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Datasheet for the decision
of 19 April 2013

Case Number: T 2025/09 - 3.5.02

Application Number: 04785030.0

Publication Number: 1685651

IPC: H03M 7/00

Language of the proceedings: EN

Title of invention:
Split runlength encoding method and apparatus

Applicant:
Peerless Systems Corporation

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no"

Decisions cited:
-

Catchword:
-

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C9620.D

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Case Number: T 2025/09 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 19 April 2013

Appellant: (Applicant)	Peerless Systems Corporation 2381 Rosecrans Avenue El Segundo California 90245 (US)
Representative:	Regimbeau 20, rue de Chazelles F-75847 Paris Cedex 17 (FR)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted 4 May 2009 refusing European patent application No. 04785030.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: M. Ruggiu
Members: M. Rognoni
                  W. Ungler

C9620.D

Summary of Facts and Submissions

I.   The applicant (appellant) appealed against the decision
        of the examining division refusing European patent
        application No. 04 785 030.0.

II.   In the decision under appeal, the examining division
        found, *inter alia*, that claims 1 and 6 of the main
        request and of the auxiliary request were not clear
        within the meaning of Article 84 EPC. Furthermore, the
        subject-matter of claim 14 of both requests was not new
        with respect to the following prior art (Article 54
        EPC):

        D1:   Held G.: "Data Compression; Techniques and
              Applications; Hardware and Software
              Considerations", Chichester, J. Wiley & Sons, GB,
              1983, pages 49 - 51, XP002074977.

III.   With the statement of grounds of appeal filed with a
        letter dated 9 September 2013, the appellant filed a
        new set of claims 1 to 17 and requested that the
        decision under appeal be set aside and a patent be
        granted on the basis of these claims. The appellant
        essentially argued that D1 did not teach or even
        suggest second and third codes to perform an encoding
        which produced lossless data compression, as specified
        in claim 1. Hence, the claimed method was new over D1
        and also involved an inventive step within the meaning
        of Article 56 EPC.

IV.   In a communication dated 4 February 2013 accompanying
        the summons to oral proceedings, the Board drew the
        appellant's attention to the following documents:

D2:   Michael L. Rhodes *et al.*: "Locally Optimal Run-
       Length Compression Applied to CT Images", IEEE
       Transactions on Medical Imaging, Vol. MI-4, No. 2,
       June 1985, pages 84 to 90,

D3:   US-A-5 521 641.

V.   Oral proceedings were held before the Board on
       19 April 2013.

VI.   The appellant withdrew the main request filed with
       letter dated 9 September 2009 and requested that the
       decision under appeal be set aside and that a patent be
       granted on the basis of claims 1 to 17 of the main
       request filed during the oral proceedings of 19 April
       2013.

VII.   Claim 1 according to the appellant's request reads as
       follows:

       "A method for performing lossless data compression for
       an output display device comprising:

           comparing the value of a set of data of one or
           more identical sequential data having said value
           with a previous value;

           encoding the set of data of the one or more
           identical sequential data with a first code if the
           difference is outside a predetermined range;

           encoding the set of data of the one or more
           identical sequential data with a second code if

the difference is not zero but is within the
predetermined range; and

encoding the set of data of the one or more
identical sequential data with a third code if the
difference is zero,

wherein the first code identifies said value of
the set of data of the one or more identical
sequential data,

wherein the second code identifies the difference
between said value of the set of data of the one
or more identical sequential data and said
previous value, and indicates, when the set of
data comprises at least two identical sequential
data, a number of identical sequential data in the
set of at least two identical sequential data,

wherein the third code indicates that said value
of the set of data of the one or more identical
sequential data is identical to said previous
value, and

wherein the encoding utilizes the first code,
second code and third code to perform the lossless
data compression."

Claim 2 to 6 are dependent on claim 1.

Claim 7 reads as follows:

"An apparatus comprising:
a processor (113) to encode an incoming stream of data
into a data stream of codes according to the method of
one of the claims 1 to 6."

Claims 8 to 13 are dependent on claim 7.

