur-reply does not account for, in Tai, all the features Petitioner has relied on Rusert to show, e.g., a prediction list and determining a subset based on the location of the block associated with the first spatial motion vector prediction candidate.

Patent Owner argues the fact that the claims of the '467 patent are broader than the claims of the '714 patent actually helps Patent Owner because, logically, the Examiner would have been expected to allow the more narrow claims of the '714 patent over Rusert. Paper 10, 1–2. We disagree. The argument is misplaced. The inquiry under *Advanced Bionics* is whether the same or substantially the same art or arguments were previously presented to the Office, not whether one can deduce the same Examiner action based on arguments actually previously presented to the Examiner but which are not the same or substantially the same as those presented by the Petitioner.

3. *Preliminary Conclusion*

For the foregoing reasons,¹⁶ we find that the same or substantially the same prior art or arguments previously were not presented to the Office. We need not proceed past the first stage of the *Advanced Bionics* framework. We decline to exercise discretion under § 325(d) to deny the Petition.

H. *Petitioner's Filing of Multiple Parallel Petitions*

The instant Petition is one of two petitions Petitioner filed on the same day, April 8, 2024, against the '714 patent. No previous petition had been filed by Petitioner against the '714 patent.

The Board has indicated that “one petition should be sufficient to challenge the claims of a patent in most situations.” Consolidated Trial

¹⁶ We do not consider § 325(d) arguments relating to Nakamura and WD4, because we determine that the alleged ground of unpatentability based on Nakamura and WD4 lacks sufficient substantive merit, and because we institute review on the basis of the alleged grounds of unpatentability based on Rusert and Karczewicz and based on Rusert, Karczewicz, and Lin.

Practice Guide 59 (Nov. 2019) (“CTPG”).¹⁷ But “the Board recognizes that there may be circumstances in which more than one petition may be necessary.” *Id.*

Petitioner has filed a paper explaining why in its view two petitions are appropriate in this case against the ’714 patent, and ranking the two petitions, if it is permitted only to file a single petition. Paper 4. Petitioner ranks the petition in IPR2024-00605, challenging claims 9–14, 23–28, and 30 of the ’714 patent first, ahead of the Petition in this proceeding, challenging claims 1–8, 15–22, and 29 of the ’714 patent. *Id.* at 1.

Petitioner explains: “Here, two petitions are necessary because of the large number of challenged claims (30). Since Patent Owner has not yet identified the claims it intends to assert in district court, all of the challenged claims therefore remain material to the parties’ dispute.” Paper 4, 1–2.

Petitioner further explains:

The ’714 patent has 30 claims, which alone includes 4,349 words, spanning 10 columns of text, reciting complex video compression subject matter. Given the volume of claims, challenging all 30 claims in a single petition would materially reduce the petitions’ thoroughness and unduly burden the Board with overly terse analysis that would be more difficult to analyze. Filing two petitions, on the other hand, allows for clearer and more detailed analysis for this volume of claims.

Institution of both Petitions would not be an inefficient use of resources because (i) the challenged claims share common limitations and similar subject matter; and (ii) the petitions are based on the same prior art. Two petitions are necessary, as discussed below, to address non-overlapping limitations relating to encoding/decoding that include different explanations regarding the same prior art.

¹⁷ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

Id. at 3.

Petitioner additionally explains that this is not a situation where multiple petitions attack the same claims. Paper 4, 3. Petitioner notes that the claims challenged in this proceeding are directed to encoding a block of pixels, and that the claims challenged in IPR2024-00605 are directed to decoding blocks of pixels. *Id.* at 3–4. Petitioner notes that although the two petitions are based on the same prior art, different disclosures from the prior art references are relied upon in the two petitions. *Id.* at 4. Petitioner asserts that “multiple petitions are warranted due to the complex nature of the claims,” and that “[t]he ’714 claims recite granular details of operations performed during motion prediction.” *Id.* at 5.

Although we do not think 30 claims are too numerous for one petition to cover, many claims in the ’714 patent are extraordinarily lengthy and include numerous limitations. For example, claim 6, which depends from claim 5, which depends from claim 1, is more than one column long in the ’714 patent. The length of claim 20, which depends from claim 19, which depends from claim 15, also is more than one column long in the ’714 patent. Additionally, we agree with Petitioner that the subject matter of the ’714 patent is complex. We further agree with Petitioner that the division of claims among the two petitions, i.e., encoder claims in IPR2024-00604 and decoder claims in IPR2024-00605, is a structured division which helps to facilitate the handling of two petitions.

Patent Owner has not presented arguments urging that the filing of two petitions by Petitioner against the ’714 patent is excessive.

For the foregoing reasons, we determine that the filing of two petitions by Petitioner against the ’714 patent is reasonable under these

circumstances. We decline to exercise discretion to deny either petition on the ground of the Petitioner filing an excessive number of petitions against the '714 patent.

IV. CONCLUSION

For the foregoing reasons, we conclude that Petitioner has shown a reasonable likelihood that it would prevail in establishing that at least one of claims 1–8, 15–22, and 29 of the '714 patent is unpatentable.

V. ORDER

In consideration of the foregoing, it is

ORDERED that *inter partes* review of all challenged claims, i.e., claims 1–8, 15–22, and 29 of the '714 patent, is instituted on all grounds stated in the Petition; and

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

IPR2024-00604
Patent 10,536,714 B2

For PETITIONER:

Harper Batts
Chris Ponder
Jeffrey Liang
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
hbatts@sheppardmullin.com
cponder@sheppardmullin.com
jliang@sheppardmullin.com

For PATENT OWNER:

Scott W. Hejny
Eric S. Hansen
MCKOOL SMITH P.C.
shejny@McKoolSmith.com
ehansen@McKoolSmith.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC. and AMAZON.COM SERVICES LLC,
Petitioner,

v.

NOKIA TECHNOLOGIES OY,
Patent Owner.

IPR2024-00605
Patent 10,536,714 B2

Before JAMESON LEE, STEVEN M. AMUNDSON,
and JASON M. REPKO, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

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

I. INTRODUCTION

Amazon.com, Inc. and Amazon.com Services LLC (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 9–14, 23–28, and 30 (“challenged claims”) of U.S. Patent No. 10,536,714 B2 (Ex. 1001, “the ’714 patent”). Paper 3 (“Pet.”). Nokia Technologies Oy (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). Petitioner filed a Preliminary Reply. Paper 9 (“Prelim. Reply”). Patent Owner filed a Preliminary Sur-reply. Paper 10 (“Prelim. Sur-reply”).

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2024). An *inter partes* review may not be instituted unless the information presented in the Petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). The “reasonable likelihood” standard is “a higher standard than mere notice pleading” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

Upon consideration of the contentions and the evidence of record before us, we conclude Petitioner has shown a reasonable likelihood that it would prevail in establishing unpatentability of at least one challenged claim of the ’714 patent. Accordingly, we institute an *inter partes* review of all challenged claims of the ’714 patent on all grounds set forth in the Petition.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself as real party in interest. Pet. 88. Patent Owner identifies itself as real party in interest. Paper 5, 2.

B. *Related Matters*

The parties each identify the following litigations as related to the '714 patent:

Nokia Corp. et al. v. Amazon.com, Inc. et al., No. 1:23-cv-01232 (D. Del.);

Nokia Techs. Oy v. HP Inc., No. 1:23-cv-01237 (D. Del);

In the Matter of Certain Video Capable Electronic Devices, Including Computers, Streaming Devices, Televisions, and Components and Modules Thereof, Inv. No. 337-TA-1380 (USITC).

Pet. 88; Paper 5, 2.

Petitioner also has filed another petition against other claims in the '714 patent. IPR2024-00604, Paper 3.

C. *The '714 Patent*

The '714 patent issued from Application No. 16/356,733, filed March 18, 2019, which claims priority to Provisional Application No. 61/555,703, filed November 4, 2011. Ex. 1001, codes (21), (22), (60).

The '714 patent relates to encoding and decoding video information. Ex. 1001, code (57). Generally, video information may be encoded in two phases. *Id.* at 1:40–43. The '714 patent describes:

In the first phase, pixel values in a certain picture area or “block” are predicted. The pixel values can be predicted for example, by motion compensation mechanisms, which involve finding and indicating an area in one of the previously encoded video frames (or a later coded video frame) that corresponds closely to the block being coded. Additionally, pixel values can be predicted

by spatial mechanisms which involve finding and indicating a spatial region relationship, for example by using pixel values around the block to be coded in a specific manner.

Prediction approaches using image information from a previous (or a later) image can also be called as Inter prediction methods, and prediction approaches using image information within the same image can also be called as Intra prediction methods.

The second phase is one of coding the error between the predicted block of pixels and the original block of pixels.

Id. at 1:43–59. The decoder reconstructs the output video by applying a prediction mechanism similar to that used by the encoder and by applying prediction error decoding to recover the prediction error signal. *Id.* at 2:4–11. “After applying pixel prediction and error decoding processes the decoder combines the prediction and the prediction error signals (the pixel values) to form the output video frame.” *Id.* at 2:12–15.

The ’714 patent introduces a method for generating a motion vector prediction list for an image block. Ex. 1001, 4:18–19. The motion prediction candidate list is constructed in a way that reduces complexity of list construction. *Id.* at 2:19–22. The method performs only a limited number of motion information comparisons between candidate pairs to remove redundant candidates rather than perform a comparison for every available candidate pair, to construct the motion prediction candidate list. *Id.* at 2:19–25. “The decision of whether comparing two candidates may depend on the order of the candidates to be considered for the list and/or coding/prediction mode and/or location of the blocks associated with the candidates.” *Id.* at 4:26–30. By this method, a list of motion prediction candidates is created from which one of the candidates is to be signaled as

the motion information for the current coding or prediction unit. *Id.* at 4:30–34.

Figure 9 of the '714 patent is reproduced below:

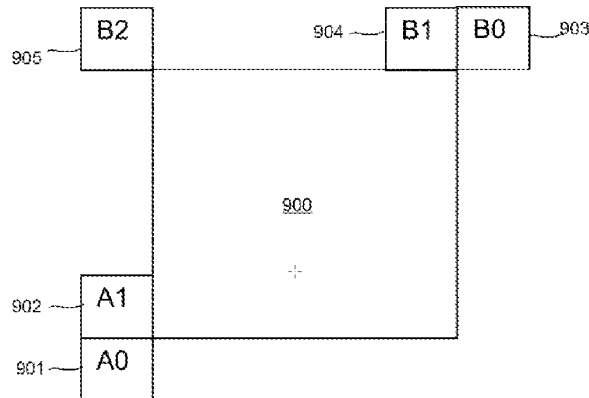


Fig. 9

Figure 9 illustrates an example of a coding unit and some neighboring blocks of the coding unit. Ex. 1001, 8:6–7. In this example the spatial motion prediction candidates are spatial neighboring blocks A0, A1, B0, B1, and B2. *Id.* at 14:64–65. These candidates for the current block being coded can be processed in a predetermined order, for example A1, B1, B0, A0, and B2. *Id.* at 15:15–16.

The '714 patent describes that a coding unit may be vertically split into two rectangular prediction units or horizontally split into two rectangular prediction units. Ex. 1001, 15:50–16:5. Figures 11a and 11b are reproduced below:

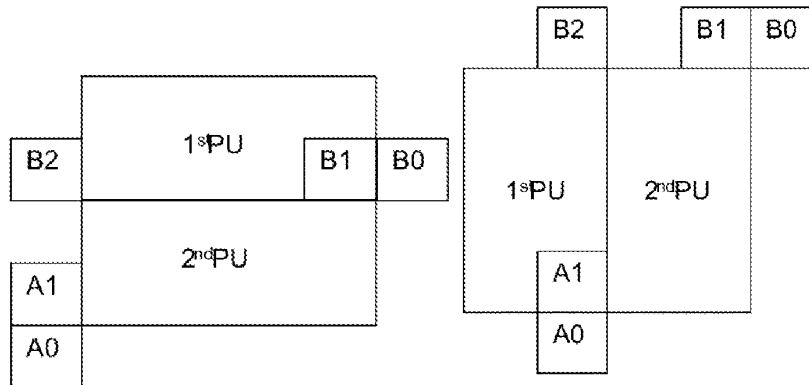


Fig. 11a

Fig. 11b

Figure 11a illustrates locations of five spatial neighbors A0, A1, B0, B1, and B2 for a prediction unit (PU) generated as the second prediction unit of a horizontally divided coding unit. Ex. 1001, 8:12–14. Figure 11b illustrates locations of five spatial neighbors for a prediction unit generated as the second prediction unit of a vertically divided coding unit. *Id.* at 8:15–17.

The '714 patent describes that if the current coding unit is horizontally split into two rectangular prediction units and the current prediction unit is the second prediction unit in the coding/decoding order, then A1 is compared only with B1, and if A1 has the same motion information as B1, then A1 would not be included in the list being constructed. Ex. 1001, 15:61–16:1. In contrast, if the comparison indicates A1 does not have the same motion information as B1, then A1 would be included in the list as a spatial motion prediction candidate, assuming that the list does not already contain a maximum number of spatial motion prediction candidates. *Id.* at 15:18–29, 16:5–7.

The '714 patent describes that if the current coding unit is horizontally split into two rectangular prediction units and the current prediction unit is the second prediction unit in the coding/decoding order, then B1 is not

included in the list being constructed. Ex. 1001, 16:11–16. If the current coding unit is not horizontally split into two rectangular prediction units and if block B1 has the same motion information as block A1, then B1 is not included in the list. *Id.* at 16:16–21. Otherwise, B1 is included in the list as a spatial motion prediction candidate, assuming that the list does not already contain a maximum number of spatial motion prediction candidates. *Id.* at 15:18–29, 16:21–23.

The '714 patent describes that if the spatial motion prediction candidate is block B0, then it is not included in the list if it has the same motion information as block B1. Ex. 1001, 16:24–27. The '714 patent describes that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block B0 is included in the list. *Id.* at 16:27–31.

The '714 patent describes that if the spatial motion prediction candidate is block A0, then it is not included in the list if it has the same motion information as block A1. Ex. 1001, 16:32–35. The '714 patent describes that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block A0 is included in the list. *Id.* at 16:27–31.

The '714 patent describes that if the spatial motion prediction candidate is block B2, then it is not included in the list if it has the same motion information as block A1. Ex. 1001, 16:45–49. The '714 patent indicates that, otherwise, if the number of spatial motion prediction candidates in the list is less than the maximum number of spatial motion prediction candidates, then block B2 is included in the list. *See id.* at 15:22–29, 15:46–49.

Claims 9, 23, and 30 are independent. Claims 9 and 23 are representative and reproduced below:¹

9. [pre] A method comprising:

- [a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;
- [b] determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;
- [c] comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;
- [d] determining to include or exclude the first spatial vector prediction candidate in the motion vector prediction list based on the comparing; and
- [e] selecting a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

Ex. 1001, 33:17–48.

¹ The bracketed headings correspond to those used by Petitioner to reference the claim elements. *See* Pet. 63–74, 85–86. We use the same headings here for ease of reference, understanding, and consistency.

23. [pre] An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

[a] select a first spatial motion vector candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

[b] determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

[c] compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

[d] determine to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on comparison of the motion information of the first spatial motion vector candidate with motion information of the spatial motion vector prediction candidate; and

[e] select a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

Id. at 37:20–57.

D. The Applied Prior Art and Declarations

Petitioner relies on the following evidence:

Name	Patent Document/Publication	Exhibit
Rusert ²	US Pat. Pub. No. 2011/0194609	1004
Karczewicz ³	US Pat. Pub. No. 2011/0249721	1005
Lin ⁴	US Pat. Pub. No. 2014/0092981	1006
Nakamura Document ⁵	Nakamura et al., “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1007
Nakamura WD Description ⁶	Nakamura et al., “WD Description of JCTVC-F419 Proposal 1” for “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1008
Nakamura Presentation ⁷	Nakamura et al., “Unification of derivation process for merge mode and MVP,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, Italy, Jul. 14–22, 2011 (Document JCTVC-F419).	1009
WD4	Bross et al., “WD4: Working Draft 4 of High-Efficiency Video Coding,” Joint Collaborative Team on Video Coding (JCT-VC) of ITC-T SG16 WP3 and ISO/IEC JCT1/SC29/WG11, 6 th Meeting: Torino, IT, Jul. 14–22, 2011 (Document JCTVC-F803).	1010

² Published August 11, 2011. Ex. 1004, code (43).

³ Published October 13, 2011. Ex. 1005, code (43).

⁴ Issued from Application No. 14/123,200, which claims priority to Provisional Application No. 61/500,903, filed June 24, 2011. Ex. 1006, codes (21), (60). Patent Owner does not dispute this priority date of Lin.

⁵ Published July 2011.

⁶ Published July 2011.

⁷ Published July 2011.

Petitioner also relies on the Declaration of Charles D. Creusere, Ph.D. Ex. 1003. With regard to the status of Nakamura and WD4 as prior art printed publications, Petitioner additionally relies on the Declarations of Vivienne Sze, Ph.D. (Ex. 1014) and Clifford Reader, Ph.D. (Ex. 1050).⁸ Patent Owner relies on the Declaration of Iain E. Richardson, Ph.D. (Ex. 2001).

E. The Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims of the '714 patent are unpatentable based on the following grounds (Pet. 16):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
9, 10, 12–14, 23, 24, 26–28, 30	103(a) ⁹	Rusert, Karczewicz
9–14, 23–28, 30	103(a)	Rusert, Karczewicz, Lin
9–14, 23–28, 30	103(a)	Nakamura, ¹⁰ WD4

⁸ Patent Owner disputes that WD4 constitutes prior art as of the effective filing date of the '714 patent. Prelim. Resp. 59–64. However, we need not reach the issue because, as discussed below, the alleged ground of unpatentability based on Nakamura and WD4 lacks sufficient substantive merit.

⁹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the '714 patent claims priority to an application filed before March 16, 2013 (the effective date of the amendments), the pre-AIA version of § 103 applies.

¹⁰ Petitioner uses the name “Nakamura” to refer to a collection of three files, i.e., the “Nakamura Document” (Ex. 1007), the “Nakamura WD Description” (Ex. 1008), and the “Nakamura Presentation” (Ex. 1009). Pet. 62–63. Petitioner asserts that “they were jointly presented in a single proposal, by the same author, packaged together in a single zip, and meant to be read together, teaching related aspects of Nakamura’s proposal.” *Id.*

III. ANALYSIS

A. *Legal Standards*

A claim is unpatentable under 35 U.S.C. § 103(a) “if the differences between the subject matter sought to be patented 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.” 35 U.S.C. § 103(a); *see KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations of nonobviousness.¹¹ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. *Level of Ordinary Skill in the Art*

Citing testimony from Dr. Creusere, Petitioner asserts a person of ordinary skill in the art (hereinafter “POSITA”) “would have had (1) a bachelor’s degree in electrical engineering, computer engineering, computer science, or a comparable field of study such as physics, and (2) approximately two to three years of practical experience with video encoding/decoding.” Pet. 21 (citing Ex. 1003 ¶¶ 57–59).

Patent Owner states that it “has applied Petitioner’s POSITA for the sake of this Response.” Prelim. Resp. 31.

On this record, we adopt Petitioner’s statement of the level of ordinary skill in the art. It is supported by the testimony of Dr. Creusere and not

¹¹ The record does not include any evidence of secondary considerations of nonobviousness.

disputed by Patent Owner. Further, it appears consistent with what is reflected by the content of the applied prior art. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill).

C. Claim Interpretation

We use the same claim construction standard that would be used to construe a claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). The claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) is applicable.

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.* at 1316. “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the

specification or during prosecution.” *Thorner v. Sony Comput. Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal, if any, can be effectuated by language in the specification or the prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. “*spatial motion vector prediction candidate*”

Petitioner construes the term “spatial motion vector prediction candidate” to mean “a candidate motion vector obtained from one or more previously-coded blocks in the current frame.” Pet. 21. Because no dispute hinges on the meaning of this term, we do not find it necessary to construe this term expressly.

2. “*subset of . . . candidates*”

Petitioner construes the term “subset of . . . candidates” in limitation [9b] to mean a subset of one or more [spatial motion vector prediction] candidates. Pet. 22. Patent Owner does not present any contrary position or argument. Because no dispute hinges on the meaning of this term, we do not find it necessary to construe this term expressly.

3. “*the block*”

Petitioner asserts:

Limitation [9b] recites “*the block*,” which could be interpreted to refer to either (a) the “block of pixels” introduced in [9a], or (b) the block from which the first spatial motion vector candidate is obtained. During prosecution of the parent ’833 patent, the Examiner applied the first interpretation, with “the” block as the “current block” (Ex-1015, 000168), which the Applicant did not dispute (Ex-1015, 000241-244). For purposes of this IPR, Petitioner applies the Examiner’s interpretation, where “the block” finds antecedent basis in the “block of pixels” in [9a]. Ex-1003, ¶ 66.

Pet. 22.

Notably, Petitioner recognizes that there are two potential choices of what is referred to by “the block” in limitation [9b], one being the block of pixels recited in limitation [9a], i.e., the current block being processed, and the other being a block, not previously recited in the claim, but from which the first spatial motion vector candidate is obtained. Overlooked by Petitioner is that the words “the block” are a part of the bigger term “the block *associated with* the first spatial motion vector prediction candidate.” Ex. 1001, 33:28–30 (emphasis added).

That specific claim language of association indicates a relationship between “the block” and the first spatial motion vector prediction candidate, that is more than how every single prediction candidate broadly may be regarded in general as related to the current block being processed, the block for which a motion vector prediction list is being generated. The modifier “associated with the first spatial motion vector prediction candidate” clearly modifies “the block” at issue here and cannot be discarded or ignored.

Further, if “the block” refers to the block recited in limitation [9a], i.e., the current block being processed, then the modifying phrase

“associated with the first spatial motion vector prediction candidate” would be superfluous and have no meaning, because “the block,” without the modifying phrase, would already derive its antecedent basis from “a block of pixels” recited in limitation [9a]. We decline to adopt a construction that reads out “associated with the first spatial motion vector prediction candidate.” Construing the claim according to what the claim language actually states, without excluding any part of the claim language recited, is more appropriate.

The Specification of the ’714 patent is consistent with the plain reading of “the block associated with the first spatial motion vector prediction candidate.” Each selected first candidate to evaluate for inclusion in a prediction list for the current block is compared with a subset of candidates associated with the first selected candidate. Ex. 1001, 15:18–29, 15:46–49, 16:1–49. Patent Owner correctly notes:

The ’714 patent makes clear that the candidate motion vectors for the current frame use either “one or more . . . neighbor blocks . . . of the current block in the same frame and/or co-located blocks . . . of the current block in one or more other frames[,]” i.e., *these are motion vectors associated with other blocks, rather than the current block*, to define a list of suitable motion vector candidates for the current block, as would be understood by a POSITA [person of ordinary skill in the art]. Ex-1001 at 12:51–56; Ex-2001 at 38.

Prelim. Resp. 50 (emphasis added) (alterations by Patent Owner). Patent Owner further correctly notes that if Petitioner’s proposed construction is adopted, that would mean the “determining a subset” recitation of limitation [9b] is satisfied regardless of whether the location of the block is associated with a first spatial motion vector candidate, directly contrary to the recitation of limitation [9b]. We agree with Patent Owner that Petitioner’s proposed

construction improperly reads out the claim language “associated with the first spatial motion vector prediction candidate.” *Id.* at 51.

The reason Petitioner provided for its construction is that an Examiner had taken that interpretation during prosecution of a parent application of the ’714 patent. Pet. 22. However, Petitioner does not provide claim language that was construed in the parent application. Nor does Petitioner specifically compare that claim language with the claim language here. Even if the claim language is the same, that an Examiner had construed the language that way does not make it a proper construction if the Applicant did not dispute that construction during prosecution of the parent application. The Applicant might not have needed to present arguments in that regard to obtain allowance of its claims.

Claim construction is a question of law, and we are not bound by an earlier construction of an Examiner who applied a different standard for claim construction in a parent application for a similar claim term.

For the foregoing reasons, we disagree with Petitioner’s proposed construction of “the block” to mean “the block of pixels” in limitation [9a]. Rather, “the block” in limitation [9b] means “the block associated with the first spatial motion vector prediction candidate,” as limitation [9b] states.

D. Alleged Obviousness of Claims 9, 10, 12–14, 23, 24, 26–28, and 30 over Rusert and Karczewicz

1. Overview of Rusert (Exhibit 1004)

Rusert’s disclosure relates to a method of selecting predicted motion vector (PMV) candidates, a video coding apparatus, a video decoding apparatus, and a computer-readable medium. Ex. 1004 ¶ 1.

Figure 1 of Rusert is reproduced below:

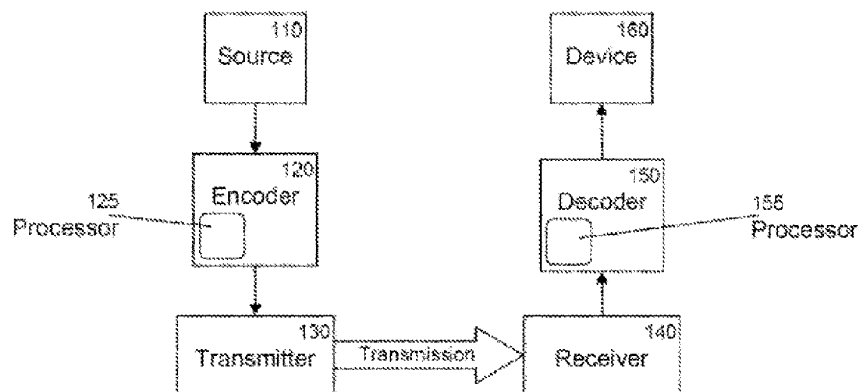


Fig. 1

Figure 1 illustrates a video coding and transmission system according to Rusert. Ex. 1004 ¶ 27.

In the illustrated coding system of Figure 1, a video signal from source 110 is ultimately delivered to device 160. Ex. 1004 ¶ 34. The video signal from source 110 is passed through encoder 120 containing processor 125. *Id.* Encoder 120 applies an encoding process to the video signal to create an encoded video stream, which is sent to transmitter 130. *Id.* Receiver 140 receives the transmitted encoded stream and passes it to decoder 150. *Id.* Decoder 150 contains processor 155 which is used to decode the encoded video stream. *Id.* The decoder outputs a decoded video stream to device 160.

Rusert describes:

The methods disclosed herein are performed in the encoder during encoding, and also in the decoder during decoding. This is achieved even though the generation of the signaling bits is done in the encoder. During decoding the decoder parses the bits and mimics of the encoder in order to achieve encoder/decoder synchronization. Because the encoder and decoder follow the same rules for creating and modifying the set of PMV candidates, the respective lists of PMV candidates stored in the encoder and decoder maintain synchronization[.]

Still, explicit signaling of PMV candidate lists may be performed under certain circumstances.

The described method assume coding of a motion vector (MV) 210 using predictive coding techniques, where a predicted motion vector (PMV) 220 is used to predict a MV 210, and the prediction error or difference (DMV) 230 is found according to $DMV = MV - PMV$. DMV 230 is signaled from the encoder 120 to the decoder 150. Additionally, a code “index” 250 is sent to select a particular PMV candidate, in this case 242 from a list of PMV candidates, PMV_CANDS 240 as shown in FIG. 2a. The index 250 may be sent once together with each transmitted motion vector MV 210, i.e., per sub-block (e.g. 8x8 pixel block). Likewise, the index may be sent for groups of motion vectors, e.g. per macroblock (16x16 block).

Ex. 1004 ¶¶ 35–36. The list PMV_CANDS 240 is identically available at both the encoder and decoder. *Id.* ¶ 37. “Using the transmitted index, the decoder 150 can determine the PMV 220 as used in the encoder as shown in FIG. 2b, and thus may reconstruct $MV = DMV + PMV$.” *Id.*

Rusert describes a method of selecting PMV candidates, wherein each PMV candidate corresponds to a motion vector used for coding of a previous block within an allowed distance from the current block. Ex. 1004 ¶ 11. The method comprises selecting a set of PMV candidates as a subset of the previously coded motion vectors that were used for previous blocks having an allowed distance from the current block. *Id.*

Rusert further describes:

A PMV candidate list is created by selecting a subset of the motion vectors previously used for previous blocks. Restricting the previous blocks that are considered reduces the number of previous motion vectors that must be considered meaning that less computation is needed, improving the processor efficiency of the coding.

Identifying allowed distance values means that certain distance values may not be allowed. These not allowed distance values result in skipped layers of blocks. The size of the PMV candidate list is limited because a very large list would require long code words to identify which PMV candidate to use[.] Skipping layers can provide increased coding efficiency by ensuring that not only the nearest neighbor previous blocks are considered, but also previous blocks. This allows a candidate list to be produced using motion vectors from a wide range of previous blocks, but that is not excessively long.

Ex. 1004 ¶¶ 12–13.

Rusert additionally describes:

The PMV_CANDS list used for coding a motion vector associated with a current motion compensation block can be dynamically generated specifically for the current motion compensation block, i.e. without consideration of the PMV_CANDS lists used for coding of MVs associated with motion compensation blocks previously coded. In that case, before a block is processed, a PMV_CANDS list is initialized and then updated with a number of previously coded or predefined motion vectors.

Ex. 1004 ¶ 41.

Rusert also describes a way to reduce the number of candidates in the PMV_CANDS list:

One measure for reducing the number of candidates is to avoid duplicate occurrences of the same motion vector in a given PMV_CANDS list. This can be done, when updating the list, by comparing the candidates already in the list with the new vector that could be added, and if a duplicate is found, either removing the duplicate vector or skipping the new vector. It is preferable to skip the new vector, otherwise a subsequent duplicate from a distant block may cause a candidate high in the order of the list to be put at the end of the list.

Ex. 1004 ¶ 71.

2. *Overview of Karczewicz (Exhibit 1005)*

Karczewicz discloses video coding techniques applicable to a coded block pattern of a coding unit (CU) of video data. Ex. 1005 ¶ 31.

Karczewicz refers to a developing coding standard H.265 as follows:

Efforts are currently in progress to develop a new video coding standard, currently referred to as High Efficiency Video Coding (HEVC). The emerging HEVC standard may sometimes be referred to as ITU-T H.265. The standardization efforts are based on a model of a video coding device referred to as the HEVC Test Model (HM).

Id. ¶ 32. Karczewicz states that “HM refers to a block of video data as a coding unit (CU).” *Id.* ¶ 33.

