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Datasheet for the decision of 12 June 2024

Case Number: T 1913/20 - 3.5.04

Application Number: 14767180.4

Publication Number: 3039870

IPC: H04N19/593, H04N19/70

Language of the proceedings: EN

Title of invention:
DETERMINING REGIONS WHEN PERFORMING INTRA BLOCK COPYING

Applicant:
Qualcomm Incorporated

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (no)
Inventive step - first to fifth auxiliary requests (no)

Decisions cited:

Catchword:

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Beschwerdekammern

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Case Number: T 1913/20 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 12 June 2024

Appellant: (Applicant)	Qualcomm Incorporated 5775 Morehouse Drive San Diego, CA 92121-1714 (US)
Representative:	Loveless, Ian Mark Reddie & Grose LLP The White Chapel Building 10 Whitechapel High Street London E1 8QS (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 25 May 2020 refusing European patent application No. 14767180.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	B. Willems
Members:	A. Seeger
	W. Ungler

Summary of Facts and Submissions

I. The appeal is against the examining division's decision to refuse European patent application No. 14 767 184.0, published as international patent application WO 2015/031253 A1.

II. The prior-art documents cited in the decision under appeal included the following:

D1: J. Ballé et al., "Extended Texture Prediction for H.264/AVC Intra Coding", Video Coding Experts Group (VCEG), 31st Meeting, Marrakech, MA, No. VCEG-AE11, 14 January 2007, XP030003514

III. The decision under appeal was based, inter alia, on the ground that the subject-matter of the independent claims of the main request and the auxiliary request did not involve an inventive step within the meaning of Article 56 EPC.

IV. The applicant (appellant) filed notice of appeal. With its statement of grounds of appeal, the appellant filed claims according to a main request and first to fifth auxiliary requests. According to the appellant, the claims of the main request were identical to those of the main request forming the basis for the decision under appeal, and the claims of the first auxiliary request were identical to those of the auxiliary request forming the basis for the decision under appeal. The appellant indicated a basis for the claimed subject-matter in the application as filed and provided arguments to support its opinion that the claims met the requirements of Articles 56 and 84 EPC.

V. The appellant was summoned to oral proceedings. With a communication under Article 15(1) RPBA, the board introduced the following document as proof of the common general knowledge into the proceedings on the basis of Article 114(1) EPC:

D7: T. Wiegand et al., "Overview of the H.264/AVC Video Coding Standard", IEEE Transactions on Circuits and Systems for Video Technology, vol. 13, No. 7, July 2003.

In the communication under Article 15(1) RPBA the board gave, inter alia, the preliminary opinion that the subject-matter of claims 1, 3 and 5 of the main request and the first to fifth auxiliary requests did not involve an inventive step in view of the disclosure of document D1 combined with the common general knowledge of the person skilled in the art (Article 56 EPC).

VI. The board held oral proceedings on 12 June 2024.

The appellant's final requests were that the decision under appeal be set aside and that a European patent be granted on the basis of the claims of the main request or, alternatively, on the basis of the claims of one of the first to fifth auxiliary requests, all requests filed with the statement of grounds of appeal.

At the end of the oral proceedings, the Chair announced the board's decision.

VII. Claim 1 of the main request reads as follows:

"A method of encoding video data comprising:
performing an intra block copying process to code a current block of a picture having multiple slices or

multiple tiles, wherein the current block comprises one of a current prediction unit (PU) or a current transform unit (TU) of a current coding unit (CU), the intra block copying process comprising:
determining a region of the picture such that the region does not include any block of the picture assigned to the different slice or the different tile than the slice or the tile in which the current block resides;
identifying a prediction block of multiple prediction blocks such that only a prediction block that resides at least partially within the determined region and that does not overlap the current CU is identified; and
encoding the current block based on the identified prediction block,
wherein pixels from a different slice or a different tile of the picture than that in which the current block resides are not included in the region used for identifying the prediction block."

