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Datasheet for the decision of 25 November 2022

Case Number: T 2792/18 - 3.5.07

Application Number: 11855360.1

Publication Number: 2664995

IPC: G06F17/14, G10L19/00, G10L21/00

Language of the proceedings: EN

Title of invention:
SIGNAL PROCESSING METHOD AND DEVICE

Applicant:
Huawei Technologies Co., Ltd.

Relevant legal provisions:
EPC Art. 56
RPBA Art. 12(4)

Keyword:
Inventive step - main request (no)
Amended claims filed with the statement of grounds of appeal - first and second auxiliary requests - not admitted

Decisions cited:
G 0001/19, T 0003/90

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Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2792/18 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 25 November 2022

Appellant: (Applicant)	Huawei Technologies Co., Ltd. Huawei Administration Building Bantian Longgang District Shenzhen, Guangdong 518129 (CN)
Representative:	Huawei European IPR Huawei Technologies Duesseldorf GmbH Riesstraße 25 80992 München(DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 June 2018 refusing European patent application No. 11855360.1 pursuant to Article 97(2) EPC**

Composition of the Board:

Chair	J. Geschwind
Members:	M. Jaedicke
	P. San-Bento Furtado

Summary of Facts and Submissions

I. The applicant (appellant) appealed the examining division's decision refusing European patent application No. 11855360.1, which claims a priority date of 10 January 2011 and was filed in Chinese as PCT/CN2011/085197 and published in English as EP 2 664 995 A1, under Article 153(4) EPC.

II. The documents cited in the contested decision included:

D1 CN 101930425 A, published on 29 December 2010

D1T EP 2 290 938 A1, published on 2 March 2011

D14 "Modified discrete cosine transform", Wikipedia, 30 May 2003, pp. 1-4, retrieved from https://en.wikipedia.org/w/index.php?title=Modified_discrete_cosine_transform&oldid=978214

D15 "Small-angle approximation", Wikipedia, 24 November 2010, pp. 1-3, retrieved from https://en.wikipedia.org/w/index.php?title=Smallangle_approximation&oldid=398600257

In the proceedings before the examining division the appellant agreed with the examining division that document D1T was an accurate translation of document D1 (see decision under appeal, point 3.1).

III. The examining division refused the application for lack of inventive step of the subject-matter of independent claims 1, 3 and 5 of the main request and of each of the first to third auxiliary requests. The examining division considered some of the claimed features of the main request and the second auxiliary request to relate to a non-technical, purely mathematical method applied to abstract data. For the auxiliary requests, document D1 (with D1T as translation) was used as the starting point for assessing inventive step. Under the heading

"Obiter Dicta", the examining division raised objections under Article 56 EPC against dependent claims 2, 4 and 6 of all the requests.

IV. In its statement of grounds of appeal, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main or one of two auxiliary requests, with all the requests being as submitted with the grounds of appeal. The main request is identical to the first auxiliary request considered in the contested decision.

V. In a communication under Article 15(1) RPBA 2020 accompanying the summons to oral proceedings, the board expressed its provisional opinion that the subject-matter of claim 1 of all the requests lacked an inventive step in view of document D1 and that the first and second auxiliary requests were inadmissible, unclear and did not have a basis in the application as filed.

VI. By letter of 5 September 2022, the appellant informed the board that it would not be attending the oral proceedings scheduled for 25 November 2022. Accordingly, the board cancelled the oral proceedings. No further submissions were received from the appellant.

VII. Claim 1 of the main request reads as follows:
"A data processing method performed by an electronic apparatus and used to implement a time-domain to frequency-domain type 4 Discrete Cosine Transform, DCT-IV, during a coding procedure, the data processing method comprising:

twiddling (101) input data, so as to obtain twiddled data, wherein the twiddled data is obtained according

to $z(p)=\tilde{x}(2p)+j\cdot\tilde{x}(L-1-2p), p=0,1,2,\cdots,\frac{1}{2}-1$, wherein z(p) denotes the twiddled data and $\tilde{x}(\ )$ denotes the input data;

pre-rotating (102) the twiddled data by using a symmetric rotate factor, wherein the rotate factor is $a\cdot W_{4L}^{2p+1}$, $W_{4L}^{2p+1}=\cos\frac{2\pi(2p+1)}{4L}-j\sin\frac{2\pi(2p+1)}{4L}$, $p=0,\ldots,\frac{L}{2}-1$, and a is a constant;

performing (103) a Fast Fourier, Fast Fourier Transform, FFT, transform of L/2 point on the pre-rotated data, wherein L is the length of the input data;

