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Datasheet for the decision of 28 June 2018

Case Number: T 1211/14 - 3.5.04

Application Number: 11164433.2

Publication Number: 2348742

IPC: H04N11/04, H04N7/26, H04N5/44, H04N5/14

Language of the proceedings: EN

Title of invention:
Image information encoding method and encoder, and image information decoding method and decoder

Applicant:
Sony Corporation

Headword:

Relevant legal provisions:
EPC Art. 76(1), 84, 56

Keyword:
Claims - main request - clarity (no)
Amendments - auxiliary request 1 - added subject-matter (yes)
Inventive step - auxiliary request 2 (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 1211/14 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 28 June 2018

Appellant: (Applicant)	Sony Corporation 1-7-1 Konan Minato-ku Tokyo 108-0075 (JP)
Representative:	Beder, Jens Mitscherlich PartmbB Patent- und Rechtsanwälte Sonnenstraße 33 80331 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 7 November 2013 refusing European patent application No. 11164433.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	C. Kunzelmann
Members:	M. Paci
	T. Karamanli

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing European patent application No. 11 164 433.2, published as EP 2 348 742 A2, a divisional application from the earlier European patent application No. 02 783 717.8, published as EP 1 353 517 A1.

II. The following document was cited in the decision under appeal:

D3: "ITU-T RECOMMENDATION H.262 (07/95), INTERNATIONAL STANDARD ISO/IEC 13818-2, MPEG-2 VIDEO, TRANSMISSION OF NON-TELEPHONE SIGNALS, INFORMATION TECHNOLOGY - GENERIC CODING OF MOVING PICTURES AND ASSOCIATED AUDIO INFORMATION: VIDEO", ITU-T TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU, Geneva, Switzerland, July 1995, pages i-viii and 1-201, XP000198491.

III. The application was refused on the grounds that the claims of the then main and first auxiliary requests did not meet the requirements of Article 123(2) EPC, and that the subject-matter of the claims of the then second auxiliary request did not involve an inventive step (Article 56 EPC) in view of prior-art document D3.

IV. With the statement of grounds of appeal, the appellant filed amended claims according to a sole request replacing all the claims previously on file.

V. The board issued a summons to oral proceedings and, in a communication annexed to the summons, informed the appellant that three consecutive days had been

scheduled for holding oral proceedings in the present appeal case and in five related appeal cases. It then issued a communication under Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA, OJ EPO 2007, 536) in which it explained how it understood the invention and raised objections under Articles 76(1) and 84 EPC.

VI. With a letter dated 25 May 2018, the appellant filed a set of amended claims according to AUXILIARY REQUESTS I and II.

VII. The board held oral proceedings in the present case on 28 June 2018, during which the appellant filed amended claims according to AUXILIARY REQUEST II and renumbered AUXILIARY REQUEST II filed with the letter dated 25 May 2018 as AUXILIARY REQUEST III. During the oral proceedings, it also filed an amended description for the claims according to AUXILIARY REQUEST II.

At the end of the oral proceedings, the appellant's requests were that the decision under appeal be set aside and that a patent be granted on the basis of

- the claims according to the main request filed as sole request with the statement of grounds of appeal or, in the alternative, according to AUXILIARY REQUEST I filed with the letter dated 25 May 2018, or
- the following documents:

  Claims: Nos. 1 to 3 according to AUXILIARY REQUEST II filed during the oral proceedings on 28 June 2018;

  Description: pages 1 to 32 filed during the oral proceedings on 28 June 2018;

  Drawings: sheets 1/23 to 23/23 as originally filed;

or

- the claims according to AUXILIARY REQUEST III filed as AUXILIARY REQUEST II with the letter dated 25 May 2018.

