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Datasheet for the decision of 21 March 2019

Case Number: T 0493/14 - 3.5.04

Application Number: 03811486.4

Publication Number: 1566970

IPC: H04N7/46, H04N7/36

Language of the proceedings: EN

Title of invention:
Moving image prediction method, moving image encoding method and device, and moving image decoding method and device

Applicant:
Godo Kaisha IP Bridge 1

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - (no)

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Catchword:

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Boards of Appeal

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Case Number: T 0493/14 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 21 March 2019

Appellant: (Applicant)	Godo Kaisha IP Bridge 1 c/o Sakura Sogo Jimusho, 1-11 Kanda Jimbocho, Chiyoda-ku, Tokyo 101-0051 (JP)
Representative:	Eisenführ Speiser Patentanwälte Rechtsanwälte PartGmbB Postfach 10 60 78 28060 Bremen (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 21 October 2013 refusing European patent application No. 03811486.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairwoman	T. Karamanli
Members:	R. Gerdes
	M. Paci

Summary of Facts and Submissions

I. The appeal is against the decision to refuse European patent application No. 03 811 486.4, published as EP 1 566 970 A1.

II. The examining division refused the patent application on the grounds that claim 1 of the then main request did not meet the requirements of Articles 84 and 123(2) EPC, and claim 1 of then auxiliary request did not meet the requirements of Article 84 EPC. It also held that the subject-matter of claim 1 of both requests did not involve an inventive step within the meaning of Article 56 EPC in view of document:

D1: Editor's Proposed Draft Text Modifications for Joint Video Specification (ITU-T Rec. H.264 ISO/IEC 14496-10 AVC), Geneva modifications draft 37, Joint Video Team (JVT) OF ISO/IEC MPEG & ITU-T VCEG (ISO/IEC JTC1/SC29/WG11 AND ITU-T SG16 Q.6), 5th Meeting: Geneva, CH, 9-17 October 2002, no. JVT-E146d37, XP002500850.

III. The applicant (appellant) filed notice of appeal against this decision. With the statement of grounds of appeal, it filed amended claims according to a main request and a first auxiliary request. The appellant requested that the decision of the examining division be set aside and that a European patent be granted on the basis of the main request or first auxiliary request. In addition, the appellant requested, as a second auxiliary request, that the case be remitted to the examining division for further substantive examination.

IV. The board issued a communication accompanying the summons to oral proceedings pursuant to Article 15(1) RPBA.

V. By letter of reply dated 14 February 2019, the appellant filed amended claims according to a new main request and a new auxiliary request I. The appellant also provided arguments as to why the amended claims met the requirements of Articles 84 and 56 EPC.

VI. Oral proceedings were held before the board on 21 March 2019.

The appellant requested 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, in the alternative, of auxiliary request I, both requests filed at the oral proceedings of 21 March 2019.

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

"An image decoding method for generating a predictive pixel value of a current picture to be decoded, using pixel values of two reference pictures, and decoding the current picture using the predictive pixel value, said method comprising:

a time information determination step of determining time information of a current picture, a first reference picture referred to by the current picture and a second reference picture referred to by the current picture;

a scaling parameter calculation step of calculating a scaling parameter based on a ratio of a first time distance (T - T0) between the first reference picture

and the current picture with respect to a second time distance (T1 - T0) between the first reference picture and the second reference picture;

a weighting coefficient determination step of determining two weighting coefficients (W0, W1) based on the scaling parameter, wherein the two weighting coefficients (W0, W1) comprise a first weighting coefficient (W0) and a second weighting coefficient (W1), the sum of the two weighting coefficients (W0, W1) is set to be equal to 1;

a predictive pixel value generation step of generating a first predictive pixel value of the current picture by scaling a pixel value of the first reference picture using the first weighting coefficient (W0) and generating a second predictive pixel value of the current picture by scaling a pixel value of the second reference picture using the second weighting coefficient (W1) and generating a predictive pixel value of the current picture by adding the first predictive pixel value and the second predictive pixel value; and

a decoding step of decoding the current picture using the predictive pixel value calculated in said predictive pixel value generation step,

characterized in that the weighting coefficient determination step includes:

