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D E C I S I O N
of 10 March 2000

Case Number: T 0521/95 - 3.5.1

Application Number: 88401840.9

Publication Number: 0299876

IPC: G06K 9/66

Language of the proceedings: EN

Title of invention:
Pattern recognition system

Applicant:
RESEARCH DEVELOPMENT CORPORATION OF JAPAN

Opponent:
-

Headword:
Pattern recognition/RDC JAPAN

Relevant legal provisions:
EPC Art. 83

Keyword:
"Sufficiency of disclosure (no)"

Decisions cited:
-

Catchword:
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Boards of Appeal

Chambres de recours

Case Number: T 0521/95 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 10 March 2000

Appellant: RESEARCH DEVELOPMENT CORPORATION OF JAPAN
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Representative: Signore, Robert
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 13 February 1995
refusing European patent application
No. 88 401 840.9 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: R. Randes
V. Di Cerbo

Summary of Facts and Submissions

- I. This appeal is against the decision of the examining division to refuse the European patent application on the ground that it lacked a clear and complete disclosure of the invention (Article 83 EPC). In particular, the application was said not to meet an adequate level of specification of either the problem or the solution. No documents were cited in the decision.
- II. The appellant (applicant) lodged an appeal against the decision and paid the prescribed fee on 11 April 1995 and filed a statement of grounds of appeal on 13 June 1995. The Board issued two communications expressing the preliminary opinion that the application did not meet the requirements of Article 83 EPC. The appellant replied to the communications and offered counter-arguments.
- III. The appellant requested that the decision under appeal be set aside, based on the application documents which have not been amended on appeal. These documents are:

Claims: 1 to 15, received 8 December 1993.

Description: pages 1 to 36, as originally filed.

Drawings: sheets 1 to 23, as originally filed.

- IV. Claim 1 of the main request reads as follows:

"A pattern recognition system comprising

at least first, second, third, and fourth basic associative units (50, 52, 54, 56), each unit having at least first and second unit ports (1, 2 in Fig. 26) for receiving pattern signal groups and a third unit port (7 in Fig. 26) for outputting a pattern signal group, each of the basic units operating (function in 10A, 10B, 10C in Fig. 24) to derive weighting values for respective signals of the pattern signal groups inputted to the first and second unit ports of the basic unit itself in accordance with the degree of consistency between a previously given weighting pattern and respective patterns specified by the pattern signal groups inputted to the first and second unit ports of the basic unit itself, each of the basic units also operating (function in 20A, 20B, 20C in Fig. 24) to modulate the respective signals of the pattern signal groups inputted to the first and second unit ports of the basic unit in accordance with the derived weighting values and to totalize the modulated signals so as to form an output signal outputted from the third unit port of the basic unit itself, said first basic associative unit (50) having its first unit port (1) coupled to receive an input pattern signal group for an object to be recognized, the first to fourth basic associative units being coupled in cascade in the name order in such a manner that the third unit port (7) of an upstream one (50, 52, 54) of each pair of adjacent basic associative units is coupled to the first unit port (1) of a downstream basic associative unit (52, 54, 56) and the third unit port of the downstream basic associative units (52, 54, 56) is coupled to the second unit port

of the upstream basic associative unit (50, 52, 54), said fourth basic associative unit (56) having its second unit port coupled to receive a reference pattern signal group, at least one of the first to fourth basic associative units having its third unit port (7 of 50) coupled to one of the first and second unit ports of a non-adjacent downstream one (54) of the basic associative units, and wherein at least some of the first two fourth basic association units are set to have different time constants from other of the first two fourth basic association units."

V. The appellant argued as follows:

The USPTO and the JPO granted a patent on the basis of the present application so that the EPO should also do so in the interest of harmonisation of patent examination.

The object of the present invention was to provide a pattern recognition system having software and hardware which was substantially independent of the kind of object to be recognised. The inventors solved this problem by studying the physiology of the human brain. They identified a fundamental functional unit and modelled the brain using a number of these units as shown in Figure 26. The application described how the units were connected together. The meaning of "derive weighting values" and "modulate", both used in claim 1, could be understood with reference to Figure 24. The skilled person would have been able to build a system corresponding to Figure 26 and to make it perform

pattern recognition.

Weighting coefficients were determined on the basis of various factors, including the recognition sequence and the required precision and speed of the recognition. It was impossible to explain this simply in the application, but a skilled person would know how to do this.