VIII. Claim 1 according to the appellant's **main request** reads as follows:

"A decoding method comprising the step of:
performing (38, 40), in units of a macro-block, motion compensation of a decoded image signal having a format of 4:2:0 and including a luma signal and chroma signal;
characterized in that
when a current macro-block is a field macro-block and when a reference field has a different parity from a current field for the motion compensation and when the motion compensation is performed with an accuracy of 1/4 pixel for a luma motion vector, the phase of the chroma signal is shifted by mv/2 + 1/4 on the macro-block basis so that the reference field will coincide in phase of the chroma signal with the current field, wherein mv is the vertical component in the luma motion vector, wherein shifting is done by linear interpolation or by using an FIR filter with several taps, wherein a reference field is a top field and a current field is a bottom field"

IX. Claim 1 according to the appellant's **AUXILIARY REQUEST I** reads as follows:

"A decoding method comprising the step of:
- performing (38,40), in units of macroblocks, motion compensation of a decoded image signal having a format of 4:2:0 and including a luma signal and chroma signal, wherein each macroblock of the macroblocks comprises a top field and a bottom field,

wherein a reference field in a reference macroblock of a reference frame is a top field of the reference macroblock and a current field of a current macroblock of a current frame is a bottom field for the motion compensation, and

- when the motion compensation is performed with an accuracy of 1/4 pixel for a luma motion vector, generating, new chroma samples within the reference field at a position in the reference field, which is vertically displaced by mv/2 + 1/4 from a position of a corresponding chroma sample in the reference field, so that the luma motion vectors between luma samples of the reference field and luma samples of the current field are parallel to chroma motion vectors between chroma samples of the reference field and chroma samples of the current field, and

determining a value of each generated chroma sample by linear interpolation or by using a FIR filter with several taps,

wherein mv is a vertical component of the luma motion vectors."

X. Claims 1 to 3 according to the appellant's **AUXILIARY REQUEST II** read as follows:

"1. A decoding method comprising the step of:

- performing (38,40), in units of macroblocks, motion compensation of an input image signal of an interlaced image with an accuracy of 1/4 pixel for a motion vector, wherein the input image signal has a format of 4:2:0 and includes a brightness signal and a color-difference signal, wherein each macroblock of the macroblocks comprises a top field and a bottom field, wherein a reference field in a reference macroblock of a reference frame is a top field of the reference macroblock and a current field of a current macroblock

of a current frame is a bottom field for the motion compensation, and

- wherein the motion compensation comprises:

determining for all existing color-difference samples in the reference field, positions of new color-difference samples in the reference field, wherein the positions of the new color-difference samples are vertically shifted by mv/2 + 1/4 from the existing positions of the existing color-difference samples in the reference field, and

generating, for each of the new color-difference samples, a value by linear interpolation, wherein the linear interpolation is done for the new color-difference sample based on the values of the two vertically adjacent existing color-difference samples, wherein mv is a vertical component of the motion vector,

wherein the unit of the mv is, in the vertical direction, the distance between two adjacent brightness samples in the reference field, and the unit of the mv/2 + 1/4 is, in the vertical direction, the distance between two adjacent existing color-difference samples in the reference field."

"2. A decoding apparatus comprising means configured to perform the following method steps:

- performing, in units of macroblocks, motion compensation of an input image signal of an interlaced image with an accuracy of 1/4 pixel for a motion vector, wherein the input image signal has a format of 4:2:0 and includes a brightness signal and a color-difference signal, wherein each macroblock of the macroblocks comprises a top field and a bottom field, wherein a reference field in a reference macroblock of a reference frame is a top field of the reference macroblock and a current field of a current macroblock

of a current frame is a bottom field for the motion compensation, and

- wherein the motion compensation comprises:

determining for all existing color-difference samples in the reference field, positions of new color-difference samples in the reference field, wherein the positions of the new color-difference samples are vertically shifted by mv/2 + 1/4 from the existing positions of the existing color-difference samples in the reference field, and

generating, for each of the new color-difference samples, a value by linear interpolation, wherein the linear interpolation is done for the new color-difference sample based on the values of the two vertically adjacent existing color-difference samples,

wherein mv is a vertical component of the motion vector,

wherein the unit of the mv is, in the vertical direction, the distance between two adjacent brightness samples in the reference field, and the unit of the mv/2 + 1/4 is, in the vertical direction, the distance between two adjacent existing color-difference samples in the reference field."