Claim 14 reads as follows:

"An apparatus comprising:
a processor (103) to decode an incoming data stream of
codes encoding a stream of data according to the method
of one of the claims 1 to 6, in order to generate a
binary output from, the data stream of codes including
a set of codes that encode the binary output where a
first code identifies a literal value to be generated
in the binary output, a second code identifies a
difference with a previous generated value to generate
a set of values in the binary output, a third code
identifies a set of matching values with a previous
generated value to be generated in the binary output."

Claims 15 to 17 are dependent on claim 14.

VIII. The appellant argued essentially as follows:

Claim 1 related to a method for performing lossless
compression of image data which combined three
different types of encoding, namely "relative
encoding", "category encoding" and "run-length
encoding". "Relative encoding" consisted in identifying
data values by their differences with respect to a

"previous value". "Category encoding" categorized data into three different categories, namely "literal", "match" and "near match", and assigned a specific code format to each category. "Run-length encoding" avoided repetition of identical sequential values. Although similar encoding schemes might be separately known, none of the prior art documents related to a lossless data compression method which combined the different types of encoding specified in claim 1 and which, in particular, univocally specified the conditions the data had to satisfy for the selection of one of the three encoding schemes.

According to claim 1, a data value from a set of data comprising one or more identical sequential data was compared with a previous value. If the difference between the data value and the previous value was outside a predetermined range, "literal encoding" was used to identify the data value (first code). If the difference was not zero, but within a predetermined range, "relative encoding" with respect to a "previous value" was selected (second code). Furthermore, if a data value encoded by relative encoding was followed by one or more identical sequential data, relative encoding was combined with run-length encoding and the resulting code not only identified the difference between the data value and the previous value, but also indicated the number of identical sequential data. Finally, if the difference was zero, run-length encoding was used to indicate the number of identical sequential data.

D2 dealt with the problem of compressing CT images and examined a number of compression schemes which could

provide a locally optimum compression format. Although
D2 suggested run-length encoding for a set of identical
sequential data, the essential teaching of this
document was directed to relative encoding. In
particular, D2 examined different compression formats
based on different ranges of allowed differences
between runs of image data and a reference value. None
of the relative compression schemes shown in D2
considered the possibility that a set of data to be
compressed included at least two identical sequential
data whose difference with respect to a reference value
fell within a predetermined range. Hence, apart from
not offering a clear scheme for categorizing all
possible data values of the set of data to be
compressed, D2 did not disclose the second code
specified in claim 1.

In fact, the application of the differential encoding
schemes shown in D2 (defined as absolute difference
packing and relative difference packing) to a set of
one or more identical sequential data whose difference
with respect to a reference value was not zero but
within a predetermined range would result in the use of
a compression format as shown in Figure 8 of D2,
whereby each data value following the reference value
was identified by its difference with respect to this
reference value. Alternatively, following the teaching
of D2 relating to constant runs, the skilled person
might choose to encode a sequence of identical data
values by a run-length code which identified the value
of the identical sequential data and indicated their
number.
In particular, the skilled person would not find any
incentive in D2 to combine differential encoding and

run-length encoding so as to arrive at the second code
of claim 1. On the contrary, the teaching of D2
relating to the selection of the optimum compression
format among different differential formats would lead
the skilled person away from the present invention.

As to D3, this document referred in its introduction to
known methods for coding image data based on
calculating a difference between input image data and
delayed image data to output differential data. In
other words, the compression schemes considered in D3
were based on the comparison of an image line with a
preceding image line and not of sequential image data
with a reference value. Hence, D3 was not relevant to
the problem considered in the present application and
offered no teaching which could be combined with D2.

In summary, the method according to claim 1 constituted
a simple but comprehensive scheme for compressing a set
of sequential image data based on the difference
between their values and a previous value. As the
claimed method was neither known from nor suggested by
the prior art, the subject-matter of claim 1 satisfied
the requirements of Articles 54 and 56 EPC.

Reasons for the Decision

1.   The appeal is admissible.

2.1   Claim 1 according to the appellant's request relates to
        a "*method for performing lossless data compression for
        an output display device*". The compression is carried
        out on "*a set of data*" including "*one or more identical*

sequential data" and comprises the step of "*comparing*"
the values of the data in the set with "*a previous
value*".

