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Datasheet for the decision
of 11 June 2015

Case Number:	T 1286/09 - 3.5.07
Application Number:	03078317.9
Publication Number:	1418509
IPC:	G06F17/30
Language of the proceedings:	EN

Title of invention:
Method using image recomposition to improve scene
classification

Applicant:
Intellectual Ventures Fund 83 LLC

Headword:
Image classifier/INTELLECTUAL VENTURES

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

Case Number: T 1286/09 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 11 June 2015

Appellant: (Applicant)	Intellectual Ventures Fund 83 LLC 7251 W Lake Mead Boulevard Suite 300 Las Vegas, NV 89128 (US)
Representative:	Carpmaels & Ransford LLP One Southampton Row London WC1B 5HA (GB)
Decision under appeal:	Decision of the Examining Division of the European Patent Office posted on 22 December 2008 refusing European patent application No. 03078317.9 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman	R. Moufang
Members:	M. Rognoni
	P. San-Bento Furtado

Summary of Facts and Submissions

I.   The transfer of the European patent application
       no. 03078317.9 from Eastman Kodak Company (legal
       predecessor of the current applicant) to Intellectual
       Ventures Fund 83 LLC (current applicant) was requested
       with letter dated 21 March 2013.

       The registration of the transfer took effect on
       21 March 2013, as confirmed by the communication of the
       EPO dated 2 April 2013.

       In the following no distinction is made between the
       current applicant/appellant and its predecessor.

II.   The applicant (appellant) appealed against the decision
       of the Examining Division to refuse European patent
       application no. 03078317.9.

III.   In the contested decision, the Examining Division came
       to the conclusion that the subject-matter of claim 1 of
       the request filed by fax on 26 November 2008 did not
       involve an inventive step with regard to the following
       document (Article 56 EPC):

       D3: EP-A2-0 800 147.

       The Examining Division identified also the following
       prior art which had been cited during examination:

       D1: WO-A-99/57622
       D2: WO-A-02/059828.

IV.   With the statement of grounds of appeal the appellant
       filed a new set of claims 1 to 7 and implicitly
       requested to set aside the decision under appeal and to

grant a patent on the basis of these claims. Additionally, the appellant requested oral proceedings before the Board, should the appeal not be allowed.

V.   With letter dated 17 December 2014, the appellant was summoned to oral proceedings to be held on 21 May 2015.

VI.   In a communication pursuant to Article 15(1) RPBA dated 2 March 2015, the Board raised some objections under Article 84 EPC against claim 1 of the appellant's request. On the other hand, the Board concurred with the appellant that document D3 did not constitute a suitable starting point for assessing the inventive step of the present invention, as understood from the description.

VII.   In reply to the Board's communication, the appellant filed with letter dated 21 April 2015 a new main request and an auxiliary request. Furthermore, the appellant asked the Board to consider, in advance of the oral proceedings, if any of the requests was potentially allowable, and to communicate its findings to the appellant in case it proved possible to cancel the oral proceedings.

VIII.   In a communication sent by fax on 8 May 2015, the Board expressed the view that neither the main request nor the auxiliary request satisfied the requirements of Article 84 EPC. However, if the appellant filed a new claim overcoming all clarity objections, the Board might decide to remit the case to the department of first instance with the order to grant a patent on the basis of such claim and a description to be adapted.

IX.   With letter dated 14 May 2015, the appellant replaced the main request and withdrew the previously filed

auxiliary request. The request for oral proceedings was
maintained in the event that the Board was unable to
remit the case to the department of first instance
based on the replacement main request.

X.   In reply to a fax by the Board dated 18 May 2015, the
        appellant filed, with letter dated 18 May 2015, a new
        replacement main request. The conditional request for
        oral proceedings was maintained.

XI.   The oral proceedings were then cancelled.

XII.   The only claim of the appellant's sole request ("main
        request") reads as follows:

        "A computer implemented method for improving image
        classification of a digital image comprising the steps
        of:
         (a) providing an exemplar color image;
         (b) systematically altering the exemplar color image
        to generate an expanded set of images, wherein
        systematically altering the exemplar color image
        comprises:

                spatially altering the exemplar color image to
            generate an expanded set of spatially altered
            images, wherein spatially altering the exemplar
            color image comprises:

                    horizontally mirroring the exemplar
                color image, thereby doubling the number of
                images in the expanded set of images, or
                    systematically cropping the edges of the
                exemplar color image from one or more sides
                of the exemplar color image, thereby
                increasing the number of images in the
                expanded set of images; and/or

temporally altering the exemplar color image
to generate an expanded set of temporally altered
images, whereby the images in the expanded set
simulate the appearance of capturing an image
earlier or later in time, wherein temporally
altering the exemplar color image comprises:

systematically shifting the color
distribution of the exemplar color image,
thereby increasing the number of images in
the expanded set of images, or

systematically shifting the illuminant
quality of the exemplar color image, thereby
increasing the number of images in the
expanded set of images; and

(c) using a semantic classifier and the expanded set
of images to determine an image classification for the
exemplar colour image;

wherein the expanded set of images are used to
train the classifier in step (c), thereby providing an
improved classifier."