Regarding trial and error, since it had not been shown that a skilled person could not have determined the weighting coefficients, it should be concluded that the disclosure of the invention was sufficient.

The inventions in a number of other applications in the field of pattern recognition filed by the same applicant also involved a substantial number of trials, but the disclosure was held to be sufficient. These were subsequently granted as EP-B-0 183 622, EP-B-0 220 077 and EP-B-0 288 332.

The applicant's failure to submit evidence of a working example of the invention was not to be construed as a refusal to do so. The project for developing the present invention and those of the above mentioned applications was discontinued soon after filing the present application. It was therefore no longer possible for the applicant to prepare the required evidence. However, given sufficient time, it might be possible to search the record of the project for such evidence (see reply of 23 February 1998).

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. The single issue to be decided is whether the application discloses the invention in a manner sufficiently clear and complete for the skilled person to be able to carry it out (Article 83 EPC).
3. *Outline of the disclosure of the present application*
 - 3.1 The application concerns a pattern recognition system. The introductory part of the description mentions explicitly the examples of reading letters, sorting components and inspecting products, although more general statements mentioning audio recognition are also made. The description states that conventional recognition systems rely on dedicated hardware and software components which are difficult to modify for different applications. The system of the invention is said to overcome this problem by simulating the operation of the human brain which can learn a variety of recognition tasks. The description makes the distinction between the structure of the brain, which is referred to as "hardware", and the action of the brain which is called "the software aspect". The description is said to be devoted to the latter aspect.
 - 3.2 The application starts out at pages 1 to 10 (of the published version) with a description of physiological research into the structure and operation of the brain. Figure 1 shows that a perceptual input to the brain is provided through the thalamus and the reticular complex to the striate cortex. The latter has a layered

structure with six layers. The application discusses the structure and function of the various parts and presents several mathematical models of their operation. In particular, the thalamus and reticular complex are said to form a "Parallel in Sequence" mechanism by which parallel input signals are converted into time sequential firing patterns of the Th cells. Positive feedback from the lower layers of the striate cortex is said to provide a "Variable-byte Formation" mechanism according to which "various features existing in parallel in time can be converted into various time sequence patterns under different feedback rules". The effects of the above mechanisms on several simple input signals are illustrated. The Py6, Py3 and Py2 cells in layers VI, III and II, respectively, of the striate cortex are each said to form associative memories (see page 7, lines 35 to 36, page 8, lines 7 to 8 and lines 40 to 41).

3.3 Equations which model an associative memory are given at page 9, lines 10 to 29. The description states that various mechanisms have been proposed for the study of weighting functions W_{ij} , and gives an example of the work of Hebb. It is stated that the input of the associative memory can be regarded as being composed of two groups of inputs one of which represents reference data.

3.4 Since the applicant has identified that various layers in the brain resemble associative memories, a model of the brain is then proposed consisting of an arrangement of associative memories. Figure 13 shows layers II, III, IV and VI of the striate cortex, and the combined reticular complex and thalamus as R2, R1, R0 and IF1,

respectively. The model has feedback paths between various levels which are derived from considering the way the levels are actually connected in the brain. The process by which the lower layers are controlled in accordance with the content held in the higher layers is described as a "Take-Grant-Control" mechanism. The effect of this mechanism on several input signals is illustrated.

3.5 The applicant proposes a basic signal processing unit which is said to be able to realise the associative memory function and the "Parallel in Sequence" and "Variable-byte Formation" mechanisms described earlier. Pairs of these basic units connected as shown in Figures 21 to 23 are said to be able to "match combinations of features", "associative a spatially layered features" and "momently associate the external pattern signal group which varies in the time sequence", respectively.

3.6 The structure of the basic unit is shown in Figure 18 and it consists of a weighting unit 10, which accepts an input pattern 1 and a reference pattern 2 and several feedback pattern signals, and an output unit 20, which modulates the output of the weighting unit. Equations which describe the function of this unit are given at page 11, lines 10 to 39. The weighting unit is shown in more detail in Figures 24 and 25.

3.7 Finally, in Figure 26 the applicant presents a particular arrangement of four of the basic units connected as in Figures 21 to 23 which is said to be equivalent to the system of Figure 13. The basic units have the same feedback paths as those in Figure 13. The

arrangement of Figure 26 is what is claimed in present claim 1.

