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D E C I S I O N
of 5 May 2006

Case Number: T 0919/03 - 3.5.01

Application Number: 98115007.1

Publication Number: 0901103

IPC: G06T 5/00

Language of the proceedings: EN

Title of invention:
Contour correction apparatus and method

Applicant:
VICTOR COMPANY OF JAPAN, LTD.

Opponent:
-

Headword:
Contour correction/VICTOR COMPANY

Relevant legal provisions:
EPC Art. 56, 83, 84, 123(2)

Keyword:
"Clarity (yes, after amendment)"
"Sufficiency of disclosure (yes)"
"Prior art incomplete"

Decisions cited:
-

Catchword:
-

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Case Number: T 0919/03 - 3.5.01

D E C I S I O N
of the Technical Board of Appeal 3.5.01
of 5 May 2006

Appellant: VICTOR COMPANY OF JAPAN, LTD.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 March 2003 refusing European application No. 98115007.1 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: S. Steinbrener
Members: R. Zimmermann
A. Pignatelli

Summary of Facts and Submissions

I. European patent application number 98 115 007.1 (A-publication number 0 901 103) claims a priority date from September 1997 for a contour correction apparatus and method. The invention uses high-frequency emphasis for sharpening contours and edges in a digital image. For this purpose, a high-frequency signal is generated for each pixel of interest from at least five samples of the digital input video signal, the samples representing neighbouring pixels, the center pixel of which is the pixel of interest and corresponds to the center sample. The high-frequency signal is added to the center sample; the resultant signal is then limited to a range of values determined from the at least five samples. The upper and lower limits of the range have values greater and smaller, respectively, than a center value among the values of the at least five samples.

II. The examining division refused the application in oral proceedings held on 8 October 2002. The reasons for the refusal were given in a written decision dated 13 March 2003 and included insufficiency of disclosure of the invention, lack of clarity in the claims and lack of inventive step. The following documents were cited as prior art:

D1: G. Ramponi et al.: "Nonlinear unsharp masking methods for image contrast enhancement", Journal of Electronic Imaging, vol. 5, no. 3, July 1996, pages 353 - 366, and

D2: B. Jähne: "Digitale Bildverarbeitung", June 1997, Springer Berlin, pages 116 f.

Insufficiency of disclosure was seen in the circumstance that the actual distribution of pixel values might render it impossible to determine the limit values in all cases. To substantiate the objection the examining division cited the sequence 125, 126, 100, 100, 100 as an example of input samples from which the selection of a lower limit value smaller than the center value was not possible.

The Japanese document JP-A-05292522 published in 1993 and already acknowledged in the original A-publication paragraphs [0003] to [0007] was not taken into consideration by the examining division.

III. The applicant lodged an appeal against the refusal decision. A notice of appeal, including a debit order for the appeal fee, was filed on 9 May 2003; a written statement setting out the grounds of appeal was filed on 18 July 2003.

IV. On 6 April 2006 and 27 April 2006, the appellant filed various main and auxiliary requests, each request accompanied by an amended set of claims. The main request filed on 27 April 2006 included apparatus and method claims, claim 1 of which reads as follows (underlining added to indicate the differences to claim 1 as originally filed and published):

"1. A contour correction apparatus comprising: first means (6; 26; 75) for selecting a first sample from among at least five plural samples of an input digital video signal as an indication of an upper limit value (B3; B13; B23), the plural samples corresponding

to neighboring pixels respectively, the first sample having a value (B3; B13; B23) greater than a center value among values of the plural samples;
second means (7; 27; 76) for selecting a second sample from among at least the five plural samples as an indication of a lower limit value (B4; B14; B24), the second sample having a value (B4; B14; B24) smaller than the center value among the values of the plural samples;
third means (8, 9; 28, 29; 77, 78) receiving the plural samples for generating high-frequency signal components (B2; B12; B22) with respect to a sample of interest (B1; B11; B21) being one of the plural samples;
fourth means (10; 30; 79) for adding the high-frequency signal components (B2; B12; B22) generated by the third means (8, 9; 28, 29; 77, 78) to the sample of interest (B1; B11; B21) to generate an addition-resultant signal (B5; B15; B25), and
fifth means (11, 12; 31, 32; 80, 81) for limiting a value of the addition-resultant signal generated by the fourth means (10; 30; 79) to within a range between the upper limit value (B3; B13; B23) and the lower limit value (B4; B14; B24) provided by the first and second means (6, 26, 75 and 7, 27, 76) respectively."

V. In oral proceedings held on 5 May 2006, the matter including the Japanese document was discussed with the appellant's representative. The Board admitted the amended claims into the proceedings for consideration.

VI. Regarding this Japanese document, the representative explained that he could not, on the spot, present a detailed comparative analysis since the document had not been considered before, neither in first instance

by the examining division nor earlier in the appeal proceedings. Under these circumstances, the Board should not take a negative decision on the appeal without giving the appellant the opportunity to provide a full reply concerning this document.

