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**Datasheet for the decision
of 8 June 2017**

Case Number: T 2249/12 - 3.5.04

Application Number: 02738883.4

Publication Number: 1404136

IPC: H04N7/26, H04N7/32, H04N7/46,
                            H04N7/50

Language of the proceedings: EN

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

Applicant:
NTT DoCoMo, Inc.

Headword:

Relevant legal provisions:
EPC 1973 Art. 84, 56
EPC Art. 123(2)

Keyword:

Claims - clarity - main request, first to fifth auxiliary requests (no)

Amendments - extension beyond the content of the application as filed - sixth auxiliary request (yes)

Inventive step - amended sixth auxiliary request (no) - seventh auxiliary request (yes)

Decisions cited:

Catchword:

Case Number: T 2249/12 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 8 June 2017

Appellant:	NTT DoCoMo, Inc.
(Applicant)	11-1, Nagatacho 2-chome,
	Chiyoda-ku
	Tokyo 100-6150 (JP)

Representative:	Viering, Jentschura & Partner mbB
	Patent- und Rechtsanwälte
	Am Brauhaus 8
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Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 24 May 2012 refusing European patent application No. 02738883.4 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 directed against the decision to refuse
        European patent application No. 02 738 883.4.

II.   The patent application was refused on the grounds that
        the independent claims of all requests then on file did
        not comply with Article 84 EPC, and that the claimed
        subject-matter did not involve an inventive step within
        the meaning of Article 56 EPC in view of documents

        D1:   US 5 126 841 A and
        D4:   VCEG-M81: "H.26L Test Model Long-Term Number 7"
        13th VCEG MEETING; 2-4 April 2001; Austin, Texas, US;
        (Videocoding experts group of ITU-T SG. 16), no. VCEG-
        M81d0, 11 May 2001, XP030003250, ISSN: 0000-0461.

III.   The applicant appealed against this decision and with
        the statement of grounds of appeal submitted claims of
        a main request and of first to ninth auxiliary
        requests. It submitted that the claims of the main and
        the first to fifth auxiliary requests were identical to
        the requests underlying the decision under appeal.

IV.   The board issued a summons to oral proceedings and
        indicated in a communication annexed to the summons
        that it considered claims 1 of the main and first to
        fifth auxiliary requests to be unclear. With respect to
        claim 1 of the sixth auxiliary request the board raised
        inter alia an objection under Article 123(2) EPC and
        indicated that the subject-matter of the independent
        claims of the sixth auxiliary request lacked inventive
        step in view of D1 combined with D4.

V.   In a letter of reply dated 3 May 2017 the appellant
        provided arguments addressing the board's observations

and submitted claims of a tenth, an eleventh and a
twelfth auxiliary request.

VI.   Oral proceedings before the board were held on 8 June
        2017. During the oral proceedings the appellant
        submitted claims 1 to 17 of an Amended Sixth Auxiliary
        Request and claims 1 to 18 of a Seventh Auxiliary
        Request named "Amended Auxiliary Request 7". 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 the First to Sixth Auxiliary
             Requests, all filed with the statement of grounds
             of appeal, or
        -    the Amended Sixth Auxiliary Request filed during
             the oral proceedings of 8 June 2017, or
        -    the Seventh Auxiliary Request filed during the oral
             proceedings of 8 June 2017.

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

        "An image coding apparatus, characterized by
        comprising:

        motion compensation predicting means for generating a
        motion-compensated prediction image by detecting
        movement amounts in predetermined partial image region
        units of an input image;

        smoothing means for performing smoothing of pixels
        located at the boundaries of adjoining partial image
        regions on the basis of predetermined evaluation
        criteria, with respect to the prediction image obtained
        by the motion compensation predicting means; and

prediction residual coding means for coding the
prediction residual signal obtained from the difference
between the input image and the smoothed prediction
image; wherein the smoothing means comprise

activity level setting means for determining the
activity level between the adjoining partial image
regions on the basis of a difference in coding mode
indicating inter coding or intra coding between the
adjoining partial image regions;

adaptive smoothing means for establishing the intensity
of the smoothing on the basis of the activity level and
then performing smoothing of pixels located at the
boundaries between the partial image regions."

VIII.   Claim 1 of the first auxiliary request contains the
        following additional feature appended to claim 1 of the
        main request:

        "..., wherein the pixels targeted for smoothing are
        changed in accordance with the activity level."