4. *The question of sufficiency*

4.1 In order to determine whether the skilled person could carry out the alleged invention, it is necessary to determine what the invention actually is. Rule 27(1)(c) EPC requires that the application discloses the invention, as claimed, in such terms that the technical problem (even if not expressly stated as such) and its solution can be understood. In most applications the problem being solved and the associated solution would at least be clear from the embodiment required by Rule 27(1)(e) EPC. A certain amount of functional definition may be considered to be a sufficient disclosure if the skilled person is in a position to carry out the invention on the basis of the application completed with his general technical knowledge. Be that as it may, the Board considers that a necessary requirement for sufficiency is that there is at least disclosed one embodiment which can be carried out.

4.2 In the present case, it is difficult to identify with confidence an embodiment which is supposed to be the detailed embodiment. Firstly, it is not clear what specific problem, pattern recognition problem in particular, is solved by any of the arrangements of associative memories described in the application. The summary of invention defines the invention as "a pattern recognition system comprising at least one pair of associative units". However, the Board considers the Figure 26 embodiment (see paragraph 3.7 above), which contains four associative units, to be the most

detailed and therefore the most likely candidate to meet the requirements for sufficiency. Moreover, this is the claimed embodiment and the one the appellant refers to as the invention in the letters of reply.

4.3 The Board therefore considers that in the present case one necessary requirement for sufficiency is that the skilled person would be able to build the hardware device shown in Figure 26. In the judgement of the Board, the skilled person would have no undue difficulty doing this. Firstly, the interconnection of the individual "basic associative units", with the associated feedback paths, is adequately defined in the application. Secondly, the operation of each unit is adequately described by the equations given on page 11 of the description.

4.4 Given that the invention as claimed concerns "A pattern recognition system", the Board considers that, even if the indication of use of this system ("pattern recognition") would not be limitative (as in some case-law, e.g. DE), it is nevertheless necessary that the subject-matter of claim 1 is suitable for pattern recognition. It was noted above (see paragraph 3.1) that the applicant also mentions that the invention has a "software aspect" of the action of the brain. However, the applicant's idea of the "software aspect" appears actually to include the interconnection of the units in Figure 26 which the Board considers to be a hardware aspect. If the whole of the applicant's "software aspect" is included in the Figure 26 embodiment it would mean that no additional "software" is required and that the arrangement could learn how to recognise patterns without any outside help at all. In

the Board's judgement it is highly doubtful that the system of the present application is completely self organising. It is well known in this field that the hardware is only a part of the invention which cannot do anything without the appropriate weighting coefficients. The situation is comparable to a computer which is not provided with appropriate software. The Board considers that a plausible interpretation would be that the invention mimics the ability of the brain to learn how to recognise different patterns, but like a child's brain needs to "learn" how to do this. As is customary in this field, this would be achieved by setting the weighting coefficients to some operating value, or to some initial value and modifying them by some training scheme. The question therefore arises whether the application enables the skilled person to determine the weighting coefficients in order to enable the recognition of specific patterns.

- 4.5 Although the invention is said to be able to recognise patterns, the description does not give a single concrete "worked" example. Thus the Board is left to speculate how the skilled person would use the hardware of the Figure 26 embodiment (see paragraph 3.3). The applicant has given some examples of possible pattern recognition tasks in the introductory part of the description (see paragraph 3.1 above). The question therefore is whether the application enables the skilled person to determine the weighting coefficients to enable the arrangement as claimed and as depicted in Fig. 26 to perform pattern recognition at the level required to read letters, sort components or inspect products.

- 4.6 Firstly, there is no mention of explicit values, initial or operating, of the weighting coefficients. Thus, it must be examined whether the application gives enough information for the skilled person to derive the coefficients based on common general knowledge in the art.
- 4.7 In the present case the Board considers that it would be reasonable, in the light of the reference to the work of Hebb at page 9, line 30 to 32 of the application (see paragraph 3.3 above), to assume that the skilled person could determine weighting coefficients for a conventional associative memory modelled by the equations on lines 10 to 20. An alternative way of looking at this is to say that a conventional associative memory, including determining at least one set of usable coefficients, represents common general knowledge in this field. The Board considers that the feature in claim 1, relating to deriving weighting values for basic units, also only defines the basic operation of an associative memory and does not add anything to the disclosure of the description.
- 4.8 However, as described above (see paragraphs 3.5 to 3.7), the invention is not simply a conventional associative memory, but is a combination of four of the "basic associative units" shown in Figure 18, each of which weights a number of signals, including an input signal and several feedback signals and is connected to the other units with various feedforward and feedback paths. It is the Board's understanding that networks of this complexity, containing feedforward and feedback paths and local inhibitory and excitatory inputs, are