VII. In presenting a provisional analysis of the Japanese document, the representative argued that the methods disclosed therein used three samples of the video signal for contour correction whereas in the present invention this number was at least five. In a digital image, the higher number of samples was essential to create any sharpening effect at all. A time-domain diagram similar to figure 2 of the application illustrated the various signals involved in the contour correction for the case of three instead of five samples of the video input signal. The diagram did not show any effect on the resultant signal. The use of five or more samples of the video input signal was the basis for the main improvement achieved by the invention; the invention thus provided an inventive contribution over the prior art of the Japanese document.

VIII. At the oral proceedings, the representative submitted and upheld, respectively, the requests that the decision under appeal should be set aside and a patent be granted on the basis of claims 1 to 8 according to the main request or of the first or second or third auxiliary requests, all filed on 27 April 2006, or claims 1 to 5 according to the fourth auxiliary request filed on 6 April 2006; alternatively, the case should be remitted to the first instance for further prosecution.

IX. The Board announced the decision on the appeal in the oral proceedings.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rules 1(1) and 64 EPC and is thus admissible.

2. The decision under appeal is to be reversed since the main request is admissible regarding the amendments and removes the objections which are material to the decision under appeal (see points 3 to 20 below). The grant of a patent on the basis of the main request, or of any one of the auxiliary requests, is not possible at this stage of the proceedings since the examination of the application has not yet taken full account of the prior art which is relevant to the invention; remittal of the case to the first instance for further prosecution is therefore necessary (see points 21 ff.).

Article 123(2) EPC

3. The requirement of Article 123(2) EPC is fulfilled.

The independent apparatus and method claims 1 and 6 correspond closely to the original claims 1 and 8.

Besides introducing reference signs into the claims in consistency with their use in the drawings and the description, the amendments clarify the claim wording without adding any new subject-matter to the content of the application.

In particular, the replacement of the term "center sample" by "sample of interest" is admissible in view of the A-publication, paragraphs [0033], [0059], [0095], [0107], which establish a direct definitional relationship between the "center pixel", the "pixel of interest", and the signal to which the high-frequency component is added.

4. Dependent claims 2 to 5 correspond directly to the original claims 2 to 4 and 6. Dependent method claims 7 and 8 define the lower and upper limits. These definitions can be derived directly and unambiguously from the application, e.g. from original dependent claims 2 and 3.

Article 84 EPC

5. The requirements of Article 84 EPC are fulfilled.

The main request clarifies the term "center" used in the claims considered by the examining division in the expressions "center sample" and "center value".

By replacing the term "center sample" by "sample of interest", the amended claims make clear that the "sample of interest" represents the "center pixel" in terms of the description (see the A-publication, paragraphs [0033], [0059], [0095], and [0107]), but that it is not necessarily the sample having the "center value".

6. Regarding the claimed number of "at least five samples", it is noted that this number cannot be construed to represent the whole image since contour correction

requires a sufficiently high resolution of the sharpening process and an iterative application on a number of "pixels of interest". The "at least five samples" must be rather construed to correspond to pixels in a local image portion significantly smaller than the overall image.

7. The expression "center value" indicates a middle level of magnitude in the rank of ordered samples values. This meaning can be derived from the paraphrase "center value among values of the plural samples" in claims 1 and 6, and is consistent with the embodiments disclosed in the description.

The A-publication states at paragraph [0096], and similar at paragraph [0061], that "the upper limit detection circuit 75 compares the values (the levels) represented by the twenty-five signals, and serially numbers the twenty-five signals in the order of their value magnitude". The paragraph continues: "the upper limit detection circuit 75 selects one signal from among the twenty-five signals which has a predetermined serial number chosen so that the value of the selected signal will be smaller than the greatest value and greater than the central value".

In these embodiments, the center value is the value which is ranked exactly in the middle of the ranked sequence of values, i.e. the value which is ranked number three in the example of five samples and number 13, respectively, in the example of twenty-five samples.

8. The is-greater and is-smaller conditions on the upper and lower limit values defined in the claims may be construed on a similar basis. In the embodiments, the limits are selected via a predefined position in the ranking order. In the example of five samples, the upper limit may be defined as the value which ranks 4th or 5th, assuming an ascending numbering, thereby meeting the conditions in the sense of a ranking order (see the examples given in paragraph [0061], and similar paragraph [0096] for 25 samples).

9. It follows that the main request removes the basis for objections raised by the examining division under Article 84. Other objections regarding clarity, conciseness or support by the description do not arise so that the claims of the main request are considered to meet the requirements of Article 84 EPC.

Article 83 EPC

10. The requirement of Article 83 EPC is fulfilled.

The examining division objected to the disclosure of the invention essentially on the basis of a specific input signal, namely 100, 100, 100, 125, 126, concluding that for sequences of such type the conditions on the upper and lower limits in respect to the center value could never be fulfilled.

11. A claim definition may fail to hold or the invention may become dysfunctional under some particular circumstances or outside of the envisaged operational range. This is not objectionable under Article 83 EPC so long as the failure is irrelevant to the practice or the skilled person knows, without having to exercise

undue efforts, how to overcome or to avoid the hurdles on the basis of the information conveyed by the application as a whole.