Karczewicz describes that a CU has a similar purpose as a macroblock in previous standard H.264, “except that a CU does not have the same size limitations associated with macroblocks.” Ex. 1005 ¶ 33. Karczewicz also describes that “[s]yntax data within a bitstream may define a largest coding unit (LCU), which is a largest coding unit in terms of the number of pixels.” *Id.*

Karczewicz describes that a CU may be split into sub-CUs, and that “[i]n general, references in this disclosure to a CU may refer to a LCU of a picture or a sub-CU of an LCU.” Ex. 1005 ¶ 33. An LCU may be split into sub-CUs, and each sub-CU may be split into sub-CUs. *Id.* Karczewicz describes that a bitstream may also define a smallest coding unit (SCU). *Id.*

According to Karczewicz, a CU may be partitioned into one or more prediction units (PUs). Ex. 1005 ¶¶ 33, 35. “[A] CU may be broken into blocks, e.g., sub-CU and/or one or more PU or TU.” *Id.* ¶ 41. In general, a PU represents all or a portion of the corresponding CU, and includes data for retrieving a reference sample for the PU. *Id.* ¶ 35. Karczewicz describes

that “[d]ata for the CU defining the PU(s) may also describe, for example, partitioning of the CU into one or more PUs.” *Id.* Karczewicz describes that “prediction operations may be performed using a PU based on a block size of PU.” *Id.* ¶ 46. Further, Karczewicz describes that it uses the term “block” to refer to any one of LCU, SCU, CU, PU, or transform unit (TU). *Id.* ¶ 33.

3. *Claim 9*

a. *Preamble recitation 9[pre]*

The preamble recites: “A method comprising:” Ex. 1001, 33:17. Petitioner asserts that its “Ground 1 teaches [9pre],” citing Rusert’s Abstract and paragraphs 1 and 11. Pet. 27. Patent Owner does not dispute the assertion. Petitioner sufficiently accounts for the preamble of claim 9, even assuming that the preamble is limiting.

b. *Limitation 9[a]*

Limitation 9[a] recites:

selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

Ex. 1001, 33:18–26.

To account for “selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels,” Petitioner explains: “Rusert teaches ‘selecting . . . PMV [prediction motion vector] candidates’ for a current block from a ‘set of previously coded motion vectors that were used for previous blocks.’”

Pet. 27 (citing Ex. 1004 ¶¶ 11–12, 15, 24–25, 39, 44, 51–66, 113, Fig. 6) (emphasis added, first alteration by Petitioner).

Petitioner further explains: “As Rusert iterates through blocks of pixels in a frame, each block will have its own unique set of previously-coded motion vectors from which to select a PMV candidate because after a block is encoded/decoded, the set of previously-coded motion vectors increases.” Pet. 27–28 (citing Ex. 1004 ¶¶ 2, 11–12, 36, 59, Fig. 3g; Ex. 1003 ¶¶ 102, 104). Petitioner further explains: “Rusert’s predicted motion vector (‘PMV’) (Ex-1004, ¶3) candidates comprise spatial motion vector prediction candidates obtained from previously-encoded blocks in the current frame,” include spatially neighboring motion vectors, and are included in “PMV_CANDS, which ‘comprise[s] *spatial . . . neighbors* of the current block’ in the current frame.” *Id.* at 28–29 (citing Ex. 1004 ¶¶ 4–6, 67; Ex. 1003 ¶ 103) (alterations by Petitioner).

Patent Owner does not dispute these assertions. Petitioner’s assertions are supported by the cited evidence. Petitioner sufficiently accounts for this portion of limitation 9[a]: “selecting a first spatial motion vector prediction candidate from set of spatial motion vector prediction candidates for an encoded block of pixels.”

Regarding the portion of limitation 9[a] that states “[selecting a first . . . candidate . . .] as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels,” Petitioner explains that Rusert teaches search patterns for an outwards going scan around the current block for “selecting PMV candidates to potentially be included in PMV_CANDS.” Pet. 29 (citing Ex. 1004 ¶¶ 44, 51–56, Figs. 3a–3n (“showing numerical scan order

around current block ‘.’ from block 1 onwards”). *Id.* Petitioner presents on page 29 of the Petition the following annotated Figure 3n of Rusert:

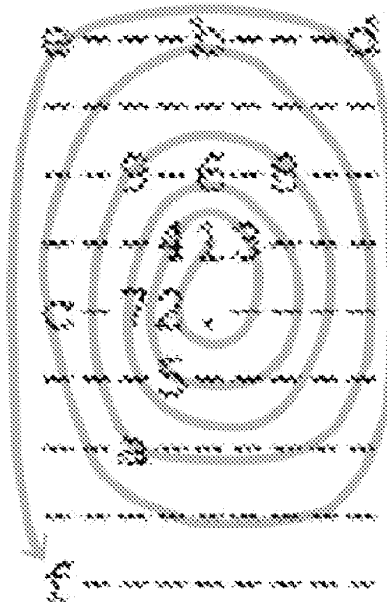


Fig. 3n

Annotated Figure 3n illustrates a possible scan pattern and distance measurements for a plurality of blocks surrounding a current block, to which Petitioner has added directional scanning order in red. *Id.* at 29; Ex. 1004 ¶ 30.

Petitioner explains that following the search pattern sequences, of which Figure 3n is an example, Rusert visits a previously coded block and selects the motion vector for that block as a candidate for potential inclusion in PMV_CANDS. Pet. 29–30 (citing Ex. 1004 ¶¶ 44, 51–56; Ex. 1003 ¶ 107). Petitioner further explains:

PMV_CANDS is a **motion vector prediction list for a prediction unit of the block of pixels**. It is a list of predicted motion vectors “used for coding a motion vector associated with

a current . . . block.” Ex-1004, ¶¶41, ¶4, ¶¶39–42. PMV_CANDS is “dynamically generated specifically for the current . . . block[.]” EX-1004, ¶41. “[B]efore a block is processed, a PMV_CANDS list is initialized and then updated with . . . motion vectors.” *Id.* When PMV_CANDS is updated, i.e., when “one or more motion vectors are added” (Ex-1004, ¶39), it comprises a subset of the set of previously-coded motion vectors that have been included in PMV_CANDS to that point. Ex-1004, ¶¶4-5, ¶¶36–39, ¶¶43–44, ¶¶51–66. When PMV_CANDS is complete, a “predicted motion vector (PMV) that “is used to predict a [motion vector]. . . is signaled” using an index “to select a particular PMV candidate . . . from PMV_CANDS[.]” Ex-1004, ¶36; Ex-1003, ¶108.

The prediction unit of Rusert’s encoded block of pixels is the encoded block itself because that is the unit for which a motion vector is assigned for motion prediction. Ex-1004, ¶¶2–4, ¶43. Rusert provides a motion vector for each “8X8 pixel block,” also called a “sub-block” because it is a portion of a “macroblock.” Ex-1004, ¶36. Rusert scans neighboring blocks because motion vectors are assigned based on encoded blocks, which are the PUs in Rusert’s teachings. *See* Ex-1004, ¶¶50–67, Figs. 3a-3n; Ex-1003, ¶109.

Pet. 30–31 (emphasis added, alterations by Petitioner).

Patent Owner does not dispute these assertions. Petitioner’s assertions are supported by the cited evidence. Petitioner sufficiently accounts for this portion of limitation 9[a]: “[selecting a first . . . candidate . . .] as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels.”

Alternatively, Petitioner relies on Karczewicz to account for a “prediction unit.” Pet. 31–32. Petitioner explains:

Additionally, Ground 1 combines Rusert’s “block” teaching (following H.264 terminology) to PUs (in H.265 terminology). *Supra* §VI.A.1; Ex-1004, 116. As Karczewicz explains, H.265 introduced terminology for a type of block called

“prediction unit[s.]” Ex-1005, ¶¶33-36; *supra* §I. “In general, a CU has a similar purpose to a macroblock of H.264” (Ex-1005, ¶33), which in its simplest case is commensurate with a PU but may also be divided into multiple PUs. Ex-1005, ¶35. “[T]he PU may include data defining a motion vector for the PU” that is used for “prediction using a PU[.]” Ex-1005, ¶¶35-36, ¶66; Ex-1003, ¶¶110-111. In short, Karczewicz explains that H.265 assigned motion vectors based on a type of block called a PU. Ex-1005, ¶¶33-36, ¶64. Rusert explained its teachings based on the blocks for which motion vectors were assigned (Ex-1004, ¶¶2-5, ¶36, ¶43). Both Karczewicz and Rusert teach the encoder and decoder use “reciprocal. . . techniques[,] which confirms these teachings are applicable to both encoding and decoding. Ex-1005, ¶50; Ex-1004, ¶35, ¶¶24-25. Therefore, it would have been obvious to apply Rusert’s teachings to PUs, with PMV_CANDS being a motion vector prediction list for a PU of the encoded block of pixels. Ex-1005, ¶¶33-36, ¶66; Ex-1003, ¶¶110-112.

A decoder using PMV_CANDS for decoding an encoded block of pixels would “follow the same rules” as the encoder that encoded the block of pixels to “maintain synchronization” of “the respective lists of PMV candidates stored in the encoder and decoder[.]” Ex-1004, ¶35, ¶¶24-25; Ex-1003, ¶112.

Id. (alterations by Petitioner). These assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding motivation to combine the teachings of Rusert and Karczewicz, and reasonable expectation of success, Petitioner presents cogent reasoning on pages 23–27 of the Petition.

Petitioner asserts that in light of Karczewicz’s teachings about H.265, “[a] POSITA would have been motivated to apply Rusert’s teachings to H.265 PUs.” Pet. 23. Petitioner explains:

Rusert does not itself use H.265 terminology. Nonetheless, Rusert explains that, while its examples were “given in the context of H.264/AVC, the principles disclosed

herein can also be applied to . . . other coding standard[s], and indeed any coding system which uses predicted motion vectors.” Ex-1004, ¶116. Karczewicz teaches the concept of PUs in H.265, which was emerging as the successor standard to H.264—both were drafted by ITU-T—sharing the same concepts of block-based video encoding with predicted motion vectors. Ex-1005, ¶32, ¶¶35-37, ¶66, ¶71; Ex-1006, ¶5. Karczewicz teaches H.265 concepts including PUs. Therefore, the art provides express motivation to apply Rusert’s teachings to other standards including H.265, as taught by Karczewicz. Ex-1003, ¶¶71-74.

This would have combined prior art elements according to known methods to yield predictable results, e.g., combining Rusert’s teachings for generating/de-duplicating MVP candidate lists with H.265 concepts, including PUs and related information for motion vectors. In Rusert’s H.264 examples, motion vectors and motion prediction operate on blocks. Ex-1004, ¶¶2-5, ¶36, ¶43. As Karczewicz explains, for H.265 drafts, motion vectors and motion prediction operated on blocks called PUs. Ex-1005, ¶¶33-36, ¶¶64-66. Karczewicz also teaches types of information conveyed by motion vectors. Ex-1005, ¶35. A POSITA would have been motivated to apply Rusert’s known techniques for selecting PMV candidates to PUs, to improve the similar draft H.265 standard in the same way that Rusert explained for H.264. This application would have been a simple substitution of Karczewicz’s PU teachings for Rusert’s block teachings, which would have yielded several advantages, including improved coding efficiency as taught by both references. Ex-1004, ¶7; Ex-1005, ¶6; Ex-1003, ¶¶75-79.

Id. at 23–24.

Regarding predictable results, Petitioner asserts:

The combination would have had predictable results. Rusert already applies its teachings to block-based encoding/decoding. Ex-1004, ¶2, ¶11. A PU is a type of block. Ex-1005, ¶35. Rusert’s concepts were readily applicable to PUs, and the combination would have had the predictable result of selecting PMV candidates (as Rusert teaches) for PUs (as Karczewicz teaches). Ex-1004, ¶116; Ex-1003, ¶83. Therefore, the combination would not have changed the principle of

operation for Rusert or Karczewicz because it applies their teachings in the manner taught by each. Applying H.265 teachings to Rusert, and vice versa, was consistent with Rusert's statement that its principles are applicable to other standards. Ex-1004, ¶116; Ex-1003, ¶84.

Pet. 25.

Regarding reasonable expectation of success, Petitioner asserts:

A POSITA would have had a reasonable expectation of success combining Rusert and Karczewicz. As explained above, the combination applies teachings according to their known purposes, in a conventional manner. The teachings are complementary aspects of block-based video encoding from H.264 and H.265. Ex-1004, ¶116. Karczewicz complements Rusert by teaching terminology and concepts from H.265. Ex-1005, ¶32. Ground 1 does not modify Rusert or Karczewicz in a way that would render either inoperative. To the contrary, the similarities of the architectures would have given a POSITA a reasonable expectation of success in combining their teachings. Ex-1004, ¶11; Ex-1005, ¶2; Ex-1003, ¶¶85-86.

Pet. 26.

Petitioner's assertions regarding motivation to combine, predictable results, and reasonable expectation of success are supported by the cited evidence and not disputed by Patent Owner. We are sufficiently persuaded that the teachings of Rusert and Karczewicz properly may be combined in the manner proposed by Petitioner.

Regarding the portion of limitation 9[a] that states "where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates," Petitioner explains:

PMV_CANDS is a "list of PMV candidates." Ex-1004, ¶37. Each candidate is a motion vector (Ex-1004, ¶11, ¶¶24-25, ¶¶39-41) including "x and y components" (Ex-1004, ¶106, ¶36, ¶¶91-94, ¶100). Therefore, Rusert's PMV_CANDS includes motion information, including motion vectors and their x and y

components, of the PMV candidates. Ex-1004, ¶¶2-3; Ex-1003, ¶113.

Additionally, Karczewicz teaches “the PU may include data defining a motion vector[,]” which includes “a horizontal component” (e.g., x-component), “a vertical component” (e.g., y-component), “a resolution. . . , a reference frame . . . and/or a reference list[.]” Ex-1005, ¶35. It would have been obvious to include this PU information in PMV_CANDS because the combination relies on Karczewicz’s PU teachings. *Supra* §VI.A.1; Ex-1003, ¶¶114-115.

Pet. 32 (alterations by Petitioner).

Petitioner’s assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently accounts for this portion of limitation 9[a]: “where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates.”

For the foregoing reasons, Petitioner sufficiently has shown that Rusert discloses limitation 9[a] and that Rusert and Karczewicz as combined by Petitioner also discloses limitation 9[a].

c. Limitation 9[b]

Limitation 9[b] recites: “determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 33:27–30.

Petitioner asserts that Rusert selects a set of PMV candidates as a “subset” of the set of previously coded motion vectors that were used for previous blocks, and that the subset members have an allowed distance from the current block and an allowed position. Pet. 33 (citing Ex. 1004 ¶¶ 11–12, 15, 24–25, 37, Figs. 2a–2b; Ex. 1003 ¶¶ 117–118).

Regarding “determining a subset of spatial motion vector prediction candidates,” Petitioner explains:

Rusert implements the subset of PMV candidates using an outward scan of blocks having previously-coded motion vectors, starting from the current block and staying within an allowed distance. Ex-1004, ¶¶4-5, ¶¶36-39, ¶¶43-44, ¶¶51-66. As the scan progresses outwards, the subset includes the previously-coded PMV candidates obtained from blocks in previous locations of Rusert’s scan. Ex-1004, ¶44, ¶¶51-66, Figs. 3a-3n. For example when the selected first spatial motion vector prediction candidate is obtained from the third block in Rusert’s scan sequence, the subset of spatial motion vector prediction candidates comprises the candidates from previous scan locations (the first and second blocks). *Id.*

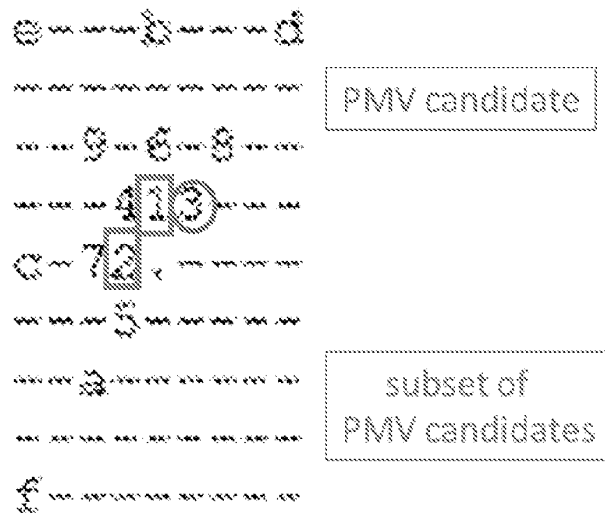


Fig. 3n

[The figure is an annotated version of Rusert’s Figure 3n (a scan pattern around the current block), in which the subset of PMV candidates is identified in red and the selected first PMV candidate is identified in blue]

Ex-1003, ¶¶119-120.

Pet. 33–34. Petitioner further explains:

Additionally, Rusert terminates the scan “as soon as a predefined number of unique PMV candidates have been

found.” Ex-1004, ¶48. Even PMV candidates that are within “a certain distance” and part of “a predetermined scan pattern” are not considered if the “pre-defined number of unique PMV candidates have been found.” Ex-1004, ¶¶44-49. Rusert improves coding efficiency by using subsets. Ex-1004, ¶¶12-13. Therefore, Rusert’s scan of previously-coded motion vectors is further cabined into a subset because it is limited to this predefined number of PMV candidates.

Id. at 34. Petitioner asserts: “As the scan progresses outwards and the subset of PMV candidates is updated, the subset is stored as a list of PMV candidates called PMV_CANDS.” *Id.* at 35 (citing Ex. 1004 ¶¶ 37–41, 44–49, 51–66).

Regarding the “based on the location of the block associated with the first spatial motion vector prediction candidate” requirement of limitation 9[b], Petitioner explains:

Here, “the block” refers to the “block of pixels” in [9a] and therefore refers to the current block for which candidates are being analyzed,. Supra §V.B. Because the subset of PMV candidates is based on “an outwards going scan . . . around the current block” (Ex-1004, ¶¶43-44), the subset of blocks that are scanned and the corresponding subset of spatial motion vector prediction candidates from those blocks are based on the location of the current block. Ex-1004, ¶44; Ex-1003, ¶¶122-123.

Furthermore, the subset of PMV candidates is based on “an allowed distance from the current block and an allowed position.” Ex-1004, ¶15, ¶¶11-13, ¶17, ¶¶24-25, ¶113, Fig. 6. The distance and position are relative to and therefore based on the location of the current block. Ex-1004, ¶¶11-17, ¶¶24-25, ¶¶43-44, ¶¶51-56, Figs. 3a-3n.

Pet. 35–36. Petitioner further explains: “Only candidates from blocks with allowed positions relative to the current block are included. Ex-1004, ¶¶15-16, ¶59 (excluding ‘blocks to the right and below the current block’), ¶65; Ex-1003, ¶¶124-126.” *Id.* at 36.

The above-quoted explanations of Petitioner on why Rusert discloses the “based on the location of the block associated with the first spatial motion vector prediction candidate” requirement of limitation 9[b] are unpersuasive because, as we determined above, “the block associated with the first spatial motion vector prediction candidate” language does not refer to the current block as Petitioner contends. Rather, it refers to the block with which the first selected spatial motion vector prediction candidate is associated, which in the example provided by Petitioner would be block 3.

However, Petitioner presents an alternative contention, in case we disagree with its primary position noted above. Pet. 36–37. The alternative contention is as follows:

Even if “the” block was the block from which the selected first candidate is obtained, Rusert also teaches this. §V.B. A “position” of a block of a PMV candidate is represented as (xpos, ypos), i.e., a location of the block associated with the first spatial motion vector prediction candidate. Ex-1004, ¶¶51-52. Based on the block’s location, the subset of PMV candidates with which the PMV candidate is compared includes the candidates of blocks located in the scan pattern up to the PMV candidate. Ex-1004, ¶44. For example, in Fig. 3n, the PMV candidate for block “3” is compared with a subset of PMV candidates for blocks “1” and “2.” Ex-1004, ¶44, ¶¶65-66, Fig. 3n:

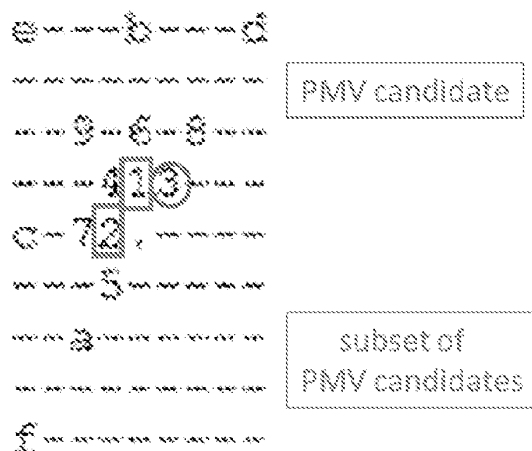


Fig. 3n

[The figure is an annotated version of Rusert's Figure 3n (a scan pattern around the current block), in which the subset of PMV candidates is identified in red and the selected first PMV candidate is identified in blue]

Ex-1003, ¶ 127.

Pet, 36–37.

Notwithstanding Patent Owner's argument to the contrary (Prelim. Resp. 51–52), we are persuaded by Petitioner's alternative contention. Patent Owner argues:

But, unlike the '714 Patent, the subset (subset of PMV candidates for blocks "1" and "2") does not actually depend in any way on the location of the first candidate (PMV candidate for block "3"). Under Rusert's method, the list of candidates (1, 2, 3, 4, etc.) is always constructed according to the same rules and the same order. Ex-1004. For example, when candidate 3 is reached, it will always be compared with 1 and 2, regardless of the location of the first candidate. Ex-2001 at 39-40.

Prelim. Resp. 51–52. Patent Owner asserts:

[A]t the time that neighboring block 2 has finished being considered, the content of PMV_CANDS for block 3 is already

known: it will be the set of candidates 1 and 2 (assuming that 1 and 2 are dissimilar). The location of, and indeed any information related to, block 3 is irrelevant to the contents of PMV_CANDS at the time that block 3 is under consideration. Ex-2001 at 45.

Id. at 57–58. Patent Owner further asserts:

[R]ather than being based on the location of a PMV candidate under consideration, the set of PMV candidates used for comparison in Rusert is determined based on the value of each PMV candidate that has already been considered and added to the list. Ex-1004. If candidate 3 is compared to candidates 1 and 2, this is not because candidate 3 is located in the top right, but because candidates 1 and 2 are dissimilar and thus neither is excluded from being added to PMV_CANDS. *See* 1004 at ¶¶ 70–72; Ex-2001 at 45.

Id. at 58.

Patent Owner’s argument is misplaced and misunderstands Petitioner’s position. The first selected spatial motion vector prediction candidate is not restricted to the third block in the scanning sequence. It can be any block along the outwardly expanding spiraling path.

Petitioner is correct that the determined subset depends on the location of the first selected spatial motion vector prediction candidate. For example, if the first selected candidate is at the location of block 5, then the subset would be the four members 1, 2, 3, and 4, and if the first selected candidate is at the location of block 3, then the subset would be the two members 1 and 2. Thus, the members of the determined subset depend on the location of the block associated with the first selected spatial motion vector prediction candidate as Petitioner contends.

For the foregoing reasons, petitioner sufficiently has shown that Rusert discloses limitation 9[b].

d. Limitation 9[c]

Limitation 9[c] recites:

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible pair from the set of spatial motion vector prediction candidates;

Ex. 1001, 33:31–37.

Petitioner identifies three such comparisons disclosed by Rusert.

Pet. 40–41. Petitioner explains:

First, Rusert compares whether “the PMV candidate is a duplicate of *another* PMV candidate” in the subset of PMV candidates, which is stored as a list in PMV_CANDS. Ex-1004, ¶21, ¶71. “This can be done, when updating the list, by comparing the candidates already in the list with the new vector that could be added, and if a duplicate is found. . . [i]t is preferable to skip the new vector” thus “reducing the number of candidates[.]” Ex-1004, ¶71, ¶62. A potential PMV candidate is selected and compared with each PMV candidate in the subset of preceding PMV candidates in Rusert’s scan sequence, which are stored in PMV_CANDS. *Supra* §VI.A.2[9b]. If the x and y components of two motion vectors are the same, they are duplicates and the potential candidate is excluded. *Id.*; Ex-1003, ¶131.

Second, Rusert compares whether “the PMV candidate is . . . within a threshold distance of an existing PMV candidate” in the subset of candidates stored in PMV_CANDS, e.g., using “a similarity measure” such as Euclidean distance to calculate whether the difference between the x and y components of their motion vectors is “smaller than a pre-defined threshold”; if so, the potential candidate is removed/skipped. Ex-1004, ¶21, ¶72, ¶87. The distance between duplicate PMV candidates is zero. Ex-1003, ¶132, ¶132n.4.

Third, Rusert compares whether “at least one alternative PMV candidate will allow motion vectors to be coded using

fewer bits” (Ex-1004, ¶21) thereby “removing PMV candidates” that “will never be used” because another PMV candidate in the subset stored in PMV_CANDS facilitates “a bit sequence that is shorter or of the same length compared for all possible motion vectors.” Ex-1004, ¶¶90-94. When the x and y values of an existing candidate’s motion vector can be added to the x and y values of a difference motion vector (“DMV”) to yield the x and y values of the selected candidate while using fewer overall bits, Rusert excludes the selected candidate. Ex-1004, ¶95 (teaching exemplary PMV/DMV combinations requiring fewer bits); Ex-1003, ¶¶133-134.

Pet. 38–39 (footnote omitted) (alterations by Petitioner). Petitioner further explains:

All three teachings compare a potential candidate with at least one other candidate from the subset of preceding candidates in Rusert’s scan sequence. Since preceding candidates have smaller index values, they would be signaled more efficiently than later duplicates, and Rusert improves efficiency by determining this subset and comparing potential new candidates to the subset. Ex-1004, ¶¶88-98; Ex-1003, ¶135.

Id. at 39.

Petitioner’s assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently accounts for limitation 9[c].

e. Limitation 9[d]

Limitation 9[d] reads: “determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing.” Ex. 1001, 33:38–40.

Petitioner explains:

As explained above, Rusert determines whether to include or exclude the selected first PMV candidate in PMV_CANDS, which stores the subset of PMV candidates based on each of the three comparisons explained for [9c]. Rusert removes

“unnecessary PMV candidates” to “ensure[] the length of the [PMV_CANDS] list is not unnecessarily long, which would reduce coding efficiency.” Ex-1004, ¶¶20–21. Rusert explains that “[a] PMV candidate *may be determined to be unnecessary*” and be therefore excluded if at least one of the three comparisons is fulfilled. Ex-1004, ¶21; *supra* § VI.A.2[9c]. “Unnecessary PMV candidates are removed . . . because it may happen that some candidates in the list will never be used.” Ex-1004, ¶90. A shorter PMV_CANDS “allows the remaining PMV candidates to be signaled using shorter codes and so fewer bits[.]” Ex-1004, ¶22, ¶90; Ex-1003, ¶¶143-144.

Rusert excludes unnecessary candidates when deciding whether to add a new candidate to the subset of PMV candidates stored in PMV_CANDS. Ex-1004, ¶21, ¶¶71-72; *supra* § VI.A.2[19c]. As part of the “update” process whereby new candidates are added, Rusert determines whether a selected PMV candidate should be included or skipped, meaning it is excluded based on any of the three comparisons from [9c]. Ex-1004, ¶¶71-72. Additionally, this would have been obvious because Rusert teaches the advantages of reducing the number of candidates in PMV_CANDS using the three comparisons from [9c] (Ex-1004, ¶12, ¶21, ¶70, ¶84, ¶90), and the natural time to perform the comparisons would have been when evaluating whether or not to add a candidate to the subset of PMV candidates stored in PMV_CANDS. As Rusert teaches, performing this check when PMV_CANDS is updated will prevent “unnecessary” candidates from being added, “because it may happen that some candidates . . . will never be used[.]” Ex-1004, ¶90; Ex-100[3], ¶145.

Pet. 42–43 (alterations by Petitioner).

These assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently has shown that Rusert discloses limitation 9[d].

f. Limitation 9[e]

Limitation 9[e] recites:

selecting a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded

block of pixels, wherein the spatial motion prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

Ex. 1001, 33:41–48.

Petitioner explains:

Rusert teaches “a code ‘index’ . . . to select a particular PMV candidate . . . from . . . PMV_CANDS” and “[u]sing the transmitted index” to “determine the PMV” and reconstruct the motion vector. Ex-1004, ¶¶36–37. These techniques are “for video decoding . . . the current block[.]” Ex-1004, ¶23, ¶35. The current block is in an “encoded video stream” that is “passe[d] to a decoder . . . employed in decoding the encoded video stream.” Ex-1004, ¶34; Ex-1003, ¶148.

Pet. 44 (alterations by Petitioner). Petitioner further explains:

Rusert teaches “a particular PMV candidate” is selected “from a list of PMV candidates, PMV_CANDS[,]” using “a code ‘index’” sent “from the encoder” and received by the decoder. Ex-1004, ¶¶36-37, Fig. 1:

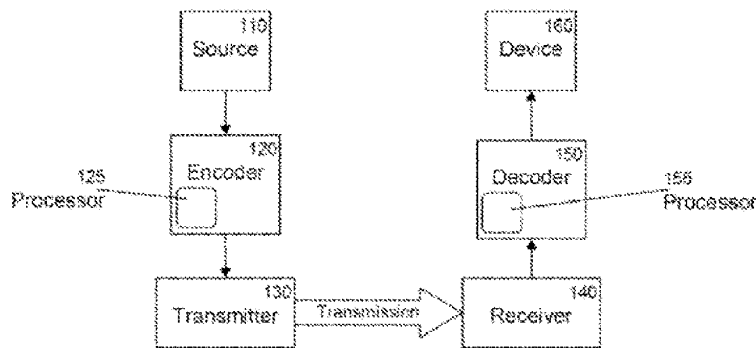


Fig. 1

[Figure 1 illustrates a video coding and transmission system according to Rusert. Ex. 1004 ¶ 27.]

The received index is information that identifies a respective PMV candidate from PMV_CANDS by pointing to a particular candidate based on its position in PMV_CANDS. In this way,

it is an index into PMV_CANDS. Rusert teaches zero-based indexing examples, starting with zero for the first candidate and ending with n-1 for a list of n candidates. Ex-1004, ¶¶88-95; Ex-1003, ¶149.

PMC_CANDS is constructed by an encoder, and the decoder “mimics the encoder” to construct the same PMV_CANDS. Ex-1004, ¶¶35-39. From PMV_CANDS, the decoder uses the index “signaled from the encoder” to “select a particular PMV candidate[.]” Ex-1004, ¶36. “Using the transmitted index, the decoder . . . can determine the PMV 220” to “reconstruct [the motion vector.]” Ex-1004, ¶27.

Pet. 44–45 (alteration by Petitioner).

These assertions are supported by the cited evidence and not disputed by Patent Owner. Petitioner sufficiently has shown that Rusert discloses limitation 9[e].

*g. Patent Owner's Assertion that Petitioner
Improperly Equates Prediction List and Subset*

Patent Owner asserts that Petitioner improperly “relies on the same evidence in Rusert to show both the ‘motion vector prediction list’ limitation and the ‘subset’ limitation” recited in claim 9. Prelim. Resp. 47. Patent Owner explains its argument as follows:

In order to show the limitation “motion vector prediction list,” Petitioner relies on the “PMV_CANDS” list of Rusert, asserting that “Rusert’s PMV_CANDS is the claimed ‘motion vector prediction list.’” Pet. 30. At the same time, however, Petitioner relies on Rusert’s “PMV_CANDS” in order to show the “subset” limitation. *Id.* at 35. Petitioner further contends that “the subset is stored as a list of PMV candidates called PMV_CANDS.” Pet. at 37; Ex-2001 at 36-37.