VIII. Claim 1 of the first auxiliary request reads as follows (features added compared with claim 1 of the main request are underlined):

"A method of encoding video data comprising:
performing an intra block copying process to code a current block of a picture having multiple slices or multiple tiles, wherein the current block comprises one of a current prediction unit (PU) or a current transform unit (TU) of a current coding unit (CU), the intra block copying process comprising:
determining a region of the picture such that the region does not include any block of the picture assigned to the different slice or the different tile than the slice or the tile in which the current block

resides and does not require pixel padding to be performed with respect to the picture;
restricting a size of an offset vector identifying a location of a prediction block relative to the current block within the determined region such that the offset vector is unable to identify those blocks of the region that reside outside of the slice or the tile in which the current block resides;
identifying a prediction block within the determined region using the offset vector;
identifying a prediction block of multiple prediction blocks such that only a prediction blocks [sic] that resides at least partially within the determined region and that does not overlap the current CU is identified; and encoding the current block based on the identified prediction block,
wherein pixels from a different slice or a different tile of the picture than that in which the current block resides are not included in the region used for identifying the prediction block."

IX. Claim 1 of the second auxiliary request reads as follows (features added compared with claim 1 of the first auxiliary request are underlined, and deleted features are ~~struck through~~):

"A method of encoding video data comprising:
performing an intra block copying process to code a current block of a picture having multiple slices or multiple tiles, wherein the current block comprises one of a current prediction unit (PU) or a current transform unit (TU) of a current coding unit (CU), the intra block copying process comprising:
determining a region of the picture such that the region does not include any block of the picture assigned to the different slice or the different tile

than the slice or the tile in which the current block resides, does not include the current CU, and does not require pixel padding to be performed with respect to the picture;
restricting a size of an offset vector identifying a location of a prediction block relative to the current block within the determined region such that the offset vector is unable to identify those block~~s~~ of the region that reside outside of the slice or the tile in which the current block resides;
identifying a prediction block within the determined region using the offset vector
~~identifying a prediction block of multiple prediction blocks~~ such that only a prediction blocks [sic] that resides ~~at least partially~~ within the determined region and that does not overlap the current CU is identified;
and encoding the current block based on the identified prediction block,
wherein pixels from a different slice or a different tile of the picture than that in which the current block resides are not included in the region used for identifying the prediction block."

X. Claim 1 of the third to fifth auxiliary requests is identical to claim 1 of the main request and the first and second auxiliary requests, respectively.

Reasons for the Decision

1. The appeal is admissible.

2. Main request - inventive step (Article 56 EPC)

2.1 It is undisputed that document D1 can be regarded as the closest prior art for the assessment of inventive step of the claimed subject-matter.

2.2 Document D1 discloses a method of encoding video data (see the term "*H.264*" in the main title and the section headed "Introduction" stating: "*Efficient intra prediction is an important aspect for video coding*") comprising:

performing an intra-block copying process to code a current block of a picture (see Figure 1(b): "*Displaced intra prediction*"), wherein the current block comprises a current prediction unit (the top left sub-block of the macroblock shown in Figure 2 can be predicted using DIP) of a current coding unit (CU) (the macroblock shown in Figure 2), the intra-block copying process comprising:

determining a region of the picture (see Figure 1(b): "*intra coded region*" including the "*candidate*" and section "Integration of the extended prediction mode into H.264", second paragraph: "*The displacement vectors are searched on the decoded part of the frame*")

identifying a prediction block of multiple prediction blocks such that only a prediction block that resides at least partially within the determined region and that does not overlap the current CU is identified (the "*intra coded region*" shown in Figure 1(b) does not include the "*current block*", in particular the top left sub-block of the macroblock shown in Figure 2. Furthermore, the "*intra coded region*" shown in Figure 1(b) does not include the other sub-blocks of the macroblock, which are to the right of, or below, the "*current block*". Hence, if the "*current block*" is the top left sub-block of the macroblock, this macroblock as a whole, i.e. the current coding unit, is

not part of the "*intra coded region*" shown in Figure 1(b))

encoding the current block based on the identified prediction block (see section "Integration of the extended prediction mode into H.264")

2.3 The subject-matter of claim 1 thus differs from the disclosure of document D1 in that the former further specifies that for a picture having multiple slices or multiple tiles the region from which a prediction block for intra-block copying can be obtained does not include any block of the picture assigned to a different slice or a different tile than the slice or the tile in which the current block resides.

This was not contested by the appellant.

2.4 The appellant identified the objective technical problem as how to apply the displaced intra-prediction (DIP) method of D1 to a frame with multiple slices of H.264.