IX.   Claim 1 of the second auxiliary request corresponds to
        claim 1 of the main request, but with a deletion in the
        feature relating to the activity level setting means
        (shown by strikethrough below):

        "... activity level setting means for determining the
        activity level between the adjoining partial image
        regions on the basis of a difference in coding mode
        ~~indicating inter coding or intra coding~~ between the
        adjoining partial image regions;".

X.   Claim 1 of the third auxiliary request contains the
        following additional feature appended to claim 1 of the
        main request:

        "...; and post-processing means for performing
        suppression processing of the results of smoothing by
        means of a threshold value established in accordance
        with the activity level wherein the differential values
        between the pixel values before the smoothing and the
        pixel values after the smoothing are controlled by
        means of the threshold value."

XI.   Claim 1 of the fourth auxiliary request contains the
        following additional feature appended to claim 1 of the
        third auxiliary request:

        "... wherein the threshold is the maximum permissible
        differential value and in cases where the differential
        value between a pixel value before the smoothing and a
        pixel value after the smoothing is equal to or more
        than the threshold value, the pixel value after the
        smoothing is corrected to diminish the differential
        value in accordance with the size of the threshold
        value."

XII.   Claim 1 of the fifth auxiliary request corresponds to
        claim 1 of the second auxiliary request with the
        additional feature of claim 1 of the third auxiliary
        request appended to it.

XIII.   Claim 1 of the sixth auxiliary request reads as
        follows:

        "An image coding apparatus, characterized by
        comprising:

motion compensation predicting means for generating a
motion-compensated prediction image by detecting
movement amounts in predetermined partial image region
units of an input image;

smoothing means for performing smoothing of pixels
located at the boundaries of adjoining partial image
regions on the basis of predetermined evaluation
criteria, with respect to the prediction image obtained
by the motion compensation predicting means; and

prediction residual coding means for coding the
prediction residual signal obtained from the difference
between the input image and the smoothed prediction
image; wherein the smoothing means comprise

activity level setting means for determining the
activity level of one or more of the adjoining partial
image regions depending on whether respective coding
modes for the adjoining partial images indicate inter
coding or intra coding;

adaptive smoothing means for changing a number of
pixels subjected to smoothing across a boundary between
the partial image regions in accordance with the
activity levels obtained by the activity level setting
means and for then performing smoothing of said number
of pixels; and

post-processing means for performing suppression
processing of the results of smoothing by means of a
threshold value established in accordance with the
activity levels, wherein the differential values
between the pixel values before the smoothing and the
pixel values after the smoothing are controlled by
means of the threshold value, wherein the threshold is

the maximum permissible differential value, and in
cases where the differential value between a pixel
value before the smoothing and a pixel value after the
smoothing is equal to or more than the threshold value,
the pixel value after the smoothing is corrected to
diminish the differential value in accordance with the
size of the threshold value."

XIV.   Claim 1 of the amended sixth auxiliary request reads as
        follows (additions to the sixth auxiliary request
        indicated by underlining, deletions by strike-through):

        "An image coding apparatus, characterized by
        comprising:

        motion compensation predicting means for generating a
        motion-compensated prediction image by detecting
        movement amounts in predetermined partial image region
        units of an input image;

        smoothing means for performing smoothing of pixels
        located at the boundaries of adjoining partial image
        regions on the basis of predetermined evaluation
        criteria, with respect to the prediction image obtained
        by the motion compensation predicting means; and

        prediction residual coding means for coding the
        prediction residual signal obtained from the difference
        between the input image and the smoothed prediction
        image; wherein the smoothing means perform the
        smoothing in accordance with a difference value for the
        movement amount between the adjoining partial image
        regions; and

        wherein the smoothing means comprise

activity level setting means for determining the
activity level of ~~one or more of~~ the adjoining partial
image regions depending on whether respective coding
modes for the adjoining partial image~~s~~ regions indicate
inter coding or intra coding;

adaptive smoothing means for changing a number of
pixels subjected to smoothing across a boundary between
the partial image regions in accordance with the
activity levels obtained by the activity level setting
means and for then performing smoothing of said number
of pixels; and

post-processing means for performing suppression
processing of the results of smoothing by means of a
threshold value established in accordance with the
activity levels, wherein the differential values
between the pixel values before the smoothing and the
pixel values after the smoothing are controlled by
means of the threshold value, wherein the threshold is
the maximum permissible differential value, and in
cases where the differential value between a pixel
value before the smoothing and a pixel value after the
smoothing is equal to or more than the threshold value,
the pixel value after the smoothing is corrected to
diminish the differential value in accordance with the
size of the threshold value."

