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Datasheet for the decision of 14 October 2021

Case Number: T 0872/19 - 3.5.07

Application Number: 14716710.0

Publication Number: 2973023

IPC: G06F17/30, G06K9/62, G06N3/04, G06N3/08, G06Q30/02

Language of the proceedings: EN

Title of invention:
SCORING CONCEPT TERMS USING A DEEP NETWORK

Applicant:
Google LLC

Headword:
Concept terms scoring/GOOGLE

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 13(2)

Keyword:
Inventive step - main and first to third auxiliary requests (no)
Admissbility - late-filed fourth auxiliary request (no)

Decisions cited:
G 0001/19, T 0208/84, T 1924/17

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Case Number: T 0872/19 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 14 October 2021

Appellant: (Applicant)	Google LLC 1600 Amphitheatre Parkway Mountain View, CA 94043 (US)
Representative:	Williams, Michael David Marks & Clerk LLP 1 New York Street Manchester M1 4HD (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 25 October 2018 refusing European patent application No. 14716710.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	J. Geschwind
Members:	C. Barel-Faucheux
	M. Jaedicke

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application No. 14716710.0, which was filed as international application PCT/US2014/026352 and published as WO 2014/160344.

The documents cited in the contested decision included:

D1: "A Deep Non-linear Feature Mapping for Large-Margin kNN Classification", 9th International Conference on Data Mining (ICDM), pp. 357-366, December 2009

D2: US 2010/121706 A1, published on 13 May 2010

The examining division refused the application for lack of novelty of the subject-matter of claim 1 over the disclosure of document D1 and lack of inventive step of the subject-matter of claim 1 having regard to D1 or D1 in combination with D2.

Furthermore, according to the examining division, the features of claim 1 going beyond a notoriously well-known general purpose computer did not contribute to the technical character of the invention and therefore could not support the presence of an inventive step. The non-technical features did not contribute to the technical character of the invention because the purpose they served in the context of claim 1 was the automatic classification of resources into categories

according to concept terms. This was clearly a non-technical task. No technical use of the classification result was implied in claim 1. However, even if it were employed for recommending data items like advertisements to a human user as envisaged in the description of the application, this would not be a technical purpose either.

II. With the 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 a main request (corresponding to the set of claims refused by the examining division) or one of the first to third auxiliary requests filed with the statement of grounds.

III. The appellant was summoned to oral proceedings. In a subsequent communication sent in advance of the oral proceedings, the board expressed its preliminary opinion that claim 1 of the main request lacked clarity, while the subject-matter of claim 1 of the main and first to third auxiliary requests lacked an inventive step having regard to document D1.

IV. Oral proceedings were held as scheduled, during which the appellant submitted a fourth auxiliary request. At the end of the oral proceedings, the Chair announced the board's decision.

V. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the main request considered in the decision under appeal or, in the alternative, one of the first to third auxiliary requests submitted with the statement of grounds of appeal or the fourth auxiliary request submitted in the oral proceedings.

VI. Claim 1 of the main request reads as follows:

"A system comprising:
a deep network implemented in one or more computers that defines a plurality of layers of non-linear operations, wherein the deep network comprises:
an embedding function layer configured to:
receive an input comprising a plurality of features of a resource, wherein each feature is a value of a respective attribute of the resource, and
process each of the features using a respective embedding function to generate one or more numeric values, and
one or more neural network layers configured to:
receive the numeric values, and
process the numeric values to generate an alternative representation of the features of the resource, wherein processing the numeric values comprises applying one or more non-linear transformations to the numeric values; and
a classifier configured to:
process the alternative representation of the input to generate a respective relevance score for each concept term in a pre-determined set of concept terms, wherein each of the respective relevance scores measures a predicted relevance of the corresponding concept term to the resource."

VII. In claim 1 of the first auxiliary request, with respect to claim 1 of the main request, the text "wherein each of the embedding functions is specific to features of a respective feature type, and wherein each of the embedding functions receives a feature of the respective type and applies a transformation to the feature that maps the feature into a numeric representation in accordance with a set of embedding function parameters" has been added after the text

"process each of the features using a respective embedding function to generate one or more numeric values".