"3. An image decoding program that, when running on a computer or loaded onto a computer, causes the computer to execute the method according to claim 1."

XI. The examining division's reasons for the decision under appeal which are relevant to the present decision may be summarised as follows:

Re the second auxiliary request underlying the decision under appeal

Document D3, which was the closest prior art, disclosed making a correction to the vertical component of the luminance motion vector to reflect the vertical shift between the lines of the top and bottom fields. The chrominance motion vector was thereafter obtained by dividing the luminance motion vector by two. It could also be derived from the disclosure of D3 that the resulting correction to the chroma motion vector amounted to shifting the reference chroma field by mv/2 + 1/4. As a result, the method of claim 1 only differed from the disclosure of D3 in that the accuracy of the motion vector was 1/4 of a pixel, instead of 1/2 of a pixel. However, this distinguishing feature was rendered obvious by the need to accommodate newer technologies which used 1/4-pixel accuracy.

Hence the method of claim 1 (and similarly the apparatus of claim 2 and the program of claim 3) did not involve an inventive step in view of prior-art document D3.

XII. The appellant's relevant arguments regarding the amended claims of its requests on which the present decision is based are summarised and addressed by the board in the "Reasons for the Decision" below.

Reasons for the Decision

1. The appeal is admissible.

The invention

2. The present invention relates to a specific problem in the field of image compression and assumes that the reader has knowledge of several video compression standards, which were either already finalised (e.g. MPEG-2: see document D3) or still under development at the priority date. The board understands the invention described in the application as filed as follows:

Several video compression standards, most notably MPEG-2, use what is known as the **4:2:0 format** for encoding **chroma** information ("**color-difference** signal" in the present application) and **luma** information ("**brightness** signal" in the present application) in each picture of a video. According to the 4:2:0 format, the chroma information is encoded with four times fewer pixels than the luma information (see, for instance, figure 6-1 on page 14 of D3). In order to compensate for their smaller numbers, the chroma pixels are four times as big as the luma pixels.

MPEG-2 and other standards also allow a picture to be either **interlaced** or **progressive**. In a progressive picture, all the pixels are in a single **frame** and represent the same instant in time. In an interlaced image, the picture consists of **two fields**, one field comprising all the even lines, the other field comprising all the odd lines. The two fields represent different instants in time separated by half the time between two successive frames.

When an interlaced picture is encoded in the 4:2:0 format, the luma and chroma pixels are distributed between the two fields as shown in figures 6-2 and 6-3 on pages 15 and 16 of D3 (figure 6-2 of D3 is identical to figure 3 of the application as filed), with half of the chroma pixels ending up in each field.

Because there are fewer chroma pixels than luma pixels in each of the two fields of an interlaced picture, the following **problem** occurs at the decoder during reconstruction with motion compensation, i.e. during the prediction of the chroma and luma pixel values of the current macroblock of a picture by using a motion vector and a reference macroblock of a previous picture: in order to use this motion vector to correctly predict the values of the chroma pixels at certain locations within the current macroblock, chroma pixels would need to exist within the reference macroblock at locations where there are none (see, in figures 8 and 9 of the application as filed, the squares showing the positions of the existing chroma pixels in the two fields of the reference picture and the triangles showing the positions in those two fields where chroma pixels would be necessary for correct motion compensation).

The **solution** of the invention to the above problem is essentially to create chroma pixels at these necessary locations **in the reference field**. These missing chroma pixels are given values obtained by interpolation from the nearby existing chroma pixels in the reference field (see figures 12 to 15 for frame-based motion compensation and figures 16 to 23 for field-based motion compensation).

