Datasheet for the decision of 17 December 2013

Case Number: T 1569/09 - 3.5.04
Application Number: 96309546.8
Publication Number: 785688
IPC: H04N7/26
Language of the proceedings: EN
Title of invention: Hierarchical encoding of videosignals
Applicant: Sony Corporation
Headword:

Relevant legal provisions:
EPC 1973 Art. 56, 111(1), 111(2)
Keyword: Inventive step - after amendment
Remittal to the department of first instance

Decisions cited:
G 0010/93

Catchword:
Decision of Technical Board of Appeal 3.5.04 of 17 December 2013

Appellant: Sony Corporation
(Applicant)
1-7-1 Konan
Minato-ku
Tokyo 108-0075 (JP)

Representative: Turner, James Arthur
D Young & Co LLP
120 Holborn
London EC1N 2DY (GB)

Decision under appeal: Decision of the Examining Division of the European Patent Office posted on 23 January 2009 refusing European patent application No. 96309546.8 pursuant to Article 97(2) EPC.

Composition of the Board:
Chairman: F. Edlinger
Members: C. Kunzelmann
T. Karamanli
Summary of Facts and Submissions

I. The appeal is against the decision of the examining division to refuse European patent application No. 96 309 546.8 under Article 97(2) of the European Patent Convention (EPC).

II. The application was refused on the ground that the subject-matter of claim 1 of the main and the first auxiliary requests then on file lacked an inventive step over a combination of


The decision under appeal also raised objections under Articles 84 and 123(2) EPC against claim 1 of the second auxiliary request then on file.

Moreover the decision under appeal also cited the further documents

D2 = EP 0 667 716 A1,

D5 = EP 0 627 859 A2.

III. The applicant appealed and requested that the decision under appeal be set aside. With the statement of grounds of appeal, the appellant filed claims according to a new main and first and second auxiliary requests and submitted arguments in support of inventive step.

IV. The board issued a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), annexed to a summons to oral proceedings. In this communication the board indicated that it tended to share the examining division's view as far as the appellant's main request was concerned, but that it tended to agree with the appellant's argument that a person skilled in the art would find no teaching in D1, D2 and D3 to adopt a quantisation method whereby the number of quantisation bits used for each hierarchy was selected in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy, as discussed on page 4 of the statement of grounds of appeal. The board also indicated that it was inclined to remit the case to the first instance for further prosecution if the appellant made the first auxiliary request its main request.

V. With letters of reply dated 23 September 2013 and 2 October 2013 the appellant informed the board that it
would not attend the oral proceedings and made the first auxiliary request its main request. The previous main request became the first auxiliary request.

VI. The oral proceedings were then cancelled.

VII. Claim 1 of the present main request reads as follows (differences with respect to claim 1 of the requests underlying the decision under appeal are set in italics):

"A video signal encoding method for generating from input image data a plurality of hierarchical image data with different resolutions to encode each of the hierarchical image data, comprising:

- a step for averaging a plurality of pixel values in each hierarchical image data to form higher hierarchy image data;
- a step for excluding from the pixel data in each hierarchy other than the top hierarchy with the lowest resolution, pixel data corresponding to one of a plurality of lower hierarchy pixels used in the same averaging operation to generate one pixel for a higher hierarchy in order to form thinned-out data formed of the remaining pixels; and

- a quantization step for compression-coding each of said top hierarchy image data and the thinned-out data in respective hierarchies other than said top hierarchy to generate a plurality of hierarchical coded data, wherein the number of quantisation bits used in the quantisation step is selected, for each hierarchy other than the bottom hierarchy, in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy, the magnitude of the influence being
dependent on the number of pixels of the lower hierarchy used in generating each pixel of that hierarchy;
said quantization step quantizes the pixel data of each hierarchy using a number of quantization bits assigned to the hierarchy such that higher hierarchies are quantized more finely than lower hierarchies."

VIII. The reasons for the decision under appeal may be summarised as follows:

Document D1 constituted the closest prior art. The method of claim 1 of the then main request differed from the image signal encoding method disclosed in section II.B "Reduced-Sum Pyramid" of D1 in that

(i) the method was a video signal encoding method, whereas D1 concerned an image signal encoding method,
(ii) a step of performing an arithmetic operation was a step of averaging, and
(iii) the quantisation step quantised the data in higher hierarchies more finely.