difficult to train successfully. Finding the correct training scheme is a critical part of the design of the system and not a matter of chance. Apart from the reference to Hebb, which as stated above the Board only considers to be applicable to a simple associative memory, the description does not even mention this matter, let alone give any guidance on how it should be done. In connection with the combination of basic units of the embodiment, the description, at page 11, line 39 to page 12, line 44, merely gives the vague functional description mentioned above (see paragraph 4.5) and refers back to the general and more abstract description of the "Parallel in Sequence" and "Variable-byte Formation" mechanisms. It is true that the description does give examples of how these mechanisms convert input signals into firing patterns. However, the examples are very general and are not related to any specific type of pattern recognition, let alone the specific ones in the present case. There is also effectively a parallel definition of the invention in terms of the "Take-Grant-Control" mechanism of Figure 13 (see paragraph 3.4 above), but this is not referred to by the description of the Figure 26 embodiment and the functions of the various parts are also given in the same abstract terms as those of the "Parallel in Sequence" and "Variable-byte Formation" mechanisms.

- 4.9 Even if the skilled person could train some of these mechanisms to perform some of the functions of the abstract examples given in the description, the Board judges that the skilled person could not train the whole system to solve the specific problems given in the application without undue burden. The Board

considers that the lack of adequate instructions, the vague functional nature of the description and the lack of any concrete definition of the invention, and the problem solved by it in particular, mean that the disclosure of the present invention fails to fulfil the requirements set up in Article 83 EPC.

4.10 Also, in the present case the appellant has not proved that the invention at all has been carried out but has, instead, stated that the project was discontinued (see paragraph V). Furthermore, the appellant has not subsequently filed any test data or other evidence despite the examining division's invitation at paragraphs 6 and 7 of the communication of 8 June 1993 and the Board's reference to this point at paragraph 10 of the communication of 18 June 1997. The Board therefore feels that the appellant has had sufficient time to file evidence. Given the lack of such evidence in support of the appellant's position in this case, and given that in ex parte proceedings the applicant bears the burden of proof of the facts in his favour, the Board holds that in the case in suit the proof concerning whether the invention could be carried out is not sufficient.

4.11 The Board finds no help for the appellant in the cited patents by the same applicant in the field of pattern recognition. The Board has studied these patents but considers that they are not comparable to the present case. Firstly, they relate to different techniques for pattern recognition and do not involve the associative memory of the present application. Secondly, the Board considers that although these patents relate to the same general problem of pattern recognition, they all

give at least one embodiment which is much more specific and is described in far greater detail than in the present case. The Board has also consulted the application which was the subject of T 183/95 and which, as far as the Board is aware, is the only other application in this field to have been referred to a Board of Appeal, albeit for consideration of inventive step. This application relates to neural networks and gives a good description of how the network of the embodiment is trained to solve the specific problem of recognising printed characters. It appears to the Board that the standard of disclosure in this application is appropriate to applications in this field.

4.12 The appellant's main counter-argument is that the USPTO and the JPO have already granted a corresponding patent so that the EPO should also do so in the interest of harmonisation of patent examination. Although such harmonisation is naturally desirable, the EPO, and in particular the Boards of Appeal, has to rely on the European Patent Convention and its interpretation as established by case law and take decisions independent of other patent offices.

4.13 The appellant also argues that if a skilled person can undertake the task in question it should be concluded that the disclosure of the invention is sufficient. In the Board's judgement there is a distinction to be made between inventions which will not work at all, such as ones that violate known physical laws, and inventions which the skilled person can not carry out on the basis of the information disclosed in the application, both of which are not allowable under Article 83 EPC. The appellant appears to be arguing that only the first

type of invention is insufficient, whereas the Board's objection in the present case in fact relates to the second situation. Thus in the Board's judgement it suffices for the application to be refused, to come to the conclusion that the skilled person could not carry out the invention on the basis of the information in the application without undue burden.

5. In summary, the present application is a definition of a new network topology that is based on recent physiological research into the structure and operation of the brain. However, the description does not give specific information required to setup the network to carry out the invention to solve the specific problems posed in the application, but remains vague and functional at the point of the invention. In the Board's judgement, the skilled person would not be able to derive the missing information from the essentially inchoate collection of abstract ideas given in the application. The application therefore does not meet the requirements of Article 83 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

P. K. J. van den Berg