2.5 Document D7 represents the common general knowledge concerning slices and their processing in H.264.

Document D7 states on page 565 (right-hand column, at the beginning of the section headed "D. Slices and Slice Groups"): "*A picture maybe split into one or several slices as shown in Fig. 6. A picture is therefore a collection of one or more slices in H.264/ AVC. Slices are self-contained in the sense that given the active sequence and picture parameter sets, their syntax elements can be parsed from the bitstream and the values of the samples in the area of the picture that the slice represents can be correctly decoded*

without use of data from other slices provided that utilized reference pictures are identical at encoder and decoder".

Furthermore, document D7 states on page 569 (left column, at the end of the section headed "G. Intra-Frame Prediction"): "*Intra prediction (and all other forms of prediction) across slice boundaries is not used, in order to keep all slices independent of each other*".

2.6 To solve the formulated objective technical problem, the person skilled in the art would have thus applied the DIP method of document D1 to a frame with multiple slices of H.264, while maintaining the commonly known restriction (see, e.g., document D7) according to which intra-prediction across slice boundaries is not used, in order to keep slices independent.

This is in line with the following passage of document D1: "*Previously encoded intra regions of a slice can be referenced by displacement vectors for prediction of the current intra block*" (see the section headed "Displaced Intra Prediction (DIP)", the paragraph bridging pages 2 and 3). In this passage, document D1 refers to previously encoded intra-regions of a slice in which the current intra-block is located and not to previously encoded intra-regions of the entire frame, the latter potentially containing multiple slices.

2.7 Therefore, the person skilled in the art would have directly arrived at the subject-matter of claim 1.

2.8 The appellant argued that it would not have been obvious to limit the region from which a prediction

block for intra-block copying could be obtained to the same slice as that in which the current block was located, for the following reasons.

(a) An advantage of the DIP method was the provision of more flexibility in prediction block selection. Restricting that flexibility would have been counter-intuitive.

(b) The block-based DIP method was more similar to block-based inter-prediction than to a traditional pixel-based intra-prediction. This was expressed in D1, the section headed "Displaced Intra Prediction (DIP)", paragraph bridging pages 1 and 2 as: "*The proposal transfers the concept of variable block size inter-prediction as specified in H.264 to intra prediction*". In block-based inter-prediction, prediction inherently crosses slice boundaries. Hence, the person skilled in the art would not have thought of imposing the claimed restrictions on the search region for prediction blocks.

The board is not convinced by these arguments, for the following reasons.

Firstly, it is common general knowledge, as expressed by document D7, that in intra-prediction a prediction across slice boundaries is prohibited; otherwise, the slices would not be independently encodable and decodable (see point 2.5 above). Hence, the person skilled in the art would have accepted this as a constraint, which then restricts the choice among the possible prediction blocks to the blocks in the current slice.

Secondly, the person skilled in the art would have known that a reference frame for inter-prediction is an entire reconstructed frame, including all slices. Once this entire frame is formed, a prediction block can be chosen from anywhere in the frame, and hence from any slice within the frame. The situation in intra-prediction is fundamentally different in that, during reconstruction of a frame, some slices are not yet decoded and, therefore, intra-prediction from these slices is impossible. Hence, the person skilled in the art would have understood that while the DIP method has some aspects in common with inter-prediction (block-based and "motion vectors"), it has to comply with the restriction of independent processing per slice, which is mandatory for all intra-prediction methods using slice processing.

2.9 In light of the above, the board finds that the subject-matter of claim 1 of the main request does not involve an inventive step within the meaning of Article 56 EPC, in view of the disclosure of document D1 combined with the common general knowledge of the person skilled in the art as exemplified by document D7.

3. First auxiliary request - inventive step (Article 56 EPC)

3.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the former further specifies:

(a) that determining a region of the picture "*does not require pixel padding to be performed with respect to the picture*"

(b) "*restricting a size of an offset vector identifying a location of a prediction block relative to the current block within the determined region such that the offset vector is unable to identify those blocks of the region that reside outside of the slice or the tile in which the current block resides; identifying a prediction block within the determined region using the offset vector*".

3.2 Feature (b) merely shows another way of formulating the features that were already present in claim 1 of the main request. If - as specified in claim 1 of the main request - the region in which prediction blocks can be found is the same slice or tile as that in which the current block resides, this implies that the size of an offset vector between a prediction block and the current block is restricted such that the offset vector cannot identify blocks outside of this region.

Therefore, feature (b) cannot establish the presence of an inventive step.