3. The appellant stated during the oral proceedings that it shared the board's understanding of the invention.

Main request - Article 84 EPC

4. In its communication under Rule 15(1) RPBA, the board informed the appellant that claim 1 according to the main request did not meet the requirements of Article 84 EPC *inter alia* for the following reasons:

(1) Claim 1 stated that "the phase of the chroma signal was shifted by mv/2 + 1/4". In other words, claim 1 stated that the values of the chroma signal were displaced by mv/2 + 1/4. However, according to the description and drawings, the shifting involved more than a mere displacement of the values of the chroma signal because chroma pixels had to be created at the necessary locations in the reference field where there were none. These missing chroma pixels were created by interpolation from the nearby existing chroma pixels, either by linear interpolation or by using a FIR filter with several taps. Hence, the expression "the phase of the chroma signal [...] is shifted" in claim 1, when used without sufficient further indications, was misleading (lack of clarity under Article 84 EPC) and several features (such as a clear indication of where the chroma pixels were missing and the direction of the shifting) essential for solving the problem of the invention were missing in claim 1.

(2) The expression "the phase of the chroma signal [...] is shifted by mv/2 + 1/4" in claim 1 was meaningless if it was not specified in which unit mv was measured and in which unit the phase of the chroma signal was measured, in particular since according to

the description and drawings they were not measured in the same unit.

5. The appellant submitted the following arguments during the oral proceedings:

Re objection (1)

The expression "the phase of the chroma signal was shifted by mv/2 + 1/4" in claim 1 meant that new colour-difference samples were generated in the reference field at positions which were such that it resembled a "shifting" of colour-difference samples in the reference field. This was how the skilled person would understood it. This expression was thus clear.

Re objection (2)

The units of "mv" and "mv/2 + 1/4" did not need to be specified in claim 1 because they would be clear to the skilled person when account was taken of his or her common general knowledge.

6. These arguments do not persuade the board for the following reasons:

Re objection (1)

The appellant's arguments do not address all the objections raised under point 4 *supra*, in particular that the new colour-difference samples have values obtained either by linear interpolation or by using a FIR filter with several taps, and thus that the generation of these new colour-difference samples involves more than a mere shifting of existing colour-difference samples.

Re objection (2)

The board disagrees that the units of "mv" and "mv/2 + 1/4" would be clear to the skilled person from the wording of claim 1 when taking into account his or her common general knowledge. This is in particular not the case because the chosen units are not the same for "mv" and "mv/2 + 1/4". Without an indication of these units in claim 1, the skilled person could not know from the wording of the claim what these units should be.

7. For the above reasons, the board affirms its view expressed in its communication under Article 15(1) RPBA that the subject-matter of claim 1 according to the appellant's main request does not meet the requirements of Article 84 EPC.

8. Hence the appellant's main request is not allowable.

AUXILIARY REQUEST I - Article 76(1) EPC

9. Claim 1 according to AUXILIARY REQUEST I has been amended *inter alia* in that the following method step has been added to the claim:

"generating, new chroma samples within the reference field at a position in the reference field, which is vertically displaced by mv/2 + 1/4 from a position of a corresponding chroma sample in the reference field, so that the luma motion vectors between luma samples of the reference field and luma samples of the current field are parallel to chroma motion vectors between chroma samples of the reference field and chroma samples of the current field".

10. During the oral proceedings, the board explained that the above method step introduced subject-matter extending beyond the content of the earlier application as filed, contrary to the requirements of Article 76(1) EPC, for the following reasons:

The earlier application as filed did not mention any of the expressions "luma motion vectors", "chroma motion vectors", "brightness motion vectors" or "color-difference motion vectors". It only used the expressions "motion vector" and "motion vector information", without any further indication as to whether these were for the motion compensation of brightness (luma) samples, colour-difference (chroma) samples or both. Several of the figures of the earlier application as filed showed a motion vector represented as an arrow, but did not provide additional information as to the kind of motion vector being used.

In view of the limited disclosure regarding the kind of motion vector used, the board considered that it was not directly and unambiguously derivable from the earlier application as filed that there were two different types of motion vectors for luma and chroma and that the new chroma-samples generating step solved a problem of keeping these two types of motion vectors parallel to each other.

11. The appellant did not submit arguments in relation to the above objection.

12. For the above reasons, the board considers that the subject-matter of claim 1 according to AUXILIARY REQUEST I extends beyond the content of the earlier application as filed, contrary to the requirements of Article 76(1) EPC.

