BESCHWERDEKAMMERN   BOARDS OF APPEAL OF   CHAMBRES DE RECOURS
DES EUROPÄISCHEN   THE EUROPEAN PATENT   DE L'OFFICE EUROPEEN
PATENTAMTS   OFFICE   DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

D E C I S I O N
of 17 January 2005

Case Number: T 0078/03 - 3.2.2

Application Number: 96908470.6

Publication Number: 0757544

IPC: A61B 6/00

Language of the proceedings: EN

Title of invention:
Computerized detection of masses and parenchymal distortions

Applicant:
ARCH DEVELOLPMENT CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 82

Keyword:
"Unity of invention (yes)"

Decisions cited:
-

Catchword:
-

Case Number: T 0078/03 **-** 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2.
of 17 January 2005

Appellant: ARCH DEVELOPMENT CORPORATION
The University of Chicago
1101 East 58th Street
Walker 213
Chicago, IL 60637 (US)

Representative: Winter, Brandl, Fürniss, Hübner, Röss,
Kaiser, Polte
Partnerschaft
Patent- und Rechtsanwaltskanzlei
Alois-Steinecker-Strasse 22
D-85354 Freising (DE)

Decision under appeal: **Decision of the Examining Division of the**
European Patent Office posted 22 August 2002
refusing European application No. 96908470.6
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: T. K. H. Kriner
Members: S. S. Chowdhury
A. Pignatelli

Summary of Facts and Submissions

I.   This appeal is against the decision of the examining
        division dated 22 August 2002 to refuse European patent
        application No. 96 908 470.6. The application was
        refused on the grounds that claims 1 and 15 of the main
        and the first auxiliary requests were not in unity as
        required by Article 82 EPC since their common subject-
        matter was known from:

D3:   "Computerized detection of masses in digital
        mammograms: Analysis of bilateral subtraction
        images", F-F. Yin et al., Medical Physics, Vol. 18
        (1991), No. 5, pages 955-963.

Claim 1 of the second auxiliary request was found to
lack an inventive step in view of D3 and D4: US-A-5 319
549.

The Board has, in addition, considered the following
documents cited by the examining division during the
examination procedure:

D1:   WO-A-9 518 561

D2:   "Hough Spectrum and Geometric Texture Feature
        Analysis", M. Zhang et al., Proceedings of the
        12th IAPR International Conference on Pattern
        Recognition, Vol 2; 9-13 October, 1994, Jerusalem,
        Israel.

II.   By letter dated 21 October 2002 the appellant lodged an
        appeal against the decision and paid the prescribed fee.

On 24 December 2002 a statement of grounds of appeal was filed.

III.   The appellant requests that the decision under appeal be set aside and that the case be remitted to the first instance for further prosecution, with a ratio decidendi acknowledging unity of invention in view of Article 82 EPC, on the basis of the following documents:

-      Description pages 1 to 36 filed with the grounds of appeal dated 19 December 2002

-      Claims 1 to 42 filed by letter dated 21 December 2004

-      Figures 1 to 27 as originally filed.

IV.   The independent claims 1, 14, 39 and 40 read as follows:

"1. A method for enhancing visualization of a mammographic image, comprising: identifying the breast border to identify the pixels of the image corresponding to the breast region, segmenting an anatomically dense portion of said breast region which dense portion excludes subcutaneous fat regions and processing said dense portion to produce a processed image having a more uniform density.

14. A method for detecting a lesion in a mammographic image, comprising: identifying the breast border to identify the pixels of the image corresponding to the breast region, segmenting an anatomically dense portion of said breast region which dense portion excludes subcutaneous fat regions and processing said dense

portion to produce a processed image having a more uniform density; extracting features from said processed image; inputting said features to a lesion detection scheme; and detecting a lesion in said image.

39. A system for enhancing visualization of a mammographic image, comprising: an image acquisition means to obtain said image; an identifying means to identify the breast border to identify the pixels of the image corresponding to the breast region; a segmenting means to segment an anatomically dense portion of said breast region which dense portion excludes subcutaneous fat regions and a processing means to process said dense portion to produce a processed image having a more uniform density.

40. A system for detecting lesions in a mammographic image, comprising: an image acquisition means (2700) to obtain said image; an identifying means (2701) to identify the breast border to identify the pixels of the image corresponding to the breast region, a segmenting means (2701) to segment an anatomically dense portion of said breast region which dense portion excludes subcutaneous fat regions, a processing means (2701) to process said dense portion to produce a processed image having a more uniform density, a feature extraction means (2704) to extract features from said processed image, and a lesion detection means (2705, 2711) to detect a lesion in said image."

Claims 2 to 13, 15 to 38, 41, and 42 are dependent claims.

V.   The appellant argued that the independent claims were
         unified by the inventive general concept of segmenting
         an anatomically dense portion of the breast, and the
         different claims focused on different applications of
         this concept.

Reasons for the Decision

1.   The appeal is admissible.

2.   *Amendments*

2.1   Article 123(2) EPC:

         The claims of the main request are based on the
         originally filed claims. Claim 1 has been amended by
         replacing "detecting a lesion in" by "enhancing
         visualization of". The broadest definition of the
         invention is given on page 4, first paragraph of the
         application, and this defines an invention which is a
         method in which a segmentation of the dense regions
         within a mammogram is performed, followed by an option
         for correction within the dense portion and/or
         detection for lesions. On page 3, third paragraph an
         object of the invention is to provide an automated
         method and system for the segmentation of the dense
         portion of the breast within the mammogram in order to
         determine the percent dense and related indices as well
         as for use in subsequent image processing for human
         vision. Thus, the application as originally filed
         envisaged an invention comprising a method for
         enhancing visualization of a mammographic image in
         which the dense portion of a breast is segmented and

rendered uniform for enhanced visualisation, so that
this amendment is acceptable.

