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Datasheet for the decision
of 27 June 2019

Case Number:	T 1690/13 - 3.5.04
Application Number:	01931769.2
Publication Number:	1282982
IPC:	H04N7/36
Language of the proceedings:	EN

Title of invention:
Method for encoding and decoding video information, a motion
compensated video encoder and a corresponding decoder

Applicant:
Nokia Technologies Oy

Headword:

Relevant legal provisions:
EPC 1973 Art. 56, 84

Keyword:
Claims - clarity after amendment (yes)
Inventive step - (yes)

Decisions cited:

EPA Form 3030

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It can be changed at any time and without notice.

Catchword:

Case Number: T 1690/13 - 3.5.04

**D E C I S I O N
of Technical Board of Appeal 3.5.04
of 27 June 2019**

Appellant:	Nokia Technologies Oy
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	02610 Espoo (FI)

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Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 19 February 2013 refusing European patent application No. 01931769.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	C. Kunzelmann
Members:	R. Gerdes
	B. Müller

Summary of Facts and Submissions

I.   The appeal is against the decision to refuse European
        patent application No. 01 931 769.2, published as
        international application WO 01/86962 A1.

II.   The examining division refused the patent application
        on the grounds that claim 1 of the main request and
        each of the first to fourth auxiliary requests did not
        meet the requirements of Article 84 EPC and that the
        subject-matter of these claims lacked inventive step
        (Article 56 EPC) in view of document:

        D3:   Zhang, Kui et al.: "Image sequence coding using
               multiple-level segmentation and affine motion
               estimation", IEEE Journal on selected areas in
               communications, vol. 15, no. 9, December 1997,
               pages 1704 to 1713, XP002946366.

III.   The applicant filed notice of appeal against this
        decision and, with its statement of grounds of appeal,
        submitted claims of a new main request and first to
        third auxiliary requests.

IV.   The board issued a communication pursuant to
        Rule 100(2) EPC indicating that it disagreed with the
        objections in the decision under appeal. However, the
        board raised several objections as to lack of clarity
        and added subject-matter. It noted that as far as the
        claims could be understood, their subject-matter seemed
        to involve an inventive step.

V.   The appellant replied by letter dated 12 April 2019 to
        the board's communication. It submitted amended claims
        according to a main request and a first auxiliary

request and withdrew its second and third auxiliary
requests.

VI.   In response to telephone conversations held on
        29 May 2019 and 14 June 2019, the appellant submitted
        amended claims of the main request and amended
        description pages.

VII.   The appellant's final requests are that the decision
        under appeal be set aside and that the case be remitted
        to the examining division with instructions to grant a
        patent on the basis of the claims of the main request
        filed on 17 June 2019 (labelled "MAIN REQUEST amended
        on 14 June 2019") or of the first auxiliary request
        filed with the letter dated 12 April 2019.

VIII.   The independent claims of the main request read as
        follows:

        "1. A method for encoding video information,
        comprising:
        - defining (401) a certain number of available
        macroblock segmentations (70, 71, 72, 83, 84, 85) that
        specify possible ways in which a macroblock can be
        segmented into blocks,
        - defining a certain finite number of available
        macroblock-segmentation - prediction-method pairs (70A,
        70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C,
        72D, 83, 84, 85) by defining (402) for each available
        macroblock segmentation (70, 71, 72, 83, 84, 85) at
        least one available prediction method as a
        predetermined subset of possible prediction methods
        (60A, 60B, 60C, 60D) in dependence of a respective
        available macroblock segmentation (70, 71, 72, 83, 84,
        85), wherein each available prediction method (60A,
        60B, 60C, 60D) defines for each block of a macroblock

one or more associated prediction blocks used in producing a prediction motion coefficient for a respective block of the macroblock, and

an associated method for deriving the prediction motion coefficient for said respective block of the macroblock from motion coefficients of said one or more associated prediction blocks,

- segmenting (403) a frame of video information into macroblocks,

- selecting (411) for a macroblock one of the available macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85), wherein the selection of the macroblock-segmentation - prediction-method pair is based on minimizing a cost function and

- segmenting the macroblock into blocks and deriving prediction motion coefficients for the blocks within said macroblock using the selected macroblock-segmentation - prediction-method pair (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85).

...