XIII.   In the statement of grounds the appellant argued that
document D3 did not put into question the inventive
step of the method of the invention. In particular, the
appellant argued that the "image" in document D3 was
specifically disclosed as a set of text-based bi-level
(black and white) symbols. Furthermore, rather than
systematically altering the primary image to generate
an expanded set of images, the method of D3 separately
preprocessed each of the input images to produce, not
an expanded set of images, but a single binary gray
level image. In other words, document D3 disclosed the
processing of many images into one, whereas the present
invention processed one image into many.

Reasons for the Decision

1.   The appeal is admissible.

2.   The present application relates generally to the field
        of digital image processing and, in particular, to a
        method for improving image classification by training a
        semantic classifier with a set of exemplar colour
        images, which represent "*recomposed versions*" of an
        exemplar image, in order to increase the diversity of
        training exemplars (cf. application as filed, page 3,
        lines 11 to 18).

2.1   According to the application as filed (paragraph
        bridging pages 1 and 2), current scene classification
        systems enjoy limited success on unconstrained image
        sets because of the incredible variety of images within
        most semantic classes. Exemplar-based systems should
        account for such variation in their training sets.
        However, even hundreds of exemplar images do not
        necessarily capture all the variability inherent in
        some classes. As an example of such variability, the
        application gives the class of sunset images which can
        be captured at various stages of the sunset and thus
        may have more or less brilliant colours and show the
        sun at different positions with respect to the horizon.

2.2   The gist of the present invention consists essentially
        in increasing the diversity of exemplar images used to
        train a semantic classifier by systematically altering
        an exemplar colour image to generate an expanded set of
        images with the same salient characteristics as the
        initial exemplar image. More specifically, an exemplar
        image may be altered by means of "spatial
        recomposition", i.e. by cropping its edges or by
        horizontally mirroring it. Another technique for

expanding the set of exemplar images is to shift the
colour distribution or to change the colour along the
illuminant (i.e. red-blue) axis (cf. paragraph bridging
pages 6 and 7 of the application).

3.   Claim 1 of the appellant's request is directed to a
        computer implemented method for improving image
        classification of a digital image and comprises the
        following steps (itemized by the Board):

    (a) providing an exemplar colour image;

    (b) <u>systematically altering</u> the exemplar colour image
        to generate an expanded set of images,
        - wherein systematically altering the exemplar
          colour image comprises:

        i)   <u>spatially altering</u> the exemplar colour image
             to generate an expanded set of spatially
             altered images,
              wherein spatially altering the exemplar
             colour image comprises:
        -       horizontally mirroring the exemplar
             colour image, thereby doubling the number of
             images in the expanded set of images, or
        -       systematically cropping the edges of the
             exemplar colour image from one or more sides
             of the exemplar colour image, thereby
             increasing the number of images in the
             expanded set of images; and/or

        ii) <u>temporally altering</u> the exemplar colour
             image to generate an expanded set of
             temporally altered images,

whereby the images in the expanded set
simulate the appearance of capturing an
image earlier or later in time,
 wherein temporally altering the exemplar
colour image comprises:
-     systematically shifting the colour
distribution of the exemplar colour image,
thereby increasing the number of images in
the expanded set of images, or
-     systematically shifting the illuminant
quality of the exemplar colour image,
thereby increasing the number of images in
the expanded set of images; and

(c) using a semantic classifier and the expanded set
of images to determine an image classification for
the exemplar colour image;

(d) wherein the expanded set of images are used to
train the classifier in step (c), thereby
providing an improved classifier.

Articles 123(2) and 84 EPC

4.   Claim 1 of the appellant's request is essentially based
on a combination of the features recited in claims 1 to
3 and 6 to 11 of the application as filed.

4.1   Original claim 1 was directed to a method which used
image recomposition to generate an expanded set of
images for improving both the training of a classifier
and the classification of an image, as the clause
*"whereby the expanded set of images provides at least
one of an improved classifier and an improved
classification result"* implies. According to claim 1 on

file, the expanded set of images obtained from an exemplar image is used to train the classifier.

Image recomposition in training is described on page 5, line 26 to page 6, line 11 of the application. Figure 9 shows a diagram of the method of the invention whereby the expanded set of images can originate from a test image or from an exemplar image (see also page 13, line 23). As specified on page 13, lines 30 to 32, "[i]*f the expanded set of images are exemplar images, they are used to train the classifier in a training stage 28, thereby providing an improved classifier according to the invention*".
Furthermore (see *ibid.* page 14, lines 6 to 9), *"it is also possible to apply the recomposition stage 16 in only one of the two paths shown in Figure 10* [sic - it should read 9] *(i.e. either in training an improved classifier or in providing an improved image classification result, but not both)"*.