That an anatomically dense portion of a mammogram image
is segmented and processed to produce an image having a
more uniform density is supported by the description
with reference to Figs. 8 and 9, for example.

Claim 1 is free from objections under Article 123(2)
EPC, accordingly. Claim 14 is similarly allowable. The
extraction of features and the lesion detection scheme
are supported by page 14, first paragraph.

Claims 39 and 40 are system claims corresponding to
method claims 1 and 14, respectively, and are,
therefore, also allowable.

3.   *Article 84 EPC*

The claims have been amended to make it clear that the
breast region as a whole is first identified, and the
dense portion within the breast region is then
identified. The amended wording corresponds to the
wording on page 8, lines 7 and 8 and original claim 2,
for example.

Two independent method claims respectively emphasise
different applications of the same basic method. That
is, the emphasis in claim 1 is on the visualisation of
a mammographic image, whereas in claim 14 it is on the
detection of a lesion in a mammographic image. The two
methods are for the purpose of human and machine
inspection, respectively, so that two independent
claims are appropriate. Similarly, two independent

system claims are also appropriate. The Board considers the conciseness requirement of Article 84 EPC to be satisfied by the independent claims 1, 14, 39, and 40, accordingly.

4.   *Article 84 EPC*

4.1   The present application is directed to a method and system for the enhanced visualisation or automatic detection of lesions such as masses within mammograms. The breast has various regions within the skin, shown in Figure 7 of the application, including subcutaneous fat, fatty portions, and dense portions. The breasts tend to be dense in the external portions and fatty near the chest wall, the dense portions tending to reside near the nipple and skin region. The dense "anatomical" portions show up as white on the mammogram, which correspond to areas of low optical density. Figure 7 shows the fatty (high optical density and low pixel value) and dense (low optical density and high pixel value) portions in the breast.

The method steps of claim 1 include identifying the breast outline defined by the outer skin, segmenting an anatomically dense portion of said breast region which dense portion excludes subcutaneous fat regions and processing said dense portion to produce a processed image having a more uniform density, as shown in Figures 9A and 9B and described on page 13, penultimate paragraph. This improves the visibility of lesions for both visual inspection as well as automatic detection of lesions (see page 14, first paragraph).

0095.D

From the dense portion, a value called the "percent dense" may be calculated (page 12, middle paragraph), which itself is a useful measure to radiologists to categorize and interpret radiographic breast images. Also, a delineation of the dense region followed by processing this region of the image to render the image with a more uniform density, helps in visualising lesions, which mainly tend to occur in the dense portion. The lesions may also be detected automatically after the dense region is delineated and made uniform.

4.2   The technical problem addressed by the application is, therefore, to process the breast image in order to facilitate the visualisation and detection of lesions.

4.3   The prior art

D1 is cited under Article 54(3) EPC. This document does not mention segmenting the dense portion of the breast in a mammogram, it only deals with segmenting the breast itself, ie detection of the breast outline defined by the skinline. The importance of locating the skinline is set out at the bottom of page 2 and on page 3, but there is no mention of detecting a dense portion (in the sense of the application) within the breast.

D2 describes the use of a Hough spectrum to measure geometric texture features for detecting lesions in a mammogram, but there is no mention of identifying dense portions of the breast.

D3 describes a scheme based on the deviation from the usual architectural symmetry of normal left and right

breasts. It uses a subtraction technique and
thresholding before subtracting. Multiple images are
obtained from a single pair of mammograms, by using
different threshold levels (5% to 50%, see page 957),
in order to eliminate some "anatomic background".

By chance, one of the threshold levels used in this
procedure might accidentally correspond to the
threshold for identifying fat as in the application,
but there is no teaching in this document that this
should then be used in a subtraction step to identify
dense regions.

D4 relates to the analysis of chest radiographs for
lung texture analysis, and is not relevant to
identifying dense portions of the breast.

4.4   The decisive fact for the question of unity of
        invention in the present case is that all the claimed
        methods and systems share a common technical feature,
        namely a method step or means for segmenting an
        anatomically dense portion of said breast region which
        dense portion excludes subcutaneous fat regions and
        processing said dense portion to produce a processed
        image having a more uniform density. It is this
        technical feature for solving the technical problem
        addressed by the present application, which forms the
        common "inventive" concept of all claims. In other
        words, this feature constitutes a special technical
        feature that defines the contribution that the claimed
        invention makes over the prior art, as required by
        Rule 30(1) EPC.

4.5   Therefore, the set of claims on file meets the
        requirement of Article 82 EPC.

Order

For these reasons it is decided that:

1.   The decision under appeal is set aside.

2.   The case is remitted to the Examining Division for
        further prosecution on the basis of the following
        documents:

        —   Description pages 1 to 36 filed with the grounds
                of appeal dated 19 December 2002

        —   Claims 1 to 42 filed by letter dated 21 December
                2004

        —   Figures 1 to 27 as originally filed.

The Registrar: The Chairman

V. Commare   T. K. H. Kriner

0095.D