XV.   The independent claims of the seventh auxiliary request
read as follows (amendments to claim 1 of the amended
sixth auxiliary request are underlined):

"1. An image coding apparatus, characterized by
comprising:

motion compensation predicting means for generating a
motion-compensated prediction image by detecting
movement amounts in predetermined partial image region
units of an input image;

smoothing means for performing smoothing of pixels
located at the boundaries of adjoining partial image
regions on the basis of predetermined evaluation
criteria, with respect to the prediction image obtained
by the motion compensation predicting means, wherein
the adjoining partial image regions comprise a central
image region and neighboring image regions each sharing
one boundary with the central image region; and

prediction residual coding means for coding the
prediction residual signal obtained from the difference
between the input image and the smoothed prediction
image;

wherein the smoothing means perform the smoothing in
accordance with a difference value for the movement
amount between the adjoining partial image regions; and
wherein the smoothing means comprise

activity level setting means for determining the
activity level of the adjoining partial image regions
depending on whether respective coding modes for the
adjoining partial image regions indicate inter coding
or intra coding, wherein the activity level setting
means adjusts the activity level according to a first
rule, if the central image region is intra coded, and a
second, different rule, if the central image region is
inter coded;

adaptive smoothing means for changing a number of
pixels subjected to smoothing across a boundary between

the partial image regions in accordance with the
activity levels obtained by the activity level setting
means and for then performing smoothing of said number
of pixels; and

post-processing means for performing suppression
processing of the results of smoothing by means of a
threshold value established in accordance with the
activity levels, wherein the differential values
between the pixel values before the smoothing and the
pixel values after the smoothing are controlled by
means of the threshold value, wherein the threshold is
the maximum permissible differential value, and in
cases where the differential value between a pixel
value before the smoothing and a pixel value after the
smoothing is equal to or more than the threshold value,
the pixel value after the smoothing is corrected to
diminish the differential value in accordance with the
size of the threshold value."

"5. An image decoding apparatus, characterized by
comprising:

motion compensation predicting means for generating a
motion-compensated prediction image by detecting
movement amounts in predetermined partial image region
units;

smoothing means for performing smoothing of pixels
located at the boundaries of adjoining partial image
regions on the basis of predetermined evaluation
criteria, with respect to the prediction image obtained
by the motion compensation predicting means; wherein
the adjoining partial image regions comprise a central
image region and neighboring image regions each sharing
one boundary with the central image region;

prediction residual decoding means for decoding a
prediction residual signal from the encoding side; and
adding means for obtaining a decoded image by adding
together a decoded prediction residual signal obtained
by the prediction residual decoding means, and the
smoothed prediction image;

wherein the smoothing means perform the smoothing in
accordance with a difference value for the movement
amount between the adjoining partial image regions; and
wherein the smoothing means comprise

activity level setting means for determining the
activity level of the adjoining partial image regions
depending on whether respective coding modes for the
adjoining partial image regions indicate inter coding
or intra coding, wherein the activity level setting
means adjusts the activity level according to a first
rule, if the central image region is intra coded, and a
second, different rule, if the central image region is
inter coded;

adaptive smoothing means for changing a number of
pixels subjected to smoothing across a boundary between
the partial image regions in accordance with the
activity levels obtained by the activity level setting
means and for then performing smoothing of said number
of pixels; and

post-processing means for performing suppression
processing of the results of smoothing by means of a
threshold value established in accordance with the
activity levels, wherein the differential values
between the pixel values before the smoothing and the
pixel values after the smoothing are controlled by

means of the threshold value, wherein the threshold is
the maximum, permissible differential value, and in
cases where the differential value between a pixel
value before the smoothing and a pixel value after the
smoothing is equal to or more than the threshold value,
the pixel value after the smoothing is corrected to
diminish the differential value in accordance with the
size of the threshold value."