VIII. In claim 1 of the second auxiliary request, with respect to claim 1 of the first auxiliary request, the text "process each of the features using a respective embedding function" has been replaced by the text "process each of the features using a respective one of a plurality of embedding functions", and the text "; wherein when a feature type comprises a single token, the respective embedding function comprises a simple embedding function, when a feature type comprises a list of two or more tokens, the respective embedding function comprises a parallel embedding function, a combining embedding function or a mixed embedding function; " has replaced the coma "," between "in accordance with a set of embedding function parameters" and "and".

IX. In claim 1 of the third auxiliary request, with respect to claim 1 of the second auxiliary request, the text "wherein if a feature of the plurality of features is not discrete, processing the non-discrete feature to generate one or more numeric values comprises using a hashing function to hash the non-discrete feature, partitioning the hashed feature into one of a pre-determined set of partitions, and processing a value corresponding to the one of the predetermined set of partitions using the embedding function for the feature" has been added after "a combining embedding function or a mixed embedding function; and".

X. Claim 1 of the fourth auxiliary request differs from claim 1 of the first auxiliary request in that the expression "a resource" has been replaced by "an image

resource" and the expression "the resource" has been replaced by "the image resource".

XI. The appellant's arguments, where relevant to this decision, are addressed in detail below.

Reasons for the Decision

The application

1. The application relates to online advertisement auctions. When an online advertisement auction is to be conducted to select one or more advertisements to be included in a particular presentation of a resource (for example, a web page), resource features are extracted from the particular resource (see also document D2, paragraph [0026], describing the determining of web page content attributes).

2. A concept term scoring system 100 uses the received resource features to predict a vector of scores that includes a score for each of the set of concept terms. A score for the concept term represents the predicted "relevance" of the concept described by the term to the resource. In online advertising, the concept term scoring system 100 can generate a score for each of a set of concept terms that may be used as advertising keywords for selecting advertisements for participation in the auction.

3. The concept term scoring system 100 includes a deep network 106 and a classifier 112. The deep network 106 includes a set of embedding functions 108 and one or more hidden artificial neural network layers 110, each having a respective set of parameters. The embedding functions 108 can apply a transformation to the

features 120 to map the features into numeric (for example, floating point) representations 122. The simple embedding function might map the token "cat" to a vector [0.1, 0.5, 0.2] and the token "tablet" to a vector [0.3, 0.9, 0.0], based on current parameter values of the embedding function, e.g. stored in a lookup table (description of the current application, page 7, lines 1 to 4).

4. An initial layer of the neural network layers 110 receives as an input the floating point representations of the input features generated by the embedding functions, and the neural network layers 110 each apply one or more respective non-linear transformations to the floating point representations to generate an alternative numeric representation of the input.

5. The classifier 112 receives the alternative representation generated by the deep network 106 and predicts a value for each field of a concept score vector in accordance with values of parameters of the classifier 112. Instead of the classifier 112, the concept term scoring system 100 can include a ranking function that orders the concept terms based on the alternative representation 124.

6. In online advertising, the system can select a specified number of one or more highest-scoring concept terms or each concept term having a score that satisfies a threshold value as advertising keywords to be used in selecting candidate advertisements for participation in an online advertising auction.