Id. at 47–48. According to Patent Owner, Petitioner’s meeting both the “motion vector prediction list” and the “subset of spatial motion vector prediction candidates” by the same structure PMV_CANDS “renders these

distinct claim elements functionally meaningless.” *Id.* at 48. In essence, Patent Owner’s argument is that the “subset” corresponds to motion vector prediction candidates with which a selected candidate is compared to determine whether the selected candidate should be included in the prediction list, and thus the subset and the prediction list cannot be the same. *See id.* at 49 (“The subset cannot, therefore, be the distinct ‘motion vector prediction list’ being constructed”).

Patent Owner’s argument has facial appeal but does not withstand closer scrutiny. It is misplaced in the context of Rusert’s parameter PMV_CANDS.

PMV_CANDS is a name for a variable and its content changes dynamically during the prediction list building process, as explained by Petitioner in the context of various limitations of claim 9 as discussed above. At the end of the dynamic process for constructing a prediction list, PMV_CANDS holds the complete prediction list. During the list building process, PMV_CANDS holds those candidates which have been determined to be included, thus far, in the prediction list, and those members constitute the subset with which a selected candidate being evaluated for inclusion in the prediction list is compared. The subset gets larger, incrementally, as more candidates are determined for inclusion in the prediction list.

There is no conflict or inconsistency in Petitioner’s referring to PMV_CANDS as the “subset” and also as the “prediction list,” given the dynamic process of constructing a prediction list by comparing a candidate being evaluated with candidates which have already been determined as good for inclusion in the list. At the end of the list construction process,

PMV_CANDS holds all members of the prediction list. Prior to the end of the list construction process, PMV_CANDS holds the claimed subset.

h. Preliminary Conclusion for Claim 9

Petitioner has shown a reasonable likelihood that it would prevail in establishing the obviousness of claim 9 over Rusert and Karczewicz.

4. Dependent Claims 10 and 12–14

Claims 10 and 12–14 each depend, directly or indirectly, from claim 9. Ex. 1001, 31:51–61, 32:1–33:16. Petitioner addresses claims 10 and 12–14 on pages 46–47 and 52–59 of the Petition. Pet. 46–47, 52–59.

Petitioner’s assertions are supported by the cited evidence and also not disputed by Patent Owner. We have already addressed, above, Patent Owner’s argument directed to Petitioner’s alternative argument regarding limitation 9[b].

Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 10 and 12–14 over Rusert and Karczewicz.

5. Independent Claims 23 and 30

The preamble of claim 23 reads: “An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to.” Ex. 1001, 37:20–23.

The preamble of claim 30 reads: “A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for.” Ex. 1001, 40:10–13.

Petitioner asserts:

Beyond the preambles, claims 23 and 30 are nearly identical to claim 9, with limitations [23a]-[23e]/[30a]-[30e] having only minor differences with [9a]-[9e], respectively, and being satisfied for reasons stated above. *Supra* §§VI.A.2[9a]-[9e]. Limitations [23c]/[30c] recite “the . . . candidate in the determined subset” where [9c] recites “another . . . candidate of the subset”; Rusert satisfies both by teaching a candidate in the subset (explained for [9b]), which is also another candidate in the larger set of previously-coded motion vectors. Limitation [23d] repeats language from [23c], which Ground 1 teaches as explained for [23c] and [9c]. Ex-1003, ¶¶210-222, ¶¶234-239.

Pet. 59 (alterations by Petitioner). Petitioner further asserts: “Ground 1 teaches [23pre] and [30pre], e.g., with a video encoding/decoding ‘apparatus’ comprising ‘a processor’ and ‘computer-readable medium, carrying instructions, which when executed[,]. . . causes [the processor] to carry out any of the methods disclosed herein.’ Ex-1004, ¶1, ¶¶24-27, ¶114, ¶116, claims 17-19; Ex-1003, ¶¶207-209, ¶¶230-233.” *Id.* at 60 (alterations by Petitioner).

Petitioner additionally asserts: “[30pre] recites ‘an encoder’ but should recite ‘a decoder’ consistent with the rest of the claim. Ex-1003, ¶¶231-232.” Pet. 60. In effect, Petitioner is asserting that claim 30’s preamble includes a drafting error in reciting “encoder” where “decoder” is intended, and asks the Board simply to read “encoder” as “decoder.” We decline to do so, because on this record the noted discrepancy appears substantive and is beyond patent recognition as mere spelling or typographical error. Nonetheless, the discrepancy is inconsequential here, because the body of claim 23 recites no execution of an encoding function or

step. Thus, we find the recitation of “for use by an encoder” in claim 30’s preamble to be non-limiting.¹²

Petitioner’s other assertions regarding the preambles of claims 23 and 30 and regarding the limitations of claims 23 and 30 as compared to the limitations of claim 9 are supported by the cited evidence and not disputed by Patent Owner. Based on our reasoning discussed above for claim 9, we determine that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 23 and 30 over Rusert and Karczewicz.

6. *Dependent Claims 24 and 26–28*

Claims 24 and 26–28 each depend, directly or indirectly, from claim 23. Ex. 1001, 37:58–63, 38:4–39:21. Petitioner asserts that other than the preambles, these claims are identical to claims 10 and 12–14. Pet. 60. Petitioner asserts that the preambles are accounted for by reference to the discussion of the preamble of claim 23. *Id.* For the rest of these claims, Petitioner relies on the same arguments and evidence submitted for claims 10 and 12–14. *Id.*

We have already addressed Petitioner’s accounting for claims 10, 12–14, and 23. For substantially the same reasons as we have provided for claims 10, 12–14, and 23, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 24 and 26–28 over Rusert and Karczewicz.

¹² We invite the parties to address the discrepancy noted by Petitioner, in Patent Owner’s Response and in Petitioner’s Reply, after institution of *inter partes* review.

*E. Alleged Obviousness of Claims 9–14 and 23–28
over Rusert, Karczewicz, and Lin*

1. Overview of Lin (Exhibit 1006)

As background, Lin describes:

In video coding systems, spatial and temporal redundancy is exploited using spatial and temporal prediction to reduce the information to be transmitted. The spatial and temporal prediction utilizes decoded pixels from the same picture and reference pictures respectively to form prediction for current pixels to be coded. In a conventional coding system, side information associated with spatial and temporal prediction may have to be transmitted, which will take up some bandwidth of the compressed video data. The transmission of motion vectors for temporal prediction may require a noticeable portion of the compressed video data, particularly in low-bitrate applications. Accordingly, motion vector prediction has been widely used in the field to reduce bitrate corresponding to the motion vector coding.

High-Efficiency Video Coding (HEVC) is a new international video coding standard that is being developed by the Joint Collaborative Team on Video Coding (JCT-VC). HEVC is based on the hybrid block-based motion-compensated DCT-like transform coding architecture. The basic unit for compression, termed Coding Unit (CU), is a $2N \times 2N$ square block, and each CU can be recursively split into four smaller CUs until a predetermined minimum size is reached. Each CU contains one or multiple Prediction Units (PUs). The PU sizes can be $2N \times 2N$, $2N \times N$, $2N \times nU$, $2N \times nD$, $N \times 2N$, $nL \times 2N$, $nR \times 2N$, or $N \times N$, where $2N \times N$, $2N \times nU$, $2N \times nD$ and $N \times 2N$, $nL \times 2N$, $nR \times 2N$ correspond to horizontal and vertical partition of a $2N \times 2N$ PU with symmetric or asymmetric PU size division respectively.

Ex. 1006 ¶¶ 3–4. Lin further describes: “When a PU is coded in either Skip or Merge mode, no motion information is transmitted except for the index of the selected candidate.” *Id.* ¶ 7.

Lin discloses a method and apparatus of deriving a motion vector predictor (MVP) for a current block in an Inter, Merge, or Skip mode.

Ex. 1006 ¶ 25. The method determines redundant MVP candidates according to a non-MV-value based criterion. *Id.* The redundant MVP candidates are then removed from the MVP candidate set. *Id.*

Lin describes an embodiment which identifies and removes redundant MVP candidates to avoid “imitation of Merge,” a scenario in which multiple partitioned PUs from an original PU are merged back to form the original PU. Ex. 1006 ¶ 44. “Consequently, the MVP candidates of a current PU that may cause the current PU to be merged with other PUs to cause imitation of Merge is considered redundant and can be removed without comparing the MV values.” *Id.*

2. *Claims 9, 10, 12–14, 23, 24, and 26–28*

Petitioner relies on Lin only to account for features added in claims 11 and 25. Pet. 47–52, 60. For claims 9, 10, 12–14, 23, 24, and 26–28, Petitioner’s analysis is the same as its analysis for these same claims as unpatentable over Rusert and Karczewicz. *Id.* at 27–60.

Accordingly, for the same reasons we discussed above why Petitioner has made an adequate showing for claims 9, 10, 12–14, 23, 24, and 26–28, as obvious over Rusert and Karczewicz, Petitioner has shown a reasonable likelihood that it would prevail in establishing the alleged obviousness of claims 9, 10, 12–14, 23, 24, and 26–28 as obvious over Rusert, Karczewicz, and Lin, with no teaching stemming from Lin.

3. *Dependent Claims 11 and 25*

Claim 11 depends directly from claim 9 and further recites: “examining whether the received encoded block of pixels is divided into a

first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector candidate from the motion vector prediction list if the prediction unit is the second prediction unit.” Ex. 1001, 33:55–60.

Claim 25 depends directly from claim 23 and further recites:
“wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector candidate from the motion vector prediction list if the prediction unit is the second prediction unit.” Ex. 1001, 37:64–38:3.

The added features of claims 11 and 25, relative to the independent claims from which they each depend, are essentially the same, with claim 11 reciting a function performed as a method step and claim 25 reciting the function as performed by the claimed apparatus.

Petitioner relies on the disclosure of Lin for the added features of claims 11 and 25. Pet. 47–52, 60. Petitioner explains:

Lin examines whether such blocks are divided. As Lin explains, in H.265/HEVC, “[t]he basic unit for compression, termed Coding Unit (CU), is a $2N \times 2N$ square block, and . . . [e]ach CU contains one or multiple Prediction Units (PUs)” with divisions “correspond[ing] to horizontal and vertical partition[s.]” Ex-1006, ¶4; Ex-1013, 000007, 000017. Horizontally-divided CUs have PUs of size $2N \times N$; vertically-divided CUs have $N \times 2N$ PUs. *Id.* Lin explains that a block of pixels can be divided into a first PU (“PU1”) and second PU (“PU2”). Ex-1006, ¶6, ¶25, ¶44, Figs. 7A-7D; Ex-1013, 000007, 000010, 000017; Ex-1003, ¶159.

Id. at 47–48 (alterations by Petitioner). Petitioner further explains:

Lin examines whether the block is divided into two PUs horizontally (having $2N \times N$ PUs) or vertically ($N \times 2N$). Lin “identifies and removes redundant candidates” by examining the CU for “scenario[s] that . . . may cause the current PU to be . . .

considered redundant and can be removed[,] including where “for the second $2N \times N$, . . . $N \times 2N$. . . PU, one or more of the MVP candidates are redundant and removed if said one or more of the MVP candidates [are] located within the previous (first) $2N \times N$, . . . $N \times 2N$. . . PU.” Ex-1006, ¶25, ¶44; Ex-1013, 000009-11, 000017. These teachings apply to an encoded block of pixels received by a decoder, which “mimics the encoder in order to achieve encoder/decoder synchronization.” Ex-1004, ¶35, ¶¶24–35; Ex-1005, ¶50; Ex-1006, ¶22, ¶47; Ex. 1013, 000008; Ex-1003, ¶160.

Id. at 48–49 (alterations by Petitioner). Petitioner additionally explains: “Lin examines whether (i) the current block is divided into two PUs and (ii) the spatial motion vector prediction candidate is from the other PU; if so, Lin excludes the candidate from the MVP list because it is redundant. Ex-1006, ¶44, ¶25, Figs. 7A-7D; Ex-1013, 000010, 000017.” *Id.* at 49.

The above assertions of Petitioner are supported by the cited evidence and not disputed by Patent Owner.

Regarding motivation to combine, Petitioner explains:

[A] CU comprises one PU when it has uniform motion and is only divided if different parts are moving in different directions, as Karczewicz explains. *See* Ex-1006, ¶4; Ex-1013, 000007; Ex-1005, ¶35. Therefore, for a divided block, the motion vector for one PU is not a good predictor for the other. Lin teaches what Karczewicz suggests, that the motion vector from one half can be removed as a candidate for the other, thereby reducing the number of candidates. Ex-1006, ¶25, ¶44; Ex-1013, 000010; Ex-1003, ¶¶163-164. This would have had the predictable result of excluding such candidates, consistent with the reason why a block was divided to begin with. Ex-1013, ¶94.

Accordingly, a POSITA would have been motivated to apply Lin’s teachings to the Rusert/Karczewicz combination because Lin provides a straightforward teaching for reducing redundant candidates when blocks are divided. This would have furthered Rusert’s goal of “reduc[ing] the number of previous

motion vectors that must be considered[.]” Ex-1004, ¶12, ¶7; Ex-1003, ¶¶88-90. Ground [2] combines Lin’s known technique to improve similar H.265 PU-based methods in the same way, which were ready for improvement to reduce the number of previous motion vectors that must be considered. Ex-1004, ¶12; Ex-1003, ¶¶90-92.

Pet. 50–51 (second and third alterations by Petitioner). Petitioner further explains: “The combination would not have changed the principle of operation for any reference, in the manner taught by each reference. Ex-1006, ¶44; Ex-1013, 000010. Ground 2 simply applies Lin’s exclusion of PUs in certain scenarios. Ex-1003, ¶95.” *Id.* at 51.

Regarding a reasonable expectation of success in applying the teachings of Lin to the combination of Rusert and Karczewicz, Petitioner asserts:

As with Ground 1, all references teach aspects of block-based video encoding for H.264/H.265 to reduce PMV candidates. Ex-1004, ¶25, ¶39, ¶¶42-44; Ex-1005, ¶3, ¶5, ¶38; Ex-1006, ¶4, ¶25; Ex-1013, 000009-11. The combination does not modify Rusert, Karczewicz, or Lin in a way that would render any reference inoperative. Indeed, many of the same reasons explained for Ground 1 likewise apply to Ground 2. Ex-1003, ¶¶96-98.

Pet. 51.

The above assertions of Petitioner are supported by the cited evidence and not disputed by Patent Owner. Petitioner has shown a reasonable likelihood that it would establish obviousness of claims 11 and 25 over Rusert, Karczewicz, and Lin.

F. Alleged Obviousness of Claims 9–14, 23–28, and 30 over Nakamura and WD4

1. Overview of Nakamura (Exhibits 1007, 1008, and 1009)

As noted above, Petitioner uses the name “Nakamura” to refer to a collection of three files, i.e., the “Nakamura Document” (Ex. 1007), the “Nakamura WD Description” (Ex. 1008), and the “Nakamura Presentation” (Ex. 1009). Pet. 65. Petitioner asserts that “they were jointly presented in a single proposal, by the same author, packaged together in a single zip, and meant to be read together, teaching related aspects of Nakamura’s proposal.” *Id.* at 62–63. Here, we focus on the Nakamura document (Ex. 1007).

In its introduction paragraph, the Nakamura document states: “This proposal is for the improvement of derivation method of the candidates for merge mode and motion vector predictor (MVP).” Ex. 1007 § 1. It unifies the location of spatial neighbors for merge mode and MVP by proposing that “the positions of the spatial neighbors that can be used as merging candidates are as same as the positions of the spatial MVP candidates.” *Id.* It also proposes to unify the derivation process for merge mode and for MVP. *Id.* The proposal “tries to reduce the number of candidates in the spatial derivation process to reduce the number of times of comparison in the removal process.” *Id.* at Abstr. It states: “The proposed techniques simplify the derivation process for merge mode and MVP.” *Id.* § 2.2.

Section 2.2.1 of the Nakamura document describes its proposed technique for merge mode and is reproduced below:

2.2.1 Proposal 1: Proposed technique for merge mode

Changes of our proposal for merge modes from HM3.0 are as follows:

- The positions of the spatial neighbors hat can be used for merging candidates are as same as the positions of

the spatial MVP candidates. That is unification of the location of spatial neighbor for merge mode and MVP.

- Two spatial merging candidates are derived in the spatial derivation process.
- The merging candidate list is constructed of two spatial merging candidates and a temporal merging candidate.

Figures 2 (a) and (b) illustrate the position of the spatial neighbors A, B, C, D and E relative to the current prediction unit in the HM3.0 and the proposed technique, respectively.

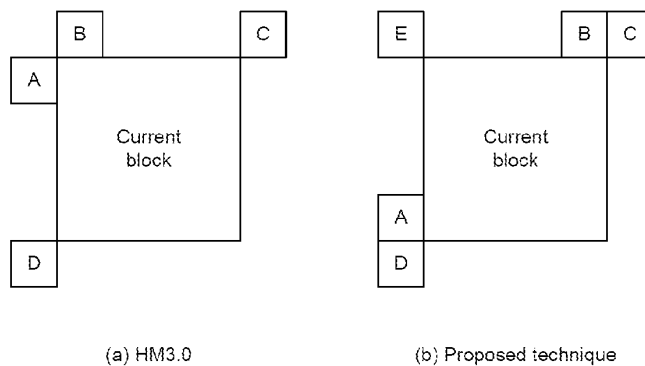


Figure 2 Spatial neighbors that can be used as merging candidates.

[Figure 2(a) shows spatial neighbors that can be used as merging candidates in existing HM3.0, and Figure 2(b) shows spatial neighbors that can be used as merging candidates in Nakamura's proposed technique]

In this proposal, two spatial candidates and a temporal candidate are derived. The number of candidates is reduced in the spatial derivation process to reduce the number of times of comparison in the removal process. Table 1 presents the number of times of comparison in the removal process in each the number of candidates. The number of times of comparison in the removal process in HM3.0 is ten times. On the other hand, the number of times of comparison in the removal process in the proposed technique is three times.

Table 1 The number of comparison in the removal process

The number of candidates in the spatial and temporal derivation process	The number of times of comparison in the removal process	Notes
3 (=2+1)	3 {times}	Proposed technique
4 (=3+1)	6 {times}	-
5 (=4+1)	10 {times}	HM3.0
6 (=5+1)	15 {times}	-

[Table 1 shows the number of comparisons in the removal process]

Table 2 presents the comparison between HM3.0 and proposed technique for merge mode:

Table 2 Comparison between HM3.0 and proposed technique for merge mode

	HM3.0	Proposal 1
The number of spatial candidates	4 in 4 {positions}	2 in 5 {positions}
Spatial derivation order	A, B, C, D	A, B, C, D, E
The number of times of comparison of redundant candidates in the spatial derivation process	0 {time}	0 {time}
The number of temporal candidates	1	1
Merging candidate list order	A, B, Col, C, D	S ₀ , S ₁ , Col
The number of times of comparison in the removal process	10 {times} (A vs B, Col, C, D, B vs Col, C, D, Col vs C, D, and C vs D)	3 {times} (S ₀ vs S ₁ , S ₀ vs Col, and S ₁ vs Col)

[Table 2 shows the comparison between HM3.0 and proposed technique for merge mode]

Notes:

S₀: The first spatial candidate found in the spatial derivation process.

S₁: The second spatial candidate found in the spatial derivation process.

Ex. 1007, 2–4.

2. *WD4 (Exhibit 1010)*

WD4 is a 222-page document titled “WD4: Working Draft 4 of High-Efficiency Video Coding.” Ex. 1010, i. It bears the following header on its title page:

Joint Collaborative Team on Video Coding (JCT-VC)
of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11
6th Meeting: Torino, IT, 14-22 July, 2011

Id.

WD4 defines a merge index, `merge_idx`, that “specifies the merging candidate index of the merging candidate list.” Ex. 1010 § 7.4.7. This merge index appears in “Prediction unit syntax” corresponding to information encoded for a prediction unit. *Id.* § 7.3.7. In this prediction unit syntax, the `merge_idx` for a prediction unit is encoded into the bitstream that is received by a decoder. *Id.*; *see also id.* §§ 0.2, 3.11, 3.12, 3.34, 3.38. Based on the `merge_idx`, one spatial candidate in the merging candidate list `mergeCandList` is assigned as the spatial candidate to use in decoding the encoded block of pixels. *Id.* § 8.4.2.1.1. `Merge_idx` points to a specific spatial motion vector prediction candidate in the merge list that is used for predicting the motion vector for the current block. *Id.* §§ 7.3.7, 7.4.7, 8.4.2.1.1.

3. *Claims 9, 23, and 30*

a. *Claim 9*

At the outset, Petitioner notes:

Nakamura satisfies claim 9 with independently sufficient teachings for H.265 merge mode (optimal for areas of uniform motion) and MVP mode (more versatile but requiring more bits). Generally, merge mode saved bits by utilizing predicted motion vectors without signaling difference vectors and other information used by MVP mode. The granular differences are

not relevant here because the claims do not require one mode or the other. Ex-1003, ¶258.

Pet. 63. Patent Owner does not present any argument based on differences between the merge mode and MVP mode disclosures of Nakamura.

(1) *Preamble [9pre]*

With regard to the preamble “A method,” Petitioner asserts: “Ground 3 teaches [9pre], e.g., an ‘improvement of derivation method of the candidates for merge mode and motion vector predictor (MVP)’ comprising the below-described steps. Ex-1007, §1, Abstract, §2.1, Fig. 1; Ex-1010, §8.4.2.1.2, §8.4.2.1.8; *infra* §VI.B.2[9pre]-[9e]. Ex-1003, ¶¶255-258.”

Pet. 63. These assertions are supported by the cited evidence and not disputed by Patent Owner.

(2) *Limitation 9[a]*

Limitation 9[a] recites:

selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

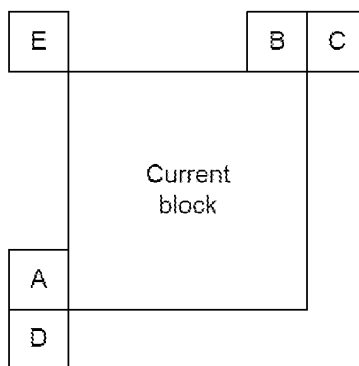
Ex. 1001, 33:18–26.

Regarding “selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels,” Petitioner asserts:

For merge mode, Nakamura teaches identifying two spatial motion vector prediction candidates for a merge list, i.e., “spatial candidate[s]” S_0 and S_1 , from “the position[s] of the spatial neighbors A, B, C, D and E relative to the current prediction unit” which “can be used for . . . candidates[.]” Ex-1007, §2.2.1, Abstract, §1, Tables 2, 4, Fig. 1; Ex-1009, 000008, 000010,

000012-14. The selection of a candidate from a spatial neighbor for S_1 satisfies the claimed step for selecting a first spatial motion vector prediction candidate. Ex-1003, ¶¶260-261.

S_0 and S_1 are spatial motion vector prediction candidates because each is a candidate motion vector obtained from one or more previously-encoded blocks in the current frame (A-E). *Supra* §V.A; Ex-1007, §2.2.1, Fig. 2(b):



(b) Proposed technique

[The figure shows spatial neighbors that can be used as merging candidates in Nakamura's proposed technique. Ex. 1007, 3]

Ex-1003, ¶¶262-264.

Pet. 64–65 (alterations by Petitioner) (footnote omitted).

Petitioner further asserts:

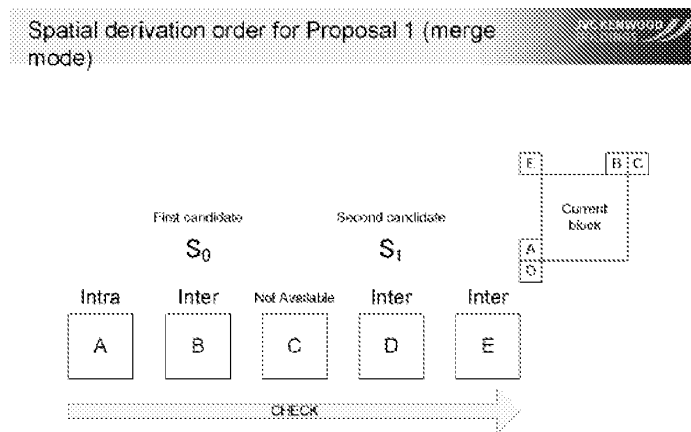
Nakamura's teachings are applied to decode an encoded block of pixels (the "current block") received from the encoder. Ex-1007, §2.2.1, Fig. 2; Ex-109, 000005, 000007-8; Ex-1010, §§8.4.2.1.1-8.4.2.1.2. WD4 explains that these techniques are used for encoding and decoding video bitstreams. Ex-1010, §3.34, §3.38. Those bitstreams are "transmitted and received" and include encoded blocks that are decoded according to the teachings of Nakamura and WD4. Ex-1010, §0.2, §3.11, §3.12, §3.34, §3.38, §§8.4.2.1.1-8.4.2.1.2; Ex-1007, §2.2.1, Fig. 2; Ex-1003, ¶265.

Pet. 65.

These assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding selection of that first candidate “as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list,” Petitioner explains:

Nakamura teaches that a “merging candidate list is constructed of two spatial merging candidates” (S_0 and S_1) selected in a “[s]patial derivation order” from the five spatial neighbor candidates “relative to the current prediction unit[.]” Ex-1007, §2.2.1, Tables 2-4; Ex-1008, 8.4.2.1.1; Ex-1009, 000008, 000010, 000012-14. Following the spatial derivation order, Nakamura steps through blocks A-E until two spatial candidates (S_0 and S_1) are selected for potential inclusion in the merging candidate list. Ex-1009, 000008; Ex-1007, §2.2.1, Table 2; Ex-1003, ¶266-268.



[The illustration shows “Spatial derivation order for Proposal 1 (merge mode)”]

Pet. 65–66 (alteration by Petitioner). The above assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding the prediction list being for “a prediction unit of the block of pixels,” Petitioner explains:

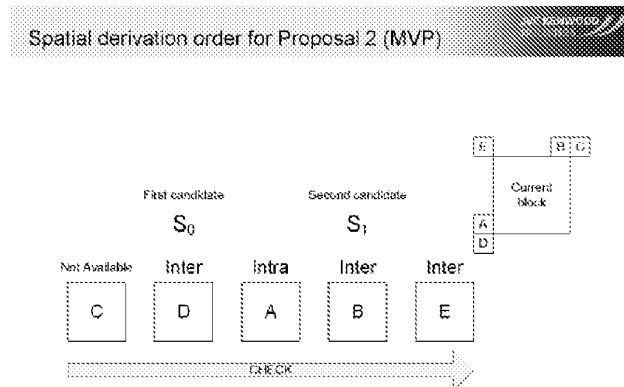
Nakamura teaches “[t]he merging candidate list, mergeCandList,” (Ex-1008, §8.4.2.1.1; Ex-1010, §8.4.2.1.1) comprises “spatial merging candidates” found from “the position[s] of the spatial neighbors. . . relative to the current prediction unit” of the current block, with one assigned as the motion vector predictor for the current prediction unit. Ex-1007, §2.2.1, Tables 2, 4, Fig. 2(b); Ex-1008, §8.4.2.1.1; Ex-1010, §7.4.7, §8.4.2.1.1, 000049, 000174; Ex-1003, ¶¶269-270.

Pet. 66–67 (alterations by Petitioner). The assertions are supported by the cited evidence and not disputed by Patent Owner.

Regarding the prediction list comprising “motion information of the spatial motion vector prediction candidates,” Petitioner asserts: “The ‘merging candidate list is constructed of’ spatial candidates (Ex-1007, §2.2.1) and includes information of those candidates in the list, including ‘availability flags. . . reference indices. . . prediction list utilizing flags. . .’ and ‘motion vectors[.]’ Ex-1008, §8.4.2.1.2; Ex-1010, §8.4.2.1.2; Ex-1003, ¶263, ¶271.” Pet. 67 (alterations by Petitioner).

Petitioner further asserts:

Ground 3’s MVP Mode teachings satisfy [9a] in a similar manner but with an “MVP list” instead of a merge list, `mvp_idx_1X` instead of `mergeIdx`, and a different spatial derivation order for selecting S_0 and S_1 . Ex-1007, Abstract, §2.2.2, Tables 3-4, Fig. 3(b); Ex-1010, §7.4.7, §8.4.2.1.1, §8.4.2.1.7, §8.4.2.1.8, §8.4.2.1.10, 000049-50, 000174; Ex-1009, 000005, 000008, 000011-14;



[The illustration shows “Spatial derivation order for Proposal 2 (MVP)”]

Ex-1003, ¶¶272-280.

Pet. 67–68 (footnote omitted).

Petitioner’s assertions are supported by the cited evidence and not disputed by Patent Owner.

(3) *Limitation 9[b]*

Limitation 9[b] recites: “determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 33:27–30.

Regarding “determining a subset of spatial motion vector prediction candidates,” Petitioner explains:

For merge mode, Nakamura teaches “[t]wo spatial merging candidates” (S_0 and S_1) “are derived in the spatial derivation process[]” from five “spatial neighbors A, B, C, D and E relative to the current prediction unit[.]” Ex-1007, §2.2.1, Tables 1, 2, 4; Ex-1009, 000008, 000010, 000014; *supra* §V.C. For S_1 , Nakamura teaches a subset (S_0) with which S_1 is compared to determine whether to include or exclude S_1 . Ex-1007, Tables 2, 4; Ex-1008, §8.4.2.1.1; Ex-1009, 000010, 13; Ex-1010, §8.4.2.1.1; Ex-1003, ¶¶284-285.

Pet. 68 (alterations by Petitioner).

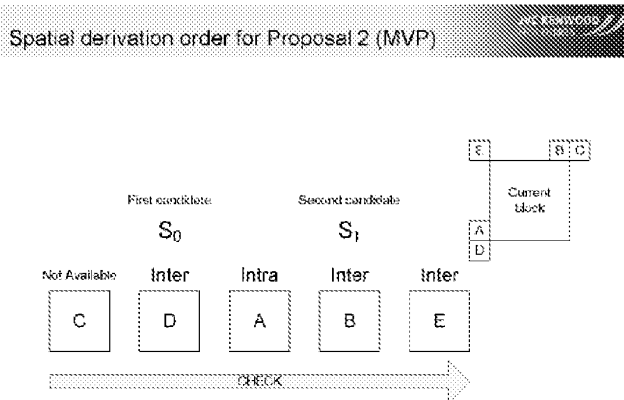
Regarding determining a subset of spatial motion vector prediction candidates “based on the location of the block associated with the first spatial motion vector prediction candidate,” Petitioner explains:

The subset is determined from a set of “spatial neighbors A, B, C, D and E relative to the current prediction unit” for the current block. Ex-1007, §2.2.1, Fig. 2(b); Ex-1009, 000008. The subset (S_0) is based on the location of S_1 following Nakamura’s spatial derivation order, which is relative to the current block. Ex-1007, §2.2.1, Fig. 2; Ex-1008, §8.4.2.1.2, Fig. 8-3; Ex-1009, 000008, 000010; Ex-1003, ¶¶287-290.