"9. An image coding method, comprising: a motion
compensation predicting step of generating a motion-
compensated prediction image by detecting movement
amounts in predetermined partial image region units of
an input image;

a smoothing step of performing smoothing of pixels
located at the boundaries of adjoining partial image
regions on the basis of predetermined evaluation
criteria, with respect to the prediction image obtained
by the motion compensation prediction step; wherein the
adjoining partial image regions comprise a central
image region and neighboring image regions each sharing
one boundary with the central image region; and

a prediction residual coding step of coding the
prediction residual signal obtained from the difference
between the input image and the smoothed prediction
image;

wherein the smoothing means perform the smoothing in
accordance with a difference value for the movement
amount between the adjoining partial image regions and

wherein the smoothing step

determines the activity level of the adjoining partial
image regions depending on whether respective coding
modes for the adjoining partial image regions indicate
inter coding or intra coding, wherein the activity
level is adjusted according to a first rule, if the
central image region is intra coded, and a second,
different rule, if the central image region is inter
coded;

changing a number of pixels subjected to smoothing
across a boundary between the partial image regions in
accordance with the activity levels obtained and then
performing smoothing of said number of pixels; and

performing suppression processing of the results of
smoothing by means of a threshold value established in
accordance with the activity levels, wherein the
differential values between the pixel values before the
smoothing and the pixel values after the smoothing are
controlled by means of the threshold value, wherein the
threshold is the maximum permissible differential
value, and in cases where the differential value
between a pixel value before the smoothing and a pixel
value after the smoothing is equal to or more than the
threshold value, the pixel value after the smoothing is
corrected to diminish the differential value in
accordance with the size of the threshold value."

"14. An image decoding method, characterized by
comprising:

a motion compensation predicting step of generating a
motion-compensated prediction image by detecting
movement amounts in predetermined partial image region
units;

a smoothing step of performing smoothing of pixels
located at the boundaries of adjoining partial image
regions on the basis of predetermined evaluation
criteria, with respect to the prediction image obtained
by the motion compensation predicting step; wherein the
adjoining partial image regions comprise a central
image region and neighboring image regions each sharing
one boundary with the central image region; and

a prediction residual decoding step of decoding a
prediction residual signal from the encoding side; and

an adding step of obtaining a decoded image by adding
together a decoded prediction residual signal obtained
by the prediction residual decoding step, and the
smoothed prediction image;

wherein the smoothing means perform the smoothing in
accordance with a difference value for the movement
amount between the adjoining partial image regions; and

wherein the smoothing step

determines the activity level of the adjoining partial
image regions depending on whether respective coding
modes for the adjoining partial image regions indicate
inter coding or intra coding, wherein the activity
level is adjusted according to a first rule, if the
central image region is intra coded, and a second,
different rule, if the central image region is inter
coded;

changing a number of pixels subjected to smoothing
across a boundary between the partial image regions in
accordance with the activity levels obtained and then
performing smoothing of said number of pixels; and

performing suppression processing of the results of
smoothing by means of a threshold value established in
accordance with the activity levels,

wherein the differential values between the pixel
values before the smoothing and the pixel values after
the smoothing are controlled by means of the threshold
value, wherein the threshold is the maximum permissible
differential value, and in cases where the differential
value between a pixel value before the smoothing and a
pixel value after the smoothing is equal to or more
than the threshold value, the pixel value after the
smoothing is corrected to diminish the differential
value in accordance with the size of the threshold
value."

XVI.   In the decision under appeal the examining division
       gave reasons why the independent claims of the fourth
       auxiliary request lacked clarity and inventive step. It
       argued that these reasons applied equally to the
       remaining requests (main request, first to third and
       fifth auxiliary requests), since the claims of these
       requests were less limited than those of the fourth
       auxiliary request (see decision under appeal, Reasons,
       section 1).

       The examining division found that the wording "activity
       level between adjoining partial image regions" in
       claim 1 was unclear. In image coding, activity levels
       were normally defined within an image region, e.g. a
       macroblock, and not between blocks. It also argued that
       the wording "establishing the intensity of the
       smoothing on the basis of the activity level" did not
       specify how the activity level determined the intensity
       of the smoothing, and "performing smoothing of the

pixels located at the boundaries" was unclear because
it did not define sufficiently which pixels were
subjected to smoothing (see decision under appeal,
Reasons, points 3.1 to 3.3).

