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D E C I S I O N
of 30 October 1997

Case Number: T 0349/97 - 3.5.1

Application Number: 90203518.7

Publication Number: 0437002

IPC: H04N 1/41

Language of the proceedings: EN

Title of invention:
Region and texture coding

Applicant:
PHILIPS ELECTRONICS UK LIMITED, et al

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 84
EPC R. 29

Keyword:
"Clarity: main request (no), auxiliary request (yes)"

Decisions cited:
-

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 0349/97 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 30 October 1997

Appellants:

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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 13 November 1996
refusing European patent application
No. 90 203 518.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: A. S. Clelland
C. Holtz

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division to refuse the European patent application on the grounds that the subject-matter of claims 1, 2, 6 and 7 was not clear and lacked "essential characteristics" (Article 84 and Rule 29(1) EPC). It was also held that various claims lacked novelty and/or inventive step, reference being made to the following document:

D1: 3rd Intellectual Conference on Image Processing & its Applications (IPA 89), July 1989, Warwick, UK, pages 536 to 540; D. MORAN et al.: "Region and Texture Coding of TV Pictures".

II. The appellant (applicant) lodged an appeal against the decision and paid the prescribed fee. A statement of grounds of appeal was subsequently received, with sets of claims of a main and three auxiliary requests. A conditional request for oral proceedings was made in the notice of appeal.

III. Following a communication from the Board the appellant filed additional sets of claims and modified his requests to a main and seven auxiliary requests.

IV. In the course of oral proceedings, held on 30 October 1997, the appellant further modified his requests; he asked that the decision under appeal be set aside and a patent granted on the basis of the following documents of a main request and a single auxiliary request:

Main request:

Claims: 1 to 10 of set A, received 30 September 1997;

Description: pages 1 to 11, submitted at the oral proceedings;

Drawings: sheet 1, as originally filed.

Auxiliary request:

Claims: 1 to 6, submitted at the oral proceedings;

Description and drawings: as main request.

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

"A method of processing a picture signal for conveyance by means of a transmission path or storage medium, said method comprising the steps of:-

- (i) producing a picture signal which corresponds to a picture,
- (ii) subjecting said picture signal to a segmentation algorithm to produce a region signal which identifies edges and closed regions in said picture,
- (iii) producing a modified region signal by post-processing the region signal produced in step (ii), and
- (iv) producing a texture signal which corresponds to the difference between the picture signal produced in step (i) and the modified region signal produced in step (iii),

characterised in that the production of said modified region signal comprises the steps of:-

- (v) producing an appropriate smooth function which is dependent on one or more characteristics of said region signal, and
- (vi) replacing the step edge of said region signal by the function produced in step (v)."

Of the remaining independent claims, claim 2 is directed to a method of recovering, i.e. decoding a picture signal, complementary to claim 1; apparatus claims 6 and 7 correspond to method claims 1 and 2 respectively.

VI. The independent claims of the auxiliary request differ from the corresponding claims of the main request in that feature (v) of claim 1 and the corresponding feature in the other independent claims defines specific properties of the smooth function. Claim 1 reads as follows:

"A method of processing a picture signal for conveyance by means of a transmission path or storage medium, said method comprising the steps of:-

- (i) producing a picture signal which corresponds to a picture,
- (ii) subjecting said picture signal to a segmentation algorithm to produce a region signal which identifies edges and closed regions in said picture,
- (iii) producing a modified region signal by post-processing the region signal produced in step (ii), and

- (iv) producing a texture signal which corresponds to the difference between the picture signal produced in step (i) and the modified region signal produced in step (iii),

characterised in that the production of said modified region signal comprises the steps of:-

- (v) producing a smooth function whose gradient is dependent on the step edge size between adjacent regions and/or the width of the region, and
- (vi) replacing the step edges of said region signal by the function produced in step (v)."

VII. The appellant argued as follows:

The generalisation of the smooth function and the characteristics on which it depends in the claims of the main request was justified; the inventor's contribution was the idea of using a smooth function dependent on the content of the region signal. The skilled person would appreciate that smooth functions other than third degree polynomials could be used to replace the edges and solve the problem of reducing the amount of high frequency information in the modified region signal. In the same way, the skilled person would readily think of characteristics other than step height and width, which were merely examples that were easy to implement. Another characteristic could be, for example, whether the transitions between a number of successive steps in the region signal changed in the same direction, which would indicate a real contour.

Reasons for the Decision

1. *Amendments*

1.1 In the independent claims of both requests, the feature of adding the smooth function has been changed to replacing the edge by the smooth function. The Board considers that this is derivable from the overall description of how the smooth function is used, in particular Figure 3; the skilled person would recognise that simply adding a smooth function to the edge, as previously stated, would not result in the desired smoothly changing form. Although Figure 5 of the application shows correction values which are read out from a look-up table and which could prima facie be added to the region signal, there is no description of negative correction values, so that simple addition would not achieve the desired waveform.