post-rotating (104) the data that has undergone the FFT transform by using a symmetric rotate factor, wherein the rotate factor is $b\cdot W_{4L}^{2q+1}$, $W_{4L}^{2q+1}=\cos\frac{2\pi(2q+1)}{4L}-j\sin\frac{2\pi(2q+1)}{4L}$, $q=0,\ldots,\frac{L}{2}-1$, and b is a constant; and

obtaining (105) output data;

wherein before obtaining (105) the output data, further comprising: a step of performing fixed rotate compensation by using a fixed rotate compensation factor;

wherein the step of performing the fixed rotate compensation by using the fixed rotate compensation factor comprises:

performing fixed rotate compensation one time, wherein a rotate compensation factor of the one time fixed rotate compensation is W_{8L}^{-3}, wherein a result of first order Taylor series expansion $1+j\left(\frac{3\pi}{4L}\right)$ is used as the approximate value of W_{8L}^{-3}."

VIII. Claim 1 of the first auxiliary request reads as follows:

"A data processing method performed by an electronic apparatus used to implement a time-domain to frequency-domain type 4 Discrete Cosine Transform, DCT-IV, during a coding procedure, the data processing method comprising:

twiddling (301) time domain data, so as to obtain twiddled data, wherein the twiddled data is obtained according to $z(p)=\tilde{x}(2p)+j\cdot\tilde{x}(L-1-2p), p=0,1,2,\cdots,L/2-1$, wherein z(p) denotes the twiddled data and $\tilde{x}(\ )$ denotes the time domain data;

pre-rotating (302) the twiddled data by using a symmetric rotate factor, wherein the rotate factor is $a\cdot W_{4L}^{2p+1}$, $W_{4L}^{2p+1}=\cos\frac{2\pi(2p+1)}{4L}-j\sin\frac{2\pi(2p+1)}{4L}$, $p=0,\ldots,\frac{L}{2}-1$, and a is a constant;

performing (303) a Fast Fourier Transform of L/2 point on the pre-rotated data, wherein L is the length of the input data;

performing (304) a fixed rotate compensation to the data that has undergone the Fast Fourier Transform, wherein the data that has undergone the FFT transform is multiplied with W_{8L}^{-3} to perform the fixed rotate compensation, or the data that has undergone the FFT transform is multiplied with an approximate value of W_{8L}^{-3} to perform the fixed rotate compensation, wherein a result of first order Taylor series expansion $1+j\left(\frac{3\pi}{4L}\right)$ is used as the approximate value of W_{8L}^{-3};

post-rotating (305) the data that has undergone the fixed rotate compensation by using a symmetric rotate factor, wherein the rotate factor is $b\cdot W_{4L}^{2q+1}$, $W_{4L}^{2q+1}=\cos\frac{2\pi(2q+1)}{4L}-j\sin\frac{2\pi(2q+1)}{4L}$, q = 0,...,L/2-1, and b is a constant; and

obtaining (306) frequency domain data for audio coding;

wherein a real part of the post-rotated data is expressed as $y(2q)$, which is the odd number frequency of the frequency domain data; and an opposite number of an imaginary part of the post-rotated data is expressed as $y(L-1-2q)$, which is the even number frequency of the frequency domain data;

wherein $\begin{cases} y(2q) = \mathrm{Re}\{\bar{Z}(q)\} \\ y(L-1-2q) = -\mathrm{Im}\{\bar{Z}(q)\} \end{cases}$, $q = 0,1,2,\ldots,L/2-1;$

wherein $\bar{Z}(q)$ is the post-rotated data, and

$$\bar{Z}(q) = (1 + j\tfrac{3\pi}{4L}) * W_{4L}^{2q+1} \sum_{p=0}^{L/2-1} \left\{ z(p) * W_{4L}^{2p+1} \right\} \overset{\mathrm{FFT}}{W_{L/2}^{pq}}, \quad p,q = 0,\ldots,L/2-1 \cdot$$

"

IX. Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that "or the data that has undergone the FFT transform" has been replaced with

"or the data that has undergone the fixed rotate compensation"

and in that

", wherein only one of a cosine data table $\mathbf{a} \cdot \cos\frac{2\pi(2p+1)}{4L}$ or a sine data table $\mathbf{a} \cdot \sin\frac{2\pi(2p+1)}{4L}$ of L/2 points is stored"

has been added after "and a is a constant" and

", wherein only one of a cosine data table $b \cdot \cos\frac{2\pi(2q+1)}{4L}$ or a sine data table $\mathbf{b} \cdot \sin\frac{2\pi(2p+1)}{4L}$ of L/2 points is stored"

has been added after "and b is a constant".