D1 was considered the closest prior art, which did not
disclose the activity level setting means, the adaptive
smoothing means and the post-processing means of
claim 1 of the fourth auxiliary request. The technical
problem solved by these distinguishing features was to
prevent artificial boundaries of blocks from standing
out among macroblocks of intra mode. The distinguishing
features were disclosed in D4 as providing the same
advantages as in the present application. D4 also
referred to the same type of encoder as the one
disclosed in D1. The skilled person would regard it as
a normal design option to include the features of D4 in
the apparatus described in D1 in order to solve the
technical problem (see decision under appeal, Reasons,
section 4).

XVII.   The appellant's arguments, as far as they are relevant
        for the present decision, may be summarised as follows:

        The wording "activity level between adjoining partial
        image regions" in claim 1 of the fourth auxiliary
        request was clear, because the activity level concerned
        the relationship between two blocks or "with the
        neighboring blocks" (see last paragraph of page 13 and
        page 16, third full paragraph). "Between adjoining
        blocks" was to be understood in the sense of "amongst
        adjoining blocks".

        The specification of an "activity level of one or more
        of the adjoining partial image regions" in claim 1 of
        the sixth auxiliary request was not to be understood to

mean that only one region was considered. Instead, the
reference to adjoining regions implied that several
regions were involved. The feature was disclosed on
page 16, third full paragraph; page 10, the paragraph
starting with "The MC procedure ..."; page 13, last
paragraph and in Rule 2(1) to (5) (see pages 14 and 15)
which provided a basis for the interpretation that the
activity level(s) of other partial image region(s)
could be determined differently than by evaluation of
the coding mode. Furthermore, in an extreme case the
image could be divided into two blocks with one common
boundary. In that case the activity level could be
determined for only one block, which necessarily took
into account the second block.

D1 was the closest prior art with respect to the
subject-matter of claim 1 of the amended sixth
auxiliary request. The skilled person would not have
combined D1 and D4, because these documents related to
incompatible concealment algorithms. D4 disclosed
smoothing of a decoded image, not of a predicted image
as in D1. In addition, D1 related to a different
problem resulting from the panning of a video camera
(see column 4, line 63 to column 5, line 6).

In the oral proceedings the appellant agreed that the
technical problem had been correctly formulated as how
to prevent artificial boundaries of blocks from
standing out among macroblocks of intra mode. The main
teaching of D1 was that intra-loop filtering could be
selectively turned off, based on considerations
unrelated to those in D4 which was based on the
distinction between intra or inter coding modes. Hence,
the skilled person would not have combined D1 and D4.
Even if such a combination had been considered, (s)he
would not have arrived at the claimed solution.

Reasons for the Decision

1.   The appeal is admissible.

The present application

2.   The present invention relates to an image coding
        apparatus, image decoding apparatus and corresponding
        methods of encoding and decoding that alleviate
        artefacts resulting from block-based motion
        compensation. Motion compensation (MC) is effected
        based on blocks predicted from a previous image, for
        example. However, due to the fact that optimal
        prediction does not result in the same MC vector for
        all blocks, discontinuities are perceived at the
        boundaries of MC blocks. Discontinuities are
        particularly visible under circumstances of disparate
        motion vectors and for intra-coded blocks which are in
        general quantised at a low resolution (see pages 1
        to 4, page 18, first paragraph and figures 21 and 22 of
        the application).

        The present invention proposes using a smoothing filter
        on the motion-compensated prediction image. This filter
        selectively filters pixels located at the boundaries of
        the MC blocks after determining an activity level that
        depends on whether inter- or intra-coding mode has been
        used for the MC blocks and on the difference in motion
        vectors. The results of the smoothing undergo a post-
        processing operation such that effects of the smoothing
        are limited to a maximum permissible value (see pages
        10 to 18 and figure 1).

Main request and first to fifth auxiliary requests
Clarity (Article 84 EPC 1973)

3.   According to Article 84 EPC 1973, the claims shall
        define the matter for which protection is sought. They
        shall be clear and concise and be supported by the
        description.

3.1   Claim 1 of each of the main request and the first to
        fifth auxiliary requests refers to an "activity level
        between adjoining partial image regions".

3.2   The board agrees with the decision under appeal, which
        held that in image coding, activity levels are normally
        defined for blocks and not between blocks (see
        point XVI above), with the term "between blocks" being
        understood as "in the space that separates the blocks".
        This understanding of the term is also consistent with
        the description of the present application, which
        refers to "a block activity level S(X) in units of
        fixed blocks X" (see page 13, last paragraph). This
        definition implies that the activity level is
        associated with a block X and not with a relationship
        between two blocks X and Y. This interpretation is also
        supported by figure 6, see steps ST1 and ST6 and the
        paragraph bridging pages 15 and 16.