1.2 The Board is accordingly satisfied that the amended claims of both requests do not contravene Article 123 EPC.

2. *Background to the application.*

2.1 In one method of image coding, homogeneous regions of the picture such as areas of sky are represented as so-called region signals. A region signal indicates the mean brightness value of the region and differs by discrete steps from the values of other regions, as shown in Figure 3A of the application. The difference between the actual value of any given pixel and the region signal is additionally derived as a so-called texture signal, which represents the detail in the image. The region and texture signals are then separately encoded.

2.2 This technique yields high data compression but can also produce undesirable artefacts. One type of artefact is caused by false contours which occur when a smoothly changing area of the image gives rise to two separate region signals and thus an edge between them. These extra edges introduce high frequencies into the texture signal which can be lost due to the limited bandwidth available for the coding of that signal. The reproduced image therefore retains some of the false contours in the region signal and exhibits a visible artefact. A real contour and a false contour are shown in Figure 2 of the application.

2.3 It is common ground that document D1 is the single most relevant prior art document; the Board notes that the independent claims of both requests have been correctly delimited with respect to this document. D1 discloses two solutions to the problem of reducing high frequency information in the texture signal. First, it suggests merging the two regions on either side of a false contour, which can result in artefacts in neighbouring regions and in errors when a false contour is wrongly signalled. The alternative solution is to detect false contours in the region signal and remove them by smoothing across the contour to produce a modified region signal; the modified signal is subtracted from the input signal to give the texture signal. This must be done at both the encoder and decoder and the encoder must flag the false contours to the decoder. In the smoothing process, a 3-point filter filters the pixels on either side of the contour.

2.4 In the application on the other hand each step edge in the modified region signal is replaced by a smooth, i.e. continuous, function which depends on characteristics of the steps themselves. The embodiment uses a cubic spline (a third degree polynomial), whose coefficients depend on the step height (2Y in Figure 4) and/or the step width (2X in Figure 4).

3. *Clarity and Support (main request)*

3.1 Claim 1 of the main request refers to "an appropriate smooth function which is dependent on one or more characteristics of said region signal". The nature of the smooth function is unspecified, other than that it must be "appropriate" and dependent on otherwise unspecified characteristics of the region signal.

3.2 The Board accepts that the skilled person would interpret the expression "smooth function" to imply a generic class of continuous functions which can be used to replace step edges and would be aware of examples, other than the third degree polynomial used in the embodiment, suitable for solving the problem of edge artifacts. Thus the "smooth function" is considered to represent a permissible generalisation.

3.3 However, the reference to the "smooth function" being dependent on "characteristics of said region signal", is of unclear limitative effect. The description only gives two specific characteristics. At page 7, lines 16 to 20 it is stated that "high contrast edges must remain relatively unchanged in both position and magnitude. This implies that the gradient of the function has to be dependent on the step size between regions to regain sharp transitions, as shown in the accompanying Figure 3B". Further on at lines 30 to 32 it is stated that "The function should also be

controlled by the region width as shown in the accompanying Figure 3C". No characteristics other than step height and width are derivable from the description.

- 3.4 Thus, on the one hand the claim is of unclear scope and on the other hand, insofar as it embraces any characteristics other than step height and width, it lacks support in the description, Article 84 EPC.

4. *Clarity and Support (auxiliary request)*

- 4.1 In claim 1 of this request the smooth function is defined as having a gradient which is dependent on the step edge size between adjacent regions and/or the width of the region. Thus, applying the above reasoning, the Board considers that the claim is supported by the examples disclosed in the description. This claim accordingly meets the requirements of Article 84 EPC.

5. *Novelty and inventive step (auxiliary request)*

- 5.1 As noted at point 2.3 above, D1 detects false contours in the region signal and removes them by smoothing to produce a modified region signal which is subtracted from the input signal to give the texture signal, the encoder flagging false contours to the decoder. The smoothing is effected by means of a 3-point filter which filters the pixels on either side of the contour. The filter characteristics are fixed. In accordance with claim 1 of the auxiliary request on the other hand the step edges in the region signal are replaced by a smooth function whose gradient is dependent on the step size and/or width. The independent claims of the auxiliary requests are therefore novel, Article 54 EPC.

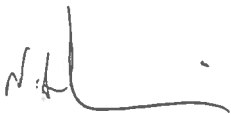
- 5.2 The Board considers that the skilled person would have no reason to replace the false contour detection and flagging of D1 with the means of the present application for producing a smooth function, which is in effect a form of adaptive filtering. The independent claims of the auxiliary request accordingly also involve an inventive step, Article 56 EPC.
6. The Board is also satisfied that the amended claims and description meet the remaining requirements of the EPC.

Order

For these reasons it is decided that:

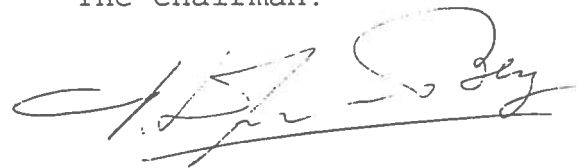
1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent in accordance with the appellant's auxiliary request.

The Registrar:



N. Maslin

The Chairman:



P. K. J. van den Berg