Pet. 69.

Petitioner further asserts:

Ground 3’s MVP mode teachings satisfy [9b] in a similar manner but with an “MVP list” instead of a merge list and a different spatial derivation order. Ex-1007, Abstract, §2.2.2, Tables 1, 3, 4, Fig. 3(b); Ex-1009, 000005, 000008, 000010-14, 000020.



[The illustration shows “Spatial derivation order for Proposal 2 (MVP)”]

Ex-1003, ¶¶290-298.

Pet. 69–70.

Petitioner’s explanation is unpersuasive. There is inadequate explanation as to why S_0 is determined on the basis of the location of S_1 ,

where S_0 and S_1 are selected in a “spatial derivation order” from the five spatial neighbor candidates relative to the current prediction unit. Ex. 1007, § 2.2.1; Ex. 1009, 00008, 00001. As Patent Owner notes, S_0 is already selected regardless of what the selection of S_1 thereafter might be. Prelim. Resp. 71. The subset S_0 does not change depending on the later choice of S_1 .

On this record, the subset S_0 has not been sufficiently shown as based on a location of the block associated with the first spatial motion vector prediction candidate, S_1 . As we explained above in Section III.C.3, “the block associated with the first spatial motion vector prediction candidate” does not refer to the current block, but refers to “the block associated with the first spatial motion vector prediction candidate.” Petitioner has not adequately shown the satisfaction of limitation 9[b].

(4) *Motivation to Combine Nakamura and WD4*

The deficiency discussed above relating to limitation 9[b] and the disclosure of Nakamura already alone undermines the alleged unpatentability of claim 9 over Nakamura and WD4. Additionally, we have concerns regarding Petitioner’s stated motivation for one of ordinary skill in the art to combine the teachings of Nakamura with the teachings of WD4.

With regard to motivation to combine the teachings of Nakamura and WD4, Petitioner explains:

Nakamura is an H.265 proposal for “reduc[ing] the number of candidates in the spatial derivation process to reduce the number of. . . comparison[s] in the removal process.” Ex-1007, Abstract. When applied to WD4, Nakamura’s teachings satisfy the challenged claims. Ex-1003, ¶241.

A POSITA would have been motivated to apply Nakamura’s teachings to the draft H.265 standard because that was its express purpose. Nakamura was proposed at the 6th JCT-VC meeting for inclusion into the standard. WD4 was the output

of that meeting, reflecting the state of the draft H.265 standard at that time. Nakamura proposed “simplifications” and “improvement[s]” to H.265. Ex-1007, 000001, §6. WD4 “[i]ncorporated spatial merge candidate positions unification” from Nakamura. Ex-1010, Abstract. There was clear motivation to apply Nakamura to WD4. Ex-1004, ¶¶241-243. This was a combination of prior art elements according to known methods to yield predictable results. Ex-1003, ¶245.

Ground 3 applies Nakamura’s known techniques to a known method (WD4) ready for improvement to yield predictable results. Nakamura teaches its “proposed technique is implemented into” the H.265 model software. Ex-1007, §2.3.1. Nakamura measured actual improvements from the combination. Ex-1007, §3; Ex-1003, ¶¶243-244, ¶248.

A POSITA would have been motivated by the references’ striking similarities and common purpose. Both are directed to H.265. Both derive motion vector prediction candidates, while seeking to reduce the number of candidates, for block-based inter prediction. Ex-1010, §0.1, §0.6, §§8.4.2.1.1-8.4.2.1.3; Ex-1007, Abstract. WD4 provides context for Nakamura’s teachings. Ex-1010, ¶3, §8; Ex-1003, ¶¶246-248.

Pet. 61–62 (alterations by Petitioner).

On motivation to combine, Petitioner does not address the particular teachings sought to be combined. Rather, according to Petitioner, anything in Nakamura properly can be combined with anything in WD4 simply because Nakamura is a proposal for the next draft version of new standard H.265, i.e., version 4, and WD4 is the resulting draft version 4 of H.265 after all the proposals had been considered. Pet. 60–62. Petitioner’s reasoning is flawed and based on mere speculation.

Nakamura is not a proposal to revise or modify WD4. WD4 did not yet exist at the time the Nakamura proposal was made. Even if some suggestions of Nakamura made it into WD4, as Petitioner asserts (Pet. 61), i.e., spatial merge candidate positions unification, that does not mean one of

ordinary skill in the art would have had reason to combine other teachings of Nakamura with particular disclosures of WD4. Even assuming Nakamura and WD4 have striking similarities in some way and also a common purpose to some general extent, that still does not mean everything in one is combinable with everything in the other, without specific consideration of what are proposed to be combined and in what manner.

(5) Preliminary Conclusion for Claim 9

Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claim 9 over Nakamura and WD4.

b. Independent Claims 23 and 30

Claims 23 and 30 are largely the same as claim 9 except for their preambles. Claim 23 is directed to an apparatus comprising a processor and a memory including computer program code, where the processor, memory, and computer program code are configured to cause the apparatus to perform functions essentially corresponding to the steps in claim 9. Ex. 1001, 37:20–23. Claim 30 is directed to a non-transitory computer readable medium having stored thereon a computer executable program code, where the “program codes comprising instructions for” actions largely corresponding to the steps in claim 9. *Id.* at 40:10–13.

Similar to claim 9, claim 23 includes the limitation “determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” Ex. 1001, 37:33–36. Similar to claim 9, claim 30 includes the limitation “determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate.” *Id.* at 40:23–26.

The same deficiency discussed above regarding Petitioner's showing for claim 9's "determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate" applies to claims 23 and 30. Additionally, we also have the same concerns regarding Petitioner's stated motivation to combine the teachings of Nakamura and WD4, as discussed above in the context of claim 9.

Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 23 and 30 over Nakamura and WD4.

c. Dependent Claims 10–14 and 24–28

Claims 10–14 each depend, directly or indirectly, from claim 9. Ex. 1001, 33:49–35:8. Claims 24–28 each depend, directly or indirectly, from claim 23. *Id.* at 37:59–39:21.

The deficiency of Petitioner's accounting for claim 9 equally applies to claims 10–14. The deficiency of Petitioner's accounting for claim 23 equally applies to claims 24–28.

Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 10–14 and 24–28 over Nakamura and WD4.

G. Discretionary Denial Under § 325(d)

Patent Owner contends that we should exercise discretion to deny institution under 35 U.S.C. § 325(d) based on the framework set forth in *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (precedential). Prelim. Resp. 32.

1. *Analytical Framework*

Section 325(d) provides that “[i]n determining whether to institute” an *inter partes* review, “the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. § 325(d).

When deciding whether to exercise our discretion under § 325(d), we follow the two-part framework set forth in *Advanced Bionics*. Specifically, we must first determine “whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office.” *Advanced Bionics*, Paper 6 at 8. That determination involves “two separate issues”:

- (1) “whether the petition presents to the Office the same or substantially the same art previously presented to the Office”; and
- (2) “whether the petition presents to the Office the same or substantially the same arguments previously presented to the Office.”

Id. at 7. “Previously presented art includes art made of record by the Examiner, and art provided to the Office by an applicant,” e.g., with an information-disclosure statement. *Id.* at 7–8.

If “either condition of first part of the framework is satisfied,” we must then determine “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” *Advanced Bionics*, Paper 6 at 8. “An example of a material error may include misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims.” *Id.* at 8 n.9.

When deciding whether to exercise our discretion under § 325(d) in view of the *Advanced Bionics* framework, we weigh the following nonexclusive factors:

- (a) the similarities and material differences between the asserted references and the prior art involved during prosecution;
- (b) the cumulative nature of the asserted references and the prior art evaluated during prosecution;
- (c) the extent to which the asserted references were evaluated during prosecution, including whether a rejection rested on any reference;
- (d) the extent of overlap between the arguments made during prosecution and Petitioner’s reliance on the asserted references or Patent Owner’s contentions concerning them;
- (e) whether Petitioner has pointed out sufficiently how the Examiner erred in analyzing the asserted references; and
- (f) the extent to which additional evidence and facts presented in the petition warrant reconsideration of the asserted references or arguments.

See Becton, Dickinson & Co. v. B. Braun Melsungen AG, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph) (“*Becton*”).

Under the *Advanced Bionics* framework, *Becton* factors (a), (b), and (d) relate to “whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office.” *Advanced Bionics*, IPR2019-01469, Paper 6 at 8, 10. *Becton* factors (c), (e), and (f) relate to “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” *See id.* at 7–8, 10.

2. *Analysis*

It is not in dispute that neither Rusert nor Karczewicz was in the prosecution record of the application which issued as the '714 patent. However, Patent Owner asserts that Rusert is cumulative of three references which were in the prosecution record of the '714 patent: (1) Han (Ex. 2006);¹³ (2) Tai (Ex. 2007);¹⁴ and (3) Huang (Ex. 2008).¹⁵ Patent Owner explains:

Even though Rusert was not cited during prosecution of the application that resulted in the '714 patent, PO disputes that this arrangement satisfies the claims, because Rusert is largely cumulative of Han, Tai, and Huang. *See* Ex-2006–Ex-2008. Both Rusert and Han disclose a hierarchy of block unit representation, while both Rusert and Tai disclose a correlation between the current block position and neighboring blocks to reduce the number of PMV predictors to be evaluated, and both Rusert and Huang disclose constructing a candidate list based on motion information. *Id.*; Ex-2001 at 31.

Prelim. Resp. 36–37.

Based on the foregoing arguments, which lack specifics and do not sufficiently map the particular teachings from Rusert relied on by Petitioner to the disclosures of Han, Tai, and Huang, we do not find Rusert to be cumulative of these references. Further, even if all of Rusert's teachings

¹³ Han, Woo-Jin, et al., *Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools*, 20 IEEE Transactions on Circuits and Systems for Video Technology 1709 (2010).

¹⁴ Tai, Shen-Chuan, et al., *A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications*, 4 Journal of Display Technology 188 (2008).

¹⁵ Huang, Ai-Mei, et al., *A Multistage Motion Vector Processing Method for Motion-Compensated Frame Interpolation*, 17 IEEE Transactions on Image Processing 694 (2008).

relied on by Petitioner can be found in Han, Tai, and Huang as a collection of separate partial teachings from each, that still does not demonstrate Rusert as a cumulative reference. The quality of disclosure simply is not the same if three references have to be combined to yield what Rusert itself discloses. Patent Owner also does not explain how it combines Han, Tai, and Huang to provide the same teachings relied on from Rusert by Petitioner.¹⁶

Patent Owner additionally asserts that Rusert was considered in an application (“the ’156 Application”) continuing from that which issued as the ’714 patent and itself issuing as U.S. Patent No. 11,570,467 (“the ’467 patent”), by the same Examiner who examined the application that issued as the ’714 patent, and that the ’467 patent has similar claims as the ’714 patent. Prelim. Resp. 34, 37–38. This argument also is unpersuasive, for several reasons.

First, the ’156 application is a continuing application and not a part of the prosecution history of the ’714 patent. The ’714 patent issued on January 14, 2020 (Ex. 1001, code (45)), and the Information Disclosure Statement including Rusert was filed in the ’156 application on June 7, 2021 (Ex. 2004, 147–153). Second, the claims in the ’467 patent issuing from the ’156 application do not include this limitation in claims 9, 23, and 30 of the

¹⁶ In its Sur-reply, Patent Owner argues that Rusert is cumulative of Tai. Paper 10, 3. Any argument that Tai alone includes all the teachings from Rusert that Petitioner has relied on should have been presented in the Preliminary Response. In any event, the Sur-reply does not account for, in Tai, all the features Petitioner has relied on Rusert to show, e.g., a prediction list and determining a subset based on the location of the block associated with the first spatial motion vector prediction candidate.

'714 patent: "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates."

Patent Owner argues the fact that the claims of the '467 patent are broader than the claims of the '714 patent actually helps Patent Owner because, logically, the Examiner would have been expected to allowed the narrower claims of the '714 patent over Rusert. Paper 10, 1–2. We disagree. The argument is misplaced. The inquiry under *Advanced Bionics* is whether the same or substantially the same art or arguments were previously presented to the Office, not whether one can deduce the same Examiner action based on arguments actually previously presented to the Examiner but which are not the same or substantially the same as those presented by the Petitioner here.

3. *Preliminary Conclusion*

For the foregoing reasons,¹⁷ we find that the same or substantially the same prior art or arguments previously were not presented to the Office. We need not proceed past the first stage of the *Advanced Bionics* framework. We decline to exercise discretion under § 325(d) to deny the Petition.

H. *Petitioner's Filing of Multiple Petitions*

The instant Petition is one of two petitions Petitioner filed on the same day, April 8, 2024, against the '714 patent. No previous petition had been filed by Petitioner against the '714 patent.

¹⁷ We do not consider § 325(d) arguments relating to Nakamura and WD4, because we determine that the alleged ground of unpatentability based on Nakamura and WD4 lacks sufficient substantive merit, and because we institute review on the basis of the alleged grounds of unpatentability based on Rusert and Karczewicz and based on Rusert, Karczewicz, and Lin.

The Board has indicated that “one petition should be sufficient to challenge the claims of a patent in most situations.” Consolidated Trial Practice Guide 59 (Nov. 2019) (“CTPG”).¹⁸ But “the Board recognizes that there may be circumstances in which more than one petition may be necessary.” *Id.*

Petitioner has filed a paper explaining why in its view two petitions are appropriate in this case against the ’714 patent, and ranking the two petitions, if it is permitted only to file a single petition. Paper 4. Petitioner ranks the petition here in IPR2024-00605, challenging claims 9–14, 23–28, and 30 of the ’714 patent first, ahead of the Petition in IPR2024-00604, challenging claims 1–8, 15–22, and 29 of the ’714 patent. *Id.* at 1.

Petitioner explains: “Here, two petitions are necessary because of the large number of challenged claims (30). Since Patent Owner has not yet identified the claims it intends to assert in district court, all of the challenged claims therefore remain material to the parties’ dispute.” Paper 4, 1–2.

Petitioner further explains:

The ’714 patent has 30 claims, which alone includes 4,349 words, spanning 10 columns of text, reciting complex video compression subject matter. Given the volume of claims, challenging all 30 claims in a single petition would materially reduce the petitions’ thoroughness and unduly burden the Board with overly terse analysis that would be more difficult to analyze. Filing two petitions, on the other hand, allows for clearer and more detailed analysis for this volume of claims.

Institution of both Petitions would not be an inefficient use of resources because (i) the challenged claims share some common limitations and similar subject matter; and (ii) the petitions are based on the same prior art. Two petitions are

¹⁸ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

necessary, as discussed below, to address non-overlapping limitations relating to encoding/decoding that include different explanations regarding the same prior art.

Id. at 3.

Petitioner additionally explains that this is not a situation where multiple petitions attack the same claims. Paper 4, 3. Petitioner notes that the claims challenged in this proceeding are directed to receiving and decoding blocks of pixels, and that the claims challenged in IPR2024-00604 are directed to encoding a block of pixels. *Id.* at 3–4. Petitioner notes that although the two petitions are based on the same prior art, different disclosures from the prior art references are relied upon in the two petitions. *Id.* at 4. Petitioner asserts that “multiple petitions are warranted due to the complex nature of the claims,” and that “[t]he ’714 claims recite granular details of operations performed during motion prediction.” *Id.* at 5.

Although we do not think 30 claims are too numerous for one petition to cover, many claims in the ’714 patent are extraordinarily lengthy and include numerous limitations. For example, claim 6, which depends from claim 5 which depends from claim 1, is more than one column long in the ’714 patent. The length of claim 20, which depends from claim 19, which depends from claim 15, also is more than one column long in the ’714 patent. Additionally, we agree with Petitioner that the subject matter of the ’714 patent is complex. We further agree with Petitioner that the division of claims among the two petitions, i.e., encoder claims in IPR2024-00604 and decoder claims in IPR2024-00605, is a structured division which helps to facilitate the handling of two petitions.

Patent Owner has not presented arguments urging that the filing of two petitions by Petitioner against the ’714 patent is excessive.

For the foregoing reasons, we determine that the filing of two petitions by Petitioner against the '714 patent is reasonable under these circumstances. We decline to exercise discretion to deny either petition on the ground of the Petitioner filing an excessive number of petitions against the '714 patent.

IV. CONCLUSION

For the foregoing reasons, we conclude that Petitioner has shown a reasonable likelihood that it would prevail in establishing that at least one of claims 9–14, 23–28, and 30 of the '714 patent is unpatentable.

V. ORDER

In consideration of the foregoing, it is

ORDERED that *inter partes* review of all challenged claims, i.e., claims 9–14, 23–28, and 30 of the '714 patent, is instituted on all grounds stated in the Petition; and

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

IPR2024-00605
Patent 10,536,714 B2

For PETITIONER:

Harper Batts
Chris Ponder
Jeffrey Liang
Sheppard, Mullin, Richter & Hampton LLP
HBatts@sheppardmullin.com
CPonder@sheppardmullin.com
JLiang@sheppardmullin.com

For PATENT OWNER:

Scott W. Hejny
Eric S. Hansen
MCKOOL SMITH P.C.
shejny@McKoolSmith.com
ehansen@McKoolSmith.com



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APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
16/356,733	10536714	2488	110349

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 00197 on 04/21/2020 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

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ALEXANDRIA, VA 22314

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/Guy R. Gosnell/
Name:	Guy R. Gosnell
Registration Number:	34610



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/356,733	01/14/2020	10536714	042933/519745	3483

10949 7590 12/24/2019
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

NOKIA TECHNOLOGIES OY, Espoo, FINLAND;
Mehmet Oguz BICI, Tampere, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

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PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 08/30/2019
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/356,733	03/18/2019	Mehmet Oguz BICI	042933/519745	3483

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPL. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	12/02/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYMALEM, NATHANIEL B	2488	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.303).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. Use of a Customer Number is required.

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(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

Alston & Bird LLP

1. _____
2. _____
3. _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Nokia Technologies Oy

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Espoo, Finland

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 16-0605

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature: /Guy R. Gosnell/

Date: November 27, 2019

Typed or printed name: Guy R. Gosnell

Registration No. 34,610

Electronic Patent Application Fee Transmittal				
Application Number:		16356733		
Filing Date:		18-Mar-2019		
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Joyce Smith		
Attorney Docket Number:		042933/519745		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt	
EFS ID:	37877836
Application Number:	16356733
International Application Number:	
Confirmation Number:	3483
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Joyce Smith
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/519745
Receipt Date:	27-NOV-2019
Filing Date:	18-MAR-2019
Time Stamp:	12:23:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$1000
RAM confirmation Number	E2019AQC24085136
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Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	ISSUEFEE519745.PDF	111658	no	1
			fcc2e1b480a6bd44c46e301b4797f5263aec1cba		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30453	no	2
			47aa112aa308642ebf4cc3d03125ce4f6b5c8562		
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Substitute for form SB08 (Revised 07/09) INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>		Complete if Known				
		Application Number		16/356,733		
		Filing Date		March 18, 2019		
		First Named Inventor		Bici et al.		
		Art Unit		2488		
Examiner Name		S. V. Perungavoor				
Attorney Docket Number		042933/519745				
Sheet	1	of	4			
U. S. PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear	
	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.		
	2	US-2007/0189389 A1	08-16-2007	Boisson et al.		
	3	US-2008/0159401 A1	07-03-2008	Lee et al.		
	4	US-2008/0232642 A1	09-25-2008	Chang		
	5	US-2011/0170602 A1	07-14-2011	Lee et al.		
	6	US-2011/0176013 A1	07-21-2011	Robertson et al.		
	7	US-2011/0176612 A1	07-21-2011	Tsai et al.		
	8	US-2011/0182362 A1	07-28-2011	Kim et al.		
	9	US-2012/0230408 A1	09-13-2012	Zhou		
	10	US-2012/0257678 A1	10-11-2012	Zhou et al.		
	11	US-2012/0269270 A1	10-25-2012	Chen et al.		
	12	US-2012/0300846 A1	11-29-2012	Sugio et al.		
	13	US-2012/0307905 A1	12-06-2012	Kim et al.		
	14	US-2012/0320984 A1	12-20-2012	Zhou		
	15	US-2013/0003850 A1	01-03-2013	Sugio et al.		
	16	US-2013/0004092 A1	01-03-2013	Sasai et al.		
	17	US-2013/0070855 A1	03-21-2013	Zheng et al.		
	18	US-2013/0083853 A1	04-04-2013	Coban et al.		
	19	US-2013/0272408 A1	10-17-2013	Chen et al.		
FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	20	CN 101271580 A	09-24-2008	HIMAX Tech Ltd		
Examiner Signature	/NATHNAEL AYNALAM/			Date Considered	08/09/2019	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.A./

Substitute for form SB08 (Revised 07/09) INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known		
				Application Number	16/356,733	
				Filing Date	March 18, 2019	
				First Named Inventor	Bici et al.	
				Art Unit	2488	
Examiner Name	S. V. Perungavoor					
Sheet	2	of	4	Attorney Docket Number	042933/519745	
FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	21	CN 101605255 B	05-04-2011	Huawei Tech Co Ltd		
	22	CN 1757238 A	04-05-2006	Thomson Licensing		
	23	WO 2011 115659 A1	09-22-2011	Thomson Licensing		
	24	WO 2011/062392 A2	05-26-2011	SK Telecom Co. Ltd.		
OTHER DOCUMENTS						
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.				English Language Translation Attached
	25	Advisory Action for U.S. Patent Application No. 13/666,680 dated November 7, 2016, 4 pages.				
	26	<u>Bici, O. et al.</u> , <i>Non-CE13: Simplification of merge mode</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting; Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages				
	27	<u>Bross, B. et al.</u> , <i>Core Experiment 9: MV Coding and Skip/Merge Operations</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages				
	28	<u>Bross, Benjamin, et al.</u> , <i>WD4: Working Draft 4 of High-Efficiency Video Coding</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803 d; 232 pages				
	29	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages				
	30	Final Office Action for U.S. Patent Application No. 13/666,680 dated March 1, 2016, 35 pages.				
	31	<u>Han, Woo-Jin, et al.</u> , <i>Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools</i> , Circuits and Systems for Video Technology; IEEE Transactions on 20.12 (2010); 1709-1720				
Examiner Signature	/NATHNAEL AYNALAM/			Date Considered	08/09/2019	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.A./

Substitute for form SB08 (Revised 07/09)		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)		Application Number	16/356,733
		Filing Date	March 18, 2019
		First Named Inventor	Bici et al.
		Art Unit	2488
		Examiner Name	S. V. Perungavoor
Sheet	3	of	4
		Attorney Docket Number	042933/519745
OTHER DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	32	<u>Huang, Ai-Mei et al.</u> , <i>A multistage motion vector processing method for motion-compensated frame interpolation</i> , Image Processing, IEEE Transactions on 17.5 (2008) 694-708	
	33	International Search Report and Written Opinion from corresponding International Application No. PCT/FI2012/051070, dated March 27, 2013	
	34	<u>J.-L. Liu, Y.-W. Chen, Y.-W. Huang, S. Lei</u> , "CE9: Results of Experiment ROB04", JCT-VC Doc. JCTVC-F052, Turin; Jul 2011	
	35	<u>Jeon, Y. et al.</u> , <i>On MVP list pruning process</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages	
	36	<u>Nakamura, H. et al.</u> , <i>Unification of derivation process for merge mode and MVP</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/ , 10 pages	
	37	Notice of Allowance for U.S. Patent Application No. 13/666,680 dated September 30, 2016, 17 pages.	
	38	Notice of Allowance for U.S. Patent Application No. 15/426,822 dated March 10, 2017, 8 pages	
	39	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016	
	40	Office Action for Chinese Application No. 201280065777.5 dated October 25, 2017 with English Translation, 8 pages	
	41	Office Action for Chinese Application No. 201280065777.5 dated October 9, 2016	
	42	Office Action for corresponding Indian Application No. 4092/CHENP/2014 dated April 11, 2018 with English Translation, 7 pages	
	43	Office Action for U.S. Patent Application No. 13/666,680 dated July 6, 2015, 25 pages.	
	44	Office Action for U.S. Patent Application No. 15/681,725 dated September 21, 2017	
	45	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015	
	46	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015	
	47	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016	
	48	<u>Oudin, S. et al.</u> , "Block Merging for Quadtree-Based Video Coding", IEEE Int. Conf. on Multimedia and Expo; July 11-15; 2011; 6 pages	
Examiner Signature	/NATHNAEL AYNALAM/		Date Considered 08/09/2019

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.A./

Substitute for form SB08 (Revised 07/09)		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>		Application Number	16/356,733
		Filing Date	March 18, 2019
		First Named Inventor	Bici et al.
		Ari Unit	2488
		Examiner Name	S. V. Perungavoor
Sheet	4	of	4
		Attorney Docket Number	042933/519745
OTHER DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	49	<u>Sullivan, G.J.</u> ; "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. On Circuits and Systems for Video Technology; Vol. 22, No. 12; December 2012; pp. 1649-1668	
	50	<u>Tai, Shen-Chuan, et al.</u> ; "A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications"; Journal of Display Technology; 4:2 (2008): 188-197	
	51	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015	
	52	<u>Wiegand, Tomas, et al.</u> ; "WD3: Working Draft 3 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5 th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages	
	53	<u>Zheng, Y. et al.</u> , Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages	
	54	Notice of Allowance for U.S. Application No. 15/681,725 dated May 30, 2018	
	55	Notice of Allowance for U.S. Application No. 15/681,725 dated October 25, 2018	
	56	Office Action for U.S. Application No. 13/666,680 dated March 1, 2016	
	57	Office Action for European Application No. EP 12 845 839.5 dated June 6, 2019, 9 pages	
Examiner Signature		/NATHNAEL AYNALAM/	Date Considered
			08/09/2019

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

10949 7590 08/30/2019
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER

AYNALEM, NATHANAL B

ART UNIT

PAPER NUMBER

2488

DATE MAILED: 08/30/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/356,733	03/18/2019	Mehmet Oguz BICI	042933/519745	3483

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	12/02/2019

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 08/30/2019
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/356,733	03/18/2019	Mehmet Oguz BICI	042933/519745	3483

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	12/02/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYNALEM, NATHNAEL B	2488	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/356,733	03/18/2019	Mehmet Oguz BICI	042933/519745	3483
10949	7590	08/30/2019	EXAMINER	
Nokia Corporation and Alston & Bird LLP c/o Alston & Bird LLP Bank of America Plaza, 101 South Tryon Street Suite 4000 Charlotte, NC 28280-4000			AYNALEM, NATHNAEL B	
			ART UNIT	PAPER NUMBER
			2488	
DATE MAILED: 08/30/2019				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/356,733	Applicant(s) BICI et al.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	AIA (FITF) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to application filed on 03/18/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/NATHNAEL AYNALEM/ Primary Examiner, Art Unit 2488	
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DETAILED ACTION

Notice of Pre-AIA or AIA Status

This is in response to Application No. 16/356,733 filed on March 18, 2019. The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the current application is a continuation of patent issued application no. 13/666,680 and includes limitations analogous to the claims of the patented application. Therefore, claim 1 is allowable in view of applicant's arguments submitted with the patented application (*See* Appl. No. 13/666,680, Remarks dated 06/01/2016, pp. 17-18). Specifically, the arguments regarding the difference between the prior arts of record and the feature of "comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates," as recited in claim 1 and similarly recited in the independent claims 9, 15, 23, 29 and 30.

Furthermore, none of the cited prior arts (*See* PTO-892) teach the above feature of the independent claims.