The gist of the claimed method consists essentially in
encoding the "*sequential data*" in the set according to
rules selected on the basis of the difference between
the data values and the "*previous value*".

2.2   In particular, claim 1 specifies the following codes
       and corresponding encoding rules for the lossless
       compression of a set of data including one or more
       identical sequential data:

       A)   if the difference between a data value and the
             previous value is outside a *"predetermined range"*,
             the code (*"first code"*) identifies the data value
             to be encoded ("first code");

       B1)   if the difference between a data value and the
             previous value is within *"the predetermined
             range"*, but not zero, the code (*"second code"*)
             identifies that difference;

       B2)   furthermore, when at least two sequential data are
             identical and thus have the same difference with
             respect to the reference value, the code indicates
             "a number of identical sequential data", namely of
             sequential data whose values have the same
             difference with respect to *"the previous value"*;

       C)   if the difference between a data value and the
             previous value is zero, the code (*"third code"*)
             indicates that the value of one or more identical

sequential data is identical to the previous value.

2.3   In other words, as pointed out by the appellant, the method of the invention combines three different types of encoding schemes which can be defined as "relative encoding" (differences in value are coded), "category encoding" (different categories of data are identified and corresponding codes applied) and "run-length encoding" (the number of sequential identical values are specified).

3.1   D2 deals with the lossless compression of CT and magnetic resonance image data. As observed in D2 (page 84, right-hand column, first full paragraph), run-length encoding techniques, which consist in storing "runs" of data as a single value and a count rather than the original run, are optimal for digital image files having low standard deviations between pixel values. Although CT and magnetic resonance image data demonstrate a wide variation in pixel values across an entire picture, local subpicture regions show relatively low standard deviation.

According to D2 (page 88, left-hand column, second paragraph), the disclosed *"locally optimal run-length coding approach uses a reference pixel value followed by series of small differences. Since differences between one pixel and its neighbor are often small, only a few bits are needed for their representation. For a typical CT image, a large number of pixels can be represented if the range of allowed differences is large"*. However, large differences need more bits for their representation.

3.2   The compression ratio (CR) is defined in D2 as the
        ratio between the number of "words used in
        representation" and the number of "pixels represented".
        Thus, CR is a number between 0 and 1, where 1
        represents no effective compression. The term "run" is
        used *"to denote the set of raster pixels that can be
        represented by one compression format. Run size is the
        number of pixels represented"* (D2, page 88, paragraph
        bridging the left-hand and the right-hand columns). In
        the same paragraph, D2 distinguishes between an
        "absolute" compression format and a "relative"
        compression format, whereby the former uses the first
        pixel in a run as the reference value and the latter
        uses the prior pixel, in raster sequence, as the
        reference value.

3.3   Figure 7 of D2 (page 88) shows the percentage of an
        image that can be represented by "difference runs"
        using different run-length format compression
        strategies and run sizes, namely different sets of
        raster pixels. It is evident that when a pixel in a set
        cannot be represented by means of the run-length
        compression strategy selected, its value must be
        represented "as is" (cf. D2, page 88, right-hand column,
        penultimate paragraph).

        On the other hand, compression *"for image areas that
        hold no information can be represented by the most
        simple run-length format, that is, a reference value
        followed by a count that indicates the number of
        contiguous pixels having the same value"* (D2, page 88,
        right-hand column, lines 23 to 27).

Finally D2 (page 88, right-hand column, lines 27 to 34)
considers a compression format for pixel elements which
represent textual information and thus can be
represented by only two values (On/Off).

3.4   In summary, D2 (page 88, right-hand column, penultimate
paragraph) discloses the following compression formats
which are relevant to the present application:

i)   use pixel as is,
ii) constant run,
iii) relative difference packing (with difference
     expressed by 4, 5 or 6 bits),
iv) absolute difference packing (with differences
     expressed by 5 or 6 bits).