26. A method for decoding encoded video information, characterized in that it comprises:

- defining (501) a certain number of available macroblock segmentations (70, 71, 72, 83, 84, 85) that specify possible ways in which a macroblock can be segmented into blocks,

- defining a certain finite number of available macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) by defining (502) for each available macroblock segmentation (70, 71, 72, 83, 84, 85) at least one available prediction method as a predetermined subset of possible prediction methods (60A, 60B, 60C, 60D) in dependence of a respective

available macroblock segmentation (70, 71, 72, 83, 84, 85), wherein each available prediction method (60A, 60B, 60C, 60D) defines for each block of a macroblock
    one or more associated prediction blocks used in producing a prediction motion coefficient for a respective block of the macroblock, and
    an associated method for deriving the prediction motion coefficient for said respective block of the macroblock from motion coefficients of said one or more associated prediction blocks,
- receiving (503) information indicating at least a macroblock segmentation (70, 71, 72, 83, 84, 85) selected for a macroblock in said encoded video information, and
- determining (505) a prediction method relating to the macroblock segmentation (70, 71, 72, 83, 84, 85) of said macroblock with reference to the defined macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) and deriving prediction motion coefficients for blocks within said macroblock using the determined prediction method.
...
32. An encoder for performing motion compensated encoding of video information, comprising:
- means for receiving a frame of video information,
- means (111) for segmenting the frame of video information into macroblocks,
- means (112) for specifying a certain number of available macroblock segmentations (70, 71, 72, 83, 84, 85) that define possible ways in which a macroblock can be segmented into blocks,
- means (122) for specifying a certain finite number of available macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) by defining at least

one available prediction method for each available
macroblock segmentation (70, 71, 72, 83, 84, 85) as a
predetermined subset of possible prediction methods
(60A, 60B, 60C, 60D) in dependence of a respective
available macroblock segmentation (70, 71, 72, 83, 84,
85), wherein each available prediction method (60A,
60B, 60C, 60D) defines for each block of a macroblock
        one or more associated prediction blocks used in
producing a prediction motion coefficient for a
respective block of the macroblock, and
        an associated method for deriving the prediction
motion coefficient for said respective block of the
macroblock from motion coefficients of said one or more
associated prediction blocks,
- means (125) for selecting one macroblock-segmentation
- prediction method pair (70A, 70B, 70C, 70D, 71A, 71B,
71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) among
the available macroblock-segmentation - prediction
method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D,
71E, 72A, 72B, 72C, 72D, 83, 84, 85), wherein the
selection of the macroblock-segmentation - prediction-
method pair is based on minimizing a cost function,
- means for segmenting a macroblock using the
macroblock segmentation (70, 71, 72, 83, 84, 85)
specified by the selected macroblock-segmentation -
prediction-method pair (70A, 70B, 70C, 70D, 71A, 71B,
71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85), and
- means (123) for deriving macroblock-segmentation-
specific prediction motion coefficients for blocks
within said macroblock using the prediction method
specified by the selected macroblock-segmentation -
prediction-method pair (70A, 70B, 70C, 70D, 71A, 71B,
71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85).
...
34. A decoder for performing motion compensated
decoding of encoded video information, comprising:

- input means for receiving encoded video information,
- means for defining a certain number of available
macroblock segmentations (70, 71, 72, 83, 84, 85) that
specify possible ways in which a macroblock can be
segmented into blocks,
- means for specifying a certain finite number of
available macroblock-segmentation - prediction-method
pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E,
72A, 72B, 72C, 72D, 83, 84, 85) by defining at least
one available prediction method for each available
macroblock segmentation (70, 71, 72, 83, 84, 85) as a
predetermined subset of possible prediction methods
(60A, 60B, 60C, 60D) in dependence of a respective
available macroblock segmentation (70, 71, 72, 83, 84,
85), wherein each available prediction method (60A,
60B, 60C, 60D) defines for each block of a macroblock
    one or more associated prediction blocks used in
producing a prediction motion coefficient for a
respective block of the macroblock, and
    an associated method for deriving the prediction
motion coefficient for said respective block of the
macroblock from motion coefficients of said one or more
associated prediction blocks,
- input means for receiving information indicating at
least the macroblock segmentation (70, 71, 72, 83, 84,
85) selected for a macroblock,
- means (132) for determining the prediction-method
relating to the segmentation of the macroblock with
reference to the defined macroblock-segmentation -
prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B,
71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85), and
- means (131) for deriving prediction motion
coefficients for blocks within said macroblock using
the determined prediction method.
...