12. The examining division is right that the conditions on the upper and lower limits, if understood as ordinary arithmetical order conditions, cannot be satisfied within very low contrast image regions. However, a wide variety of subjects provide high contrast images resulting in video signals which vary, around contours and edges, significantly from pixel to pixel, and which thus pose no problem in selecting limits which satisfy the conditions in the most literal of senses.

13. Even for very low contrast regions, there are straightforward solutions to keep the invention operational, e.g. by blocking the sharpening operation or by skipping the is-greater or the is-smaller condition in such regions. In any case however, the embodiments disclosed in the present application work properly on high as well as on low or even zero contrast signals.

14. The embodiment using the maximum and minimum as limit values (see the A-publication, paragraphs [0034] to [0035]) results clearly in a correct signal output even if the momentary video signal input has constant values. The is-greater and is-smaller conditions have no technical relevance in this case.

15. The embodiments using predefined limits in-between the minimum and maximum also operate properly on low-contrast and constant video samples. According to the A-publication, paragraphs [0096] ff., the limit

detection circuits number the samples sequentially "in the order of their value magnitude". Via these order numbers, the center as well as the lower and upper limits can be predefined so that that their values are always determined and can be selected even when all samples have the same value.

Taking as sample values 100, 100, 100, 125, and 126, which is the example cited by the examining division, and as ranking positions 2, 3, and 4, the values 100, 100, and 125 would be selected for center, lower limit and upper limit, respectively.

If the values differ from sample to sample, however, the ranking correctly reproduces the ordinary order relationship known from elementary arithmetics, and thus ensures that the is-greater and is-smaller conditions in respect to the center value are automatically satisfied whenever possible.

16. For these reasons, the objections raised by the examining division under Article 83 EPC are not justified.

Inventive step in respect to document D1

17. The requirement of inventive step is fulfilled in respect to document D1.

The decision under appeal states in point 2.2 (see page 6, third paragraph) that the objective technical problem solved by the invention in respect to the prior art of document D1 may "be regarded as avoiding an increase of the dynamic range of the local set of the considered samples by the effect of the unsharp masking

operation". It appreciates that the final thresholding operation disclosed in document D1 relates to "the whole original image", whereas the invention takes into account "only the local set of considered samples" (see the decision under appeal, page 7, penultimate paragraph).

Then, however, the decision refers back to the statement of the objective problem, drawing the following conclusion: "The above stated problem implies that the maximum and minimum value of the local set of the considered samples has to be determined as the dynamic range" (see decision under appeal, page 7, last paragraph).

18. This is a fallacy of *petitio principii*: the decision under appeal assumes true for what it would have to give reasons, namely that it was part of the prior art or at least obvious in the light of the prior art to turn to a "local set" of samples or to the local dynamic range of the image signal for reducing signal distortions around contours and edges. On the basis of document D1 there is no motivation at all to move from preserving the maximum dynamic range of the original image, in document D1 a constant range from 0 to 255 (see document D1, figures 3 and 4), to preserving the local dynamic range within a local window of few neighbouring pixels centred around the pixel of interest.

19. Actually, the formulation of the objective technical problem in point 2.2 of the decision under appeal is already incorrect. By referring to the "local set of samples" it includes an inadmissible pointer to the

solution, which leads to the fallacy in the assessment of inventive step.

20. The objection of lack of inventive step as raised in the decision under appeal is, for these reasons, not justified.

Remittal to the first instance for further prosecution

21. It follows from the above considerations that the objections which are material to the decision under appeal are not an obstacle to the grant of a patent, at least not on the basis of the present main request.

However, the Japanese patent application number JP-A-05292522 appears to be a pertinent piece of prior art which has not yet been taken fully into account in examining patentability of the invention.

22. According to the present A-publication (see paragraphs [0003] to [0007]), the Japanese document concerns "a colour picture quality improving circuit provided with a section for sharpening contours in a picture represented by a video signal". Figures 1 and 3 of the Japanese document lead to the conclusion that a locally adapting threshold operation like the one of the present application is used for removing the over- and undershoot portions from the resultant signal. The maximum and minimum levels as well as the high-frequency signal component are apparently determined from three samples of a colour difference signal.

23. The appellant's representative explained in the oral proceedings before the Board that the decisive difference to the Japanese document was the use of at

least five instead of only three samples. With three samples, a digital video signal could not be improved.

Whether the disclosure of the Japanese document is limited to three samples and whether a lack of any enhancing effect is due to using such a low number of samples or may have other reasons, for example the rather artificial ramp form of the input image signal used in the calculations, can only be decided by a thorough examination of the Japanese document regarding its relevance for the present invention. The examination should include the assessment of the full content of the Japanese document.

24. In the present case, the appellant has a legitimate interest to have the merits of the invention reconsidered in first instance for safeguarding the right to appeal. The substantive examination is primarily the task of the examining division. It is thus appropriate to apply Article 111(1) EPC and to remit the case, on the basis of the main request, to the examining division for further prosecution.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance for further prosecution.

The Registrar: The Chairman:

P. Guidi S.V. Steinbrener