The rest of the dependent claims are allowed based on their dependency from allowed claims 1, 9, 15 and 23.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHNAEL AYNALÉM whose telephone number is (571)270-1482. The examiner can normally be reached on M-F 9AM-5:30 PM ET.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SATH PERUNGAVOOR can be reached on 571-272-7455. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would

Application/Control Number: 16/356,733
Art Unit: 2488

Page 4

like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NATHNAEL AYNALÉ/
Primary Examiner, Art Unit 2488

Notice of References Cited	Application/Control No. 16/356,733		Applicant(s)/Patent Under Reexamination BICI et al.	
	Examiner NATHNAEL AYNALAM		Art Unit 2488	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20110176013-A1	07-2011	Robertson; Mark	H04N5/145	348/208.4
*	B	US-20120230408-A1	09-2012	Zhou; Minhua	H04N19/105	375/240.15
*	C	US-20120257678-A1	10-2012	Zhou; Minhua	H04N19/52	375/240.16
*	D	US-20120269270-A1	10-2012	Chen; Ying	H04N19/597	375/240.16
*	E	US-20120300846-A1	11-2012	SUGIO; Toshiyasu	H04N19/521	375/240.16
*	F	US-20120320984-A1	12-2012	Zhou; Minhua	H04N19/50	375/240.16
*	G	US-20130003850-A1	01-2013	SUGIO; Toshiyasu	H04N19/105	375/240.16
*	H	US-20130004092-A1	01-2013	SASAI; Hisao	H04N19/70	382/233
*	I	US-20130070855-A1	03-2013	Zheng; Yunfei	H04N19/105	375/240.16
*	J	US-20130083853-A1	04-2013	Coban; Muhammed Zeyd	H04N19/563	375/240.16
*	K	US-20130272408-A1	10-2013	CHEN; Ying	H04N19/597	375/240.16
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20190808

<i>Search Notes</i> 	Application/Control No. 16/356,733	Applicant(s)/Patent Under Reexamination BICI et al.
	Examiner NATHNAEL AYNALAM	Art Unit 2488

CPC - Searched*		
Symbol	Date	Examiner
H04N19/52 , H04N19/00684 , H04N19/00703 , H04N19/147 , H04N19/30 , H04N19/597 , H04N19/105 , H04N19/11 , H04N19/119 , H04N19/174 , H04N19/176 , H04N19/187 , H04N19/513 , H04N19/58 , H04N19/70	08/10/2019	NA

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
375	240.01-240.29	08/09/2019	NA

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor's name search	08/10/2019	NA
Assignee search	08/10/2019	NA
East keyword search	08/10/2019	NA
NPL search on ip.com	08/10/2019	NA

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	Interference search of the claims (USPGPUB,USPAT)	08/09/2019	NA

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Issue Classification 	Application/Control No. 16/356,733	Applicant(s)/Patent Under Reexamination BICI et al.
	Examiner NATHNAEL AYNALÉM	Art Unit 2488

CPC						
Symbol					Type	Version
H04N	/	19	/	521	F	2014-11-01
H04N	/	19	/	52	I	2014-11-01
H04N	/	19	/	176	A	2014-11-01
H04N	/	19	/	182	A	2014-11-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/				

NONE (Assistant Examiner)		Total Claims Allowed: 30	
/NATHNAEL AYNALÉM/ Primary Examiner, Art Unit 2488 (Primary Examiner)		09 August 2019 (Date)	O.G. Print Claim(s) 1
			O.G. Print Figure 1

Issue Classification 	Application/Control No. 16/356,733	Applicant(s)/Patent Under Reexamination BICI et al.
	Examiner NATHNAEL AYNALÉM	Art Unit 2488

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H04N19/513	/	19	/ 513
H04N19/52	/	19	/ 52
H04N19/176	/	19	/ 176
H04N19/182	/	19	/ 182
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 30	
/NATHNAEL AYNALÉM/ Primary Examiner, Art Unit 2488 (Primary Examiner) _____ (Date) _____		09 August 2019 O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification 	Application/Control No. 16/356,733	Applicant(s)/Patent Under Reexamination BICI et al.
	Examiner NATHNAEL AYNALÉM	Art Unit 2488

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner) _____ (Date)		Total Claims Allowed: 30	
/NATHNAEL AYNALÉM/ Primary Examiner, Art Unit 2488 (Primary Examiner) _____ (Date)		09 August 2019 (Date)	O.G. Print Claim(s) 1
			O.G. Print Figure 1

Substitute for form SB08 (Revised 07/09) INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known		
				Application Number	16/356,733	
				Filing Date	March 18, 2019	
				First Named Inventor	Bici et al.	
				Art Unit	2488	
Examiner Name	S. V. Perungavoor					
Sheet	2	of	4	Attorney Docket Number	042933/519745	
FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	21	CN 101605255 B	05-04-2011	Huawei Tech Co Ltd		
	22	CN 1757238 A	04-05-2006	Thomson Licensing		
	23	WO 2011 115659 A1	09-22-2011	Thomson Licensing		
	24	WO 2011/062392 A2	05-26-2011	SK Telecom Co. Ltd.		
OTHER DOCUMENTS						
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.				English Language Translation Attached
	25	Advisory Action for U.S. Patent Application No. 13/666,680 dated November 7, 2016, 4 pages.				
	26	<u>Bici, O. et al.</u> , <i>Non-CE13: Simplification of merge mode</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting; Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages				
	27	<u>Bross, B. et al.</u> , <i>Core Experiment 9: MV Coding and Skip/Merge Operations</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages				
	28	<u>Bross, Benjamin, et al.</u> , <i>WD4: Working Draft 4 of High-Efficiency Video Coding</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803 d; 232 pages				
	29	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages				
	30	Final Office Action for U.S. Patent Application No. 13/666,680 dated March 1, 2016, 35 pages.				
	31	<u>Han, Woo-Jin, et al.</u> , <i>Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools</i> , Circuits and Systems for Video Technology; IEEE Transactions on 20.12 (2010); 1709-1720				
Examiner Signature	/NATHNAEL AYNALAM/			Date Considered	08/09/2019	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Substitute for form SB08
(Revised 07/09)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 4

Complete if Known

Application Number	16/356,733
Filing Date	March 18, 2019
First Named Inventor	Bici et al.
Art Unit	2488
Examiner Name	S. V. Perungavoor
Attorney Docket Number	042933/519745

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	32	<u>Huang, Ai-Mei et al.</u> , <i>A multistage motion vector processing method for motion-compensated frame interpolation</i> , Image Processing, IEEE Transactions on 17.5 (2008) 694-708	
	33	International Search Report and Written Opinion from corresponding International Application No. PCT/FI2012/051070, dated March 27, 2013	
	34	<u>J.-L. Liu, Y.-W. Chen, Y.-W. Huang, S. Lei</u> , "CE9: Results of Experiment ROB04", JCT-VC Doc. JCTVC-F052, Turin; Jul 2011	
	35	<u>Jeon, Y. et al.</u> , <i>On MVP list pruning process</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages	
	36	<u>Nakamura, H. et al.</u> , <i>Unification of derivation process for merge mode and MVP</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/ , 10 pages	
	37	Notice of Allowance for U.S. Patent Application No. 13/666,680 dated September 30, 2016, 17 pages.	
	38	Notice of Allowance for U.S. Patent Application No. 15/426,822 dated March 10, 2017, 8 pages	
	39	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016	
	40	Office Action for Chinese Application No. 201280065777.5 dated October 25, 2017 with English Translation, 8 pages	
	41	Office Action for Chinese Application No. 201280065777.5 dated October 9, 2016	
	42	Office Action for corresponding Indian Application No. 4092/CHENP/2014 dated April 11, 2018 with English Translation, 7 pages	
	43	Office Action for U.S. Patent Application No. 13/666,680 dated July 6, 2015, 25 pages.	
	44	Office Action for U.S. Patent Application No. 15/681,725 dated September 21, 2017	
	45	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015	
	46	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015	
	47	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016	
	48	<u>Oudin, S. et al.</u> , "Block Merging for Quadtree-Based Video Coding", IEEE Int. Conf. on Multimedia and Expo; July 11-15; 2011; 6 pages	
Examiner Signature	/NATHNAEL AYNALAM/		Date Considered 08/09/2019

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Substitute for form SB08 (Revised 07/09)				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Application Number	16/356,733
				Filing Date	March 18, 2019
				First Named Inventor	Bici et al.
				Art Unit	2488
				Examiner Name	S. V. Perungavoor
Sheet	4	of	4	Attorney Docket Number	042933/519745
OTHER DOCUMENTS					
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			English Language Translation Attached
	49	Sullivan, G.J.; "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. On Circuits and Systems for Video Technology; Vol. 22, No. 12; December 2012; pp. 1649-1668			
	50	Tai, Shen-Chuan, et al.; "A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications"; Journal of Display Technology; 4.2 (2008): 188-197			
	51	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015			
	52	Wiegand, Tomas, et al.; "WD3: Working Draft 3 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages			
	53	Zheng, Y. et al., Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages			
	54	Notice of Allowance for U.S. Application No. 15/681,725 dated May 30, 2018			
	55	Notice of Allowance for U.S. Application No. 15/681,725 dated October 25, 2018			
	56	Office Action for U.S. Application No. 13/666,680 dated March 1, 2016			
	57	Office Action for European Application No. EP 12 845 839.5 dated June 6, 2019, 9 pages			
Examiner Signature		/NATHNAEL AYNALAM/		Date Considered	08/09/2019

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	63216	(spatial or intra) with predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:14
L2	12150	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or examin\$3 or comparison or match\$3) with (predict\$3 or candidate\$1 or mv\$1 or vector\$1 or mvp\$1 or imvc\$1 or pmvc\$1) with (subset\$1 or sub adj1 set\$1 or sub or limit\$2) with (available or candidate\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:14
L3	512	L2 and L1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:14
L4	395	L3 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:14
L5	63647	(spatial or intra or spatio) with predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:16
L6	100	5 same 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:17
L7	19498	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (spatial\$2 or intra or spatio)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:17

L8	38	6 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:18
L9	964122	(includ\$3 or add\$3 or merg\$3) with (list)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:19
L10	19299	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (spatial\$2 or intra)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L11	708	9 same 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L12	21431	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (candidate\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L13	959908	(includ\$3 or add\$3) with (list)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L14	1992	L12 same L13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L15	218	((("BICI") near3 ("Mehmet")) OR (("LAINEMA") near3 ("Jani")) OR (("UGUR") near3 ("Kemal"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/08/10 12:20
L16	47	L14 and L15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20

L17	1930	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (candidate\$1) with (spatial\$2 or intra)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
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L19	16910	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (location or position or coordinate) with (block or macroblock or picture or frame)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L20	74	L18 same L19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L21	72	L20 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:20
L22	13	(US-20130070855-\$ or US-20130004092-\$ or US-20130016782-\$ or US-20130077689-\$ or US-20120230408-\$ or US-20120257678-\$ or US-20120269270-\$ or US-20120300846-\$ or US-20110176013-\$ or US-20130003850-\$ or US-20120320984-\$).did. or (US-9473787-\$ or US-9635383-\$).did.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:22
L23	1	L22 and L18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:22
L46	2413	((("NOKIA") near3 ("TECHNOLOGIES") near3 ("OY"))).AS.AANM.	USPAT	OR	ON	2019/08/10 12:40
L47	29744	(select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (list\$3 or candidate\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2019/08/10 12:40

			IBM_TDB			
L48	41402	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or examin\$3 or comparison or match\$3) with (predict\$3 or candidate\$1 or mv\$1 or vector\$1 or mvp\$1 or imvc\$1 or pmvc\$1 or motion\$1) with (subset\$1 or sub adj1 set\$1 or sub or limit\$2))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:40
L49	2252	L47 and L48	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:40
L50	8	L46 and L49	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/10 12:40

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L24	94725	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3 or comparison) with (predict\$3 or candidate\$1 or mv or vector\$1)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:23
L25	5544	((select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3 or identify\$3 or estimat\$3 or recogni\$5) with predict\$3 with (list\$3 or candidate\$1)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:23
L26	2243	L24 and L25	US-PGPUB; USPAT	OR	ON	2019/08/10 12:23
L27	2243	L24 and L25	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L28	900	(candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or remov\$3)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L29	67	L28 and L27	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L30	5113	((select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with predict\$3 with (list\$3 or candidate\$1)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L31	94725	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3 or comparison) with (predict\$3 or candidate\$1 or mv or vector\$1)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L32	2070	L30 and L31	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24

L33	1440	(candidat\$1 with merg\$3).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L34	142	L33 and L32	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L35	108139	((includ\$3 or add\$3 or merg\$3) with list).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L36	371	((select\$3 or choos\$3 or chos\$2 or determin\$3 or calculat\$3 or elect\$3 or pick\$3 or decid\$3) with (vector or mv or mvp\$1 or mvc\$1) with (candidate\$1) with (spatial\$2 or intra)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L37	94725	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3 or comparison) with (predict\$3 or candidate\$1 or mv or vector\$1)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L38	86	L35 same L36	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L39	40	L37 and L38	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L40	40	L37 and L38	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L41	128323	((transmit\$4 or transmission or send\$3 or signaling or signaled or output\$4) with (predict\$3 or mv or vector or candidate or list or merg\$3)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L42	9	L41 and L40	US-PGPUB; USPAT	OR	ON	2019/08/10 12:24
L43	1135	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with predict\$3 with candidat\$1).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:40
L44	900	(candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or remov\$3)).clm.	US-PGPUB; USPAT	OR	ON	2019/08/10 12:40
L45	40	L43 and L44	US-PGPUB; USPAT	OR	ON	2019/08/10 12:40

8/10/2019 12:42:15 PM

C:\Users\nayna\Documents\EAST\Workspaces\13666680.wsp

Complete Main Concept Text

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selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit; determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate; comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates; determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing

(No Concept Modifiers)

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(No Filters)

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Options

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De-dup: None

Cut-off: None

Sort: Relevance

Collections (25)

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IEEE Xplore Publications: IEEE Periodicals
 IEEE Xplore Publications: IEEE Conferences
 IEEE Xplore Publications: IEEE Standards
 IEEE Xplore Publications: IEEE Early Access
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IP.com Prior Art Database: The IP.com Journal
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OnePetro.org: Periodicals at OnePetro.org
OnePetro.org: Conferences at OnePetro.org
OnePetro.org: Standards at OnePetro.org
Other Literature: IBM Redbooks
Other Literature: PubMed Central

Bibliographic Data

Application No: 16/356,733

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /NATHNAEL AYNALÉM/

Examiner's Signature

Initials

Title:

METHOD FOR CODING AND AN APPARATUS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/18/2019	375	2488	042933/519745
RULE			

APPLICANTS

NOKIA TECHNOLOGIES OY, Espoo, FINLAND

INVENTORS

Mehmet Oguz BICI Tampere, FINLAND

Jani LAINEMA Tampere, FINLAND

Kemal UGUR Tampere, FINLAND

CONTINUING DATA

This application is a CON of 15681725 08/21/2017 PAT 10237574

15681725 is a CON of 15426822 02/07/2017 PAT 9743105

15426822 is a CON of 13666680 11/01/2012 PAT 9571833

13666680 has PRO of 61555703 11/04/2011

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

04/03/2019

STATE OR COUNTRY

FINLAND

ADDRESS

Nokia Corporation and Alston & Bird LLP

c/o Alston & Bird LLP

Bank of America Plaza, 101 South Tryon Street

Suite 4000

Charlotte, NC 28280-4000

UNITED STATES

FILING FEE RECEIVED

\$4,100

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce
Electronic Petition Request	TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	
Application Number	16356733	
Filing Date	18-Mar-2019	
First Named Inventor	Mehmet BICI	
Attorney Docket Number	042933/519745	
Title of Invention	METHOD FOR CODING AND AN APPARATUS	
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Owner	Percent Interest	
Nokia Technologies Oy	100%	
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- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.
- ☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

- ☐ Small Entity
- ☐ Micro Entity
- ☒ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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- ☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application
- Registration Number 34610
- ☐ A sole inventor
- ☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application
- ☐ A joint inventor; all of whom are signing this request

Signature	/Guy R. Gosnell/
Name	Guy R. Gosnell

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		16356733		
Filing Date:		18-Mar-2019		
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Janet Snider		
Attorney Docket Number:		042933/519745		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16356733

Filing Date: 18-Mar-2019

Applicant/Patent under Reexamination: BICI

Electronic Terminal Disclaimer filed on August 8, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	36825625
Application Number:	16356733
International Application Number:	
Confirmation Number:	3483
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Janet Snider
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/519745
Receipt Date:	08-AUG-2019
Filing Date:	18-MAR-2019
Time Stamp:	16:42:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$160
RAM confirmation Number	E201988G42505250
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
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1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33755	no	2
			0d90cf4e90707fbb131493ed061dd0bffa1e21c		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30505	no	2
			2539a59c7a397e7c5c2e7d162a3cb84e027be1b2		
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Total Files Size (in bytes):			64260		
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/356,733	03/18/2019	Mehmet Oguz BICI	042933/519745

CONFIRMATION NO. 3483

PUBLICATION NOTICE

10949

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000



OC000000109566388

Title:METHOD FOR CODING AND AN APPARATUS

Publication No.US-2019-0215530-A1

Publication Date:07/11/2019

NOTICE OF PUBLICATION OF APPLICATION

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Substitute for form SB08 (Revised 07/09) INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known		
				Application Number		16/356,733
				Filing Date		March 18, 2019
				First Named Inventor		Bici et al.
				Art Unit		2488
Examiner Name		S. V. Perungavoor				
Attorney Docket Number		042933/519745				
Sheet	1	of	4			
U. S. PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear	
	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.		
	2	US-2007/0189389 A1	08-16-2007	Boisson et al.		
	3	US-2008/0159401 A1	07-03-2008	Lee et al.		
	4	US-2008/0232642 A1	09-25-2008	Chang		
	5	US-2011/0170602 A1	07-14-2011	Lee et al.		
	6	US-2011/0176013 A1	07-21-2011	Robertson et al.		
	7	US-2011/0176612 A1	07-21-2011	Tsai et al.		
	8	US-2011/0182362 A1	07-28-2011	Kim et al.		
	9	US-2012/0230408 A1	09-13-2012	Zhou		
	10	US-2012/0257678 A1	10-11-2012	Zhou et al.		
	11	US-2012/0269270 A1	10-25-2012	Chen et al.		
	12	US-2012/0300846 A1	11-29-2012	Sugio et al.		
	13	US-2012/0307905 A1	12-06-2012	Kim et al.		
	14	US-2012/0320984 A1	12-20-2012	Zhou		
	15	US-2013/0003850 A1	01-03-2013	Sugio et al.		
	16	US-2013/0004092 A1	01-03-2013	Sasai et al.		
	17	US-2013/0070855 A1	03-21-2013	Zheng et al.		
	18	US-2013/0083853 A1	04-04-2013	Coban et al.		
	19	US-2013/0272408 A1	10-17-2013	Chen et al.		
FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	20	CN 101271580 A	09-24-2008	HIMAX Tech Ltd		
Examiner Signature				Date Considered		

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Substitute for form SB08
(Revised 07/09)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known

				Application Number	16/356,733
				Filing Date	March 18, 2019
				First Named Inventor	Bici et al.
				Art Unit	2488
				Examiner Name	S. V. Perungavoor
Sheet	2	of	4	Attorney Docket Number	042933/519745

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	21	CN 101605255 B	05-04-2011	Huawei Tech Co Ltd		
	22	CN 1757238 A	04-05-2006	Thomson Licensing		
	23	WO 2011 115659 A1	09-22-2011	Thomson Licensing		
	24	WO 2011/062392 A2	05-26-2011	SK Telecom Co. Ltd.		

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	25	Advisory Action for U.S. Patent Application No. 13/666,680 dated November 7, 2016, 4 pages.	
	26	<u>Bici, O. et al.</u> , <i>Non-CE13: Simplification of merge mode</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting; Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages	
	27	<u>Bross, B. et al.</u> , <i>Core Experiment 9: MV Coding and Skip/Merge Operations</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages	
	28	<u>Bross, Benjamin, et al.</u> , <i>WD4: Working Draft 4 of High-Efficiency Video Coding</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803 d; 232 pages	
	29	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages	
	30	Final Office Action for U.S. Patent Application No. 13/666,680 dated March 1, 2016, 35 pages.	
	31	<u>Han, Woo-Jin, et al.</u> , <i>Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools</i> , Circuits and Systems for Video Technology; IEEE Transactions on 20.12 (2010); 1709-1720	

Examiner Signature	Date Considered
--------------------	-----------------

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Substitute for form SB08
(Revised 07/09)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 4

Complete if Known

Application Number	16/356,733
Filing Date	March 18, 2019
First Named Inventor	Bici et al.
Art Unit	2488
Examiner Name	S. V. Perungavoor
Attorney Docket Number	042933/519745

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	32	<u>Huang, Ai-Mei et al.</u> , <i>A multistage motion vector processing method for motion-compensated frame interpolation</i> , Image Processing, IEEE Transactions on 17.5 (2008) 694-708	
	33	International Search Report and Written Opinion from corresponding International Application No. PCT/FI2012/051070, dated March 27, 2013	
	34	<u>J.-L. Liu, Y.-W. Chen, Y.-W. Huang, S. Lei</u> , "CE9: Results of Experiment ROB04", JCT-VC Doc. JCTVC-F052, Turin; Jul 2011	
	35	<u>Jeon, Y. et al.</u> , <i>On MVP list pruning process</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages	
	36	<u>Nakamura, H. et al.</u> , <i>Unification of derivation process for merge mode and MVP</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/ , 10 pages	
	37	Notice of Allowance for U.S. Patent Application No. 13/666,680 dated September 30, 2016, 17 pages.	
	38	Notice of Allowance for U.S. Patent Application No. 15/426,822 dated March 10, 2017, 8 pages	
	39	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016	
	40	Office Action for Chinese Application No. 201280065777.5 dated October 25, 2017 with English Translation, 8 pages	
	41	Office Action for Chinese Application No. 201280065777.5 dated October 9, 2016	
	42	Office Action for corresponding Indian Application No. 4092/CHENP/2014 dated April 11, 2018 with English Translation, 7 pages	
	43	Office Action for U.S. Patent Application No. 13/666,680 dated July 6, 2015, 25 pages.	
	44	Office Action for U.S. Patent Application No. 15/681,725 dated September 21, 2017	
	45	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015	
	46	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015	
	47	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016	
	48	<u>Oudin, S. et al.</u> , "Block Merging for Quadtree-Based Video Coding", IEEE Int. Conf. on Multimedia and Expo; July 11-15; 2011; 6 pages	
Examiner Signature			Date Considered

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Substitute for form SB08 (Revised 07/09)				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Application Number	16/356,733
				Filing Date	March 18, 2019
				First Named Inventor	Bici et al.
				Ari Unit	2488
				Examiner Name	S. V. Perungavoor
Sheet	4	of	4	Attorney Docket Number	042933/519745
OTHER DOCUMENTS					
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			English Language Translation Attached
	49	Sullivan, G.J.; "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. On Circuits and Systems for Video Technology; Vol. 22, No. 12; December 2012; pp. 1649-1668			
	50	Tai, Shen-Chuan, et al.; "A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications"; Journal of Display Technology; 4.2 (2008): 188-197			
	51	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015			
	52	Wiegand, Tomas, et al.; "WD3: Working Draft 3 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5 th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages			
	53	Zheng, Y. et al., Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages			
	54	Notice of Allowance for U.S. Application No. 15/681,725 dated May 30, 2018			
	55	Notice of Allowance for U.S. Application No. 15/681,725 dated October 25, 2018			
	56	Office Action for U.S. Application No. 13/666,680 dated March 1, 2016			
	57	Office Action for European Application No. EP 12 845 839.5 dated June 6, 2019, 9 pages			
Examiner Signature				Date Considered	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Submitted June 17, 2019

Electronic Acknowledgement Receipt	
EFS ID:	36316713
Application Number:	16356733
International Application Number:	
Confirmation Number:	3483
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Joyce Smith
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/519745
Receipt Date:	17-JUN-2019
Filing Date:	18-MAR-2019
Time Stamp:	13:42:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS519745.PDF	434732	yes	5
			528ad61e0922c1fc76319e175ede598c46a9476b		

	Multipart Description/PDF files in .zip description								
	Document Description		Start	End					
	Transmittal Letter		1	1					
	Information Disclosure Statement (IDS) Form (SB08)		2	5					
Warnings:									
Information:									
2	Non Patent Literature	519745_EPOA.PDF	414838	no	9				
			7f9a84aa7fae298e3fa0f58f930d0af4b7ace795						
Warnings:									
Information:									
Total Files Size (in bytes):			849570						
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.									

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Bici et al. Confirmation No.: 3483
Appl. No.: 16/356,733 Art Unit: 2488
Filed: March 18, 2019 Examiner: S.V. Perungavoor
For: METHOD FOR CODING AND AN APPARATUS

Submitted via EPS-Web
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
CITATION UNDER 37 C.F.R. § 1.97

Attached is a list of documents on form PTO-SB08.

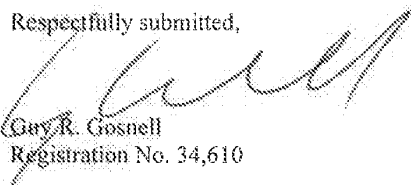
It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

Copies of all listed documents (other than U.S. patents, U.S. patent application publications, or patents or publications otherwise determined cumulative) are attached, except those (if any) that were previously submitted to, or cited by, the Office during the prosecution of any application(s) upon which the present application directly relies for an earlier effective filing date under 35 U.S.C. § 120. It is noted that 37 C.F.R. § 1.98(d) establishes that copies of documents previously submitted to, or cited by, the Office during prosecution of said application(s) are not required to be furnished; however, copies of such documents will be furnished upon request.

In accordance with 37 C.F.R. § 1.98(d) the reference above to said application(s) includes those application(s) properly identified in the table below:

Application No.	Filing Date	Pub./Patent No.	Status
15/681,725	August 21, 2017	10,237,574	Patented
15/426,822	February 7, 2017	9,743,105	Patented
13/666,680	November 1, 2012	9,571,833	Patented

Respectfully submitted,


Gary R. Gosnell
Registration No. 34,610

Customer No. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

LEGAL02/39034874v1



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
16/356,733	03/18/2019	2482	4100	042933/519745	30	6

CONFIRMATION NO. 3483

FILING RECEIPT



10949

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 04/04/2019

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

NOKIA TECHNOLOGIES OY, Espoo, FINLAND;

Assignment For Published Patent Application

NOKIA TECHNOLOGIES OY, Espoo, FINLAND

Power of Attorney: The patent practitioners associated with Customer Number 10949

Domestic Priority data as claimed by applicant

This application is a CON of 15/681,725 08/21/2017 PAT 10237574
which is a CON of 15/426,822 02/07/2017 PAT 9743105
which is a CON of 13/666,680 11/01/2012 PAT 9571833
which claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 04/03/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/356,733**

Projected Publication Date: 07/11/2019

Non-Publication Request: No

Early Publication Request: No
Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

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No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/356,733				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	30	minus 20 = *	10			x 100 =	1000			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6	minus 3 = *	3			x 460 =	1380			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	4100			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
TOTAL ADD'L FEE								TOTAL ADD'L FEE		
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
TOTAL ADD'L FEE								TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	TO BE ASSIGNED
Filing Date	Concurrently Herewith
First Named Inventor	Mehmet Oguz BICI et al.
Title	METHOD FOR CODING AND AN APPARATUS
Art Unit	
Examiner Name	
Attorney Docket Number	042933/519745

SIGNATURE of Applicant or Patent Practitioner

Signature	/Guy R. Gosnell/	Date (Optional)	03/18/2019
Name	Guy R. Gosnell	Registration Number	34,610
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	NOKIA TECHNOLOGIES OY		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐

*Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

10949

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name				
Address				
City	State	Zip		
Country				
Telephone	Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

NOKIA TECHNOLOGIES OY

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

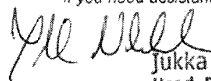
Signature		Date (Optional)	23 January 2015
Name	Jukka Nihtila		
Title	Legal and Intellectual Property		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.


Jukka Nihtila
Head, Business Development
Legal & IP

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Janet Snider		
Attorney Docket Number:		042933/519745		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	10	100	1000
INDEPENDENT CLAIMS IN EXCESS OF 3	1201	3	460	1380
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				4100

Electronic Acknowledgement Receipt	
EFS ID:	35455593
Application Number:	16356733
International Application Number:	
Confirmation Number:	3483
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Janet Snider
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/519745
Receipt Date:	18-MAR-2019
Filing Date:	
Time Stamp:	16:43:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$4100
RAM confirmation Number	031919INTEFSW00004120160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	519745_ADS.PDF	1828635	no	9
			eef709681ff88df14d2233a6d94020d389ace81		
Warnings:					
Information:					
2		519745_Application.pdf	292170	yes	60
			e38fd8a6ef43f58648c274ae4aced8e376018f18		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Abstract		60	60	
	Claims		46	59	
	Specification		1	45	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	519745_Drawings.PDF	257901	no	13
			68dce893aba7cd5c3f4f634c98400f743bcf0ede		
Warnings:					
Information:					
4	Oath or Declaration filed	519745_Declaration.PDF	327213	no	3
			73b74c8a6c4c004618a63bdc3ee8f3791f1e987e		
Warnings:					
Information:					
5	Power of Attorney	519745_POA.pdf	558171	no	2
			e3d9ac9c38cd1eb15e507ddac7a55ce0ad31e8ca		

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	38095	no	2
			09a0fb89900a04af40245d874c6126f38b6c073		
Warnings:					
Information:					
Total Files Size (in bytes):			3302185		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Mehmet	Oguz	BICI		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Tampere		Country of Residence ⁱ	FI	
Mailing Address of Inventor:					
Address 1	Tammelan puistokatu 1-3 D 46				
Address 2					
City	Tampere		State/Province		
Postal Code	33500		Country ⁱ	FI	
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jani		LAINEMA		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Tampere		Country of Residence ⁱ	FI	
Mailing Address of Inventor:					
Address 1	Kisakentankatu 12 B 6				
Address 2					
City	Tampere		State/Province		
Postal Code	33230		Country ⁱ	FI	
Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kemal		UGUR	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Tampere	Country of Residence ⁱ	FI	
Mailing Address of Inventor:				
Address 1	Lapintie 6D 25			
Address 2				
City	Tampere	State/Province		
Postal Code	33100	Country ⁱ	FI	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence Information of this application.	
Customer Number	10949
Email Address	Add Email Remove Email

Application Information:

Title of the Invention	METHOD FOR CODING AND AN APPARATUS		
Attorney Docket Number	042933/519745	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	13	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:			
☒	Customer Number	☐	Limited Recognition (37 CFR 11.9)
Customer Number	10949		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15/681725	2017-08-21
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15/681725	Continuation of	15/426822	2017-02-07
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15/426822	Continuation of	13/666680	2012-11-01

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
13/666680	Claims benefit of provisional	61/555703	2011-11-04
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This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^j (if applicable)	Remove
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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
☒ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	NOKIA TECHNOLOGIES OY		
Mailing Address Information For Applicant:			
Address 1	Karaportti 3		
Address 2			
City	Espoo	State/Province	
Country	FI	Postal Code	02610
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Assignee 1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.			
			Remove
If the Assignee or Non-Applicant Assignee is an Organization check here. ☒			
Organization Name	NOKIA TECHNOLOGIES OY		
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Country i	FI	Postal Code	02610
Phone Number		Fax Number	
Email Address			
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Signature: [Remove](#)

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See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Guy R. Gosnell/		Date (YYYY-MM-DD)	2019-03-18	
First Name	Guy	Last Name	Gosnell	Registration Number	34,610
Additional Signature may be generated within this form by selecting the Add button.				Add	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/519745
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ABSTRACT

The invention relates to a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder for video information. The motion vector for a block in a video image is predicted from a set of motion vector prediction candidates determined based on previously-coded motion vectors. A motion vector prediction candidate is included in the set based on the location of the block associated with the first spatial motion vector prediction candidate and in comparison with motion vector prediction candidates already in the set.

Claims:

1. A method comprising:

selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates;

determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

2. The method according to claim 1 further comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. The method according to claim 1, further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. The method according to claim 1 further comprising examining whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

5. The method according to claim 1, further comprising
determining a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and
limiting the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

6. The method according to claim 5 comprising:
examining, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;
if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
if so, performing at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:
– the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;
– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;
for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:
– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. The method according to claim 1 further comprising including a temporal motion prediction candidate into the motion vector prediction list.

8. The method according to claim 1 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the block of pixels.

9. A method comprising:

selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

selecting a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

10. The method according to claim 9 further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. The method according to claim 9 further comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

12. The method according to claim 9 further comprising
determining a maximum number of spatial motion vector prediction candidates to be
included in the motion vector prediction list; and
limiting the number of spatial motion vector prediction candidates in the motion vector
prediction list smaller or equal to the maximum number.

13. The method according to claim 12 further comprising:
examining, if the number of spatial motion vector prediction candidates in the motion
vector prediction list smaller than the maximum number;
if so, examining whether the prediction unit to which the potential spatial motion vector
prediction candidate belongs is available for motion prediction;
if so, performing at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction
unit, excluding the potential spatial motion vector prediction candidate from the motion vector
prediction list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first
prediction unit and a second prediction unit;
- the received encoded block of pixels is horizontally divided into a first
prediction unit and a second prediction unit, and if the prediction unit is the second
prediction unit, and the potential spatial motion vector prediction candidate has
essentially similar motion information than a spatial motion vector prediction candidate
above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit,
excluding the potential spatial motion vector prediction candidate from the motion vector
prediction list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first
prediction unit and a second prediction unit, and the prediction unit is the second
prediction unit;
- the potential spatial motion vector prediction candidate has essentially
similar motion information than the spatial motion vector prediction candidate on the left
side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. The method according to claim 9 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the encoded block of pixels.

15. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

select a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction

candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

determine to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on comparison of the motion information of the first spatial motion vector candidate with motion information of the spatial motion vector prediction candidate; and

cause information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

16. The apparatus according to claim 15 wherein the apparatus is further caused to select spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

17. The apparatus according to claim 15, wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

18. The apparatus according to claim 15 wherein the apparatus is further caused to examine whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

19. The apparatus according to claim 15, wherein the apparatus is further caused to:
determine a maximum number of spatial motion vector prediction candidates to be
included in the motion vector prediction list; and
limit the number of spatial motion vector prediction candidates in the motion vector
prediction list smaller or equal to the maximum number .