(i) determining the two weighting coefficients (W0, W1) to be a predetermined value of 1/2 in the case that the generation of the predictive pixel value cannot be performed within a significant bit number of 16 under a

condition that a pixel value can be expressed by 8 bits in said predictive pixel value generation step; and

(ii) determining the two weighting coefficients (W0, W1) to be a value calculated using the scaling parameter in the case that the generation of the predictive pixel value can be performed within a significant bit number of 16 under the condition that a pixel value can be expressed by 8 bits in said predictive pixel value generation step."

VIII. Claim 1 of the first auxiliary request (auxiliary request I) differs from claim 1 of the main request in that the following additional feature has been appended to the claim:

"..., wherein the determination whether the generation of the predictive pixel value can be performed within a significant bit number of 16 under the condition that a pixel value can be expressed by 8 bits in said predictive pixel value generation step is based on judging whether the value of the scaling parameter is in a predetermined range."

IX. In the decision under appeal, the examining division had held that the subject-matter of claim 1 of the then main request was distinguished from D1 by choosing default weighted prediction if it was not possible to generate a predicted pixel value within a predetermined significant bit number. The objective technical problem was formulated as "generating a predicted pixel within a predetermined significant bit number being less than 32 bits, using weighted prediction, wherein preference is given to implicit weighted prediction". Starting from D1, the solution to that problem would have been obvious to the skilled person in the art. The method of

claim 1 provided a best-effort approach trying first to code the weights using implicit weighted prediction and, if that was not possible (because of arithmetic overflow) to use a less optimal, but simpler method. The skilled person in the art would have arrived at the claimed method without inventive skill (see decision under appeal, Reasons, points 1.4.2 to 1.4.4).

X. The appellant's arguments, as far as relevant to the present decision, may be summarised as follows:

The invention was supported by the embodiment of figure 9 together with page 30, line 16, to page 31, line 1. In particular, the values of the weighting coefficients, or alternatively of the products of pixel values and weighting coefficients should be used to judge whether it was possible "to generate predictive values of T, T1 and T0 with a predetermined significant bit number" (see figure 9: S90).

Claim 1 of the main request differed from D1 by the features of its characterising portion. The objective technical problem should be formulated as "to further improve the weighted prediction processes specified in D1", since the decision to limit the resources for performing the weighted prediction calculations was already one that favoured the requirement of implementation efficiency over others, e.g. coding efficiency. To include the requirement of limited resources in the technical problem already provided a pointer to the solution.

The choice whether the encoder used implicit weighted prediction or default weighted prediction was signalled in the bitstream by means of a flag. Weighting coefficients of 1/2 were only used in D1 if the

distance T1 - T0 was equal to zero, i.e. if the reference pictures were the same. Using equations (1) to (3) of the application, this amounted to an unallowable division by zero. In this case, because the first and second reference pictures were the same and had the same time distance to the current picture, the weighting coefficients of the two reference pictures should also have the same values, namely 128 in fixed-point calculations (corresponding to 1/2). The weighting coefficients W0 and W1 that were selected when T1 - T0 was equal to zero were thus "correct", and no negative effect on the coding efficiency might therefore be expected in this situation. This was completely different from the present invention, according to which the generation of the predictive pixel could not be performed within 16 bits. According to the present invention, the assignment of weighting factors of 1/2 might occur when the two reference pictures (i) were not the same and (ii) had different time distances to the current picture. In this case, it might not be expected that setting the weighting coefficients W0 and W1 both to 1/2 could result in a sufficient coding efficiency, since the correlation of the reference picture (that has a larger time distance to the current picture) with the current picture would typically be smaller than the correlation of the other reference picture with the current picture (see statement of grounds, point 1.5.2 and letter of reply dated 14 February 2019, point I.3).

