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Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Radiation image processing apparatus and method

Klassifikation / Classification / Classement : H04N 1/40

ENTSCHEIDUNG / DECISION

vom / of / du 2. January 1991

Anmelder / Applicant / Demandeur : 1) Fuji Photo Film Co. Ltd.
2) Philips Medical Systems Inc.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 84, 111, 123(2)

Schlagwort / Keyword / Mot clé : "Clarity of claims - yes, after admissible amendment" - "Remittal for further prosecution"

Leitsatz / Headnote / Sommaire

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Case Number : T 412/89 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 2 January 1991

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Decision under appeal : Decision of Examining Division 058 of the European Patent Office dated 5 April 1989 refusing European patent application No. 85 201 811.8 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : P.K.J. van den Berg
Members : W.B. Oettinger
J. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 85 201 811.8, claiming priorities as from 14 November 1984, filed on 8 November 1985 and published under No. 182 423, was refused by a decision of Examining Division 2.2.02.058 dated 5 April 1989.

The reason given for the refusal was that Claims 1 and 7 filed on 28 July 1988 lacked clarity because they referred to "a median" without giving any explicit definition of the intended limitated (or, according to the previous communication: limitative) effect of this term (Article 84 EPC).

It was added that the dependent claims failed to meet the requirements of clarity for the same reason.

II. On 23 May 1989, the Applicants lodged an appeal against that decision, paid the appeal fee and filed a statement of grounds.

III. In response to communications from the Board, the Appellants filed amended claims and requested that further amendments be made in the application documents on file by the Office.

Taking these into consideration, the Appellants' requests are that the impugned decision be cancelled and - by implication - that the examination procedure be continued on the basis of the following application documents:

Description:
pages 1, 2 and 4 as published but amended as requested on 28 July 1988,

pages 3 and 5 as published but amended as requested on 28 July 1988 and 8 November 1990 (with the reference to "page 3a" to be taken as a reference to page 3 of the amendments filed on 28 July 1988, and the reference to "page 56" to be taken as a reference to page 5 as published),
pages 6 and 9 as published,
page 7 as published but amended as requested on 8 November 1990,
pages 8 (a and b) and 10 filed on 21 May 1990,
page 11 as filed on 21 May 1990 but amended as requested on 8 November 1990 (however the reference to "line 17" to be taken as a reference to line 17 of page 11 as published);

Claims:
Claims 1 and 4 to 8 filed on 8 November 1990,
Claims 2 and 3 filed on 28 July 1988;

Drawings:
Sheets 1, 3 and 4 as published,
Sheet 2 filed on 21 May 1990.

The independent claims of the aforementioned set of claims read as follows:

"1. Image processing method for scanning an information storing means to obtain an electric image signal therefrom and for conversion of said electric image signal into a visible image, said image processing method comprising the steps of: converting said electric image signal into a number of digital signals (Dorg) for respective picture elements of said image corresponding to scanning points and obtaining a low-frequency signal (Dus) for each picture element from a group of said digital signals

within a mask of a pre-determined size, and conducting an operation of Dorg + ß (Dorg - Dus) using a frequency emphasising co-efficient ß, characterised in that, for the low-frequency signal Dus a signal value is used for which in a cumulative distribution (accumulated histogram) of the signals of the picture elements within the mask, half the number of picture elements is found, i.e. the median of said group of digital signals in said cumulative distribution.

7. A radiation image processing apparatus for a radiation image information recording and reproducing system which comprises a stimulating ray source (12) for emitting scanning stimulating rays which scan a stimulable phosphor sheet (11) carrying radiation image information and causes light carrying said radiation image information to be emitted by the stimulable phosphor sheet, a photodetector (15) for detecting said emitted light and converting same into an electric image signal, and an operating means (16), (17), (18), (19), (20), for processing said electric image signal, said operating means comprising: a converter (17) for converting said electric image signal into a number of digital signals (Sorg) for respective picture elements of said image, an operating means (19) for conducting an operation of Sorg + ß (Sorg - Sus) where Sus is a low-frequency signal and ß is a frequency emphasising co-efficient, the radiation image processing apparatus comprising a further operating means (18) for obtaining the low frequency signal Sus from a group of said digital signals in a mask of a pre-determined size, characterised in that Sus is the value for which in a cumulative distribution (accumulated histogram) of the signals of the picture elements within the mask, half the number of picture elements is found, i.e. the median of said group of digital signals in said cumulative distribution."