The decision held that the use of image signal encoding methods for video signal encoding was well-known and trivial, and that it was at least obvious from D1 that the sum of pixel values calculated in D1 could be divided by the number of pixels thereby yielding the mean pixel value. Feature (iii) solved the problem of how to perform quantisation. It was well-known that in hierarchical encoding the problem of choosing quantisation for the different hierarchies (i.e. the different hierarchical levels) presented itself. D3 pointed out that quantisation was critical in pyramid schemes because errors at high levels spread down over lower levels. A person skilled in the art confronted with the problem of how to perform
quantisation in the method of D1 would have recognised that it was appropriate to perform quantisation in such a way that the quantisation step in each layer quantised the data in higher hierarchies more finely than that of lower hierarchies as disclosed in D3.

The same arguments applied to claim 1 of the then first auxiliary request.

In the application as filed there was no clear disclosure of how the number of quantisation bits could be selected in accordance with both the number of levels and the number of pixels used in generating the higher hierarchy. This feature in claim 1 of the second auxiliary request infringed both Article 84 EPC and Article 123(2) EPC. If it was interpreted in terms of a 4-fold finer quantisation step in each level as disclosed in the description, this would be considered an obvious choice.

IX. The appellant's arguments may be summarised as follows:

The section "Reduced-Sum Pyramid" of D1 was completely silent regarding quantisation. In D1 the averaging of a 2x2 block of pixel values would typically result in a non-integer average value and thus entail an undesirable increase of the amount of data. If the average was rounded/quantised (for transmission) the result would be a quantisation error in the higher hierarchy created by the averaging operation. A quantisation error would also result in the lower hierarchy because the rounded average value would be used to restore the pixel excluded from the 2x2 block under the "Reduced-Sum Pyramid" scheme. The quantisation error in the higher hierarchy would influence the restoration of the excluded lower
hierarchy pixels by a factor of four and provide a disincentive to average rather than take the sum of the pixel values.

The invention reduced the negative image quality effects of quantisation errors and avoided the data amount increase which would result from not rounding/quantising.

D3 concerned differential pyramid encoding rather than non-differential encoding such as provided by the "Reduced-Sum Pyramid" method in D1. There was no suggestion that the quantisation teachings of D3 could be usefully applied to non-differential encoding.

A person skilled in the art, starting from D1 and seeking to quantise the encoded hierarchical data without introducing errors, would find no teaching to adopt a quantisation method whereby the number of quantisation bits used for each hierarchy was selected in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy, the magnitude of the influence being dependent on the number of pixels of the lower hierarchy used in generating each pixel of that hierarchy.

Reasons for the Decision

1. Main request: admission (Article 13(1) RPBA)

The present main request was filed in reaction to the board's indication given in the communication and thus constitutes an amendment to the appellant's case within
the meaning of Article 13(1) RPBA. It corresponds to the first auxiliary request filed with the statement of grounds of appeal and therefore does not increase the complexity of the case. It allowed the board to focus on the essential objections raised in the decision under appeal and was therefore admitted into the appeal proceedings.

2. **Main request: amendments (Article 123(2) EPC)**

2.1 Claim 1 of the main request is based on originally filed claim 1. The selection of the number of quantisation bits in accordance with the magnitude of the influence of the quantisation errors on restored excluded pixels of lower hierarchy is disclosed on page 28, second full paragraph, of the application as filed. The number of quantisation bits used in the quantisation step in higher and lower hierarchies is disclosed for instance on page 19, second full paragraph, or page 28, second full paragraph, of the application as filed.

2.2 In the decision under appeal the examining division objected in this respect that in the application as filed there was no teaching or clear disclosure of the selection of the number of quantisation bits unless the selection was interpreted as a 4-fold finer quantisation step in the higher hierarchy.

