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Datasheet for the decision of 8 March 2013

Case Number: T 0763/12 - 3.5.04

Application Number: 06113727.9

Publication Number: 1684530

IPC: H04N7/30, H04N7/34, H04N7/26

Language of the proceedings: EN

Title of invention:
Video coder providing implicit coefficient prediction and scan adaption for image coding and intra coding of video

Applicant:
AT&T Corp.

Relevant legal provisions:
EPC Art. 54(3), 123(2)
EPC 1973 Art. 54(1), 54(2), 56, 76(1), 87(1)

Keyword:
Inventive step - non-obvious alternative
Priority - basis in priority document (yes)
Novelty - (yes)

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Case Number: T 0763/12 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 8 March 2013

Appellant: (Applicant)	AT&T Corp. 32 Avenue of the Americas New York, NY 10013-2412 (US)
Representative:	Suckling, Andrew Michael Marks & Clerk LLP Fletcher House Heatley Road The Oxford Science Park Oxford OX4 4GE (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 September 2011 refusing European patent application No. 06113727.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: F. Edlinger
Members: A. Dumont
T. Karamanli

Summary of Facts and Submissions

I. The appellant appealed against the decision by the examining division refusing European patent application No. 06 113 727.9.

II. The present application claims priority from three applications, the earliest being US patent application:

P1: US 60/026,963 P filed on 20 September 1996.

III. The examining division refused the application on the ground that the subject-matter of the claims of the requests then on file lacked inventive step over the combination of documents:

D4: PLOYSONGSANG A. et al.: "DCT/DPCM Processing of NTSC Composite Video Signal", in IEEE TRANSACTIONS ON COMMUNICATIONS, USA, Vol. COM-30, No.3, March 1982, pages 541 to 549, XP002062314, ISSN 0090-6778,

with one of documents:

D5: US 2,905,756 A;

D6: MUSMANN H.G. et al.: "Advances in Picture Coding", in PROCEEDINGS OF THE IEEE, Vol. 73, No. 4, April 1985, pages 523 to 548, XP002057834, ISSN: 0018-9219;

D7: NETRAVALI A.N. et al.: "Picture Coding: A Review", PROCEEDINGS OF THE IEEE, Vol. 68, No. 3, March 1980, pages 366 to 407, XP002028499, ISSN: 0018-9219;

D8: GRAHAM R.E.: "PREDICTIVE QUANTIZING OF TELEVISION SIGNALS", IRE Wescon, Convention Record, Part 4,

Vol. 2, No. 4, 19 August 1958, pages 147 to 157, XP002051791.

IV. The examining division further commented *obiter* in the decision that, should the earliest priority (P1) not be valid, the subject-matter of the claims might not be novel, in particular in view of documents:

D9: PURI A. et al.: "Improvements in DCT Based Video Coding", PROCEEDINGS OF THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, SPIE, Vol. 3024, 12 February 1997, pages 676 to 688, XP000199866, ISSN: 0277-786X;

D10: ISO/IEC Ad hoc group on MPEG-4 video VM editing: "MPEG-4 Video Verification Model Version 5.0", ISO/IEC JTC1/SC29/WG11, MPEG96/N1469, 1 November 1996, pages 1 to 165, XP000992566;

EP 0 833 520 A2; and

EP 0 863 673 A2.

V. The following further documents were also cited in the proceedings:

D3: TAN T.K. et al.: "Intra Prediction (T9/T10) and DC/AC Prediction Results", ISO/IEC JTC1/SC29/WG11, No. MPEG96/0939, 30 June 1996; XP030030333, ISSN 0000-0331;

D12: GONZALEZ R.C. et al.: "Digital Image Processing", third edition, Prentice Hall, 2008, pages 543, 566 to 573, 580 to 584, 596 to 602 and 621 to 622;

D13: PENNEBAKER W.B.: "JPEG Still Image Data Compression Standard", New York, 1993; two cover pages and pages 29 to 37; 11 pages in total;

D14: printout dated 07—10—2010 of http://mpeg.chiariglione.org/about_mpeg.htm, two pages;

D15: ISO/IEC JTC1/SC 29 N 1963, "Coding of Audio, Picture, Multimedia and Hypermedia Information", 12 March 1997, seven pages.

VI. In a communication under Article 15(1) RPBA annexed to the summons to oral proceedings, the board further raised an objection of lack of inventive step, starting from document D3. The board further expressed doubts about the entitlement to priority from P1 as well as the compliance with Article 76(1) EPC 1973 and Article 123(2) EPC.

VII. Oral proceedings were held jointly on 7 and 8 March 2013 in appeal cases T 0762/12 and T 0763/12, both relating to divisional applications from the same parent European patent application No. 97 307 378.6.