3.3 As far as feature (a) is concerned, the description sets out in paragraph [0104] that pixel padding with respect to the picture is not required if "*the region does not include any block of the picture assigned to a different slice or the different tile than the slice or the tile in which the current block resides*". This is quite different from a situation in which the region can extend beyond the slice or tile in which the current block resides and there is thus a need for padding of the slice or tile (see paragraph [0103] of the description).

As set out above for claim 1 of the main request, the board is of the opinion that it would have been obvious

to the person skilled in the art to restrict the region to the same slice as that in which the current block resides. This means that prediction blocks are only selected from this region and thus no padding is required.

Therefore, feature (a) cannot establish the presence of an inventive step either.

3.4 The appellant referred to the section of document D1 headed "Extended Texture Prediction Mode (ETP)". The penultimate sentence of this section reads: "*For prediction over the boundaries of the frame, padding by nearest neighbor extrapolation is applied*".

3.5 The appellant argued that document D1 taught the application of prediction across boundaries. In the case of multiple slices it was thus not obvious to restrict a region containing a prediction block for intra-block copying to the same slice or tile as that in which the current block resided.

The board is not convinced by this argument, because document D1 mentions prediction across boundaries in the context of applying padding by nearest-neighbour extrapolation. This makes it clear that the prediction is not meant to access the true image data beyond the boundary but instead accesses data which has been extrapolated using the image data inside of the boundary. When applied to a prediction across slice boundaries, this means that only data of a slice containing the current block is extrapolated and used for prediction but that data of a previous slice is not used. This is in line with the restrictions formulated in document D7 (see point 2.5 above).

3.6 The appellant then argued that document D1 taught the application of padding in the case of prediction across boundaries. Hence, starting from document D1 and faced with the objective technical problem formulated under point 2.4 above, the person skilled in the art would not have restricted the search region for candidate blocks to the same slice as the current block but would have implemented a prediction across slice boundaries by using padding. Therefore, feature (a) quoted under point 3.1 above rendered the subject-matter of claim 1 inventive.

The board is not convinced by this argument, for two reasons.

Claim 1 restricts the selection of prediction blocks such that they reside "*at least partially within the determined region*", wherein the region is determined "*such that the region does not include any block of the picture assigned to the different slice or tile than the slice or the tile in which the current block resides*". Hence, prediction blocks that reside entirely in a different slice are not selected.

For prediction blocks that reside at least partially within the same slice as the current block, a part of the prediction block is already decoded and available for prediction. Hence, no padding is required to generate this part of the prediction block. To generate other parts of the prediction block, i.e. those that reside in an adjacent slice, padding is indeed an option in H.264, but it is not a requirement.

3.7 In light of the above, the board is of the preliminary opinion that the subject-matter of claim 1 of the first auxiliary request does not involve an inventive step

within the meaning of Article 56 EPC in view of the disclosure of document D1 combined with the common general knowledge of the person skilled in the art.

4. Second auxiliary request - inventive step (Article 56 EPC)

4.1 Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that the former further specifies that:

(a) a region of the picture "*does not include the current CU*"

(b) "*a prediction block resides within the determined region*" (not at least partially within the determined region)

Furthermore, the redundant feature "*identifying a prediction block of multiple prediction blocks*" was removed in claim 1 of the second auxiliary request.

4.2 The examination of inventive step of claim 1 of the first auxiliary request (see point 3. above) already interpreted feature (a) in the way it is now specified. Furthermore, feature (b) means that an entire prediction block is available and there is no need for any padding at all.

4.3 The appellant had no further comments beyond those already submitted for the main request and the first auxiliary request.

4.4 Therefore, the board finds that the subject-matter of claim 1 of the second auxiliary request lacks inventive step within the meaning of Article 56 EPC for the same

reasons as those set out under point 3. for the first auxiliary request.

5. Third to fifth auxiliary requests

According to the appellant, claim 1 of the third to fifth auxiliary requests is identical to claim 1 of the main request and the first and second auxiliary requests, respectively (see statement of grounds of appeal, sections 8 to 10).

Hence, the objections of lack of inventive step raised against claim 1 of the main request and the first and second auxiliary requests (see points 2., 3. and 4.) apply to claim 1 of the third to fifth auxiliary requests, respectively.

6. Conclusion

The main request and the first to fifth auxiliary requests are not allowable because the subject-matter of claim 1 of each of these requests does not involve an inventive step within the meaning of Article 56 EPC. Since none of the appellant's requests is allowable, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

K. Boelicke B. Willems

Decision electronically authenticated