7. Figure 1 reproduced below illustrates this concept term scoring system 100:

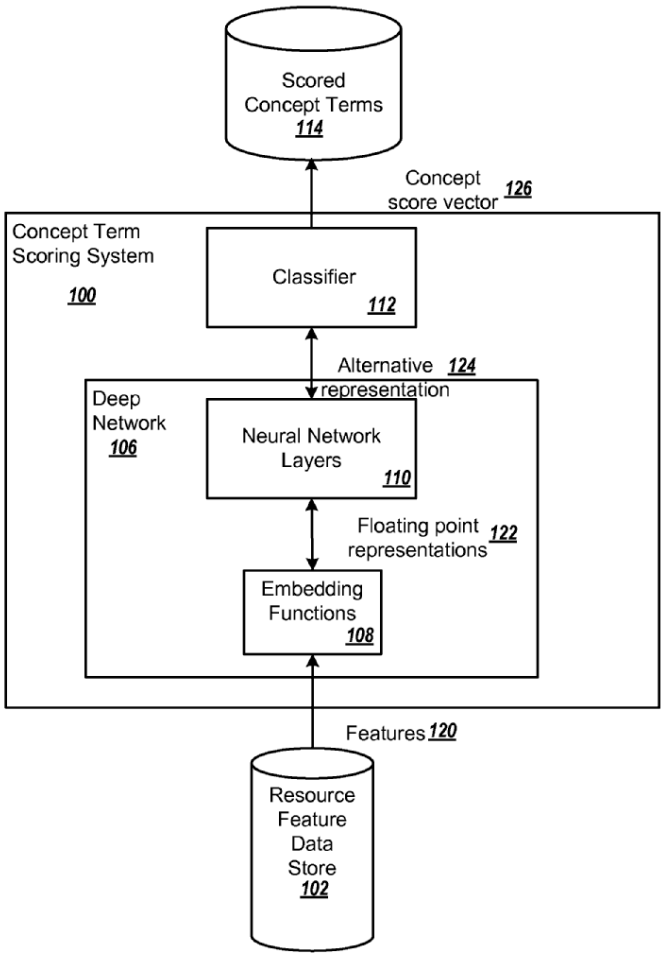

FIG. 1

Main request - inventive step

8. The board considers document D1 as an appropriate starting point for assessing inventive step.

9. In document D1, by combining the idea of deep learning and large-margin discriminative learning, a new kNN classification and supervised dimensionality reduction method called "DNet-kNN" is proposed. It encompasses a non-linear feature transformation to directly achieve the goal of large-margin kNN classification, which is based on a deep encoder network with four hidden layers pretrained with restricted Boltzmann machines (RBMs) (page 358, left-hand side, last paragraph; page 359,

right-hand side, first paragraph; page 360, section "4 Large-margin kNN classification using deep neural networks", first paragraph; Figure 2).

10. Document D1 discloses that "kNN" is one of the most popular classification methods due to its simplicity and reasonable effectiveness. It has been shown to have good performance for classifying many types of data (section "1 Introduction", page 357, left-hand column). The method of document D1 uses non-linear transformations so that each data point stays closer to its nearest neighbours having the same class as it than to any other data in the non-linearly transformed feature space (page 358, left-hand side, first paragraph).

11. The method of document D1 is applied to classify 20 newsgroup text data with binary features. This newsgroup text data constitutes a data set that contains binary occurrences for 100 words. The binary feature vectors have been used to classify the postings into four categories (or "concept terms" in the language of claim 1), which are "computer", "recreation", "science", and "talks" (section 5.3 on page 365). The board agrees with the examining division that an "embedding function" according to claim 1 is implicitly disclosed by this passage of document D1, since the newsgroup text data has to be transformed into numeric values at some stage.

12. Thus, document D1 discloses a system comprising, in the language of claim 1 of the main request:

a deep network implemented in one or more computers that defines a plurality of layers of non-linear operations, wherein the deep network comprises:

an embedding function layer configured to:

receive an input comprising a plurality of features of a resource, wherein each feature is a value of a respective attribute of the resource, and

process each of the features using a respective embedding function to generate one or more numeric values, and

one or more neural network layers configured to:

receive the numeric values, and

process the numeric values to generate an alternative representation of the features of the resource, wherein processing the numeric values comprises applying one or more non-linear transformations to the numeric values; and

a classifier configured to process the alternative representation of the input to generate *a plurality of concept terms* (the part in italics being different from the definition of the classifier in claim 1).

13. The following are the distinguishing features of claim 1 having regard to document D1:

the classifier according to claim 1 is configured to process the alternative representation of the input to generate a respective relevance score for each concept term in a pre-determined set of concept terms, wherein each of the respective relevance scores measures a predicted relevance of the corresponding concept term to the resource (the underlined part being the distinguishing features).