20. The apparatus according to claim 19 wherein the apparatus is further caused to:
examine, if the number of spatial motion vector prediction candidates in the motion
vector prediction list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector
prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction
unit, exclude the potential spatial motion vector prediction candidate from the motion vector
prediction list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit
and a second prediction unit;

- the received block of pixels is horizontally divided into a first prediction
unit and a second prediction unit, and if the prediction unit is the second prediction unit,
and the potential spatial motion vector prediction candidate has essentially similar motion
information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit,
exclude the potential spatial motion vector prediction candidate from the motion vector
prediction list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction
unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially
similar motion information than the spatial motion vector prediction candidate on the left
side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

21. The apparatus according to claim 15 wherein the apparatus is further caused to include a temporal motion prediction candidate into the motion vector prediction list.

22. The apparatus according to claim 15 wherein the apparatus is further caused to select one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the block of pixels.

23. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

select a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

determine to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on comparison of the motion information of the first spatial motion vector candidate with motion information of the spatial motion vector prediction candidate; and

select a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

24. The apparatus according to claim 23 wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

25. The apparatus according to claim 23 wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a

second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

26. The apparatus according to claim 23 wherein the apparatus is further caused to:
determine a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and
limit the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

27. The apparatus according to claim 26 wherein the apparatus is further caused to:
examine if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

28. The apparatus according to claim 23 wherein the apparatus is further caused to select one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the received encoded block of pixels.

29. A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

- selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

- determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

- comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

- determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

- causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

30. A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

- selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;

- determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

- comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of

spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

selecting a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

METHOD FOR CODING AND AN APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Application No. 15/681,725, filed August 21, 2017, which is a continuation of U.S. Application No. 15/426,822, filed February 7, 2017, which is a continuation of U.S. Application No. 13/666,680, filed November 1, 2012, which claims priority to U.S. Provisional Application No. 61/555,703, filed November 4, 2011, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] There is provided a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder.

BACKGROUND INFORMATION

[0003] This section is intended to provide a background or context to the invention that is recited in the claims. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived or pursued. Therefore, unless otherwise indicated herein, what is described in this section is not prior art to the description and claims in this application and is not admitted to be prior art by inclusion in this section

[0004] A video codec may comprise an encoder which transforms input video into a compressed representation suitable for storage and/or transmission and a decoder that can uncompress the compressed video representation back into a viewable form, or either one of them. The encoder may discard some information in the original video sequence in order to represent the video in a more compact form, for example at a lower bit rate.

[0005] Many hybrid video codecs, operating for example according to the International Telecommunication Union's ITU-T H.263 and H.264 coding standards, encode video information in two phases. In the first phase, pixel values in a certain picture area or "block" are predicted. These pixel values can be predicted, for example, by motion compensation mechanisms, which involve finding and indicating an area in one of the previously encoded video frames (or a later coded video frame) that corresponds closely to the block being coded. Additionally, pixel values can be predicted by spatial mechanisms which involve finding and

indicating a spatial region relationship, for example by using pixel values around the block to be coded in a specified manner.

[0006] Prediction approaches using image information from a previous (or a later) image can also be called as Inter prediction methods, and prediction approaches using image information within the same image can also be called as Intra prediction methods.

[0007] The second phase is one of coding the error between the predicted block of pixels and the original block of pixels. This may be accomplished by transforming the difference in pixel values using a specified transform. This transform may be e.g. a Discrete Cosine Transform (DCT) or a variant thereof. After transforming the difference, the transformed difference may be quantized and entropy encoded.

[0008] By varying the fidelity of the quantization process, the encoder can control the balance between the accuracy of the pixel representation, (in other words, the quality of the picture) and the size of the resulting encoded video representation (in other words, the file size or transmission bit rate).

[0009] The decoder reconstructs the output video by applying a prediction mechanism similar to that used by the encoder in order to form a predicted representation of the pixel blocks (using the motion or spatial information created by the encoder and stored in the compressed representation of the image) and prediction error decoding (the inverse operation of the prediction error coding to recover the quantized prediction error signal in the spatial domain).

[0010] After applying pixel prediction and error decoding processes the decoder combines the prediction and the prediction error signals (the pixel values) to form the output video frame.

[0011] The decoder (and encoder) may also apply additional filtering processes in order to improve the quality of the output video before passing it for display and/or storing as a prediction reference for the forthcoming frames in the video sequence.

[0012] In some video codecs, such as High Efficiency Video Coding Working Draft 4, video pictures may be divided into coding units (CU) covering the area of a picture. A coding unit consists of one or more prediction units (PU) defining the prediction process for the samples within the coding unit and one or more transform units (TU) defining the prediction error coding process for the samples in the coding unit. A coding unit may consist of a square block of samples with a size selectable from a predefined set of possible coding unit sizes. A coding unit with the maximum allowed size can be named as a largest coding unit (LCU) and the video

picture may be divided into non-overlapping largest coding units. A largest coding unit can further be split into a combination of smaller coding units, e.g. by recursively splitting the largest coding unit and resultant coding units. Each resulting coding unit may have at least one prediction unit and at least one transform unit associated with it. Each prediction unit and transform unit can further be split into smaller prediction units and transform units in order to increase granularity of the prediction and prediction error coding processes, respectively. Each prediction unit may have prediction information associated with it defining what kind of a prediction is to be applied for the pixels within that prediction unit (e.g. motion vector information for inter predicted prediction units and intra prediction directionality information for intra predicted prediction units). Similarly, each transform unit may be associated with information describing the prediction error decoding process for samples within the transform unit (including e.g. discrete cosine transform (DCT) coefficient information). It may be signalled at coding unit level whether prediction error coding is applied or not for each coding unit. In the case there is no prediction error residual associated with the coding unit, it can be considered there are no transform units for the coding unit. The division of the image into coding units, and division of coding units into prediction units and transform units may be signalled in the bitstream allowing the decoder to reproduce the intended structure of these units.

[0013] In some video codecs, motion information is indicated by motion vectors associated with each motion compensated image block. These motion vectors represent the displacement of the image block in the picture to be coded (in the encoder) or decoded (at the decoder) and the prediction source block in one of the previously coded or decoded images (or pictures). In order to represent motion vectors efficiently, motion vectors may be coded differentially with respect to block specific predicted motion vector. In some video codecs, the predicted motion vectors are created in a predefined way, for example by calculating the median of the encoded or decoded motion vectors of the adjacent blocks.

[0014] Another way to create motion vector predictions is to generate a list or a set of candidate predictions from blocks in the current frame and/or co-located or other blocks in temporal reference pictures and signalling the chosen candidate as the motion vector prediction. A spatial motion vector prediction is a prediction obtained only on the basis of information of one or more blocks of the same frame than the current frame whereas temporal motion vector prediction is a prediction obtained on the basis of information of one or more blocks of a frame

different from the current frame. It may also be possible to obtain motion vector predictions by combining both spatial and temporal prediction information of one or more encoded blocks.

These kinds of motion vector predictions are called as spatio-temporal motion vector predictions.

[0015] In addition to predicting the motion vector values, the reference index in the reference picture list can be predicted. The reference index may be predicted from blocks in the current frame and/or co-located or other blocks in a temporal reference picture. Moreover, some high efficiency video codecs employ an additional motion information coding/decoding mechanism, often called merging/merge mode, where all the motion field information, which includes motion vector and corresponding reference picture index for each available reference picture list, may be predicted and used without any modification or correction. Similarly, predicting the motion field information may be carried out using the motion field information of blocks in the current frame and/or co-located or other blocks in temporal reference pictures and the used motion field information is signalled among a list of motion field candidate list filled with motion field information of available blocks in the current frame and/or co-located or other blocks in temporal reference pictures.

[0016] In some video codecs the prediction residual after motion compensation is first transformed with a transform kernel (like DCT) and then coded. The reason for this is that often there still exists some correlation among the residual and transform can in many cases help reduce this correlation and provide more efficient coding.

[0017] Some video encoders utilize Lagrangian cost functions to find optimal coding modes, e.g. the desired Macroblock mode and associated motion vectors. This kind of cost function uses a weighting factor λ to tie together the (exact or estimated) image distortion due to lossy coding methods and the (exact or estimated) amount of information that is required to represent the pixel values in an image area:

$$C = D + \lambda R \quad (1)$$

where C is the Lagrangian cost to be minimized, D is the image distortion (e.g. Mean Squared Error) with the mode and motion vectors considered, and R the number of bits needed to represent the required data to reconstruct the image block in the decoder (including the amount of data to represent the candidate motion vectors).

[0018] Some video codecs such as hybrid video codecs may generate a list of motion vector predictions (MVP) consisting of motion vectors of spatial adjacent blocks (spatial MVP) and/or

motion vectors of blocks in a previously decoded frame (temporal MVP). One of the candidate motion vectors in the list is signalled to be used as the motion vector prediction of the current block. After the list is generated, some of the motion vector prediction candidates may have the same motion information. In this case, the identical motion vector prediction candidates may be removed to reduce redundancy. During the decoding, if the temporal motion vector prediction information is unavailable due to e.g. loss of reference frame, the decoder may not know if the temporal motion vector prediction candidate in the list is to be removed. This may lead to uncertainty for mapping the decoded candidate index to the candidates whose removal decision is based on comparing motion information with the temporal motion vector prediction. As a result, false assignment of motion vector prediction candidates may occur which may lead to degradation in the picture quality and drift of false motion information throughout the decoding process.

SUMMARY

[0019] The present invention introduces a method for generating a motion vector prediction list for an image block. In some embodiments video codecs employ in a motion prediction candidate list construction a way to reduce the complexity of the implementation. This can be achieved by performing a limited number of motion information comparisons between candidate pairs to remove the redundant candidates rather than comparing every available candidate pair. The decision of whether comparing two candidates may depend on the order of the candidates to be considered for the list and/or coding/prediction mode and/or location of the blocks associated with the candidates. In some embodiments a video codec employs a merge process for motion information coding and creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates are obtained from the motion information of e.g. spatial neighbour blocks.

[0020] According to a first aspect of the present invention there is provided a method comprising:

receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0021] According to a second aspect of the present invention there is provided a method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0022] According to a third aspect of the present invention there is provided an apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

- receive a block of pixels
- including a prediction unit;
- determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;
- selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;
- determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;
- comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;
- if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0023] According to a fourth aspect of the present invention there is provided an apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

- receive an encoded block of pixels
- including a prediction unit;
- determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;
- selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;
- determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0024] According to a fifth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[0025] According to a sixth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by a decoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0026] According to a seventh aspect of the present invention there is provided an apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0027] According to an eighth aspect of the present invention there is provided an apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

DESCRIPTION OF THE DRAWINGS

[0028] For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

[0029] Figure 1 shows schematically an electronic device employing some embodiments of the invention;

[0030] Figure 2 shows schematically a user equipment suitable for employing some embodiments of the invention;

[0031] Figure 3 further shows schematically electronic devices employing embodiments of the invention connected using wireless and wired network connections;

[0032] Figure 4a shows schematically an embodiment of the invention as incorporated within an encoder;

[0033] Figure 4b shows schematically an embodiment of a prediction reference list generation and modification according to some embodiments of the invention;

[0034] Figures 5a and 5b show a flow diagram showing the operation of an embodiment of the invention with respect to the encoder as shown in figure 4a;

[0035] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit;

[0036] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit;

[0037] Figure 7 shows schematically an embodiment of the invention as incorporated within a decoder;

[0038] Figures 8a and 8b show a flow diagram of showing the operation of an embodiment of the invention with respect to the decoder shown in figure 7;

[0039] Figure 9 illustrates an example of a coding unit and some neighbour blocks of the coding unit;

[0040] Figure 10a illustrates an example of a horizontal division of the coding unit;

[0041] Figure 10b illustrates an example of a vertical division of the coding unit;

[0042] Figure 11a illustrates locations of five spatial neighbours A0, A1, B0, B1, B2 for a prediction unit generated as the second prediction unit of a horizontally divided coding unit;

[0043] Figure 11b illustrates locations of five spatial neighbours for a prediction unit generated as the second prediction unit of a vertically divided coding unit; and

[0044] Figure 12 illustrates an example of blocks between some spatial neighbours of a coding unit.

DETAILED DESCRIPTION OF SOME EXAMPLE EMBODIMENTS

[0045] The following describes in further detail suitable apparatus and possible mechanisms for the provision of improving the prediction accuracy and hence possibly reducing information to be transmitted in video coding systems. In this regard reference is first made to Figure 1 which shows a schematic block diagram of an exemplary apparatus or electronic device 50, which may incorporate a codec according to an embodiment of the invention.

[0046] The electronic device 50 may for example be a mobile terminal or user equipment of a wireless communication system. However, it would be appreciated that embodiments of the invention may be implemented within any electronic device or apparatus which may require encoding and decoding or encoding or decoding video images.

[0047] The apparatus 50 may comprise a housing 30 for incorporating and protecting the device. The apparatus 50 further may comprise a display 32 in the form of a liquid crystal

display. In other embodiments of the invention the display may be any suitable display technology suitable to display an image or video. The apparatus 50 may further comprise a keypad 34. In other embodiments of the invention any suitable data or user interface mechanism may be employed. For example the user interface may be implemented as a virtual keyboard or data entry system as part of a touch-sensitive display. The apparatus may comprise a microphone 36 or any suitable audio input which may be a digital or analogue signal input. The apparatus 50 may further comprise an audio output device which in embodiments of the invention may be any one of: an earpiece 38, speaker, or an analogue audio or digital audio output connection. The apparatus 50 may also comprise a battery 40 (or in other embodiments of the invention the device may be powered by any suitable mobile energy device such as solar cell, fuel cell or clockwork generator). The apparatus may further comprise an infrared port 42 for short range line of sight communication to other devices. In other embodiments the apparatus 50 may further comprise any suitable short range communication solution such as for example a Bluetooth wireless connection or a USB/firewire wired connection.

[0048] The apparatus 50 may comprise a controller 56 or processor for controlling the apparatus 50. The controller 56 may be connected to memory 58 which in embodiments of the invention may store both data in the form of image and audio data and/or may also store instructions for implementation on the controller 56. The controller 56 may further be connected to codec circuitry 54 suitable for carrying out coding and decoding of audio and/or video data or assisting in coding and decoding carried out by the controller 56.

[0049] The apparatus 50 may further comprise a card reader 48 and a smart card 46, for example a UICC and UICC reader for providing user information and being suitable for providing authentication information for authentication and authorization of the user at a network.

[0050] The apparatus 50 may comprise radio interface circuitry 52 connected to the controller and suitable for generating wireless communication signals for example for communication with a cellular communications network, a wireless communications system or a wireless local area network. The apparatus 50 may further comprise an antenna 44 connected to the radio interface circuitry 52 for transmitting radio frequency signals generated at the radio interface circuitry 52 to other apparatus(es) and for receiving radio frequency signals from other apparatus(es).

[0051] In some embodiments of the invention, the apparatus 50 comprises a camera capable of recording or detecting individual frames which are then passed to the codec 54 or controller for processing. In some embodiments of the invention, the apparatus may receive the video image data for processing from another device prior to transmission and/or storage. In some embodiments of the invention, the apparatus 50 may receive either wirelessly or by a wired connection the image for coding/decoding.

[0052] With respect to Figure 3, an example of a system within which embodiments of the present invention can be utilized is shown. The system 10 comprises multiple communication devices which can communicate through one or more networks. The system 10 may comprise any combination of wired or wireless networks including, but not limited to a wireless cellular telephone network (such as a GSM, UMTS, CDMA network etc), a wireless local area network (WLAN) such as defined by any of the IEEE 802.x standards, a Bluetooth personal area network, an Ethernet local area network, a token ring local area network, a wide area network, and the Internet.

[0053] The system 10 may include both wired and wireless communication devices or apparatus 50 suitable for implementing embodiments of the invention.

[0054] For example, the system shown in Figure 3 shows a mobile telephone network 11 and a representation of the internet 28. Connectivity to the internet 28 may include, but is not limited to, long range wireless connections, short range wireless connections, and various wired connections including, but not limited to, telephone lines, cable lines, power lines, and similar communication pathways.

[0055] The example communication devices shown in the system 10 may include, but are not limited to, an electronic device or apparatus 50, a combination of a personal digital assistant (PDA) and a mobile telephone 14, a PDA 16, an integrated messaging device (IMD) 18, a desktop computer 20, a notebook computer 22. The apparatus 50 may be stationary or mobile when carried by an individual who is moving. The apparatus 50 may also be located in a mode of transport including, but not limited to, a car, a truck, a taxi, a bus, a train, a boat, an airplane, a bicycle, a motorcycle or any similar suitable mode of transport.

[0056] Some or further apparatuses may send and receive calls and messages and communicate with service providers through a wireless connection 25 to a base station 24. The base station 24 may be connected to a network server 26 that allows communication between the

mobile telephone network 11 and the internet 28. The system may include additional communication devices and communication devices of various types.

[0057] The communication devices may communicate using various transmission technologies including, but not limited to, code division multiple access (CDMA), global systems for mobile communications (GSM), universal mobile telecommunications system (UMTS), time divisional multiple access (TDMA), frequency division multiple access (FDMA), transmission control protocol-internet protocol (TCP-IP), short messaging service (SMS), multimedia messaging service (MMS), email, instant messaging service (IMS), Bluetooth, IEEE 802.11 and any similar wireless communication technology. A communications device involved in implementing various embodiments of the present invention may communicate using various media including, but not limited to, radio, infrared, laser, cable connections, and any suitable connection.

[0058] With respect to Figure 4a, a block diagram of a video encoder suitable for carrying out embodiments of the invention is shown. Furthermore, with respect to Figures 5a and 5b, the operation of the encoder exemplifying embodiments of the invention specifically with respect to construction of the list of candidate predictions is shown as a flow diagram.

[0059] Figure 4a shows the encoder as comprising a pixel predictor 302, prediction error encoder 303 and prediction error decoder 304. Figure 4a also shows an embodiment of the pixel predictor 302 as comprising an inter-predictor 306, an intra-predictor 308, a mode selector 310, a filter 316, and a reference frame memory 318. In this embodiment the mode selector 310 comprises a block processor 381 and a cost evaluator 382. The encoder may further comprise an entropy encoder 330 for entropy encoding the bit stream.

[0060] Figure 4b depicts an embodiment of the inter predictor 306. The inter predictor 306 comprises a reference frame selector 360 for selecting reference frame or frames, a motion vector definer 361, a prediction list modifier 363 and a motion vector selector 364. These elements or some of them may be part of a prediction processor 362 or they may be implemented by using other means.

[0061] The pixel predictor 302 receives the image 300 to be encoded at both the inter-predictor 306 (which determines the difference between the image and a motion compensated reference frame 318) and the intra-predictor 308 (which determines a prediction for an image block based only on the already processed parts of the current frame or picture). The output of

both the inter-predictor and the intra-predictor may be passed to the mode selector 310. The intra-predictor 308 may have more than one intra-prediction modes. Hence, each mode may perform the intra-prediction and provide the predicted signal to the mode selector 310. The mode selector 310 also receives a copy of the image 300.

[0062] The mode selector 310 determines which encoding mode to use to encode the current block. If the mode selector 310 decides to use an inter-prediction mode it will pass the output of the inter-predictor 306 to the output of the mode selector 310. If the mode selector 310 decides to use an intra-prediction mode it will pass the output of one of the intra-predictor modes to the output of the mode selector 310.

[0063] The output of the mode selector is passed to a first summing device 321. The first summing device may subtract the pixel predictor 302 output from the image 300 to produce a first prediction error signal 320 which is input to the prediction error encoder 303.

[0064] The pixel predictor 302 further receives from a preliminary reconstructor 339 the combination of the prediction representation of the image block 312 and the output 338 of the prediction error decoder 304. The preliminary reconstructed image 314 may be passed to the intra-predictor 308 and to a filter 316. The filter 316 receiving the preliminary representation may filter the preliminary representation and output a final reconstructed image 340 which may be saved in a reference frame memory 318. The reference frame memory 318 may be connected to the inter-predictor 306 to be used as the reference image against which the future image 300 is compared in inter-prediction operations.

[0065] The operation of the pixel predictor 302 may be configured to carry out any known pixel prediction algorithm known in the art.

[0066] The pixel predictor 302 may also comprise a filter 385 to filter the predicted values before outputting them from the pixel predictor 302.

[0067] The operation of the prediction error encoder 302 and prediction error decoder 304 will be described hereafter in further detail. In the following examples the encoder generates images in terms of 16x16 pixel macroblocks which go to form the full image or picture. Thus, for the following examples the pixel predictor 302 outputs a series of predicted macroblocks of size 16x16 pixels and the first summing device 321 outputs a series of 16x16 pixel residual data macroblocks which may represent the difference between a first macro-block in the image 300

against a predicted macro-block (output of pixel predictor 302). It would be appreciated that other size macro blocks may be used.

[0068] The prediction error encoder 303 comprises a transform block 342 and a quantizer 344. The transform block 342 transforms the first prediction error signal 320 to a transform domain. The transform is, for example, the DCT transform. The quantizer 344 quantizes the transform domain signal, e.g. the DCT coefficients, to form quantized coefficients.

[0069] The prediction error decoder 304 receives the output from the prediction error encoder 303 and performs the opposite processes of the prediction error encoder 303 to produce a decoded prediction error signal 338 which when combined with the prediction representation of the image block 312 at the second summing device 339 produces the preliminary reconstructed image 314. The prediction error decoder may be considered to comprise a dequantizer 346, which dequantizes the quantized coefficient values, e.g. DCT coefficients, to reconstruct the transform signal and an inverse transformation block 348, which performs the inverse transformation to the reconstructed transform signal wherein the output of the inverse transformation block 348 contains reconstructed block(s). The prediction error decoder may also comprise a macroblock filter (not shown) which may filter the reconstructed macroblock according to further decoded information and filter parameters.

[0070] In the following the operation of an example embodiment of the inter predictor 306 will be described in more detail. The inter predictor 306 receives the current block for inter prediction. It is assumed that for the current block there already exists one or more neighbouring blocks which have been encoded and motion vectors have been defined for them. For example, the block on the left side and/or the block above the current block may be such blocks. Spatial motion vector predictions for the current block can be formed e.g. by using the motion vectors of the encoded neighbouring blocks and/or of non-neighbour blocks in the same slice or frame, using linear or non-linear functions of spatial motion vector predictions, using a combination of various spatial motion vector predictors with linear or non-linear operations, or by any other appropriate means that do not make use of temporal reference information. It may also be possible to obtain motion vector predictors by combining both spatial and temporal prediction information of one or more encoded blocks. These kinds of motion vector predictors may also be called as spatio-temporal motion vector predictors.

[0071] Reference frames used in encoding the neighbouring blocks have been stored to the reference frame memory 404. The reference frames may be short term references or long term references and each reference frame may have a unique index indicative of the location of the reference frame in the reference frame memory. When a reference frame is no longer used as a reference frame it may be removed from the reference frame memory or marked as a non-reference frame wherein the storage location of that reference frame may be occupied for a new reference frame. In addition to the reference frames of the neighbouring blocks the reference frame selector 360 may also select one or more other frames as potential reference frames and store them to the reference frame memory.

[0072] Motion vector information of encoded blocks is also stored into the memory so that the inter predictor 306 is able to retrieve the motion vector information when processing motion vector candidates for the current block.

[0073] In some embodiments the motion vectors are stored into one or more lists. For example, motion vectors of uni-directionally predicted frames (e.g. P-frames) may be stored to a list called as list 0. For bi-directionally predicted frames (e.g. B-frames) there may be two lists (list 0 and list 1) and for multi-predicted frames there may be more than two lists. Reference frame indices possibly associated with the motion vectors may also be stored in one or more lists.

[0074] In some embodiments there may be two or more motion vector prediction procedures and each procedure may have its own candidate set creation process. In one procedure, only the motion vector values are used. In another procedure, which may be called as a Merge Mode, each candidate element may comprise 1) The information whether 'block was uni-predicted using only list0' or 'block was uni-predicted using only list1' or 'block was bi-predicted using list0 and list1' 2) motion vector value for list0 3) Reference picture index in list0 4) motion vector value for list1 5) Reference picture index list1. Therefore, whenever two prediction candidates are to be compared, not only the motion vector values are compared, but also the five values mentioned above may be compared to determine whether they correspond with each other or not. On the other hand, if any of the comparisons indicate that the prediction candidates do not have equal motion information, no further comparisons need be performed.

[0075] The motion vector definer 361 defines candidate motion vectors for the current frame by using one or more of the motion vectors of one or more neighbour blocks and/or other blocks

of the current block in the same frame and/or co-located blocks and/or other blocks of the current block in one or more other frames. These candidate motion vectors can be called as a set of candidate predictors or a predictor set. Each candidate predictor thus represents the motion vector of one or more already encoded block. In some embodiments the motion vector of the candidate predictor is set equal to the motion vector of a neighbour block for the same list if the current block and the neighbour block refer to the same reference frames for that list. Also for temporal prediction there may be one or more previously encoded frames wherein motion vectors of a co-located block or other blocks in a previously encoded frame can be selected as candidate predictors for the current block. The temporal motion vector predictor candidate can be generated by any means that make use of the frames other than the current frame.

[0076] The candidate motion vectors can also be obtained by using more than one motion vector of one or more other blocks such as neighbour blocks of the current block and/or co-located blocks in one or more other frames. As an example, any combination of the motion vector of the block to the left of the current block, the motion vector of the block above the current block, and the motion vector of the block at the up-right corner of the current block may be used (i.e. the block to the right of the block above the current block). The combination may be a median of the motion vectors or calculated by using other formulas. For example, one or more of the motion vectors to be used in the combination may be scaled by a scaling factor, an offset may be added, and/or a constant motion vector may be added. In some embodiments the combined motion vector is based on both temporal and spatial motion vectors, e.g. the motion vector of one or more of the neighbour block or other block of the current block and the motion vector of a co-located block or other block in another frame.

[0077] If a neighbour block does not have any motion vector information a default motion vector such as a zero motion vector may be used instead.

[0078] Figure 9 illustrates an example of a coding unit 900 and some neighbour blocks 901—905 of the coding unit. As can be seen from Figure 9, if the coding unit 900 represents the current block, the neighbouring blocks 901—905 labelled A0, A1, B0, B1 and B2 could be such neighbour blocks which may be used when obtaining the candidate motion vectors.

[0079] Creating additional or extra motion vector predictions based on previously added predictors may be needed when the current number of candidates is limited or insufficient. This kind of creating additional candidates can be performed by combining previous two predictions

and/or processing one previous candidate by scaling or adding offset and/or adding a zero motion vector with various reference indices. Hence, the motion vector definer 361 may examine how many motion vector candidates can be defined and how many potential candidate motion vectors exist for the current block. If the number of potential motion vector candidates is smaller than a threshold, the motion vector definer 361 may create additional motion vector predictions.

[0080] In some embodiments the combined motion vector can be based on motion vectors in different lists. For example, one motion vector may be defined by combining one motion vector from the list 0 and one motion vector from the list 1 e.g. when the neighbouring or co-located block is a bi-directionally predicted block and there exists one motion vector in the list 0 and one motion vector in the list 1 for the bi-directionally predicted block.

[0081] To distinguish the current block from the encoded/decoded blocks the motion vectors of which are used as candidate motion vectors, those encoded/decoded blocks are also called as reference blocks in this application.

[0082] In some embodiments not only the motion vector information of the reference block(s) is obtained (e.g. by copying) but also a reference index of the reference block in the reference picture list may be copied to the candidate list. The information whether the block was uni-predicted using only list0 or the block was uni-predicted using only list1 or the block was bi-predicted using list0 and list1 may also be copied. The candidate list may also be called as a candidate set or a set of motion vector prediction candidates.

[0083] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit. There is depicted the current block 601 in the frame 600 and a neighbour block 602 which already has been encoded. The motion vector definer 361 has defined a motion vector 603 for the neighbour block 602 which points to a block 604 in the previous frame 605. This motion vector can be used as a potential spatial motion vector prediction 610 for the current block. Figure 6a depicts that a co-located block 606 in the previous frame 605, i.e. the block at the same location than the current block but in the previous frame, has a motion vector 607 pointing to a block 609 in another frame 608. This motion vector 607 can be used as a potential temporal motion vector prediction-611 for the current frame.

[0084] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit. In this example the block 606 of the previous frame 605 uses bi-directional prediction based on the block 609 of the frame preceding the frame 605 and on the block 612

succeeding the current frame 600. The temporal motion vector prediction for the current block 601 may be formed by using both the motion vectors 607, 614 or either of them.

[0085] The operation of the prediction list modifier 363 will now be described in more detail with reference to the flow diagram of Figures 5a and 5b. The prediction list modifier 363 initializes a motion vector prediction list to default values in block 500 of Figure 5a. The prediction list modifier 363 may also initialize a list index to an initial value such as zero. Then, in block 501 the prediction list modifier checks whether there are any motion vector candidates to process. If there is at least one motion vector candidate in the predictor set for processing, the prediction list modifier 363 generates the next motion vector candidate which may be a temporal motion vector or a spatial motion vector. The comparison can be an identity/equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[0086] In the following, a merge process for motion information coding according to an example embodiment will be described in more detail. The encoder creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding unit or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates can be obtained from the motion information of e.g. the spatial neighbour blocks A0, A1, B0, B1, B2, whose motion information is used as spatial candidate motion predictions. The temporal motion prediction candidate may be obtained by processing the motion of a block in a frame other than the current frame. In this example embodiment, the encoder operations to construct the merge list for the spatial candidates may include the following. The operations may be carried out by the prediction list modifier 363, for example.

[0087] A maximum number of spatial motion prediction candidates to be included in the merge list may be defined. This maximum number may have been stored, for example, to the memory 58 of the apparatus 50, or to another appropriate place. It is also possible to determine the maximum number by using other means, or it may be determined in the software of the encoder of the apparatus 50.

[0088] In some embodiments the maximum number of spatial motion prediction candidates to be included in the merge list is four but in some embodiments the maximum number may be less than four or greater than four.

[0089] In this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2. The spatial motion vector prediction candidate A1 is located on the left side of the prediction unit when the encoding/decoding order is from left to right and from top to bottom of the frame, slice or another entity to be encoded/decoded. Respectively, the spatial motion vector prediction candidate B1 is located above the prediction unit. third; the spatial motion vector prediction candidate B0 is on the right side of the spatial motion vector prediction candidate B1; the spatial motion vector prediction candidate A0 is below the spatial motion vector prediction candidate A1; and the spatial motion vector prediction candidate B2 is located on the same column than spatial motion vector prediction candidate A1 and on the same row than the spatial motion vector prediction candidate B1. In other words, the spatial motion vector prediction candidate B2 is cornerwise neighbouring the prediction unit as can be seen e.g. from Figure 9.