X. The appellant's arguments, where relevant to the present decision, are discussed in detail below.

Reasons for the Decision

1. The appellant's statement that it would not be attending the oral proceedings is to be understood, in the absence of any indication to the contrary, as a withdrawal of its request for oral proceedings (see T 3/90, point 1 of the Reasons, and the further decisions cited in Case Law of the Boards of Appeal, 10th edition, 2022, III.C.4.3.2). The decision is therefore taken without oral proceedings being held.

The invention

2. The application relates to digital signal processing (application as published, paragraph [0002]). The background of the invention is that, in the field of digital communications, transmission of speeches, pictures, audio and video data has a very broad field of application, such as cell phone communications, audio/video conferences, broadcast television, and multimedia entertainment. In order to reduce the resources for storage or transmission of audio/video signals, audio/video compression coding technologies emerge. A technique of transforming a signal from a time domain to a frequency domain and then performing coding, also referred to as a transform-domain coding technique, is widely applied due to desired compression characteristics (paragraph [0003]).

The invention aims to provide a time-domain to frequency-domain transform method with low storage needs (paragraph [0006]).

Main request

3. Claim 1 of the main request is directed to a data processing method that is performed by an electronic apparatus and is used to implement a time-domain to frequency-domain type 4 Discrete Cosine Transform (DCT-IV) during a coding procedure. The claimed processing method comprises the following steps (with mathematical details omitted; see point VII. above for these details):

S1 twiddling input data to obtain twiddled data;
S2 pre-rotating the twiddled data by using a symmetric rotate factor;
S3 performing a Fast Fourier Transform (FFT) on the pre-rotated data;
S4 post-rotating the data obtained by the FFT by using a symmetric rotate factor;
S5 performing a fixed rotate compensation to the data by using a fixed rotate compensation factor;
S6 obtaining output data.

4. *Inventive step - Article 56 EPC*

4.1 The board considers that the method according to claim 1 is directed to an implementation of a mathematical transformation of input data during a coding procedure. The method is patent-eligible, i.e. is an invention in the sense of Article 52(1) EPC, as it is performed by an electronic apparatus as a technical means (see decision G 1/19, points 28, 29 and 78).

4.2 The examining division objected that the method in claim 1 lacked an inventive step over document D1 (using D1T as the accepted translation). The prior art,

D1, is a patent application filed by the appellant and having two inventors in common with the present application.

The examining division argued that document D1 disclosed a data processing method performed by an electronic apparatus used to implement a time-domain to frequency-domain type 4 Discrete Cosine Transform (DCT-IV) for an audio coding procedure (see D1T, paragraphs [0005], [0006] and [0029]). The method disclosed in D1 comprised steps S1 to S4 and S6 as specified in claim 1 of the main request (see D1T, paragraphs [0029], [0030], [0041] and [0044]). Therefore, the distinguishing features were the features corresponding to step S5.

4.2.1 According to the examining division, these distinguishing features had the effect of improving the accuracy of the DCT-IV (type 4 Discrete Cosine Transform). Consequently, the objective technical problem was that of improving the accuracy of the approximation performed in the method disclosed in document D1.

4.2.2 The examining division argued that the skilled person would compare the formulas in paragraphs [0024] and [0064] of D1T and arrive at the solution by making obvious choices.

4.3 In its statement of grounds of appeal, the appellant argued that the method according to claim 1 differed from the method disclosed in document D1 at least on account of the following distinguishing features:
a) pre-rotating (102) the twiddled data by using a symmetric rotate factor as claimed;

b) performing (103) a Fast Fourier Transform of L/2 point on the pre-rotated data, wherein L is the length of the input data;
c) post-rotating (104) the data that has undergone the FFT transform by using a symmetric rotate factor as claimed; and
d) performing fixed rotate compensation one-time, wherein an approximate rotate compensation factor (as claimed) of the one-time fixed rotate compensation is used.

With regard to the alleged distinguishing features a) and c), the appellant argued that the specific rotate factors used were different from those used in document D1. The symmetry of the factors had the technical effect of reducing the storage requirements. Feature b) was not disclosed in D1 as document D1 disclosed performing a Discrete Fast Fourier Transform of N/4 points and had the technical effect of accelerating the speed of the transform. Distinguishing feature d) was not known as D1 did not mention anything regarding fixed rotate compensation and this distinguishing feature had the technical effect of improving the accuracy of the transform. All the distinguishing features in combination reduced the computational complexity and the storage requirements, while at the same time improving the accuracy of the transform.