VIII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 4 according to the sole request filed in the oral proceedings on 8 March 2013.

IX. Independent claim 1 reads as follows:

"A method of decoding MPEG-4 video signals associated with a block X of 64 coefficients, the method comprising:
receiving MPEG-4 video signals comprising a plurality of blocks of data, each block comprising a quantised DC residual signal;
identifying a previously decoded block A horizontally adjacent to and left of the block X, a previously decoded block B vertically adjacent to and above the block A, and a previously decoded block C vertically adjacent to and above the block X;

determining a first difference between a quantised DC coefficient of the block A and a quantised DC coefficient of the block B, and determining a second difference between a quantised DC coefficient of the block C and the quantised DC coefficient of the block B,
wherein, if the blocks A and B are outside a video object plane containing the block X, the method comprises assigning a half strength signal value for the quantised DC coefficient of the block A and for the quantised DC coefficient of the block B and using the assigned value for the DC coefficient of the block A and for the DC coefficient of the block B in determining the first difference and the second difference;
if the first difference is less than the second difference, predicting a DC coefficient of the block X from the quantised DC coefficient of the block C, otherwise predicting a DC coefficient of the block X from the quantised DC coefficient of the block A;
identifying the residual signal for the block X from the MPEG-4 video signals; and
generating a DC coefficient for the block X from the predicted DC coefficient of the block X and the residual signal."

X. Independent claim 3 reads as follows:

"A system for decoding MPEG-4 video signals associated with a block X of 64 coefficients, the system configured:
to receive MPEG-4 video signals comprising a plurality of blocks of data, each block comprising a quantised DC residual signal;
to identify a previously decoded block A horizontally adjacent to and left of a block X, a previously decoded

block B vertically adjacent to and above the block A, and a previously decoded block C vertically adjacent to and above the block X;
to determine a first difference between a quantised DC coefficient of the block A and a quantised DC coefficient of the block B, and to determine a second difference between a quantised DC coefficient of the block C and the quantised DC coefficient of the block B, wherein if the blocks A and B are outside a video object plane containing the block X the system is configured to assign a half strength signal value for the quantised DC coefficient of the block A and for the quantised DC coefficient of the block B and the system is configured to use the assigned value for the DC coefficient of the block A and for the DC coefficient of the block B in determining the first difference and the second difference;
if the first difference is less than the second difference, to predict a DC coefficient of the block X from the quantised DC coefficient of the block C, otherwise to predict a DC coefficient of the block X from the quantised DC coefficient of the block A;
to identify the residual signal for the block X from the MPEG-4 video image signals; and
to generate a DC coefficient for the block X from the predicted DC coefficient of the block X and the residual signal."

XI. The reasoning in the decision under appeal as regards lack of inventive step still relevant for amended claim 1 as filed on 8 March 2013 may be summarised as follows:

The decoding method of claim 1 differs from the method known from the closest prior-art document D4 by the neighbouring blocks of data used for predicting the DC

coefficient of block X and by defining a value to be used when block X is at a boundary.

These two differences solve separate technical problems, namely the problems of implementing an alternative block-based predictive decoding method without overhead transmission and implementing the method at the boundary of a video object plane, respectively.

The solution according to claim 1 to the first problem is known in the prior art as Graham's rule (see documents D5 to D8). The skilled person would immediately recognise that the rule is applicable to pixel prediction in the spatial domain as well as to prediction of the DC coefficient in the frequency domain. The separate second problem would necessarily arise for blocks at a boundary of an MPEG-4 object plane. Assigning a half-strength value of 128 is adopted for instance in D2 or D3.

Adopting these solutions in the method of D4 is obvious.

XII. The examining division commented *obiter* in the decision under appeal that the claims were not entitled to the earliest priority from P1, so that documents D9 and D10 deprived their subject-matter of novelty within the meaning of Article 54(1) and (2) EPC. The reasoning as regards entitlement to priority from P1 was taken up by the board in its communication under Article 15(1) RPBA and may be summarised as follows:

P1 describes a very specific method using predicted DC and AC transform coefficients to determine gradients and to predict coefficient DC_X. P1 does not contain

claims. Generalising the specific method disclosed in P1 as applicable to any (unquantised) transform coefficients is not directly and unambiguously derivable from P1. Furthermore, predicting coefficient DC_X "based on a comparison" is also a generalisation of the specific formulas disclosed in P1. Hence the independent claims of the requests on file are not entitled to the priority from P1.

XIII. The examining division further commented *obiter* that documents EP 0 833 520 A2 and EP 0 863 673 A2 might constitute prior-art documents within the meaning of Article 54(3) EPC.