[0090] These spatial motion prediction candidates can be processed in a predetermined order, for example, A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it may be determined whether the merge list already contains a maximum number of spatial motion prediction candidates. Hence, the prediction list modifier 363 compares 502 the number of spatial motion prediction candidates in the merge list with the maximum number, and if the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 526. On the other hand, if the number of spatial motion prediction candidates in the merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 504-522).

[0091] For all the spatial motion prediction candidates for which the further analyses is to be performed, some or all of the following conditions below may be tested for determining whether to include the spatial motion prediction candidate in the merge list.

[0092] The prediction list modifier 363 examines 504 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[0093] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[0094] The prediction list modifier 363 determines 506 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined 508, 510 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (508), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (510), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (524).

[0095] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 512, 514 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (512), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (514), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (524).

[0096] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion

information than the block B1 (516). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (524).

[0097] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion information than the block A1 (518). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (524).

[0098] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (520). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (522).

[0099] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[00100] Comparing two blocks whether they have the same motion may be performed by comparing all the elements of the motion information, namely 1) The information whether 'the prediction unit is uni-predicted using only reference picture list0' or 'the prediction unit is uni-predicted using only reference picture list1' or 'the prediction unit is bi-predicted using both reference picture list0 and list1' 2) Motion vector value corresponding to the reference picture list0 3) Reference picture index in the reference picture list0 4) Motion vector value corresponding to the reference picture list1 5) Reference picture index in the reference picture list1.

[00101] In some embodiments similar restrictions for comparing candidate pairs can be applied if the current coding unit is coded/decoded by splitting into four or any number of prediction units.

[00102] The maximum number of merge list candidates can be any non-zero value. In the example above the merger list candidates were the spatial neighbour blocks A0, A1, B0, B1, B2 and the temporal motion prediction candidate, but there may be more than one temporal motion prediction candidate and also other spatial motion prediction candidates than the spatial neighbour blocks. In some embodiments there may also be other spatial neighbour blocks than the blocks A0, A1, B0, B1, B2.

[00103] It is also possible that the maximum number of spatial motion prediction candidates included in the list can be different than four.

[00104] In some embodiments the maximum number of merge list candidates and maximum number of spatial motion prediction candidates included in the list can depend on whether a temporal motion vector candidate is included in the list or not.

[00105] A different number of spatial motion prediction candidates located at various locations in the current frame can be processed. The locations can be the same as or different than A1, B1, B0, A0 and B2.

[00106] The decision of including which spatial motion prediction candidates in the list can be realized in two steps. In the first step, some of the candidates are eliminated by checking whether the candidate block is available and/or the candidate block's prediction mode is intra and/or whether the current block is a second prediction unit of a coding unit coded with two prediction units and the candidate has the same motion with the first prediction unit. In the second step, remaining candidates are examined and some or all of them are included in the merge list. The examination in the second step does not include comparing motion information of each possible candidate pair but includes a subset of the possible comparison combinations.

[00107] The decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel.

[00108] For each candidate and/or a subset of the candidates, the following conditions may also be checked: Whether the candidate block has the same motion as the first prediction unit of the current coding unit when the current coding unit is split into two rectangle prediction units and the current prediction unit is the second prediction unit in the coding/decoding order.

[00109] Additional conditions related to various properties of current and/or previous slices and/or current and/or neighbour blocks can be utilized for determining whether to include a candidate in the list.

[00110] Motion comparison can be realized by comparing a subset of the whole motion information. For example, only the motion vector values for some or all reference picture lists and/or reference indices for some or all reference picture lists and/or an identifier value assigned to each block to represent its motion information can be compared. The comparison can be an identity or an equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[00111] Conditions for deciding whether a candidate is to be included in the list can include motion information comparison with any subset of the candidates as long as not all possible candidate pairs are compared eventually.

[00112] Deciding whether a temporal motion vector candidate is to be included in the list can be based on comparing its motion information with motion information of a subset of the spatial motion vector prediction candidates.

[00113] When comparing motion information of two blocks, motion information of additional blocks can be considered too. For example, when comparing the block B2 and the block A1, all the blocks between the block B2 and the block A1 (illustrated in Figure 12) are checked whether they have the same motion; and when comparing the block B2 and the block B1, all the blocks between the block B2 and the block B1 (illustrated in Figure 12) are checked whether they have the same motion. This embodiment can be implemented so that the right-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the above have the same motion information. Also the bottom-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the left have the same motion information. Using this information the condition for not including B0 in the list can be realized by checking if the number of consecutive blocks with the same motion to the left of B0 is greater than 0. The condition for not including A0 in the list can be realized by checking if the number of consecutive blocks with same motion to the above of A0 is greater than 0. The conditions for not including B2 can be modified as follows:

[00114] It is not examined whether the block B2 has same motion as the block B1 or whether the block B2 has same motion as the block A1, but how many consecutive blocks exists to the left of the block B1 with the same motion than the block B1 and/or how many consecutive blocks exist above the block A1 with the same motion. If the number of consecutive blocks with the same motion to the left of the block B1 is greater than the number of blocks between B2 and B1, or if the number of consecutive blocks with the same motion above the block A1 is greater than the number of blocks between the block B2 and the block A1, the block B2 is not included in the merge list.

[00115] If the above implementation is used, the value of how many consecutive blocks to the left/above have the same motion information can be determined by direct comparison of motion information or checking the prediction mode and/or the merge index if the block employs a merge process.

[00116] When coding/decoding the selected merge index, the information whether the merge process is employed for coding/decoding a Skip mode coding unit or an Inter Merge mode prediction unit can be taken into account. For example, if a context adaptive binary arithmetic coder (CABAC) is used for entropy coding/decoding, different contexts can be used for the bins depending on the coding mode (Skip mode or inter merge mode) of the current block. Furthermore, assigning two contexts depending on whether the merge process is employed in a Skip mode coding unit or an inter Merge mode prediction unit can be applied for only the most significant bin of the merge index.

[00117] During the process of removal of redundant candidates, comparison between motion vector predictor candidates can also be based on any other information than the motion vector values. For example, it can be based on linear or non-linear functions of motion vector values, coding or prediction types of the blocks used to obtain the motion information, block size, the spatial location in the frame/(largest) coding unit/macroblock, the information whether blocks share the same motion with a block, the information whether blocks are in the same coding/prediction unit, etc.

[00118] The following pseudo code illustrates an example embodiment of the invention for constructing the merging list.

[00119] Inputs to this process are

- a luma location (xP, yP) specifying the top-left luma sample of the current prediction unit relative to the top-left sample of the current picture;
- variables specifying the width and the height of the prediction unit for luma, nPSW and nPSH; and
- a variable PartIdx specifying the index of the current prediction unit within the current coding unit.

[00120] Outputs of this process are (with N being replaced by A₀, A₁, B₀, B₁ or B₂ and with X being replaced by 0 or 1)

- the availability flags availableFlagN of the neighbouring prediction units,
- the reference indices refIdxLXN of the neighbouring prediction units,
- the prediction list utilization flags predFlagLXN of the neighbouring prediction units,
- the motion vectors mvLXN of the neighbouring prediction units.

[00121] For the derivation of availableFlagN, with N being A₀, A₁, B₀, B₁ or B₂ and (xN, yN) being (xP-1, yP + nPSH), (xP-1, yP + nPSH-1), (xP + nPSW, yP-1), (xP+nPSW-1, yP-1) or (xP-1, yP-1), the following applies.

- If one of the following conditions is true, the availableFlagN is set equal to 0, both components mvLXN are set equal to 0, refIdxLXN and predFlagLX[xN, yN] of the prediction unit covering luma location (xN, yN) are assigned respectively to mvLXN, refIdxLXN and predFlagLXN.
- N is equal to B₂ and availableFlagA₀ + availableFlagA₁ + availableFlagB₀ + availableFlagB₁ is equal to 4.
- The prediction unit covering luma location (xN, yN) is not available or PredMode is MODE_INTRA.
- N is equal to A₁ and PartMode of the current prediction unit is PART_Nx2N or PART_nLx2N or PART_nRx2N and PartIdx is equal to 1.
- N is equal to A₁ and PartMode of the current prediction unit is PART_2NxN or PART_2NxN_U or PART_2NxN_D and PartIdx is equal to 1 and the prediction units covering luma location (xP+nPSW-1, yP-1) (N = B₁) and luma location (xN, yN) (Cand. N) have identical motion parameters:
- $mvLX[xP+nPSW-1, yP-1] == mvLX[xN, yN]$
- $refIdxLX[xP+nPSW-1, yP-1] == refIdxLX[xN, yN]$

- $\text{predFlagLX}[xP+nPSW-1, yP-1] == \text{predFlagLX}[xN, yN]$
- N is equal to B1 and PartMode of the current prediction unit is $2N \times N$ or $\text{PART_}2N \times nU$ or $\text{PART_}2N \times nD$ and PartIdx is equal to 1.
 - N is equal to B1 and the prediction units covering luma location $(xP-1, yP+nPSH-1)$ ($N = A1$) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $\text{mvLX}[xP-1, yP+nPSH-1] == \text{mvLX}[xN, yN]$
 - $\text{refIdxLX}[xP-1, yP+nPSH-1] == \text{refIdxLX}[xN, yN]$
 - $\text{predFlagLX}[xP-1, yP+nPSH-1] == \text{predFlagLX}[xN, yN]$
 - N is equal to B0 and the prediction units covering luma location $(xP+nPSW-1, yP-1)$ ($N = B1$) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $\text{mvLX}[xP+nPSW-1, yP-1] == \text{mvLX}[xN, yN]$
 - $\text{refIdxLX}[xP+nPSW-1, yP-1] == \text{refIdxLX}[xN, yN]$
 - $\text{predFlagLX}[xP+nPSW-1, yP-1] == \text{predFlagLX}[xN, yN]$
 - N is equal to A0 and the prediction units covering luma location $(xP-1, yP+nPSH-1)$ ($N = A1$) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $\text{mvLX}[xP-1, yP+nPSH-1] == \text{mvLX}[xN, yN]$
 - $\text{refIdxLX}[xP-1, yP+nPSH-1] == \text{refIdxLX}[xN, yN]$
 - $\text{predFlagLX}[xP-1, yP+nPSH-1] == \text{predFlagLX}[xN, yN]$
 - N is equal to B2 and the prediction units covering luma location $(xP+nPSW-1, yP-1)$ ($N = B1$) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $\text{mvLX}[xP+nPSW-1, yP-1] == \text{mvLX}[xN, yN]$
 - $\text{refIdxLX}[xP+nPSW-1, yP-1] == \text{refIdxLX}[xN, yN]$
 - $\text{predFlagLX}[xP+nPSW-1, yP-1] == \text{predFlagLX}[xN, yN]$
 - N is equal to B2 and the prediction units covering luma location $(xP-1, yP+nPSH-1)$ ($N = A1$) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $\text{mvLX}[xP-1, yP+nPSH-1] == \text{mvLX}[xN, yN]$
 - $\text{refIdxLX}[xP-1, yP+nPSH-1] == \text{refIdxLX}[xN, yN]$
 - $\text{predFlagLX}[xP-1, yP+nPSH-1] == \text{predFlagLX}[xN, yN]$
- PartMode of the current prediction unit is $\text{PART_}N \times N$ and PartIdx is equal to 3 and the prediction units covering luma location $(xP-1, yP)$ (PartIdx = 2) and luma location $(xP-1, yP-1)$ (PartIdx = 0) have identical motion parameters:

- $mvLX[xP-1, yP] == mvLX[xP-1, yP-1]$
- $refIdxLX[xP-1, yP] == refIdxLX[xP-1, yP-1]$
- $predFlagLX[xP-1, yP] == predFlagLX[xP-1, yP-1]$

and the prediction units covering luma location $(xP, yP-1)$ (PartIdx = 1) and luma location (xN, yN) (Cand. N) have identical motion parameters:

- $mvLX[xP, yP-1] == mvLX[xN, yN]$
- $refIdxLX[xP, yP-1] == refIdxLX[xN, yN]$
- $predFlagLX[xP, yP-1] == predFlagLX[xN, yN]$
- PartMode of the current prediction unit is PART_NxN and PartIdx is equal to 3 and the prediction units covering luma location $(xP, yP-1)$ (PartIdx = 1) and luma location $(xP-1, yP-1)$ (PartIdx = 0) have identical motion parameters:

- $mvLX[xP, yP-1] == mvLX[xP-1, yP-1]$
- $refIdxLX[xP, yP-1] == refIdxLX[xP-1, yP-1]$
- $predFlagLX[xP, yP-1] == predFlagLX[xP-1, yP-1]$

and the prediction units covering luma location $(xP-1, yP)$ (PartIdx = 2) and luma location (xN, yN) (Cand. N) have identical motion parameters:

- $mvLX[xP-1, yP] == mvLX[xN, yN]$
- $refIdxLX[xP-1, yP] == refIdxLX[xN, yN]$
- $predFlagLX[xP-1, yP] == predFlagLX[xN, yN]$
- Otherwise, availableFlagN is set equal to 1 and the variables $mvLX[xN, yN]$, $refIdxLX[xN, yN]$ and $predFlagLX[xN, yN]$ of the prediction unit covering luma location (xN, yN) are assigned respectively to $mvLXN$, $refIdxLXN$ and $predFlagLXN$.

[00122] For the motion vector predictor candidate list generation process, each list candidate can include more information than the motion vector value, such as the reference lists used, the reference frames used in each list and motion vector for each list.

[00123] When all motion vector candidates have been examined, one motion vector is selected to be used as the motion vector for the current block. The motion vector selector 364 may examine different motion vectors in the list and determine which motion vector provides the most efficient encoding result, or the selection of the motion vector may be based on to other criteria as well. Information of the selected motion vector is provided for the mode selector for encoding and transmission to the decoder or for storage when the mode selector determines to

use inter prediction for the current block. The information may include the index of the motion vector in the list, and/or motion vector parameters or other appropriate information.

[00124] The selected motion vector and the block relating to the motion vector is used to generate the prediction representation of the image block 312 which is provided as the output of the mode selector. The output may be used by the first summing device 321 to produce the first prediction error signal 320, as was described above.

[00125] The selected motion vector predictor candidate can be modified by adding a motion vector difference or can be used directly as the motion vector of the block. Moreover, after the motion compensation is performed by using the selected motion vector predictor candidate, the residual signal of the block can be transform coded or skipped to be coded.

[00126] Although the embodiments above have been described with respect to the size of the macroblock being 16x16 pixels, it would be appreciated that the methods and apparatus described may be configured to handle macroblocks of different pixel sizes.

[00127] In the following the operation of an example embodiment of the decoder 600 is depicted in more detail with reference to Figure 7.

[00128] At the decoder side similar operations are performed to reconstruct the image blocks. Figure 7 shows a block diagram of a video decoder 700 suitable for employing embodiments of the invention and Figures 8a and 8b show a flow diagram of an example of a method in the video decoder. The bitstream to be decoded may be received from the encoder, from a network element, from a storage medium or from another source. The decoder is aware of the structure of the bitstream so that it can determine the meaning of the entropy coded codewords and may decode the bitstream by an entropy decoder 701 which performs entropy decoding on the received signal. The entropy decoder thus performs the inverse operation to the entropy encoder 330 of the encoder described above. The entropy decoder 701 outputs the results of the entropy decoding to a prediction error decoder 702 and a pixel predictor 704.

[00129] In some embodiments the entropy coding may not be used but another channel encoding may be in use, or the encoded bitstream may be provided to the decoder 700 without channel encoding. The decoder 700 may comprise a corresponding channel decoder to obtain the encoded codewords from the received signal.

[00130] The pixel predictor 704 receives the output of the entropy decoder 701. The output of the entropy decoder 701 may include an indication on the prediction mode used in encoding the

current block. A predictor selector 714 within the pixel predictor 704 determines that an intra-prediction or an inter-prediction is to be carried out. The predictor selector 714 may furthermore output a predicted representation of an image block 716 to a first combiner 713. The predicted representation of the image block 716 is used in conjunction with the reconstructed prediction error signal 712 to generate a preliminary reconstructed image 718. The preliminary reconstructed image 718 may be used in the predictor 714 or may be passed to a filter 720. The filter 720, if used, applies a filtering which outputs a final reconstructed signal 722. The final reconstructed signal 722 may be stored in a reference frame memory 724, the reference frame memory 724 further being connected to the predictor 714 for prediction operations.

[00131] Also the prediction error decoder 702 receives the output of the entropy decoder 701. A dequantizer 792 of the prediction error decoder 702 may dequantize the output of the entropy decoder 701 and the inverse transform block 793 may perform an inverse transform operation to the dequantized signal output by the dequantizer 792. The output of the entropy decoder 701 may also indicate that prediction error signal is not to be applied and in this case the prediction error decoder produces an all zero output signal.

[00132] The decoder selects the 16x16 pixel residual macroblock to reconstruct. This residual macroblock is also called as a current block.

[00133] The decoder may receive information on the encoding mode used in encoding of the current block. The indication is decoded, when necessary, and provided to the reconstruction processor 791 of the prediction selector 714. The reconstruction processor 791 examines the indication and selects one of the intra-prediction mode(s), if the indication indicates that the block has been encoded using intra-prediction, or the inter-prediction mode, if the indication indicates that the block has been encoded using inter-prediction.

[00134] For inter-prediction mode the reconstruction processor 791 may comprise one or more elements corresponding to the prediction processor 362 of the encoder, such as a motion vector definer, a prediction list modifier and/or a motion vector selector.

[00135] The reconstruction processor 791 initializes a motion vector prediction list to default values in block 800. As was the case in the encoding part, in this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2 and these spatial motion prediction candidates are processed in the same predetermined order than in the encoder: A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further

examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it is examined whether the merge list already contains a maximum number of spatial motion prediction candidates. If the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 826. On the other hand, if the number of spatial motion prediction candidates in the merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 804-822).

[00136] The decoder examines 804 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[00137] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[00138] The decoder determines 806 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined 808, 810 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (808), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (810), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (824).

[00139] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 812, 814 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (812), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (814), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (824).

[00140] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion information than the block B1 (816). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (824).

[00141] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion information than the block A1 (818). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (824).

[00142] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (820). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (822).

[00143] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check

between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[00144] When the merge list has been constructed the decoder may use 828 the indication of the motion vector received from the encoder to select the motion vector for decoding the current block. The indication may be, for example, an index to the merge list.

[00145] Basically, after the reconstruction processor 791 has constructed the merge list, it would correspond with the merge list constructed by the encoder if the reconstruction processor 791 has the same information available than the encoder had. If some information has been lost during transmission the information from the encoder to the decoder, it may affect the generation of the merge list in the decoder 700.

[00146] The above examples describe the operation mainly in the merge mode but the encoder and decoder may also operate in other modes.

[00147] The embodiments of the invention described above describe the codec in terms of separate encoder and decoder apparatus in order to assist the understanding of the processes involved. However, it would be appreciated that the apparatus, structures and operations may be implemented as a single encoder-decoder apparatus/structure/operation. Furthermore in some embodiments of the invention the coder and decoder may share some or all common elements.

[00148] Although the above examples describe embodiments of the invention operating within a codec within an electronic device, it would be appreciated that the invention as described below may be implemented as part of any video codec. Thus, for example, embodiments of the invention may be implemented in a video codec which may implement video coding over fixed or wired communication paths.

[00149] Thus, user equipment may comprise a video codec such as those described in embodiments of the invention above.

[00150] It shall be appreciated that the term user equipment is intended to cover any suitable type of wireless user equipment, such as mobile telephones, portable data processing devices or portable web browsers.

[00151] Furthermore elements of a public land mobile network (PLMN) may also comprise video codecs as described above.

[00152] In general, the various embodiments of the invention may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example,

some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[00153] The embodiments of this invention may be implemented by computer software executable by a data processor of the mobile device, such as in the processor entity, or by hardware, or by a combination of software and hardware. Further in this regard it should be noted that any blocks of the logic flow as in the Figures may represent program steps, or interconnected logic circuits, blocks and functions, or a combination of program steps and logic circuits, blocks and functions. The software may be stored on such physical media as memory chips, or memory blocks implemented within the processor, magnetic media such as hard disk or floppy disks, and optical media such as for example DVD and the data variants thereof, CD.

[00154] The memory may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The data processors may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multi core processor architecture, as non limiting examples.

[00155] Embodiments of the inventions may be practiced in various components such as integrated circuit modules. The design of integrated circuits is by and large a highly automated process. Complex and powerful software tools are available for converting a logic level design into a semiconductor circuit design ready to be etched and formed on a semiconductor substrate.

[00156] Programs, such as those provided by Synopsys, Inc. of Mountain View, California and Cadence Design, of San Jose, California automatically route conductors and locate components on a semiconductor chip using well established rules of design as well as libraries of pre stored design modules. Once the design for a semiconductor circuit has been completed, the

resultant design, in a standardized electronic format (e.g., Opus, GDSII, or the like) may be transmitted to a semiconductor fabrication facility or "fab" for fabrication.

[00157] The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the exemplary embodiment of this invention. However, various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention.

[00158] In the following some examples will be provided.

[00159] In some embodiments a method comprises:

- receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

- selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

- determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

- comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

- if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00160] In some embodiments the method comprises including neighbouring blocks of the received block of pixels in the set of spatial motion vector prediction candidates.

[00161] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more encoded blocks in a same frame than the block of pixels.

[00162] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00163] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00164] In some embodiments the method comprises prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00165] In some embodiments the method comprises
determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

[00166] In some embodiments the method comprises
examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00167] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00168] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

[00169] In some embodiments a method according to the second aspect comprises:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00170] In some embodiments the method comprises including neighbouring blocks of the received encoded block of pixels in the set of spatial motion vector prediction candidates.

[00171] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more decoded blocks in a same frame than the received encoded block of pixels.

[00172] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00173] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00174] In some embodiments the method comprises examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00175] In some embodiments the method comprises
determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and
limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

[00176] In some embodiments the method comprises
examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00177] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00178] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

[00179] In some embodiments an apparatus according to the third aspect comprises a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels
including a prediction unit;
determining a set of spatial motion vector prediction candidates for the block of pixels;
the spatial motion vector prediction candidates being provided with motion information;
selecting a first spatial motion vector prediction candidate from the set of spatial motion
vector prediction candidates as a potential spatial motion vector prediction candidate to be
included in a merge list for the prediction unit;
determining a subset of spatial motion vector predictions based on the location of the
block associated with the first spatial motion vector prediction candidate;
comparing motion information of the first spatial motion vector prediction candidate
with motion information of the spatial motion vector prediction candidate in the determined
subset of spatial motion vector prediction candidates;
if at least one the comparisons indicates that the motion vector information of the spatial
motion vector prediction candidates correspond with each other, excluding the first spatial
motion vector prediction candidate from the merge list.

[00180] In some embodiments an apparatus according to the fourth aspect comprises a
processor and a memory including computer program code, the memory and the computer
program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;
determine a set of spatial motion vector prediction candidates for the encoded block of
pixels; the spatial motion vector prediction candidates being provided with motion information;
select a first spatial motion vector prediction candidate from the set of spatial motion
vector prediction candidates as a potential spatial motion vector prediction candidate to be
included in a merge list for the prediction unit;
determine a subset of spatial motion vector predictions based on the location of the
block associated with the first spatial motion vector prediction candidate;
compare motion information of the first spatial motion vector prediction candidate with
motion information of the spatial motion vector prediction candidate in the determined subset of
spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[00181] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00182] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00183] In some embodiments an apparatus comprises:

means for receiving a block of pixels including a prediction unit;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

[00184] In some embodiments an apparatus comprises:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

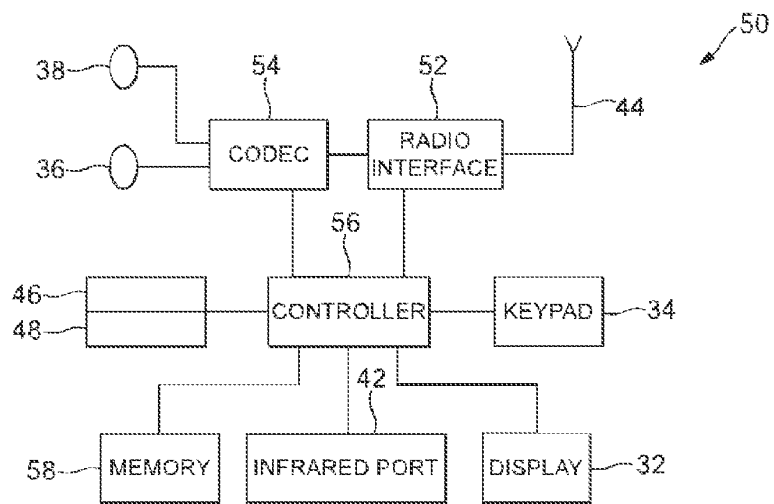


FIG. 1

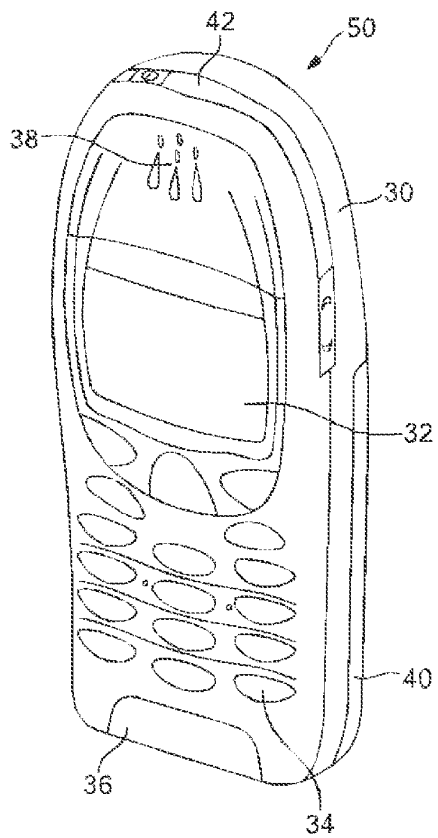
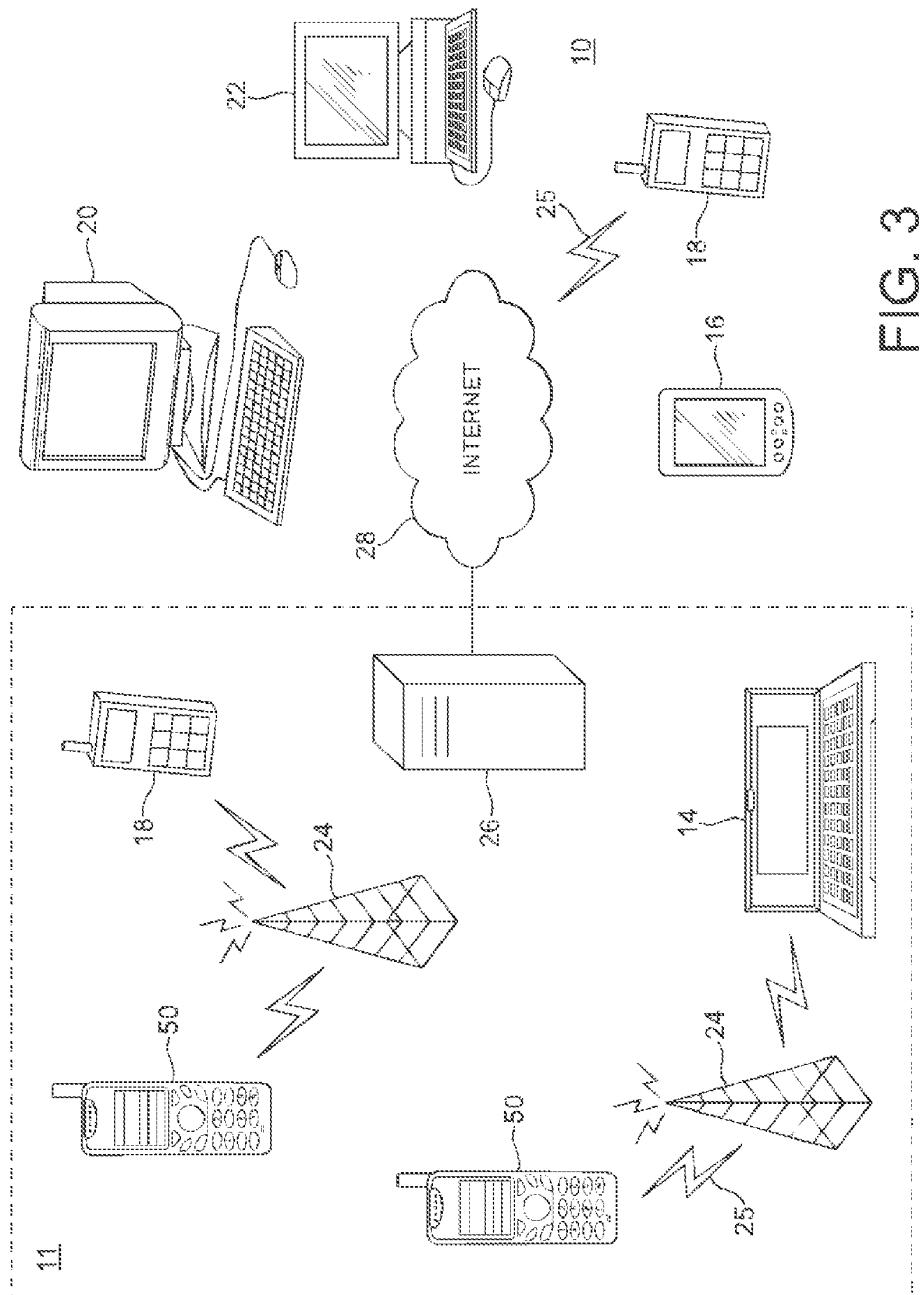