IV. In the notice of appeal, the Appellants had further requested oral proceedings.

In its communication of 19 July 1990, the Board interpreted this request, in view of the amendments meanwhile made to Claims 1 and 7 as an auxiliary request which would only take effect in case the Board would intend to uphold the impugned decision. It invited the Appellants to expressly state that their request for oral proceedings was intended to be an unconditional request, if this interpretation were incorrect.

No such statement was made by the Appellants in their response filed on 8 November 1990.

Reasons for the Decision

1. The appeal is admissible (Articles 106 to 108 and Rule 64 EPC).

2. The appealed decision was based on the objection that Claims 1 and 7 then on file lacked clarity.

The amendments made to Claims 1 and 7 on 8 November 1990 are intended to meet this objection.

The issue to be decided is therefore whether these amendments do render these claims clear (Article 84 EPC).

3. Some of the expressions used in Claims 1 and 7 are capable of interpretation if regarded in isolation.

The Board wishes, however, to explain how it interprets these expressions in the context of the whole claim.

3.1 The prior art portion of Claim 1 is understood as meaning that - briefly - a video signal resulting from scanning a stored image with its amplitudes having been digitized (Dorg) is subdued to an electronic processing step consisting of superimposing (+) a signal which is derived from that portion of itself which exceeds (-) a threshold (Dus), by amplifying (or attenuating) this portion (Dorg - Dus) with a particular factor (ß).

The threshold (Dus) is obtained from a group of the digital signals lying within a mask containing the actual signal and is, relatively to the signal to be processed, slowly varying when the mask is being shifted during the scanning of the image.

The amplification (or attenuation) factor (ß) can take various values and can even vary as a function of the signal to be processed (Fig. 7).

3.2 The characterising portion of Claim 1 is understood as defining how the relatively slowly varying threshold signal (Dus) is generated:

For this purpose, first a "cumulative distribution" of the digital signal elements lying within the mask is produced, and this "cumulative distribution" is also called "accumulated histogram".

The expressions "distribution" and "histogram" are understood as referring to a statistical distribution in the sense that it is the number of occurrences, or the frequency, of each signal value which counts, i.e. that number, or frequency, as a function of signal value, similar to the probability distribution, or density, in statistics.

This statistic-like distribution of the numbers of occurrences versus signal values is rendered "cumulative" in that said numbers of occurrences are "accumulated", or intergrated stepwise, starting with the occurrences of the lowest and proceeding to those of the higher values.

The important method step as it is defined in the characterising portion of Claim 1 is understood as meaning that the accumulation process is interrupted as soon as half the number of total occurrences of signal values have been used. In other words: If n is the number of picture elements lying within the mask, and thus the total number of occurrences of all signal values considered, the numbers of occurrences are added to each other, starting from those of the lowest and proceeding to those of the higher values, until a total of (n+1)/2 (with a correction if n is even rather than odd) occurrences have been counted.

The signal having the value whose occurrences have last contributed to the accumulation is then taken as the said threshold signal. This signal is, in fact, the central value in the accumulated distribution or histogram and called "median".

3.3 The Board interprets Claim 7 as defining an apparatus for carrying out the method defined in Claim 1 in purely functional terms, i.e. in terms of its operation without adding any technological detail.

Said functional terms being the same as those used in Claim 1 for the method steps, in respect of the Board's interpretation of Claim 7 the same applies as for that of Claim 1 (paragraphs 3.1 and 3.2).

4. Proceeding now to the issue proper to be decided:

4.1 Firstly, it is noted that the pre-characterising portions of Claims 1 and 7 are intended to reflect a prior art represented by a US patent document cited in the description (page 2), and no clarity problem arises insofar.