3.3   Also, the third full paragraph on page 16, which was
        relied on by the appellant to support its
        interpretation, is unambiguous in this respect. It
        specifies "In the filter processing below, processing
        is performed for two block boundaries and therefore,
        the larger value of the values of S(X) for the two
        blocks processed is used as the block activity level
        S." The passage clearly refers to "values of S(X) for
        the two blocks" (underlining added by the board), which

implies that there are (at least) two values for two
blocks and not a single value specifying a relationship
between the blocks. The fact that the larger of the
activity values is selected to control the filter
processing is a different issue which relates to the
subsequent use of the determined activity values.

The appellant argued in addition that "between
adjoining blocks" was to be understood in the sense of
"amongst adjoining blocks". According to this
interpretation the activity level is determined in some
unspecified way for a group of blocks, which is not
consistent with the description of the present
application (see the above cited passages).

4.   It follows from the above that claim 1 of each of the
        main and first to fifth auxiliary requests does not
        meet the requirements of Article 84 EPC 1973.

Sixth auxiliary request
Added subject-matter, Article 123(2) EPC

5.   Claim 1 of the sixth auxiliary request specifies
        "activity level setting means for determining the
        activity level of one or more of the adjoining partial
        image regions".

5.1   It was undisputed that the option of activity level
        setting means determining the activity level of <u>one</u> of
        the adjoining partial image regions was not explicitly
        disclosed in the application as filed. However,
        according to the appellant the application as filed
        implicitly provided a basis for this feature on
        page 10, the paragraph starting with "The MC
        procedure ..."; page 13, last paragraph; page 16, third
        full paragraph and pages 14 and 15, Rule 2(1) and (5).

5.2   The passage on page 10 only describes the division of
       macroblocks into rectangular image regions. The last
       paragraph on page 13 specifies that the "block activity
       level calculation section 125 determines a block
       activity level S(X) in units of fixed blocks X". S(X)
       is initialised to a value S0 over the whole area of the
       frame. The passage also refers to the flow of
       processing in figure 6, which shows a loop being
       carried out until "finished for all fixed blocks".
       Hence, these passages do not disclose the determination
       of an activity level for one block.

       The third paragraph on page 16 concerns the influence
       of the activity level on the filtering of block
       boundaries. The strength of the filtering depends on
       the larger of the activity levels of the two blocks
       sharing the boundary. Hence, according to this passage
       two activity levels are determined for two neighbouring
       blocks.

       The appellant argued that it followed from the latter
       passage that in an extreme case the image could be
       divided into two blocks with one common boundary. In
       that case the activity level could be determined for
       only one block, which necessarily took the other block
       into account. The board cannot agree. Even if the image
       were only composed of two MC blocks, it follows from
       the third paragraph on page 16 that the activity level
       would be determined for both blocks, with the larger of
       the two levels being chosen to determine the filtering
       strength.

       Finally, both Rules 1 and 2 (see application, pages 13
       to 15) are dependent on the coding mode, so that the
       coding mode is evaluated for all blocks.

5.3   Hence, claim 1 of the sixth auxiliary request contains
        subject-matter extending beyond the content of the
        application as filed (Article 123(2) EPC).

Amended sixth auxiliary request
Inventive step, Article 56 EPC 1973

6.   It is common ground that D1 may be considered to be the
        closest prior art for the subject-matter of claim 1.

6.1   It is also undisputed that D1 (see figure 1 and
        column 7, line 40 to column 8, line 11) discloses the
        motion compensation predicting means, smoothing means
        and prediction residual coding means of claim 1 of the
        sixth auxiliary request. These means correspond to the
        general structure of the image coding apparatus of
        claim 1. D1 starts from the realisation that intra-loop
        filtering (i.e. smoothing) is ineffective if the motion
        vectors of adjacent blocks are substantially identical,
        which is the case if a picture is taken by panning a
        television camera. Hence, according to D1 the smoothing
        means perform the smoothing in accordance with a
        difference value for the movement amount between
        adjoining partial image regions, such that intra-loop
        filtering is switched off when adjacent blocks have
        substantially identical motion vectors and switched on
        if the motion vectors differ (see figure 1; column 4,
        line 63 to column 5, line 6; column 8, line 45 to
        column 9, line 7 and column 10, lines 32 to 45).