FIG. 2



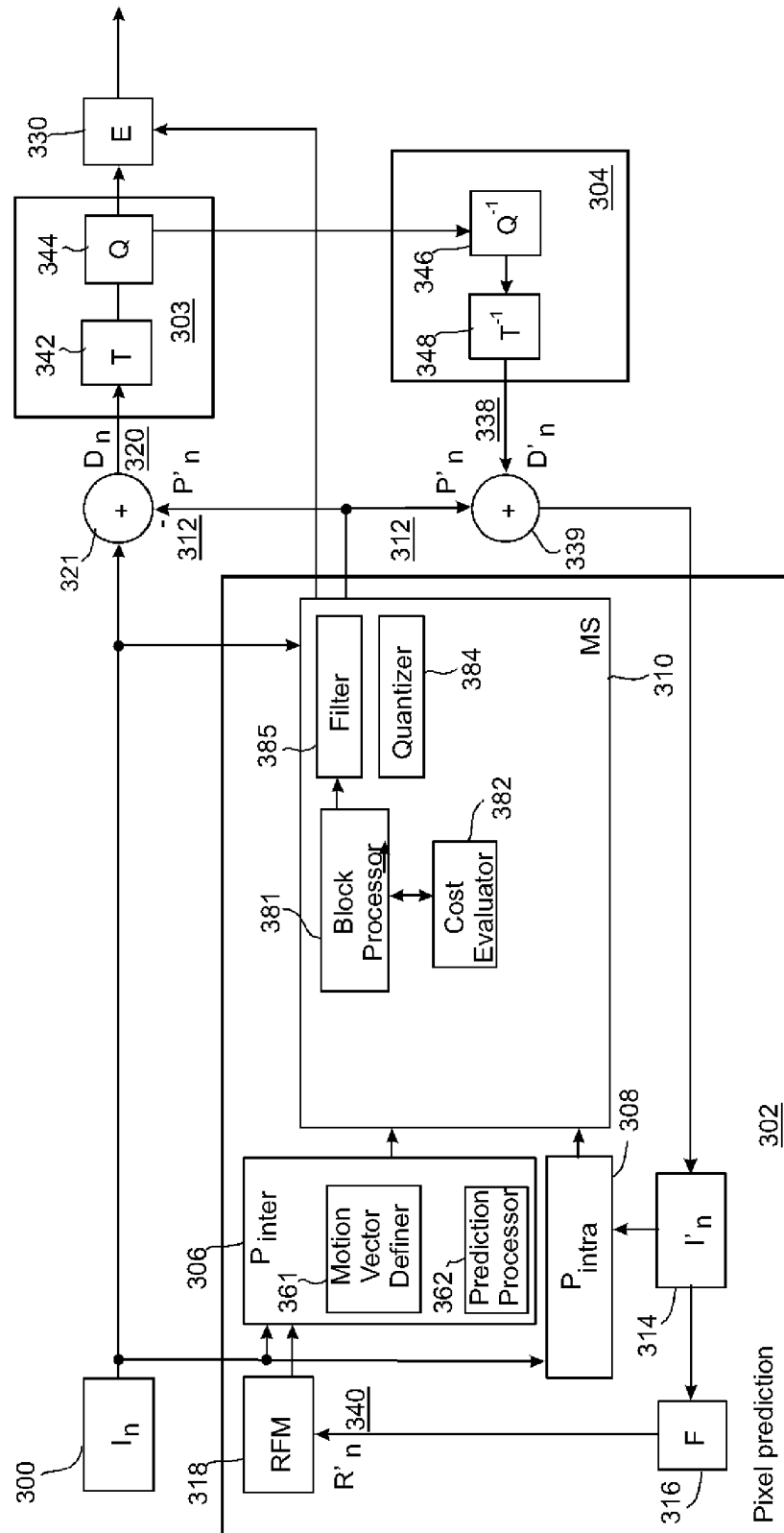


Fig. 4a

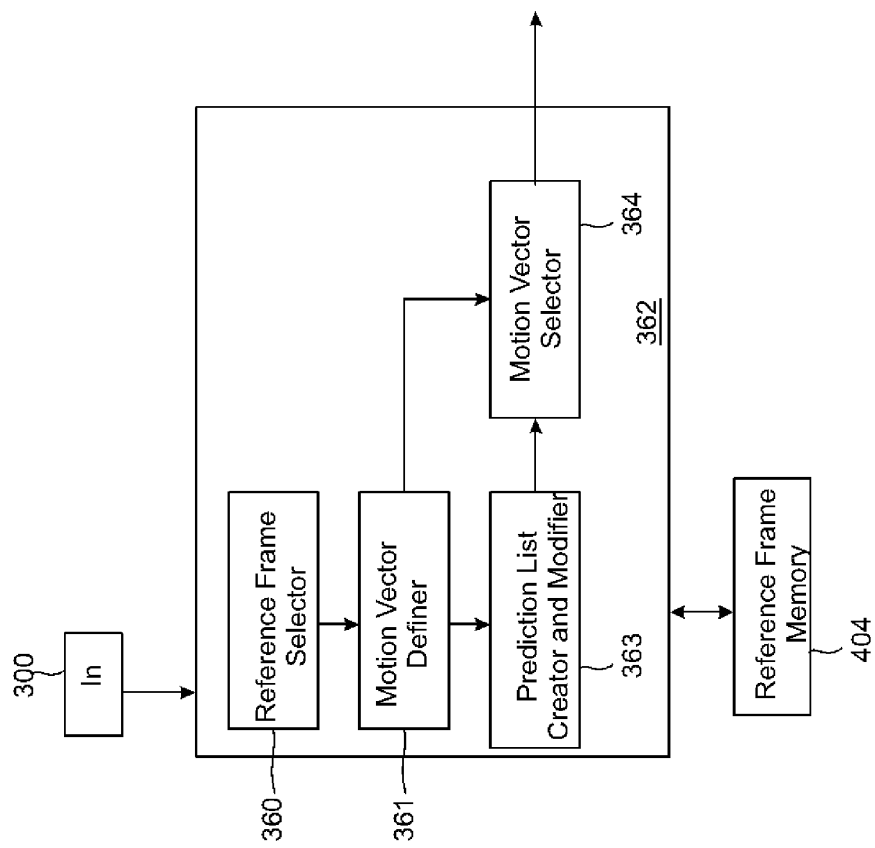


Fig. 4b

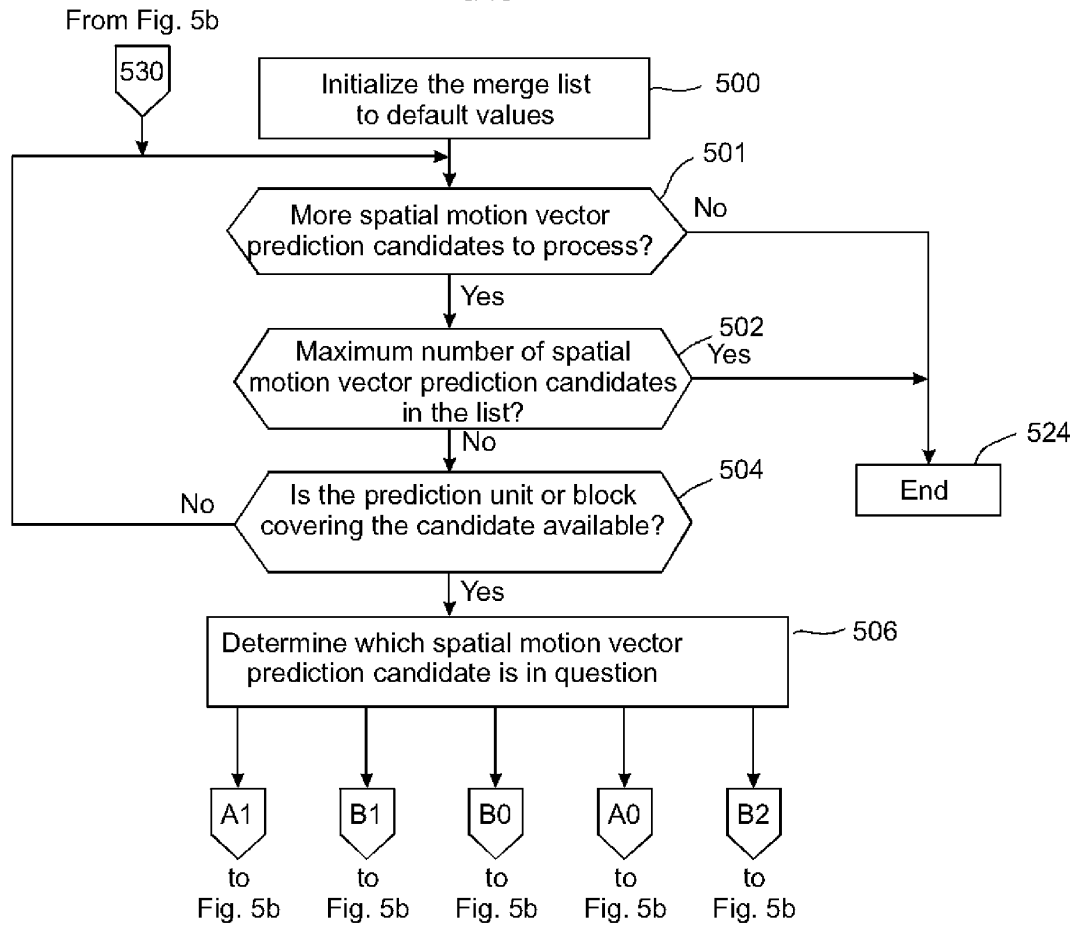


Fig. 5a

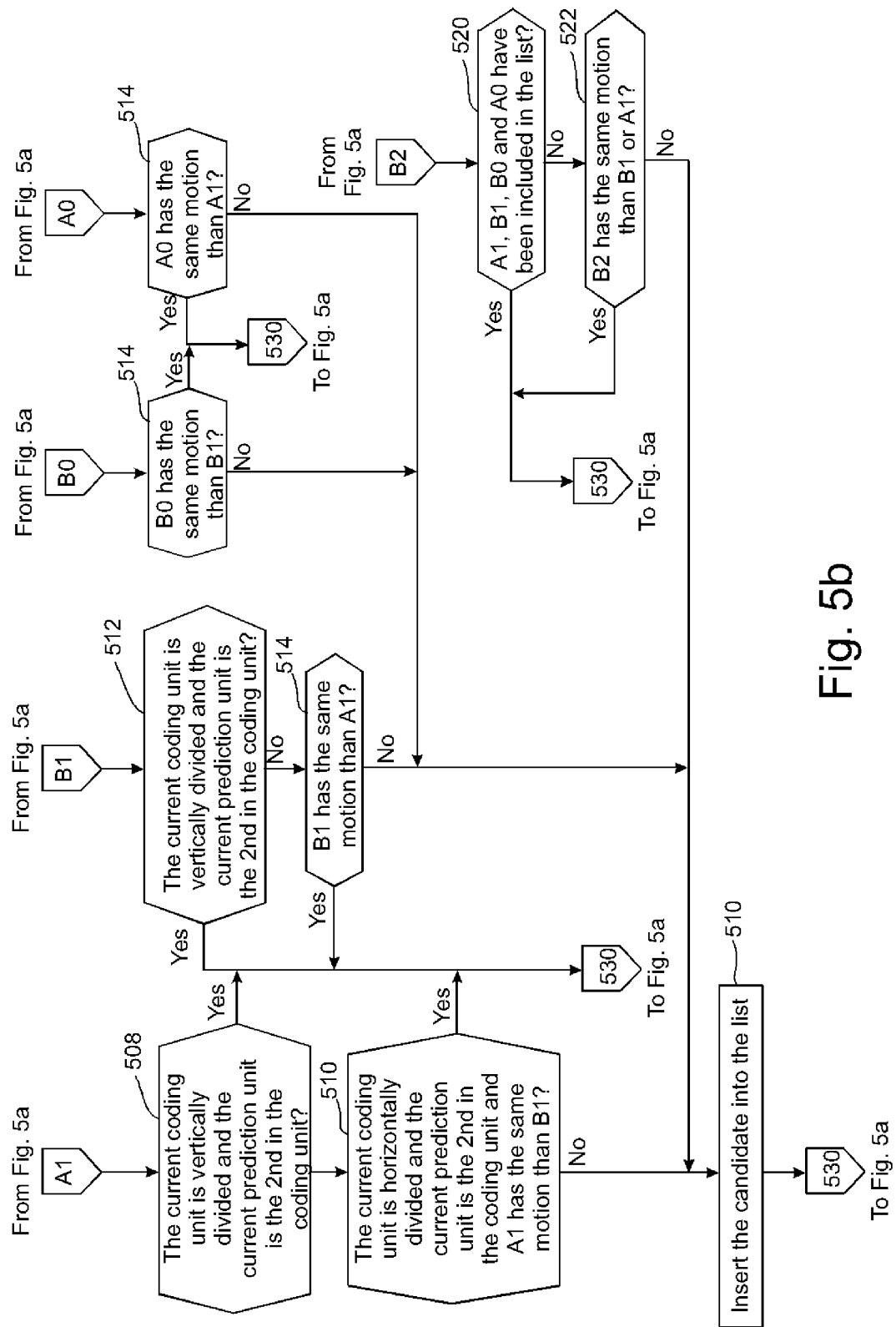


Fig. 5b

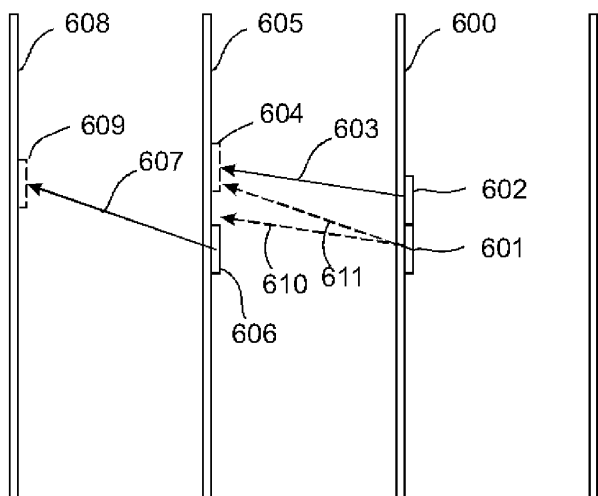


Fig. 6a

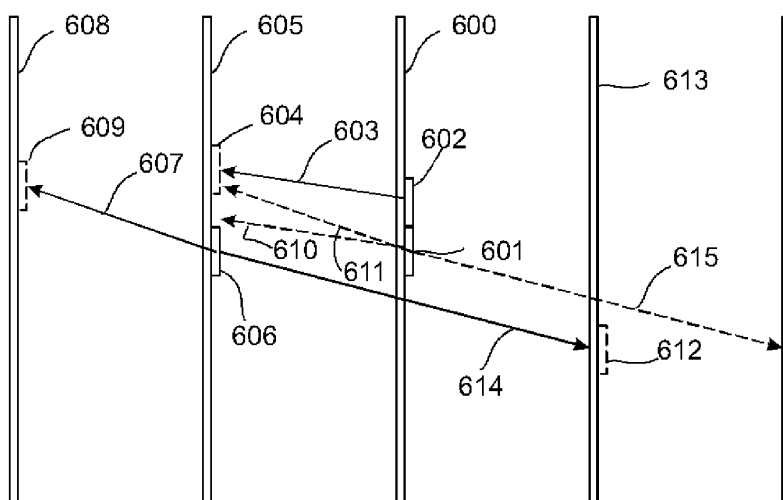


Fig. 6b

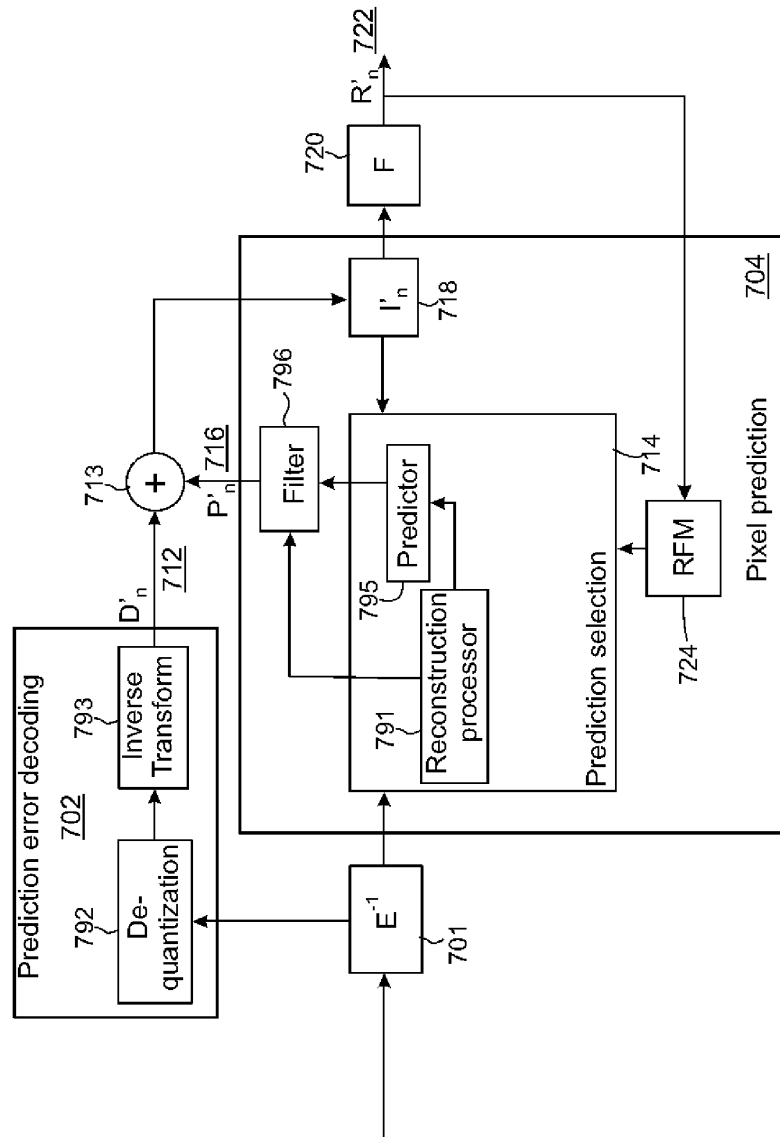


Fig. 7

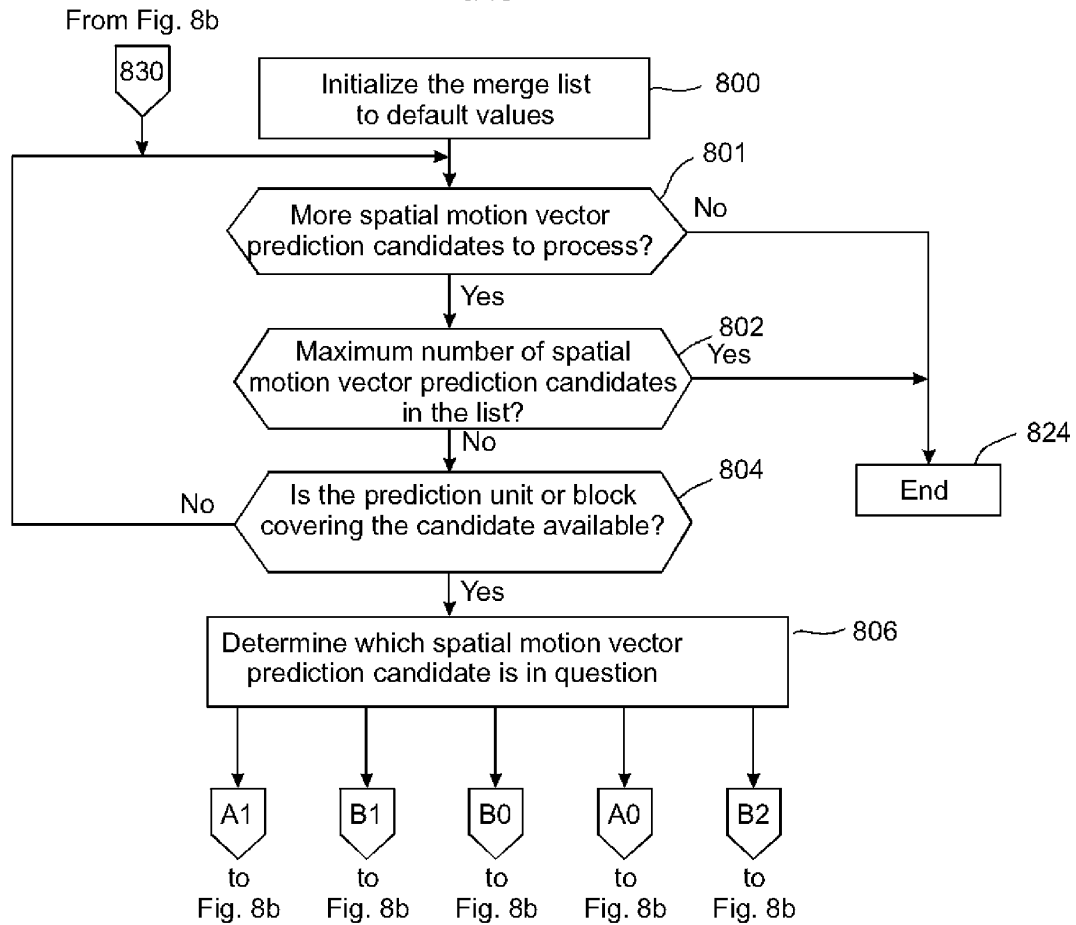
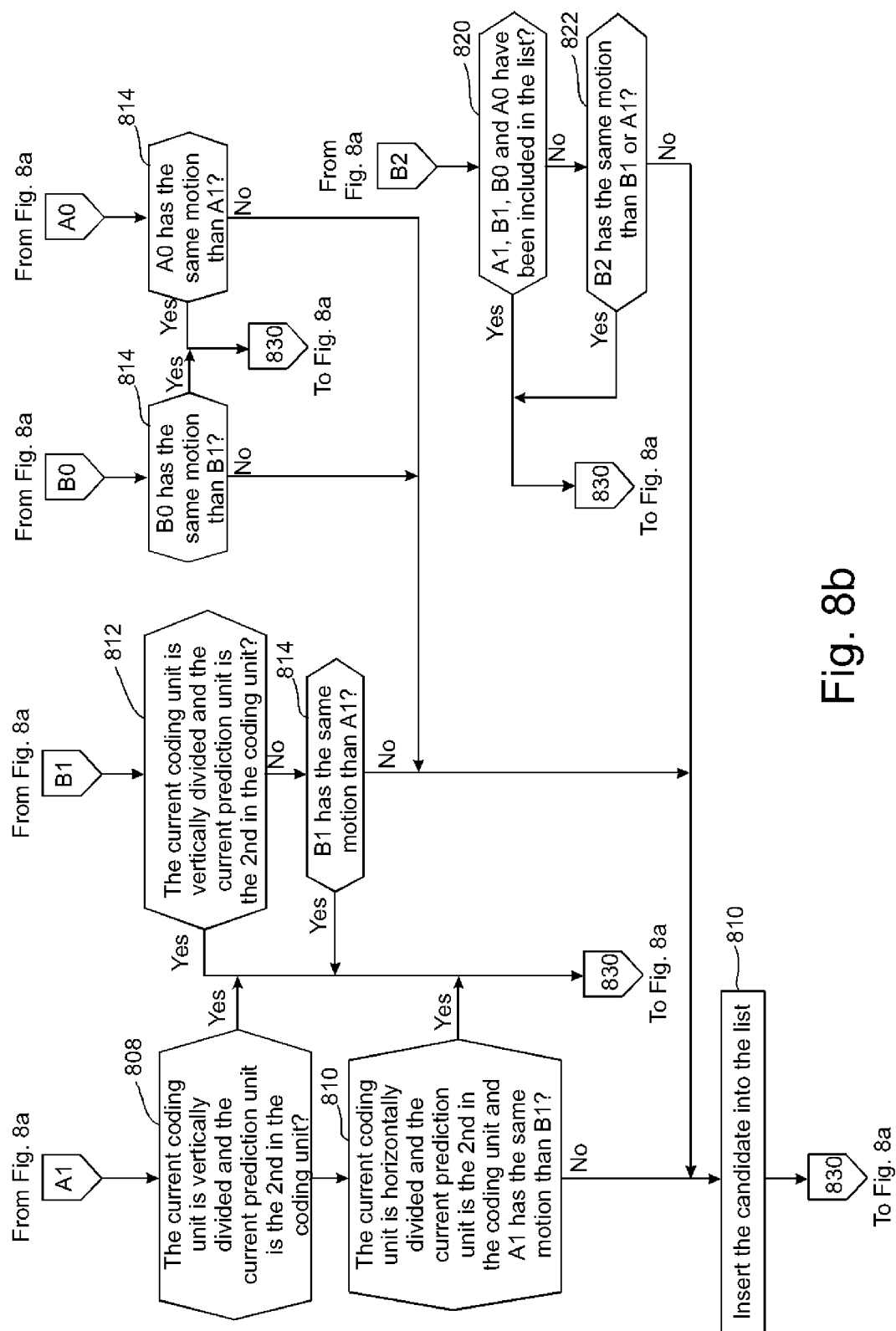


Fig. 8a



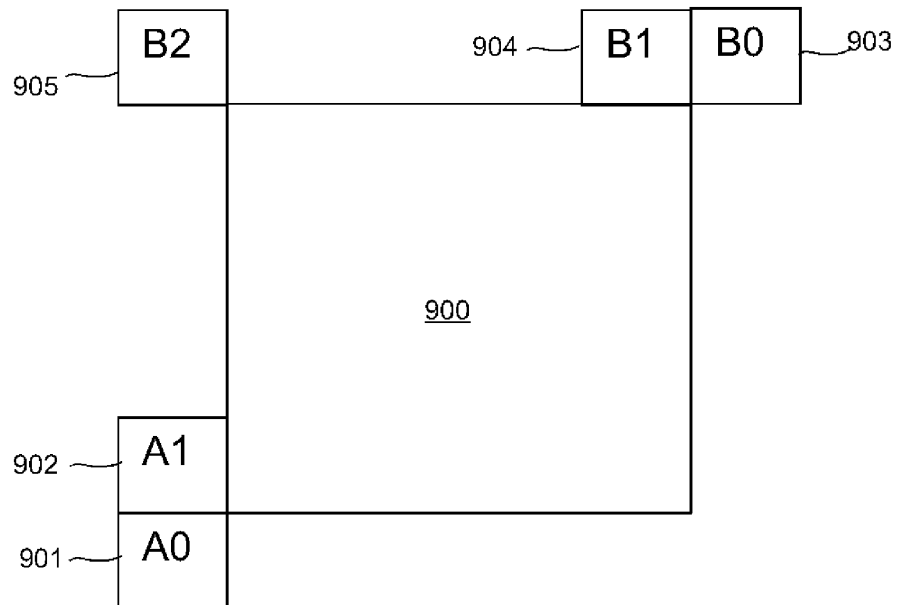


Fig. 9

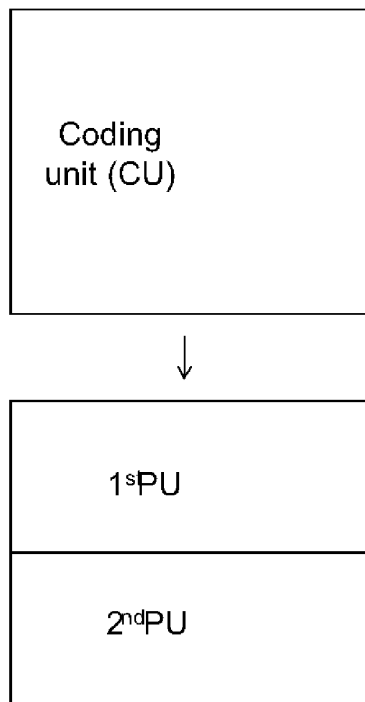


Fig. 10a

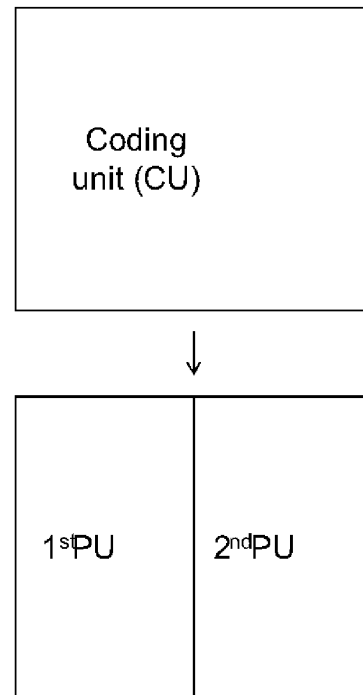


Fig. 10b

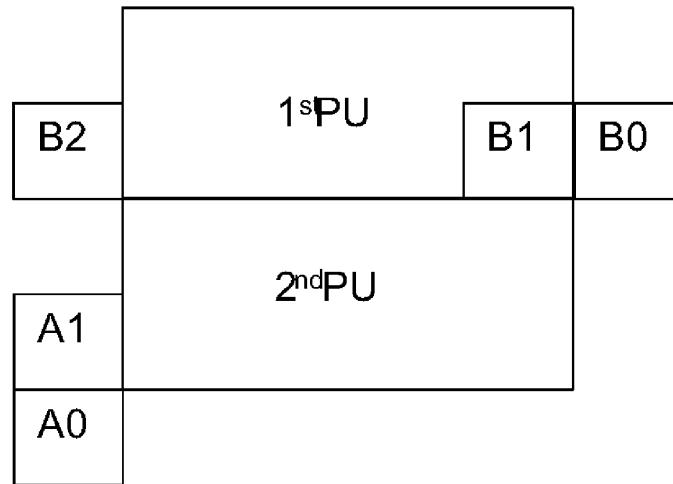


Fig. 11a

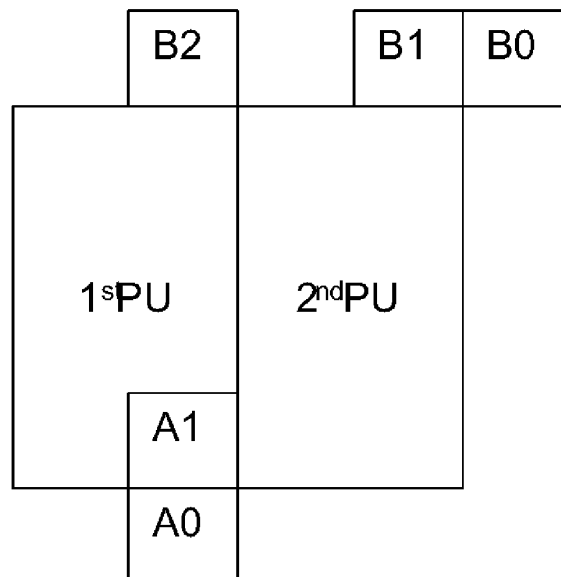


Fig. 11b

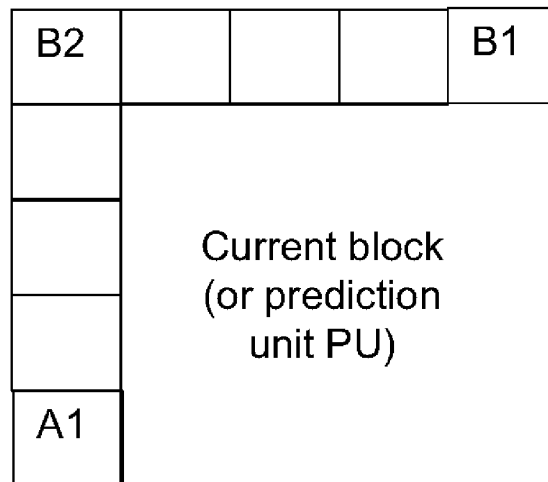


Fig. 12

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD FOR CODING AND AN APPARATUS
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>13/666680</u> filed on <u>November 1, 2012</u>. The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR Inventor: <u>Mehmet Oguz BICI</u> Date (Optional): <u>NOV - 05 - 2012</u> Signature: 	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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LEGAL NAME OF INVENTOR Inventor: <u>Jani LAINEMA</u> Date (Optional): <u>NOV-02-2012</u> Signature: <u></u>	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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LEGAL NAME OF INVENTOR Inventor: <u>Kemal UGUR</u> Date (Optional): <u>Nov-02-2012</u> Signature: 	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.	

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