39. A computer program element for performing motion compensated encoding of video information, comprising:
- means for receiving a frame of video information,
- means (111) for segmenting the frame of video information into macroblocks,
- means (112) for specifying a certain number of available macroblock segmentations (70, 71, 72, 83, 84, 85) that define possible ways in which a macroblock can be segmented into blocks,
- means (122) for specifying a certain finite number of available macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) by defining at least one available prediction method for each available macroblock segmentation (70, 71, 72, 83, 84, 85) as a predetermined subset of possible prediction methods (60A, 60B, 60C, 60D) in dependence of a given available macroblock segmentation (70, 71, 72, 83, 84, 85), wherein each available prediction method (60A, 60B, 60C, 60D) defines for each block of a macroblock

    one or more associated prediction blocks used in producing a prediction motion coefficient for a respective block of the macroblock, and

    an associated method for deriving the prediction motion coefficient for said respective block of the macroblock from the motion coefficients of said one or more associated prediction blocks,
- means (125) for selecting one macroblock-segmentation - prediction method pair (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) among the available macroblock-segmentation - prediction method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) wherein the selection of the macroblock-segmentation - prediction-method pair is based on minimizing a cost function,

- means for segmenting a macroblock using the macroblock segmentation (70, 71, 72, 83, 84, 85) specified by the selected macroblock-segmentation - prediction-method pair (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85), and
- means (125) for deriving macroblock-segmentation- specific prediction motion coefficients for blocks within said macroblock using the prediction method specified by the selected macroblock-segmentation - prediction-method pair (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85).
...
41. A computer program element for performing motion compensated decoding of encoded video information, comprising:
- input means for receiving encoded video information,
- means for defining a certain number of available macroblock segmentations (70, 71, 72, 83, 84, 85) that specify possible ways in which a macroblock can be segmented into blocks,
- means for specifying a certain finite number of available macroblock-segmentation - prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85) by defining at least one available prediction method for each available macroblock segmentation (70, 71, 72, 83, 84, 85) as a predetermined subset of possible prediction methods (60A, 60B, 60C, 60D) in dependence of a given available macroblock segmentation (70, 71, 72, 83, 84, 85), wherein each available prediction method (60A, 60B, 60C, 60D) defines for each block of a macroblock

   one or more associated prediction blocks used in producing a prediction motion coefficient for a respective block of the macroblock, and

   an associated method for deriving the prediction motion coefficient for said respective block of the

macroblock from the motion coefficients of said one or
more prediction blocks,
- input means for receiving information indicating at
least the macroblock segmentation (70, 71, 72, 83, 84,
85) selected for a macroblock,
- means (132) for determining the prediction-method
relating to the segmentation of the macroblock with
reference to the defined macroblock-segmentation -
prediction-method pairs (70A, 70B, 70C, 70D, 71A, 71B,
71C, 71D, 71E, 72A, 72B, 72C, 72D, 83, 84, 85), and
- means (131) for deriving prediction motion
coefficients for blocks within said macroblock using
the determined prediction method."

Further claims 2 to 25, 27 to 31, 33 and 35 to 38, 40
and 42 to 49 are dependent on claims 1, 26, 32, 34, 39
and 41, respectively. The wording of the claims of the
auxiliary request is of no relevance to this decision.

IX.   In the decision under appeal, the examining division
      held that then valid claim 1 of the main request was
      not clear (see Reasons, points 3.1.1.2 and 3.3.1). In
      particular, the examining division argued that:

      (a) the term "subset" did not limit the ways in which a
          macroblock segmentation might occur, and

      (b) it was unclear whether any specific criteria needed
          to be adhered to in order to obtain a subset.

      (c) Claim 1 also did not solve the problem posed by the
          applicant. Such inconsistency between the claims
          and description cast doubt on the matter for which
          protection was sought.

Based on these objections, the examining division
considered the "defining" step in claim 1 as unclear
and technically meaningless. The examining division
acknowledged that D3 did not disclose pairs of
macroblock segmentations and prediction methods.
However, since the claim allowed for the interpretation
that a single prediction method was assigned to each
macroblock segmentation, the pairing was - in the
absence of any details regarding the limitations
thereto - obvious (see decision under appeal, Reasons,
points 3.2 and 3.3.2).