During the oral proceedings, the appellant did not question that these were the distinguishing features of claim 1 having regard to document D1.

14. The board notes that the application describes that the concept terms might be "advertising keywords" that are "relevant" to a resource. More relevant search results (in this example, more relevant "advertisements") are included in the resource (the resource might be a web page determined by its uniform resource locator (URL)), e.g., by increasing the relevance to the resource of the advertisements selected for participation in an advertising auction conducted to place one or more advertisements in the resource (description of the application as originally filed, page 3, lines 7 to 13; page 3, line 30 to page 4, line 6; page 4, line 32 to page 5, line 2).

15. The effect "increasing the relevance to the resource of the advertisements selected for participation in an advertising auction conducted to place one or more advertisements in the resource" is non-technical. It relates to a method of doing business (i.e. related to "advertising" and "advertising auction"). The relevance to the resource of the advertisement could be, for example, measured by a prediction of the number of clicks by users on the advertisement embedded in the resource. Thus, the "relevance" of the advertisement to the resource appears to be linked to its semantic content or visual attractiveness for the user accessing the web page (the "resource"). This does not constitute a technical feature.

16. In the absence of any technical effect going beyond the mere automation by means of one or more computers, the subject-matter of claim 1 of the main request cannot be considered to involve an inventive step (Article 56 EPC).

First to third auxiliary requests - inventive step

17. The additional feature of claim 1 of the first auxiliary request with respect to claim 1 of the main request is related to the embedding functions (see point VII. above).

18. The additional feature of claim 1 of the second auxiliary request with respect to claim 1 of the first auxiliary request is also related to the embedding functions (see point VIII. above).

18.1 The additional feature of claim 1 of the third auxiliary request with respect to claim 1 of the second auxiliary request is related to the action of transforming non-discrete features into numeric values for the processing via the embedding functions (see point IX. above).

19. The features added by the first to third auxiliary requests are disclosed neither in document D1 nor in document D2.

20. The effect of these additional distinguishing features (having regard to document D1) is to generate a numeric representation (i.e. one or more numeric values) according to the respective type of the resource features. A (resource) feature type might be the "URL" type (according to the description as originally filed, at page 6, lines 29 to 32), while a token might be for example the word "cat", and an ordered list of tokens might be {"Atlanta", "Hotel"} (description as originally filed, at page 6, line 33, to page 8, line 2). One of the features of the resource might also be non-discrete.

21. During the oral proceedings, the appellant argued that the objective problem to be solved was to provide a more accurate representation of the resource features by generating an alternative representation of these resource features "in a new way".

22. During the oral proceedings, the appellant referred to decision T 208/84, in particular points 3, 6 and 7 of the Reasons.

22.1 In decision T 208/84, point 3, the board found that a method for image processing was susceptible of industrial application within the meaning of Article 57 EPC. It stated the following: "Clearly a method for obtaining and/or reproducing an image of a physical object or even an image of a simulated object (as in computer-aided design/computer-aided manufacturing (CAD/CAM) systems) may be used e.g. in investigating properties of the object or designing an industrial article and is therefore susceptible of industrial application. Similarly, a method for enhancing or restoring such an image, without adding to its informational content, had to be considered as susceptible of industrial application."

22.2 In decision T 208/84, points 6 and 7, the board stated that it was of the opinion that "even if the idea underlying an invention may be considered to reside in a mathematical method a claim directed to a technical process in which the method is used does not seek protection for the mathematical method as such" and concluded that "[i]n contrast, a 'method for digitally filtering data' remains an abstract notion not distinguished from a mathematical method so long as it is not specified what physical entity is represented by the data and forms the subject of a technical

process, i.e. a process which is susceptible of industrial application". Thus, the appellant argued that the board equated a "technical process" with "a process susceptible of industrial application".

The appellant concluded that in accordance with the case law, "processing images" was considered as being susceptible of industrial application and thus was technical. According to the appellant, a "web page" was a "physical entity". The board agrees that the electrical signals producing the "web page" are physical entities and that a web page printed on a piece of paper becomes physical, but it has strong doubts that a "web page" can be considered as a "physical entity". Rather, it is data representing information.