The limitation to calculations of 16-bit precision disclosed in D1, see bottom of page 108, had the purpose of restricting the bit width of transmitted weighting coefficients, since this section referred to explicit weighting.

D1 also did not disclose the additional feature of claim 1 of the first auxiliary request. This feature defined a selection from one of several terms to check for arithmetic overflow. Also, the choice of the weighting factors which should be used in that case was based on an inventive selection (see letter of reply dated 14 February 2019, point II.3).

Reasons for the Decision

1. The appeal is admissible.

The invention

2. The application relates to a decoding method and a decoder using implicit weighted prediction in moving picture (de-)coding.

In implicit weighted prediction, an estimation of a pixel value P of a bidirectionally predicted picture is calculated as a weighted sum of pixel values P1 and P2 from two (usually different) reference pictures. The pixel values of reference pictures closer in time to the predicted picture have a higher weight than those of pictures that are farther away:

$P = (P0 \cdot W0 + P1 \cdot W1 + 64) >> 7$ (formula (3) of the application)

with $W0 = 128 \cdot (T1-T)/(T1-T0)$ and $W1 = 128 \cdot (T-T0)/(T1-T0)$

with T0, T1, T being picture order indices of the first and second reference pictures and the current picture (see present application, page 1, line 12, to page 3,

line 13, and D1, page 107, from equation (8-35) to the bottom of that page).

The present invention is concerned with the implementation of the above equations on a 16-bit processor. If it is not possible to perform the calculations of the predictive pixel values within 16 bits, default values for the weights are chosen, such that W0 = W1 = 128, corresponding to equal weights of 1/2 in floating point arithmetic. The application discloses two cases in which such default weighted prediction is implemented; the first one judging "the values of the weighting coefficients W0 and W1", and the second judging "with the values of each pixel value in two reference pictures multiplied by the weighting coefficients W0 and W1" (see figure 9 and page 31, line 30, to page 31, line 1). These passages are understood as meaning that it is either checked whether the values of the weighting coefficients can be represented by 8 bits (presuming that the pixel values are also represented by 8 bits, thereby ensuring that the products P0·W0 and P1·W1 can be represented by 16 bits). Alternatively, it may be directly checked whether each product P0·W0 and P1·W1 can be represented by 16 bits.

Main request

3. It is common ground that D1 might be considered as the closest prior art for the subject-matter of claim 1 (see paragraph 8.2.2 "Decoding process for picture order count" and paragraph 8.4.2.3.2 "Weighted sample prediction process") with equation (8-35) of D1 corresponding to formula (3) of the present application for the special case of LWD = 7, and O0 = O1 = 0 (see

bottom of page 107). As a result, D1 discloses the features of the preamble of claim 1.

3.1 The appellant agreed that the subject-matter of claim 1 is distinguished from D1 in that the weighting coefficient determination step includes:

(i) determining the two weighting coefficients (W0, W1) to be a predetermined value of 1/2 in the case that the generation of the predictive pixel value cannot be performed within a significant bit number of 16 under a condition that a pixel value can be expressed by 8 bits in said predictive pixel value generation step; and

(ii) determining the two weighting coefficients (W0, W1) to be a value calculated by using the scaling parameter in the case that the generation of the predictive pixel value can be performed within a significant bit number of 16 under the condition that a pixel value can be expressed by 8 bits in said predictive pixel value generation step.

3.2 Features (i) and (ii) provide a distinction between cases in which a pixel value can be predicted using formula (3) of the application (see feature (ii) and point 2 above) and cases in which an arithmetic overflow occurs (see feature (i)). In the event of the latter, default weighting factors of 1/2 are assigned to W0 and W1. The distinguishing features ensure that arithmetic overflow does not occur. Hence, the assignment of arbitrary values to the predicted pixel value is avoided.