Reasons for the Decision

1.   The appeal is admissible.

The invention

2.   The present invention relates to motion compensated
        prediction in video coding.

2.1   Motion compensated prediction utilises the fact that,
        in a typical video sequence, image intensity values in
        a particular frame segment can be predicted using image
        intensity values of a segment in another already coded
        and transmitted frame, given the motion vector between
        these two segments. Hence, video data can be compressed
        by coding motion vector coefficients representing
        motion vectors instead of image intensity values (see
        present application as published, page 1, lines 4 and 5
        and page 2, lines 16 to 30).

        In order to further minimise the amount of information
        needed in sending the video frames to a decoder, the
        motion vector coefficients can themselves be predicted

from the coefficients of neighbouring segments, which
have been previously coded. When this kind of motion
prediction is used, a motion vector is expressed as a
sum of a predicted motion vector and a refinement
motion vector. Only the refinement motion vector
coefficients need to be coded and transmitted to the
decoder because the predicted motion vector can be
predicted from the coefficients of the neighbouring
segments in the decoder in the same way as in the
encoder. This approach typically results in
transmission bit rate savings (see page 5, lines 4
to 17).

Motion vectors are not computed for every pixel.
Instead, the image is divided into macroblocks, which
are further segmented in blocks. Motion vectors are
then determined for each block. There may be many
possible ways to segment a macroblock and many
different methods of how to predict the motion
coefficients of a specific block from those of
neighbouring blocks. As a consequence, the calculation
of an optimal segmentation together with an optimal
prediction method is computationally complex (see
page 6, lines 23 to 30 and page 7, lines 5 to 34).

2.2   The inventive idea of the application is to form pairs
        of macroblock segmentations and prediction methods,
        such that only a limited number of prediction methods
        are available for each macroblock segmentation. By
        restricting the number of possible prediction methods
        per macroblock segmentation to a subset of all possible
        pairs, the complexity of the encoding process is
        reduced. The search for an optimal combination is
        restricted to these allowed pairs, and the pair
        minimising a cost function is chosen for determining

the motion coefficients (see page 9, line 32 to
page 10, line 23).

Main request, amendments (Article 123(2) EPC)

3.   The claims of the present main request are based on the
          claims of the first auxiliary request underlying the
          decision under appeal. Compared with claim 1 of the
          latter request, present claim 1 has been reformulated
          to specify more clearly the step of defining pairs of
          macroblock segmentations and prediction methods. The
          reformulation of claim 1 is based on page 9, line 31 to
          page 10, line 14 of the application as published. The
          further independent claims, namely claims 26, 32, 34,
          39 and 41, have been amended to correspond to claim 1.
          In addition, dependent claims 2 and 3 have been amended
          based on claims 2 and 3 of the application as
          published. Claims 28, 37 and 40 now refer to "at least
          two macroblock segmentation - prediction methods",
          whose basis is found in claim 28 as published.

          Hence, the board finds that the claims of the
          appellant's main request do not contain subject-matter
          extending beyond the content of the application as
          filed and that they thus comply with Article 123(2)
          EPC.

Main request, clarity (Article 84 EPC 1973)

4.   In the decision under appeal, the examining division
          argued that then valid claim 1 lacked clarity (see
          point IX above).

4.1   In particular, the examining division objected that

(a) the term "subset" did not limit the ways in which a macroblock segmentation might occur, and

(b) it was unclear whether any specific criteria needed to be adhered to in order to obtain a subset.

(c) Claim 1 also did not solve the problem posed by the applicants. Such inconsistency between the claims and description cast doubt on the matter for which protection was sought.

4.2   The interpretation of claim 1 by the examining division in (a) is tantamount to stating that the "defining" step in claim 1 is technically meaningless. This applies when subsets contain <u>all</u> possible pairs of macroblock segmentations and prediction methods. Furthermore, this argument implies that the step of "defining a certain finite number of ... pairs" is only a mental step, or at least, it is unclear what technical limitations are conveyed by the definition of pairs.

4.3   The board is of the opinion that this interpretation of claim 1 can be ruled out on a proper reading of the claim. It would not be technically meaningful to define subsets that contain all pairs.

4.4   More importantly, the board considers the step of "defining a certain finite number of ... pairs" to imply a technical limitation, which goes beyond a simple (mental) assignment of prediction methods to macroblock segmentations. The "available" pairs are used in the further method step of "selecting (411) for a macroblock one of the available macroblock-segmentation - prediction-method pairs". In order to be selectable, the available pairs have to be represented

using technical means in a corresponding encoder or encoding program. The "predetermined subset" of prediction methods in dependence on available macroblock segmentations could, for example, be represented in the form of a table mapping macroblock-segmentations to corresponding prediction methods in the internal storage of the encoder. Other representations are possible, but the predetermined subsets have to be stored in an encoder carrying out the method of claim 1 in order to retrieve the possible prediction methods for a certain macroblock segmentation.