2.3 The board, however, notes that the original description discloses on page 28, second full paragraph, that the number of quantisation bits (1, 4, 16) is selected in consideration of the influence of the quantisation errors in the higher hierarchy (level) on the restored pixel value in the lower hierarchy. This influence of the quantisation errors is analysed on page 25, line 5
to page 29, line 17 and shown in figure 6 in table form (see page 28, first paragraph). The quantisation errors contribute with an absolute factor of 1 or 4 to the restored pixel values in the lower hierarchy (and with an absolute factor of 16 to the next lower hierarchy). The factors 1 and 4 result from the number of pixels of the lower hierarchy used in generating the pixels of the higher hierarchy when forming the average (see equations (1) and (2) on page 17) and used in the corresponding restoring of excluded pixel data (see equations (3) and (4) on pages 22 and 23 and equations (7) to (10) on pages 26 and 27). Thus, the specific values of 1, 4 and 16 bits discussed on page 28, second full paragraph, are the result of a specific teaching disclosed in relation to the embodiment of the application.

2.4 In view of the above the board finds that the objection under Article 123(2) EPC raised in the decision under appeal is not valid against present (amended) claim 1.

3. **Main request: clarity (Article 84 EPC 1973)**

3.1 In the decision under appeal the examining division also objected that there was no clear disclosure of how the number of quantisation bits could be selected in accordance with the number of hierarchies and the number of pixels used in generating the higher hierarchy.

3.2 Present claim 1, however, now specifies that the selection of the number of quantisation bits is made "in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy". Claim 1 also
specifies that this magnitude is dependent on the number of pixels of the lower hierarchy used in generating each pixel of that hierarchy. Taking into account the relevant teaching of the application (see section 2.3 above) the relationship between the number of quantisation bits in the different hierarchies is clear.

3.3 In view of the above the board finds that the objection under Article 84 EPC raised in the decision under appeal is not valid against present (amended) claim 1.

4. **Inventive step (Article 56 EPC 1973)**

4.1 It is undisputed that the "Reduced-Sum Pyramid" method disclosed in section II.B of D1 is an appropriate starting point for the assessment of inventive step.

4.2 According to that method, hierarchy n is the original image and hierarchy k-1 is formed from hierarchy k (0 < k ≤ n) by calculating, for each spatially contiguous, non-overlapping block of 2x2 nodes at hierarchy k the sum of the node values in the block. Subsequently, one of the 2x2 nodes is dropped. In the "Reduced-Sum Pyramid" of D1 there is neither an averaging step nor a quantisation step. The number of bits used in the "Reduced-Sum Pyramid" method at any hierarchy k is dependent on the number of bits used for the values of the original image (hierarchy n) and the level of roundoff error which is accepted in the hierarchies k ≠ n. If roundoff errors are not to be introduced, the values at hierarchy k require two more bits than those at hierarchy k-1.

4.3 The "Reduced-Sum Pyramid" specifically addresses a data expansion problem of a "Mean Pyramid" approach (see
section II.A of D1) in which for each spatially contiguous, non-overlapping block of 2x2 nodes at hierarchy k the average of the node values in the block is calculated to form hierarchy k-1. The data expansion problem is caused by the forming of hierarchies k ≠ n which results in the total number of nodes in the mean pyramid being larger than the number of pixels in the original image. The "Reduced-Sum Pyramid" avoids the data expansion problem by dropping one of the 2x2 nodes in each block. Thus an averaging step would be contrary to the teaching of the "Reduced-Sum Pyramid" approach as it would mean returning to the "Mean Pyramid" approach.

4.4 In this context the board notes that extra bits per node are needed in both the "Mean Pyramid" and "Reduced-Sum Pyramid" approach: in the former to accurately record the average and in the latter to avoid roundoff errors. In the "Mean Pyramid" approach, these extra bits can be avoided by rounding off the node values to the same resolution as the original image.

4.5 The examining division identified three distinguishing features over the "Reduced-Sum Pyramid" approach in D1, one of which was that the quantisation step quantised the data in higher hierarchies more finely (see point VIII above). But the examining division considered that there was no clear disclosure in the application as to how the number of quantisation bits could be selected (see also section 3 above) and that, in view of D3, finer quantisation, in particular a 4-fold finer quantisation step in each level, would be an obvious choice. Based on these considerations the examining division held that it was at least obvious from D1 that the sum of pixel values calculated in the
"Reduced-Sum Pyramid" approach in D1 could be divided by the number of pixels, thereby yielding the mean pixel value and that consequently "the technique of averaging and excluding" was obvious (emphasis by the board, see point 2.I.1.c.1 of the decision under appeal).