6.2   The subject-matter of claim 1 differs from D1 in the
        implementation of the smoothing means. In particular,
        the smoothing means of claim 1 contain

(a) an activity level setting means for determining the
    activity level of the adjoining partial image
    regions depending on whether respective coding
    modes for the adjoining partial image regions
    indicate inter coding or intra coding;

(b) adaptive smoothing means for changing a number of
    pixels subjected to smoothing across a boundary
    between the partial image regions in accordance
    with the activity levels obtained by the activity
    level setting means, and for then performing
    smoothing of said number of pixels; and

(c) post-processing means for performing suppression
    processing of the results of smoothing by means of
    a threshold value established in accordance with
    the activity levels, wherein the differential
    values between the pixel values before the
    smoothing and the pixel values after the smoothing
    are controlled by means of the threshold value,
    wherein the threshold is the maximum permissible
    differential value, and in cases where the
    differential value between a pixel value before the
    smoothing and a pixel value after the smoothing is
    equal to or more than the threshold value, the
    pixel value after the smoothing is corrected to
    diminish the differential value in accordance with
    the size of the threshold value.

6.3   The technical effect of these features is that
       suppression of artefacts in intra mode can be improved.
       The corresponding technical problem can be formulated
       as how to prevent artificial boundaries of blocks from
       standing out among macroblocks of intra mode.

6.4   D4 is a document drawn up by a standardisation
        committee concerned with video coding. It discloses a
        deblocking filter (i.e. a smoothing means) designed to
        solve the above technical problem. It discloses that
        the smoothing means have activity level setting means
        for determining the activity level in dependence on the
        coding mode (see chapter 4.5.3, the condition that "One
        or both of the adjacent macroblocks are intra coded").
        It also discloses that the smoothing means are
        adaptively changing a number of pixels subjected to
        smoothing (according to chapter 4.5.3 three pixels to
        the left and to the right of a macroblock boundary in a
        luminance frame are filtered, "Otherwise filtering is
        done as described in the section above", i.e. zero to
        two pixels are filtered, see chapter 4.5.2). D4 also
        discloses the post-processing means of claim 1, wherein
        the maximum permissible differential value is
        controlled by means of the threshold value C (see
        bottom of chapter 4.5.2).

6.5   The board holds that the skilled person would have
        realised that the smoothing according to D1 could be
        further improved by incorporating the features of the
        deblocking filter of D4.

6.6   The appellant argued that the skilled person would not
        have combined D1 and D4, because these documents
        related to incompatible concealment algorithms. D4
        disclosed smoothing of a reconstructed/decoded image
        and not of a predicted image as in D1 (see its
        chapter 4.5.1, first sentence).

        D4 does not explicitly specify the location of its
        deblocking filter, apart from a reference to the
        reconstructed picture which is used to assign a
        strength value to each block. However, the board sees

no obstacle preventing the skilled person from implementing the smoothing algorithm of D4 in the smoothing filter of D1. On the contrary, starting from D1 as the closest prior art the most straightforward solution for implementing the smoothing algorithm of D4 in D1 would have been to place its additional filtering at the same place as in D1, i.e. in the smoothing filter.

The appellant argued correctly that D1 related to an improvement which was effective for video sequences resulting from the panning of a video camera. In these situations the modified algorithm of D1 provides better image quality, because the smoothing filter is selectively switched off. However, the board regards the fact that the smoothing filter of D1 is adapted to different input sequences as showing that the skilled person was aware of shortcomings in the smoothing filter for certain input sequences and that these shortcomings could be alleviated by an adaptive filter. Filtering based on intra or inter coding mode is just a further adaptation which is effective under specific conditions and can be added to the existing filter. At least in circumstances in which this further adaptation is effective, a person skilled in the art would have added it in order to alleviate the shortcomings and so would have arrived at the subject-matter of claim 1.

6.7   As a result, the subject-matter of claim 1 would have been obvious to a skilled person in view of D1 and thus lacks inventive step (Article 56 EPC 1973).