13. Hence the appellant's AUXILIARY REQUEST I is not allowable.

AUXILIARY REQUEST II - Articles 76(1) and 123(2) EPC

14. The board is satisfied that the method of claim 1 meets the requirements of Articles 76(1) and 123(2) EPC in that it is directly and unambiguously derivable from both the earlier application as filed and the present application as filed.

More specifically, the method steps of claim 1 are derivable from the embodiments shown in figures 20 and 21 of both applications as filed, which are to be understood in the context of the explanations given in relation to figures 1 to 15, in particular those relating to how values of new colour-difference samples are generated by linear interpolation (see figures 12 to 14 and equations (3), (6) and (8) in the description).

The same conclusion applies to the apparatus of claim 2 and the program of claim 3.

AUXILIARY REQUEST II - Article 84 EPC

15. The board is satisfied that the claims according to AUXILIARY REQUEST II meet the requirements of Article 84 EPC.

AUXILIARY REQUEST II - Article 54(1) and (2) EPC

16. The board is satisfied that the subject-matter of claims 1 to 3 according to AUXILIARY REQUEST II is novel compared to the available prior art.

AUXILIARY REQUEST II - Article 56 EPC

17. Closest prior art

The appellant did not dispute on appeal that document D3 represents the closest prior art. Document D3 is the part of the MPEG-2 standard which defines the video coding for interlaced and non-interlaced video signals.

18. Disclosure of D3

Prior-art document D3 discloses *inter alia* a method for decoding an interlaced image having top and bottom fields and brightness (luminance) and colour-difference (chrominance) pixels arranged in the 4:2:0 format (see section "Intro. 4.1.2 Coding interlaced video" on page vi and section "6.1.1.8 4:2:0 format" on pages 14 to 16, in particular figure 6-2 on page 15 which is identical to figure 3 of the present application). Field-based motion compensation is performed on a macroblock basis (see section "Intro. 4.1.3 Motion representation - Macroblocks" on page vi and sections "7.6 Motion compensation" and "7.6.1 Prediction modes" on pages 73 and 74). Field-based motion compensation may predict either field of the current macroblock from either field of the reference macroblock (see sections "7.6.2.1 Field prediction" on pages 74 to 76 and "7.6.3.6 Dual prime additional arithmetic" on pages 80 to 82). When the predicted field and the reference field have different parities, i.e. one is the top field and the other is the bottom field or vice versa, the luminance motion vector is corrected to reflect the different temporal distance between the fields (see section "7.6.3.6 Dual prime additional arithmetic" on pages 80 to 82). The chrominance motion vector is

obtained by dividing the luminance motion vector by two (see section "7.6.3.7 Motion vectors for chrominance components" on page 82).

The appellant did not dispute the above assessed disclosure of D3.

19. Distinguishing features

The board concurs with the appellant that the method of claim 1 differs from the method of D3 by essentially the following features:

(a) motion compensation is performed with an accuracy of 1/4 pixel;

(b) the step of determining positions of new colour-difference samples in the reference field vertically shifted by mv/2 + 1/4 from existing positions of the existing colour-difference samples, with mv and mv/2 + 1/4 expressed in the units defined in claim 1;

(c) the step of generating, for each of the new colour-difference samples, a value by linear interpolation from the values of the two vertically adjacent existing colour-difference samples.

20. Objective technical problem

According to the present application as filed (see, in particular, from page 7, line 23, to page 8, line 19, and figures 8 and 9), the invention solves the problem that colour-difference samples are missing in the reference field at positions where they would be needed (i.e. at the positions of the triangles in figures 8 and 9), thereby causing image quality degradation, in

particular when motion compensation is performed at 1/4 pixel accuracy.

In the method of D3, when the predicted field and the reference field have different parities, i.e. one is the top field and the other is the bottom field or vice versa, the luminance motion vector is corrected to reflect the different temporal distance between the fields (see section "7.6.3.6 Dual prime additional arithmetic" on pages 80 to 82).

D3 does not explain what technical effect is achieved by the above correction of the luminance motion vector in D3. However, the board concurs with the examining division that it can be assumed that, like the present invention, it avoids image quality degradation.