4.6 Present claim 1 comprises the feature that the number of quantisation bits used in the quantisation step is selected, for each hierarchy other than the bottom hierarchy, in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy, the magnitude of the influence being dependent on the number of pixels of the lower hierarchy used in generating each pixel of that hierarchy. Thus the method of present claim 1 implies a step of analysing the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy. It is clear from the present application that the 4-fold finer quantisation step in each level arises from the particular pyramid scheme disclosed in the present application (see point 2.3 above). For instance, different values for the influence of the quantisation errors would result if block sizes other than 2x2 were used or if the "Reduced-Sum Pyramid" known from D1 were used for forming the higher hierarchy.

4.7 When forming the "Reduced-Sum Pyramid" in D1 there is no need for quantisation. Quantisation only becomes necessary when compression coding is additionally considered, typically for transmission. In this respect the board agrees with the finding in the decision under
appeal that it was well-known that lossy encoding could be performed by means of quantisation and that in any method of hierarchical encoding (such as the different approaches disclosed in D1) the problem of choosing quantisation for the different hierarchical layers presented itself (see point 2.I.1.a.7 of the decision under appeal).

4.8 D3 proposes a modified "Gaussian-Laplacian Pyramid", which is a type of pyramid discussed in section II.F of D1 and is different from the "Mean Pyramid" and the "Reduced-Sum Pyramid". The general statement in D3, point 3.2, that "Quantisation is critical in pyramid schemes, because errors at high levels may be spread down over lower ones" does not disclose which specific quantisation scheme must be chosen for any particular type of pyramid. This general statement implies that finer quantisation is required for higher levels than for lower levels if errors at high levels spread down over lower ones. But the extent to which quantisation must be finer for higher levels needs to be determined separately for each type of pyramid, because the influence of quantisation errors at a high level on the lower levels depends on the particular type of pyramid. In particular, D3 does not discuss if or how the manner in which quantisation errors at high levels may spread down over lower ones is influenced by node dropping if a "Reduced-Sum Pyramid" is used.

4.9 In view of the above the board finds that the objection under Article 56 EPC raised in the decision under appeal is not valid against present (amended) claim 1.

5. Moreover, also in the other documents discussed in the decision under appeal there is no teaching to adopt a quantisation method whereby the number of quantisation
bits used for each hierarchy is selected in accordance with the magnitude of the influence of the quantisation errors at that hierarchy on the excluded pixel of the lower hierarchy when restored using the pixel data of that hierarchy. Thus on the basis of claim 1 of the present main request the board finds that the decision under appeal is to be set aside.

5.1 Since the board decided that the decision under appeal is to be set aside on the basis of the appellant's present main request, there is no need for the board to consider the allowability of the appellant's present first and second auxiliary requests.

6. **Remittal (Article 111(1) EPC 1973)**

6.1 In the present case, in the decision under appeal the examining division decided only on the patentability of the subject-matter of claim 1 of the requests then on file and took no decision on the other independent claims or the dependent claims of the requests then on file. Hence full examination of the application as to patentability requirements has not yet been carried out. Further examination, however, is still necessary since there are, for instance, further independent claims in the present main request. The board sees no reason to go beyond its primary task of examining the contested decision. Full examination as to patentability requirements is the task of the examining division (G 10/93, OJ EPO 1995, 172, point 4 of the Reasons).

6.2 Thus the board considers it appropriate to exercise its discretionary power under Article 111(1) EPC 1973 to remit the case to the department of first instance for further prosecution. Consequently, according to
Article 111(2), first sentence, EPC 1973, the examining division is bound by the ratio decidendi of the board on claim 1 of the present main request, in so far as the facts are the same. Therefore it depends on the facts whether and to which extent the ratio decidendi for claim 1 of the present main request applies also to the other claims of that request or to the claims of any further requests which the examining division might admit into the proceedings under Rule 137(3) EPC for example.

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