3.5   It is evident that the compression format i) is to be
used for data values that cannot be expressed by format
iii) or format iv), because their difference to the
preceding value or to a previous value taken as
reference falls outside the interval that can be
expressed by 4, 5 or 6 bits. Hence, the compression
format i) corresponds to the "first code" specified in
claim 1 (see A) in item 2.2 of the decision). It is
also evident that format ii) corresponds to the "third
code" (see C) above).

If the difference between a data value and the previous
value is within a predetermined range, which can be
expressed by 4, 5 or 6 bits, D2 teaches to use either
the compression format iii) or iv), as specified by the
"second code" of claim 1 (see B1) above).

3.6   However, D2 does not explicitly teach what kind of
         encoding scheme should be used to compress a run of two
         or more identical sequential data whose difference from
         the reference value falls within the predetermined
         range.

4.1   Hence, the method according to claim 1 of the
         appellant's request differs from the method known from
         D2 in that it defines an explicit rule for encoding
         runs of at least two sequential data which are
         identical and have the same difference with respect to
         the reference value. As indicated in item 2.2 of the
         decision (see B2)), this encoding format consists in
         identifying the difference between the value of the
         identical sequential data and the reference value (*i.e.
         "the previous value"*), and in indicating their number.

4.2   Starting from the teaching of D2, the problem solved by
         the method of claim 1 can be seen in further optimizing
         the compression of a run of identical sequential data.

4.3   As pointed out above, D2 (page 88, right-hand column,
         lines 23 to 27) teaches that a number of contiguous
         pixels having the same value can be represented by the
         most simple run-length format, that is, a <u>reference
         value</u> followed by a count that indicates the number of
         contiguous pixels having the same value (see item 3.4
         of the decision, format ii)).

         The appellant has argued that by applying the above
         compression format ii), the skilled person would start
         a new run and use the data value, and not the
         difference between this data value and the *"previous
         value"*, to identify the following sequence of identical

data. As more bits were required to express the
absolute value, this would result in an encoding scheme
less efficient than the one of the invention.

4.4   The particular case of a set of identical sequential
        data whose difference from a "previous value" falls
        within a predetermined interval can be regarded as
        being covered in D2 by both format ii) and format iii),
        in the sense that format ii) teaches not to repeat the
        same data value but to use "a reference value" followed
        by a count indicating the number of identical data and
        format iii) teaches to use the difference between a
        data value and a reference value, *i.e.* a *"previous
        value"* according to the language used in the
        application, whenever allowed by the available formats,
        as fewer bits are required to express a difference.

4.5   In light of the underlying teaching of D2, which seeks
        to find an optimum combination of different compression
        formats for encoding image data, a person skilled in
        the art would realize that there was no need to repeat
        a sequence of identical differential values, generated,
        for instance, by applying format iii), in order to
        encode a set of identical sequential data and that in
        this particular case relative encoding could be
        advantageously combined with run-length encoding
        (format ii)).

4.6   In the Board's opinion, the skilled person would find
        an incentive to combine the formats ii) and iii) taught
        in D2 in the general advice given in D2 (page 89, left-
        hand column, first full paragraph) to look for the most
        efficient compression scheme for a set of pixel data
        and also in the fact that it was well known before the

priority data of the application (see D3, columns 1
and 2, description of the related arts) to code image
data by counting up the same values of differential
data obtained by comparing image data with delayed
image data.

4.7   Hence, it would be obvious to a skilled person,
        starting from the teaching of D2 and looking for an
        efficient way for performing lossless compression of a
        set of data comprising, in particular, a run of
        identical data whose difference from a previous value
        was within a predetermined interval, to use as a
        reference value for the constant run (format ii)) not
        the absolute value of the identical data but their
        difference with respect to the previous value, as
        specified by the coding format iii). In doing so, the
        skilled person would arrive at a compression method
        falling within the terms of claim 1.

4.8   In summary, the Board comes to the conclusion that the
        subject-matter of claim 1 of the appellant's request
        does not involve an inventive step within the meaning
        of Article 56 EPC.

5.1   As the method claim according to the main request is
        not allowable, there is no need to consider the
        corresponding apparatus claims 7 and 14.

5.2   As the appellant's only request does not provide a
        basis for granting a patent, the appeal has to be
        dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

U. Bultmann   M. Ruggiu