4.4 With regard to the difference between the claimed method and document D1, the board is not convinced by the appellant's arguments. The appellant has not addressed the examining division's arguments provided in point 4.1 of the contested decision, according to which the rotation factors in features a) and c) were the same as in D1. It did not provide any evidence for its allegation, either. The board considers that since

N may be equal to 2L (see point 4.1 of the decision under appeal), a DFT of N/4 in D1 corresponds to a DFT of L/2 in claim 1. The same reasoning applies to feature c). With regard to feature d), the board sees no reason to disagree with the examining division and the appellant that D1 does not disclose performing a rotate compensation as claimed. Consequently, the board agrees with the examining division that the sole distinguishing feature over document D1 is feature d).

4.5 The board considers that the distinguishing feature d), corresponding to step S5, does not contribute to solving a technical problem for the following reasons.

4.5.1 The characteristics of the output data cannot be derived from the wording of the claim, as claim 1 does not specify any specific relationship between step S6 of obtaining output data and the further steps, including step S5, of the method.

4.5.2 The claimed mathematical transformation does not solve a particular technical problem, as it transforms unspecified input data by means of implementing a time-domain to frequency-domain type 4 Discrete Cosine Transform "during a coding operation" without further addressing a particular technical problem solved by the "coding" (e.g. by being limited to a particular coding method). As noted in paragraph [0003] of the description, in transform-domain coding techniques, the coding is done after transforming the domain. The method according to claim 1 is limited to transforming the domain to the frequency domain. Consequently, should step S5 indeed improve the accuracy of the transform (see statement of grounds of appeal, page 7, III-3), this does not appear to be a technical effect, but at best a mathematical effect. In view of the

foregoing considerations, the board considers the method to be a "mere" automation, by means of a well-known electronic apparatus, of a per se non-technical mathematical transformation method as specified in steps S1 to S5 of claim 1.

4.6 In view of the above, the subject-matter of claim 1 of the main request does not meet the requirements of Article 56 EPC.

First and second auxiliary requests

5. Claim 1 of the first auxiliary request differs from claim 1 of the third auxiliary request considered in the contested decision as follows:

A1 The reference signs referring to Figure 1 have been deleted.

A2 The feature "post-rotating the data that has undergone the FFT transform by using a symmetric rotate factor" has been amended to read "post-rotating the data that has undergone the fixed rotate compensation by using a symmetric rotate factor".

A3 The text "for audio coding" has been added after "obtaining (306) frequency domain data".

According to the appellant, the basis for amendment A2 is page 14, lines 22 and 23, of the description as originally filed. The appellant neither indicated nor provided a basis for amendment A3.

6. Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request essentially in that it adds the following features (see above, point IX.):

A4 wherein only one of a cosine data table $a \cdot \cos \frac{2\pi(2p+1)}{4L}$ or a sine data table $a \cdot \sin \frac{2\pi(2p+1)}{4L}$ of L/2 points is stored;

A5 wherein only one of a cosine data table $b \cdot \cos \frac{2\pi(2q+1)}{4L}$ or a sine data table $b \cdot \sin \frac{2\pi(2p+1)}{4L}$ of L/2 points is stored.

According to the appellant, amendments A4 and A5 are supported by page 7, lines 14 to 15 and 25 to 27 of the description as originally filed.

7. *Admissibility of the first and second auxiliary requests*

7.1 According to Article 12(4) RPBA 2007, the board has the power to hold inadmissible facts, evidence or requests which could have been presented in the first-instance proceedings.

7.2 Amendments A2 to A5 introduce features taken from the description which could and should have been added in a request submitted during the first-instance proceedings.

Furthermore, the feature "comprising an audio coder", found in the main request filed before the examining division, is no longer claimed in the claims submitted with the grounds of appeal, and therefore amendment A3 attempts to reintroduce the fact that the claimed subject-matter relates to audio coding by means of different wording.

The appellant did not put forward any arguments as to why the auxiliary requests were admissible either in

its statement of grounds of appeal or in its reply to the board's communication.

7.3 In view of the above, the board does not admit the auxiliary requests into the appeal proceedings under Article 12(4) RPBA 2007.

Conclusion

8. Since none of the requests admitted into the appeal proceedings is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

S. Lichtenvort J. Geschwind

Decision electronically authenticated