Since it is impossible to assess without experimental tests whether image quality degradation is further reduced by the method of claim 1 compared to the method of D3, the board considers that the **objective technical problem** should be formulated conservatively as being "how to find an alternative way to reduce image quality degradation".

The appellant stated during the oral proceedings that it accepted the above formulation of the objective technical problem.

21. Obviousness

It appears from the Reasons for the decision (see, in particular points 3.7 and 3.8 of the decision) that the examining division considered that the step of correcting the luminance motion vector to reflect the different temporal distance between the fields of

different parities was essentially the same as "shifting the reference chroma field".

The board is of the view that while the above consideration may have had some merit regarding claim 1 of the then main request which did not specify how the phase of the chroma signal was shifted, it no longer applies to claim 1 according to present AUXILIARY REQUEST II for the following reasons:

Claim 1 according to AUXILIARY REQUEST II makes it clear that

(a) positions of new colour-difference samples in the reference field are determined, wherein the positions of the new colour-difference samples are vertically shifted by mv/2 + 1/4 from the existing positions of the existing colour-difference samples in the reference field, and

(b) a value is generated by linear interpolation, for each of the new colour-difference samples, wherein the linear interpolation is done for the new colour-difference sample based on the values of the two vertically adjacent existing colour-difference samples,

wherein mv is a vertical component of the motion vector.

In section 7.6.3.6 of D3, the step of correcting the luminance motion vector to reflect the different temporal distance between the fields of different parities relies on the conventional motion compensation approach of using motion vectors to compensate motion in the image.

First, it should be noted that there is no suggestion in D3 that additional colour-difference samples in the

reference field should be created instead of correcting motion vectors.

Second, if the colour-difference samples in the reference field were merely "shifted" in the reference field, this might be regarded as essentially equivalent to correcting a motion vector by the amount of the vertical shift. However, according to claim 1, the colour-difference samples are not merely shifted in the reference field; indeed, the new colour-difference samples are given values obtained by linear interpolation from the values of the two vertically adjacent existing colour-difference samples. There is nothing like that disclosed in D3.

Finally, the correction of the luminance motion vector in section 7.6.3.6 of D3 concerns the luminance (brightness) samples, not the chrominance (colour-difference) samples, even though the chrominance motion vector obtained by dividing the luminance motion vector by two is also automatically corrected. Hence, D3 does not suggest creating new colour-difference samples in the reference field and giving them new values in order to address a problem specific to the colour-difference samples, i.e. that colour-difference samples are missing at positions where they would be needed for proper motion compensation because there are four times fewer colour-difference samples than brightness samples, which causes an uneven distribution of the colour-difference samples between the two fields of an interlaced image in the 4:2:0 format (see figure 3 of the application).

22. For the above reasons, the board considers that the subject-matter of claim 1, which includes these features distinguishing the claimed invention from the

disclosure of D3 (see point 19 above), would not have been obvious to a person skilled in the art.

23. Hence the method of claim 1 according to AUXILIARY REQUEST II involves an inventive step in view of D3.

24. The above finding for the method of claim 1 also applies to the apparatus of claim 2 and the program of claim 3.

25. The board is satisfied that the amended description according to AUXILIARY REQUEST II meets the requirements of Articles 76(1) and 123(2) EPC.

26. Conclusion in relation to AUXILIARY REQUEST II

For the reasons set out above, the board concludes that the appellant's AUXILIARY REQUEST II is allowable.

27. Since AUXILIARY REQUEST II is found to be allowable, there is no need for the board to decide on the lower-ranking AUXILIARY REQUEST III.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent in the following version:
Claims: Nos. 1 to 3 according to AUXILIARY REQUEST II filed during the oral proceedings on 28 June 2018.
Description: Pages 1 to 32 filed during the oral proceedings on 28 June 2018.
Drawings: Sheets 1/23 to 23/23 as originally filed.

The Registrar: The Chairman:

K. Boelicke C. Kunzelmann

Decision electronically authenticated