XIV. The further objection under Article 76(1) EPC 1973 and Article 123(2) EPC raised by the board in the annex to the summons to oral proceedings may be summarised as follows:

The parent European patent application discloses assigning a half-strength signal value for the quantised DC coefficient of only blocks A and B, if those blocks are outside a video object plane containing the block X. Assigning that value to block C is not disclosed in the parent application.

XV. The appellant's arguments as regards inventive step may be summarised as follows:

The decoding method of claim 1 differs from the decoding method of the prior art D4 by:

- decoding MPEG-4 signals;
- predicting the DC coefficient based on the result of the comparison of differences between previously decoded DC coefficients;

- assigning a particular value at the left boundary of a video object plane.

The technical problem formulated in the appealed decision contains a pointer to the solution ("without overhead transmission") and should be formulated more generally as providing an alternative block-based coding scheme.

D4 relies on decorrelation (see also D12 and D13). The DC coefficient of one subblock only represents the average intensity of that subblock and thus does not represent the average intensity of spatially adjacent pixels, whereas D5 relies on spatial correlation between adjacent pixels. D4 and D5 are thus fundamentally incompatible.

DC coefficient prediction is based in D4 on a subblock to be predicted and four neighbouring subblocks and requires to transmit overhead information. The skilled person would not have considered selecting a less accurate method, such as Graham's rule, which uses only values of previously received adjacent pixels and does not require overhead transmission.

In conclusion, there was no incentive at the filing date of the present application to apply Graham's rule to subblock processing. As a result, the subject-matter of claim 1 is inventive starting from D4.

D5, not D4, should be regarded as the closest prior art. However, each individual pixel of D5 cannot be regarded as a block of size 1x1. The method of claim 1 is thus also inventive starting from D5.

D3 appears to have been submitted for confidential consideration at the July 1996 Tampere MPEG meeting. D3 is dated "July 1996" and the decision under appeal refers to D3 as made available to the public on "30 June 1996". As explained in documents D14 and D15, at least some of the documents of the MPEG working group are restricted to MPEG members or might be post-published. Neither the examining division nor the board has provided evidence of the date on which D3 became available to the public. Thus D3 should be excluded from further consideration.

The amended claims are entitled to priority from P1. Thus their subject-matter is novel over the prior art cited *obiter* in the decision under appeal. The amended claims also comply with both Article 76(1) EPC 1973 and Article 123(2) EPC.

Reasons for the Decision

1. The appeal is admissible.

2. Article 76(1) EPC 1973 and Article 123(2) EPC

Present claims 1 and 3 were amended to set out that the quantised DC coefficient of blocks A and B are assigned a half-strength signal value when outside a video object plane containing block X, as disclosed in the paragraph bridging pages 7 and 8 in the description of both the parent application as filed and the present application as filed. The objection under Article 76(1) EPC 1973 and Article 123(2) EPC raised by the board thus does not apply to the amended present claims.

3. Inventive step (Article 56 EPC 1973)

3.1 Document D4 is in the board's view closer to the invention than D5 since D4 relates to a hybrid DCT/DPCM decoding method as the method of claim 1. Each 4x12 block in the frequency (DCT) domain is divided into three 4x4 subblocks (see Figures 3 and 4). The DC coefficient associated with a subblock X is predicted based on a comparison with coefficients of previously decoded subblocks neighbouring subblock X. Contrary to the present invention, D4 requires to transmit overhead information ("directional bits") together with the video signals in order to determine which of the neighbouring subblocks is to be used for prediction.

3.2 The method of D4 and the method of claim 1 differ (*inter alia*) by the prediction scheme for the DC coefficient. The objective technical problem may thus be generally formulated as providing an alternative prediction scheme for a block-based decoding method.

3.3 Graham's rule according to D5 exploits the expected correlation between pixels, in particular in small (contiguous) picture regions, to predict the value of a picture element, thereby achieving compression without overhead transmission (see D5, column 1, lines 28 to 37 and column 5, lines 1 to 10). Further documents also refer to Graham's rule in the spatial (pel) domain (see D6, section "B. Adaptive Prediction" on pages 533 and 534; D7, Figure 28 and the corresponding description on page 382; and D8, section "Nonlinear Predictor" on pages 149 and 150).

3.4 On the one hand, orthogonal transformation into the frequency domain (for instance by discrete Fourier transform DFT in D12; or by discrete cosine transform DCT in D13 or in the MPEG-4 standard) aims to

decorrelate transform coefficients within a block (see D12, second paragraph of section 8.2.8 on page 566; and D13, first paragraph on page 29). On the other hand, prediction following Graham's rule essentially relies on correlation between neighbouring blocks (see D4, page 544, left-hand column, first paragraph).