4.2   Hence, the Board considers that claim 1 does not contain subject-matter extending beyond the content of the application as filed (Article 123(2) EPC), and that the claim is clear and supported by the description (Article 84 EPC).

Article 56 EPC

5.   Document D3 relates to document image processing and in particular to recognising images from an image source, for example, a printed document (D3, page 2, lines 9 and 10).

        As pointed out in the background section of the description (D3, page 2, lines 14 to 20), a *"fundamental problem in the art of automatic document*

image processing relates to *image defects, that is, imperfections in the image as compared to the original ideal artwork used to create the image. The sources of image defects are numerous and well known. For example, the original printed document (e.g., paper document) which was the source of the image may be defective (e.g., the paper has spots of dirt, folds, or was printed from a faulty printing device). Further, when the paper document was scanned, the paper may have been skewed while being placed in the scanner, resulting in a distortion of the image. In addition, the optics of the scanning process itself can produce defects due to, for example, vibration, pixel sensor sensitivity or noise"* (underlining added).

As stated on page 2, lines 29 to 32, "[o]*ne known technique for improving the image classifiers' ability to handle defective image representations is through so called training. For example, automatic training is frequently employed in which certain recognition algorithms are used to train the classifier to recognize defective images. One approach of such training is to use document-image degradation models"* (underlining added).

According to D3 (page 2, lines 35 to 40), known "*document-image degradation models read a single ideal prototype image (e.g., a machine-printed symbol) and as prescribed by the particular model's degradation algorithm, generate a large number of pseudorandomly degraded images. These generated degraded images (i.e., examples of potential representations of defective symbols in an image) are then used to train the classifier for use in the image recognition process to recognize defective symbols. Of course, this technique requires that an image degradation model (i.e., a*

prediction of how the original image will degrade) is known in order to generate the degraded images for the classifier" (underlining added).

As pointed out on page 3 lines 50 to 52, the method of D3 operates on bi-level images (*i.e.* black and white, not grey or colour). The set of input images represents images from the source on which, because of image defects and degradation, an OCR system would have difficulty in performing recognition. Furthermore, the set of degraded input images is collected in such a manner that the set captures those images from the source thought to be representative of a single symbol (page 3, line 52 to 55). For instance, Figure 3 shows an illustrative input character set 20 representative of the printed character "A". As explained on page 3, lines 37 to 56, and shown in Figures 1 and 2, the captured input images are preprocessed prior to the application of image averaging which produces a single binary image (see step 14 in Figure 2 of D3). Finally some postprocessing is applied to the single binary image to produce an approximation of the ideal character which is then sent to the image classifier for classification of the original image source (see steps 16 and 18 in Figure 2). These classifications are then used by the OCR engine 11 to produce a corresponding OCR system output 7.

5.1   Document D3 does not deal with the problem of training a colour image classifier, but with the problem of improving the recognitions of an original character represented by a set of degraded bi-level images. Furthermore, it discloses the processing of many (degraded) images of a character to provide an approximation of the original character, whereas the present application teaches processing an exemplar

image to generate a set of exemplar images, such that
the original exemplar image and the corresponding set
of exemplar images share some salient characteristics
of a certain semantic class of images.

Furthermore, also the use of image degradation models
for the automatic training of image classifiers
referred to in D3 (see page 2, "Background of the
invention"), is not comparable to the present
invention. In fact, the prior art acknowledged in D3
starts from a single <u>ideal prototype image</u> and
processes it to generate a large number of
pseudorandomly <u>degraded</u> images which train the
classifier to recognise <u>defective</u> images of the same
symbol (D3, page 2, lines 35 to 37). The present
invention, however, starts from a real-world exemplar
image and alters it "spatially" or "temporally", so as
to produce a set of images which simulate other
possible "real-world images" in the same image
category.

5.2   Hence, in the Board's opinion, the teaching of document
        D3 cannot be regarded as a suitable starting point for
        the present invention.

6.   As to the prior art documents D1 and D2 cited in the
        course of the examination, document D1 is concerned
        with the use of learning machines to discover knowledge
        from data. It relates therefore to a different field of
        technology and is not relevant to the present
        invention. Document D2 was cited by the Examining
        Division only as evidence that it was generally known
        to provide a digital representation of an image (see
        penultimate sentence of point 3.1 of the communication
        dated 28 April 2005).

7.   In view of the available prior art, the Board finds
        that the subject-matter of claim 1 involves an
        inventive step within the meaning of Article 56 EPC.

7.1   In summary, the Board comes to the conclusion that the
        the only claim of the appellant's request satisfies the
        requirements of the EPC. However, before a patent can
        be granted, the description and drawings must be
        adapted to the subject-matter of claim 1.

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 with the order to grant a patent on the basis
        of claim 1 according to the appellant's main request
        and a description and drawings to be adapted thereto.

The Registrar: The Chairman:

I. Aperribay   R. Moufang

Decision electronically authenticated