Seventh auxiliary request
Added subject-matter, Article 123(2) EPC

7.   Claim 1 of the seventh auxiliary request essentially
        differs from claim 1 of the fourth auxiliary request
        (whose compliance with Article 123(2) EPC was
        undisputed) in the following features:

        (a) the adjoining partial image regions comprise a
            central image region and neighbouring image regions
            each sharing one boundary with the central image
            region;

        (b) the smoothing means perform the smoothing in
            accordance with a difference value for the movement
            amount between the adjoining partial image regions;

        (c) activity level setting means for determining the
            activity level of the adjoining partial image
            regions depending on whether respective coding
            modes for the adjoining partial image regions
            indicate inter coding or intra coding;

        (d) the activity level setting means adjust the
            activity level according to a first rule, if the
            central image region is intra coded, and a second,
            different rule, if the central image region is
            inter coded;

        (e) adaptive smoothing means for changing a number of
            pixels subjected to smoothing across a boundary
            between the partial image regions in accordance
            with the activity levels obtained by the activity
            level setting means, and for then performing
            smoothing of said number of pixels.

7.1   Feature (a) is based on figure 7 and page 13, last
        paragraph of the application. Feature (b) corresponds
        to claim 3 as originally filed. Features (c) and (d)
        are disclosed as the first embodiment of the invention,
        see in particular the passage starting on page 13, last
        paragraph to page 15. Feature (e) is based on claim 10
        as originally filed and on figures 5 and 8, together
        with page 16, last two paragraphs and the first two
        paragraphs on page 17.

7.2   Corresponding amendments have been made to the other
        independent claims and - where necessary - dependent
        claims have been deleted.

7.3   Hence, the board is satisfied that the requirements of
        Article 123(2) EPC are fulfilled.

Clarity, Article 84 EPC 1973

8.   The objected-to wording "activity level between
        adjoining partial image regions" in claim 1 has been
        amended to read "activity level of the adjoining
        partial image regions". In addition, according to the
        decision under appeal, the wording "establishing the
        intensity of the smoothing on the basis of the activity
        level" and "performing smoothing of the pixels located
        at the boundaries" was unclear because it did not
        define sufficiently which pixels were subjected to
        smoothing and how the intensity of the smoothing was
        determined (see point XVI above). Both wordings have
        been amended to further specify the smoothing
        operation.

8.1   Hence, the clarity objections of the decision under
        appeal have been successfully addressed. There is no

other aspect under which the board considers the
present set of claims to lack clarity.

8.2   It follows from the above that the claims of the
         seventh auxiliary request meet the requirements of
         Article 84 EPC 1973.

Inventive step, Article 56 EPC 1973

9.   Compared with claim 1 of the amended sixth auxiliary
         request, claim 1 of the seventh auxiliary request
         contains the additional features (a) and (d), see
         point 7 above.

9.1   In D4 these features are not disclosed in the same
         context as in claim 1. D4 discloses changing the
         threshold of the post-processing means if the central
         image region (D4: C) is intra coded (see D4,
         section 4.5.1 and last paragraph of section 4.5.2). The
         activity level in claim 1 is considered to correspond
         to the activity parameters "ar" or "al" according to
         section 4.5.2 or alternatively to the combination of
         the conditions mentioned in section 4.5.3, including
         "one or both of the adjacent macroblocks being intra
         coded". Neither the one nor the other activity level is
         changed in dependence on whether the central image
         region is intra coded. Instead, in D4 the smoothing
         according to section 4.5.3 is only applied if adjacent
         macroblocks are intra coded. Hence, according to D4 the
         coding mode of the central image region is not taken
         into account for determining the activity level.

9.2   Based on the documents on file the board sees no reason
         why the person skilled in the art, starting from
         document D1 and adapting its teaching in view of D4,

would have modified the algorithm of D4 in such a way as to arrive at the claimed subject-matter.

9.3   Hence, the subject-matter of claim 1 is considered to involve an inventive step (Article 56 EPC 1973). The same applies to independent claims 5, 9 and 14 which specify an image decoding apparatus, an image encoding method and an image decoding method corresponding to the image encoder of claim 1. Further claims 2 to 4, 6 to 8, 10 to 13 and 15 to 18 are dependent claims and, hence, also allowable.

Conclusion

10.   The board finds that, taking into consideration the amendments made by the appellant during the appeal proceedings, the claims of the seventh auxiliary request meet the requirements of the EPC.

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 with the following
      claims and a description to be adapted thereto:
      Claims No. 1 to 18 according to the Seventh Auxiliary
      Request filed during the oral proceedings of
      8 June 2017.

The Registrar: The Chairman:

K. Boelicke   C. Kunzelmann

Decision electronically authenticated