4.2 As regards the characterising portions of Claims 1 and 7, these must be considered as objectively clear if the Board's subjective interpretation (paragraph 3) is the only one possible.

In the Board's opinion, this is indeed the case. More particularly, the expression "distribution" can, in its context, only be interpreted as meaning the number of occurrences, or the frequency, as a function of signal value.

Only as long as its context is ignored might it be possible to misunderstand the expression "distribution" as referring to the sequence in time of the quants of the digital video signal, but such a misinterpretation is clearly no longer possible as soon as the following contextual facts are taken into account.

- The expression "histogram" is only understood in statistics and designates there (see any standard book) a statistical distribution function, i.e. the number of occurrences, or the frequency, or density, as a function of the values of a set of events.

- The expressions "cumulative" and "accumulated" can only be understood in this context. With an assumed sequence in time as of a video signal, an accumulation would result in a very high level signal representing a total

amount of energy which would clearly not be suitable for a threshold in the claimed method. Such an assumption would not, therefore, make sense.

- Searching for "half the number of picture elements" can only be understood in the context of said statistic-like distribution. In an assumed sequence in time as of a video signal, such a half-number search could only result in finding a picture element which, even though it is "central", would yield a value which is random and, therefore, unsuitable as a threshold.

- The expression "median" is not generally understood in electronics but clearly defined in statistics (see any encyclopedias), for instance, in the following terms: "the middle value in a distribution, above and below which lie an equal number of values". With a "cumulative distribution", the "median" is, consequently, defined for instance in the following terms: "the argument of the cumulative distribution function of a random variable corresponding to a probability of one half".

It is, therefore, not possible that the expression "distribution" could,in its proper context, be misinterpreted as meaning anything other than a statistic-like distribution, for instance a sequence in time as of a video signal.

4.3 For these reasons it is concluded that the subjective interpretation the Board gives to Claims 1 and 7 (paragraphs 3.1 to 3.3) is objectively the only one which is reasonable in the context and therefore correct, and this conclusion implies that Claims 1 and 7 meet the requirement of clarity (Article 84 EPC).

5. It still remains to be decided whether, in this interpretation, Claims 1 and 7 are supported by the original disclosure because if they are not, the amendments cannot be admitted under Article 123(2) EPC even though they meet the lack of clarity objection on which the appealed decision was based.

No problem arises in this respect. The subject-matter of Claims 1 and 7 is fully disclosed in the original application documents, as will be explained subsequently:

5.1 Claim 1 is based on the original Claim 1 with the following exceptions:

(a) The original restriction to "X-ray images" has been generalised to "radiation images". Support is found for this generalisation in the original Claim 7.

(b) The originally missing definition of "median" has been introduced. This definition is based on the description, as follows:

On page 5, line 7, the "median" is defined as a "central value".

On page 9, lines 28-30, it is disclosed that, for the purpose of obtaining the "median", first an accumulated histogram in the mask is made, and reference is made to Figure 6. It is clear from the values shown along the abscissa axis in Fig. 6 and from page 9, lines 35-36 that the accumulated histogram is a function of the values of the digital signal; in the particular example given on page 9, line 32 where the digital data is designated by 8

bits and assuming as usual that the lowest value is 0, the maximum value is the 8th power of 2 minus 1, i.e. 255 as indeed shown in Fig. 6.

Further, it is clear from the data shown along the axis of ordinates in Fig. 6 and from page 5, lines 8-13 and Fig. 5 with its description, page 9, lines 25-27, 30-31 and 32-33, that the function constituting the accumulated histogram represents numbers of picture elements within the mask; in the particular example of a square mask having N x N picture elements (page 5, line 9 and page 9, lines 31 and 33), that number runs from 1 to N^2 (Fig. 6), and if N=3 (page 9, line 31 and Fig. 5), it runs up to 9 (page 9, line 33 and Fig. 6).

It is, therefore, clear that the accumulated histogram shown in Fig. 6 is no longer a temporal sequence of signals as was the original video signal but a statistical distribution in the sense that it represents the numbers of occurrences, or the frequency, of the different values of the digital signal versus these values.