3.5 The DC coefficient in the frequency domain, which corresponds to the average intensity of a subblock (see D4, page 542, right-hand column, last paragraph), does not directly correspond to a spatially adjacent block of pixels in D4 as in the present invention, where adjacent 64x64 blocks in the frequency domain directly correspond to spatially adjacent blocks of 64x64 pixels, and where a DC coefficient thus directly corresponds to the average intensity of the corresponding adjacent blocks of pixels. Consequently, D4, by dividing blocks into subblocks prior to prediction, blurs the correspondence between DC coefficients in the frequency domain and corresponding adjacent picture regions, or their average intensity, in the spatial domain.

3.6 As a result, the board is not convinced by the reasoning in the decision under appeal that the skilled person would have readily envisaged replacing the DC prediction method according to D4 by the alternative method following Graham's rule known exclusively in the pixel domain. Consequently, the subject-matter of claim 1 is found to involve an inventive step over a combination of D4 with any one of documents D5 to D8.

3.7 Document D3 relates to the proposal by the working group (ISO/IEC JTC1/SC29/WG11) responsible for the MPEG-4 standard. D3 is dated "July 1996", which is the date of the Tampere meeting of the working group.

According to D14, such a working group is usually a large group of experts from companies and organisations. However, the board cannot determine without further investigations whether the members of the particular working group for the MPEG-4 standard can be regarded as members of the public or whether they were bound to confidentiality. According to D14 and D15 (section "2 Media"), not all documents are published during a meeting, and some documents might be published after the meeting. In view of the available evidence, the board cannot determine whether D3 was made public during that meeting or at a later date preceding the priority date of the present application, i.e. 20 September 1996. As a result, since there is insufficient evidence on file for the public availability of D3 before the relevant date of the present application, the board decides to disregard D3 in the present appeal proceedings.

4. Entitlement of the claims to priority from P1

4.1 Amended claim 1 specifies the essential features of the adaptive DC prediction in a method of decoding MPEG-4 video signals. It expressly sets out that the DC coefficients DC_A, DC_B and DC_C used in the steps of determining the first and second differences are quantised. The predicted coefficient DC_X of claim 1 is calculated according to the formulas in sections 2.1 and 2.2 of P1 and the DC coefficient is generated from the predicted coefficient DC_X and the residual signal (see also Figures 1(b) and 2(b) of P1). The amendment thus has a direct basis in P1.

4.2 Amended claim 1 sets out a step of predicting DC_X "from" either DC_C or DC_A. This constitutes in the board's view a wording derivable from, and covering, both

alternatives disclosed in the formulas in sections 2.1 and 2.2 of P1, read together with the passage (page 2, lines 6 to 8) mentioning prediction "from the horizontally adjacent or from vertically adjacent previous block". The amendment thus has a direct basis in P1.

4.3 Thus the board is convinced that the objections raised in the communication under Article 15(1) RPBA and those expressed *obiter* in the decision under appeal have been overcome by amended claim 1. The board is satisfied that the subject-matter of amended claim 1 is directly and unambiguously derivable from P1.

4.4 Independent apparatus claim 3 was amended accordingly, in particular with the coefficients DC_A, DC_B and DC_C being quantised and with DC_X being predicted from either DC_C or DC_A.

4.5 The board is also satisfied that the features of the dependent claims are directly and unambiguously derivable from P1.

4.6 In conclusion, the subject-matter according to claims 1 to 4 and the subject-matter according to the earliest priority document P1 relate to "the same invention" within the meaning of Article 87(1) EPC 1973. Those claims thus enjoy the right to priority from P1.

5. Novelty (Article 54(1) EPC 1973)

5.1 Since the claims are entitled to priority from P1, they enjoy a priority date, within the meaning of Article 89 EPC 1973, of 20 September 1996. Since documents D9 and D10 were published after that date, they are not

comprised in the state of the art within the meaning of Article 54(2) EPC 1973.

5.2 Since the European patent application published as EP 0 833 520 A2 was filed on 30 September 1996 and the European patent application published as EP 0 863 673 A2 was filed at the earliest on 7 March 1997, those European patent applications are not comprised in the state of the art documents within the meaning of Article 54(3) EPC.

5.3 No further objection was raised under Article 54(1) EPC 1973 in the proceedings. The board is also satisfied that the subject-matter of the claims is novel over the prior-art documents on file.

6. Further prosecution

In view of the above the board considers that the reasons for refusing the present application, even taking account of the further comments made by the examining division, have been overcome by the amended claims, at least in so far as the available documents belong to the state of the art. However, the issue of methods for decoding MPEG-4 signals has arisen for the first time in the appeal proceedings because of the amended claims. Since this issue was not examined by the examining division, the board remits the case to it for further prosecution.

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 for further prosecution.

The Registrar: The Chairman:

K. Boelicke F. Edlinger

Decision electronically authenticated