3.3 In view of these distinguishing features and their associated technical effect, the board considers the objective technical problem as how to generate a

predicted pixel within a predetermined significant bit number being less than or equal to 16 bits using weighted prediction.

3.4 The appellant argued that this formulation of the technical problem provided a pointer to the solution. There were many requirements to be met in moving image coding, such as coding efficiency, transmission quality, etc. The decision to limit the resources for performing the weighted prediction calculations was a decision that favoured the requirement of implementation efficiency over others, e.g. coding efficiency.

The board is not convinced by these arguments. Performing calculations with limited bit width so as to avoid overflow was a common requirement in moving image coding before the relevant date. It is explicitly referred to in the context of the calculations of weighting coefficients in D1 (see the bottom of page 108, last sentence). The appellant counter-argued that this passage referred to explicit weighted prediction which had different requirements from implicit weighted prediction, because the weighting coefficients were transmitted in that case and hence had to be restricted in size. However, the board takes the view that the encoded bitstream is compressed using variable length or arithmetic coding such that weighting coefficients are not transmitted using their original size. In addition, the passage refers explicitly to the calculations and not to the final result.

3.5 Hence, the board considers the formulation of the technical problem to be justified.

3.6 D1 discloses on the bottom of page 107 that the weighting coefficients may be set to a default value of 1/2 (corresponding to 128 for fixed-point calculations). Contrary to the appellant's arguments (see point X, fourth paragraph), this setting is not only chosen if T1 = T0, but also "if one or both reference pictures is a long term reference picture". Hence, on a proper reading of D1, the skilled person would have retrieved the information from D1 that default weighting coefficients of 1/2 should be used if the calculation could not be carried out using equation (8-35).

3.7 As a result, the board holds that the skilled person would have also considered assigning default weights of 1/2 if the determination of weighting coefficients could not be effected in 16 bits.

3.8 It is also noted that the specific weights of 1/2 are only presented as one alternative in the present application (see figure 6, step S507, which assigns values of BWD = 1 and LWD = 0 resulting in P = P1, i.e. weights of 0 and 1). There is no indication that the specific choice of default weighting coefficients represents a purposive selection. It may be argued that calculations with these values can be easily carried out by bit shifting. However, this advantage is well known to the skilled person and applies equally for the alternative weights of 0 and 1.

3.9 Hence, the skilled person would have had no problems to adapt the determination of weighting coefficients using steps (i) and (ii) of claim 1 if it was required to generate a predicted pixel within a predetermined significant bit number being less than or equal to 16 bits using weighted prediction.

3.10 Therefore, the subject-matter of claim 1 was obvious to a person skilled in the art in view of D1 and common general knowledge and thus lacks inventive step (Article 56 EPC 1973).

First auxiliary request

4. Claim 1 of the first auxiliary request additionally specifies that the determination is based on judging whether the value of the scaling parameter is in a predetermined range.

4.1 According to claim 1, the scaling parameter is the ratio of the first time distance (T - T0) to the second time distance (T1- T0). Hence, the scaling parameter is proportional to the weight W0.

4.2 As argued for claim 1 of the main request, D1 discloses limiting the calculation to 16-bit precision for explicit weighted prediction, which is attained by limiting the value of W0 to the interval [-128; 128] (see page 108). Hence, for the same reasons as for the main request, the skilled person would have considered using default values for the weighting coefficients in case of arithmetic overflow, and therefore implicitly for the scaling factor too, if it was required to generate a predicted pixel within a predetermined significant bit number being less than or equal to 16 bits using weighted prediction.

4.3 As a consequence, the subject-matter of claim 1 according to the first auxiliary request does not involve an inventive step (Article 56 EPC 1973).

Conclusion

5. It follows from the above that none of the appellant's requests is allowable. Therefore, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairwoman:

K. Boelicke T. Karamanli

Decision electronically authenticated