Further, it is clear from the expression "accumulated" and from the monotony of the function represented by Fig. 6 that this function represents indeed an accumulation, or stepwise integration, of said numbers. It represents thus the numbers of digital signals which have already been used, starting from the number of the lowest possible signal value and proceeding to those of the higher values, in the accumulation process.

The number of picture elements in the mask being, in the particular case of a square mask as shown in Fig. 5, N^2, the ordinate numbers run, consequently, from 1 to N^2; and in the example of N=3, up to 9; as indeed shown in Fig. 6.

Finally, it can be derived from page 5, lines 10-12, from Fig. 6 and from page 9, line 34 and page 10, lines 1 ff., that the median (M) is the signal value (I) where the numbers of picture element signals so far having contributed to the accumulation have reached the central number in the accumulated histogram; in the particular example of a square mask with N^2 elements, this is the $(N^2+1)/2$th, or in the specific example of N=3, the fifth, as shown in Fig. 6.

In other words: It is clear from the original application documents that the "median" is the signal value (I) for which in the cumulative distribution (accumulated histogram, Fig. 6) of the signals of the picture elements (30) within the mask (Fig. 5), half the number of picture elements is found.

5.2 It is noted that this derivation of the subject-matter of Claim 1 from the original disclosure is fully consistent with the Board's interpretation of this claim based on its wording alone (paragraph 3).

In the particular example of a square mask with N x N elements, n as used in paragraph 3.2 becomes N^2.

5.3 Consequently, the subject-matter of Claim 1 is to be regarded as fully derivable from the original application documents.

The amended Claim 1 does not, for this reason, introduce any matter extending beyond the content of this application (Article 123(2) EPC).

5.4 Claim 7 is based on the original Claim 11 with the same exception (b) as mentioned in paragraph 5.1.

For this exception exactly the same applies as pointed out in that paragraph with regard to Claim 1.

5.5 Therefore, the amended Claim 7 does also not introduce any matter extending beyond the content of the application as originally filed.

6. Even though the Examining Division stated that "unfortunately, the description at page 9, line 25 is also obscure", it did not conclude lack of sufficiency in the sense of Article 83 EPC.

The Board agrees with this view. The claimed subject-matter, as it is understood (paragraph 3) and defined (paragraph 4), is disclosed in the original application documents (paragraph 5), although concisely, in such a way as to enable the skilled reader to carry out the method of Claim 1 and implement the apparatus of Claim 7 without any difficulty.

7. No formal objection arises against the dependent claims.

8. Superficially, at least most of the amendments requested to be made to the description would also appear to be admissible under Article 123(2) EPC.

However, it is not immediately apparent that this applies also to the amendment requested for page 7, lines 37 and 38 ("cathode ray tube" instead of "cat of a photosensitive

material"). The Board wishes, therefore, not to prejudice the Examining Division in respect of the admissibility of this amendment.

9. It is moreover noted that apparently the description still suffers from clerical errors which should be corrected, for instance in the last line of page 11 ("Dor an").

10. No opinion has been given by the Examining Division on the question of patentability (Article 52 EPC), and it would therefore be inappropriate for the Board, as an Appeal Board, to deal with it.

With particular reference to the Examining Division's opinion expressed in the second paragraph on sheet 4 of the appealed decision, it should only be noted that a "median" as now defined in Claims 1 and 7 distinguishes clearly from an "average" as mentioned on page 5, line 4 of the description and from a "mean", more particularly an "arithmetic mean", as mentioned in the US document referred to in paragraph 4.1 above.

11. For these reasons (paragraphs 8 to 10), the Board considers it appropriate to make use of its discretion to remit the case to the first instance for continuation of the examination procedure (Article 111(1) EPC).

12. The condition for the Appellants' auxiliary request for oral proceedings (as interpreted by the Board and silently confirmed by the Appellants; cf. paragraph IV above) does not, in the circumstances, apply and this request is, therefore, not relevant.

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 on the basis of the application documents on file as listed in paragraph III above, with the proviso that the claims meet the requirements of clarity and formal admissibility.

The Registrar: The Chairman:

M. Kiehl P.K.J. van den Berg