The appellant expressed its opinion that it would thus be correct to consider processing other entities, such as text, to be technical as well. It questioned the difference between processing images versus processing text: the words in a particular language had a meaning (except for nonsensical words or sounds) that a (sufficient) number of people understood in the same manner as a (sufficient) number of people recognised a particular colour as being "red", for example, even though this understanding was not "universal". The appellant was of the opinion that both an image and a web page were physical entities and that the claimed system concerned the processing, i.e. the analysing and classification, of physical entities. It went on by stating that the classification of images had been recognised in the case law as solving a technical problem.

The board did not consider whether the system of claim 1 might be susceptible of industrial application but indeed whether the system had a technical effect going beyond the mere implementation of a non-technical method on one or more computers. However, the board notes that providing a more accurate "alternative representation" of the resource features, and therefore refined relevance scores, is not a technical effect since the relevance scores do not constitute technical features. This does not depend on whether the "resources" are text, web pages, images or multimedia content, as in page 1, lines 4 to 5, of the description (as originally filed), and thus does not depend on whether the "resource features" are features of text, web pages, images or multimedia content (G 1/19 of 10 March 2021, Reasons 126, last sentence; see also T 1924/17 of 29 July 2019, Reasons 12 to 13).

The board recalls that the relevance scores measure a predicted relevance of the "concept terms" to the resource.

Taking the example of an "image" as a "resource", the concept term might be "cat". The (first) relevance of this "concept term" to a first image comprising only dogs might be lower than its (second) relevance to a second image comprising exactly one dog and one cat, which might itself be lower than its (third) relevance to a third image comprising two cats or more, as an example. Inversely, the three images exemplified here might be classified by their relevance to the concept term "cat": the third image is more relevant than the second image, which is itself more relevant than the first image.

The board notes that the system of claim 1 does not explicitly stipulate that the classifier is also "configured to classify the concept terms" or "configured to classify the resources". On the contrary, the description on page 6, lines 10 to 13 discloses that it is the concept term scoring system (100) and not the classifier (112) that orders the concept terms based on the alternative representation 124.

Moreover, not all image classifications solve a technical problem. If a user classifies displayed images via a user interface to have the images arranged according to the user's viewing preferences, the image classification will, in most cases, not solve a technical problem.

23. In the absence of any technical effect beyond its mere implementation in one or more computers, the subject-matter of claim 1 of the first to third auxiliary requests cannot be considered to involve an inventive step (Article 56 EPC).

Fourth auxiliary request - Admission into the proceedings - Article 13(2) RPBA 2020

24. The fourth auxiliary request was filed during the oral proceedings before the board. Its admission into the appeal proceedings is therefore to be assessed under Article 13(2) RPBA 2020. This provision stipulates that any amendment to the appellant's appeal case made after the notification of the summons to oral proceedings is, in principle, not to be taken into account unless there are exceptional circumstances which have been justified with cogent reasons by the appellant.

25. Claim 1 of the fourth auxiliary request differs from claim 1 of the first auxiliary request in that the expression "a resource" has been replaced by "an image resource" and the expression "the resource" has been replaced by "the image resource". For the reasons stated above under point 22.2, claim 1 does not *prima facie* overcome the inventive-step objection.

26. The fourth auxiliary request was intended to overcome the lack of inventive-step objection raised for the first auxiliary request. This objection was addressed in the board's communication. This means that the appellant could have filed the fourth auxiliary request already in response to that communication. However, no reply to the communication was received.

The board's communication contained detailed reasons for the objection which, in the board's opinion, should have allowed the appellant to understand the objection and consider whether it was necessary to file an amendment.

27. During the oral proceedings, the appellant conceded that there were no exceptional circumstances.

Since the board also does not see any exceptional circumstances justifying the filing of the fourth auxiliary request during the oral proceedings rather than in advance of them, it does not admit the fourth auxiliary request into the appeal proceedings (Article 13(2) RPBA 2020).

Conclusion

28. 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