4.5   Hence, the board considers objection (a) as not justified.

4.6   Regarding objection (b), the board is convinced that the skilled person in the technical field of video coding would have realised that possible pairs could be identified, for example, by carrying out statistical analyses to figure out which pairs are mostly used in an unrestricted encoder having no limitation on the pairs of macroblock segmentations and prediction methods. Hence, the skilled person would have been in a position to obtain meaningful subsets.

4.7   As a consequence of the above and contrary to objection (c), the subject-matter of claim 1 also solves the problem posed by the applicant.

4.8   Hence, the board is not convinced by the objections in the decision under appeal with respect to the then valid set of claims. The board also sees no other lack of clarity in the claims.

Main request, inventive step

5.   It is common ground that D3 may be considered as the
          closest prior art with respect to the claimed subject-
          matter.

5.1   D3 relates to a low bit-rate video codec that employs
          multiple-level segmentation and affine motion
          compensation. The video codec of D3 uses variable block
          size motion compensation (see abstract and
          chapter II.C). D3 is based on the realisation that for
          objects undergoing coherent movement and being divided
          into a number of blocks, it is likely that neighbouring
          blocks have the same motion vectors. In order to reduce
          the data for image data transmission, it is sufficient
          to indicate which of the neighbouring blocks moves with
          the same motion as the current block or minimises an
          error criterion. If a suitable neighbouring block is
          detected, no motion vectors need to be transmitted.
          Instead, the location of that neighbouring block is
          coded. Furthermore, in a situation where no good match
          between the velocity of the neighbouring blocks and the
          current block can be detected, a reference velocity is
          determined using the median of the velocity of the
          first block to the left, the velocity of the first
          block on the top, and the velocity of the first block
          on the top-right corner. The velocity difference
          between the current block and the reference velocity is
          then encoded using variable length coding (see
          chapter III.B).

5.2   D3 does not disclose defining pairs of macroblock
          segmentations and prediction methods, as specified in
          claim 1. Instead, it compares the motion vectors of the
          current block with those of neighbouring blocks and -
          if need be - with the reference motion vector being

computed as the median of the motion vectors of neighbouring blocks. Consequently, D3 also does not disclose the selecting step of claim 1, which selects one of the available macroblock-segmentation prediction-method pairs.

5.3   The distinguishing features have the technical effect of reducing the complexity of the encoding process and increasing flexibility by allowing preselection of optimal pairs between macroblock segmentations and prediction methods.

5.4   Hence, these features solve the technical problem of how to reduce the complexity and increase the flexibility of the encoding process in motion compensated prediction.

5.5   None of the cited documents discloses a relationship being formed between macroblock segmentations and prediction methods, let alone organising them in pairs. Also, there is no indication on file that a person skilled in the art would form such a relationship in an obvious manner on the basis of common general knowledge. The realisation that a prediction method may be selected in dependence on the macroblock segmentation allows the determination of combinations of pairs of macroblock segmentations and prediction methods that achieve near optimal results in terms of the selected cost function and reduce the computational load on the encoder.

5.6   As a consequence of the above, the subject-matter of claim 1 involves an inventive step in view of the available state of the art.

5.7   The same reasoning applies to independent claim 26,
       which specifies a method for decoding using steps
       corresponding to those of the encoding method of
       claim 1. Similarly, independent claims 32 and 34
       relating to an encoder and a decoder, respectively,
       specify the devices corresponding to the methods of
       claims 1 and 26. Claims 39 and 41 define computer
       program elements for encoding and decoding
       corresponding to the methods of claims 1 and 26.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent in the following version:

Description:
- pages 1 to 7, 13 to 17 and 19 to 23 as published
- pages 8 and 10 to 12 filed by telefax on 24 February 2009
- pages 9, 18 and 24 filed in electronic form on 3 June 2019

Claims:
      Nos. 1 to 49 filed in electronic form on 17 June 2019

Drawings:
      Sheets 1/8 to 8/8 as published.

The Registrar: The Chairman:

K. Boelicke   C. Kunzelmann

Decision electronically authenticated