Paper No. 43

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MAYUMI TOMIKAWA,
SEIICHI AIKAWA,
and FUMIKO MATSUZAWA

Appeal No. 1998-3335
Application 08/014,867[1]

HEARD: February 7, 2001

Before KRASS, JERRY SMITH, and BARRETT, Administrative Patent Judges.

BARRETT, Administrative Patent Judge.

DECISION ON APPEAL

[1] Application for patent filed February 8, 1993, entitled "Method And Apparatus For Extracting And Evaluating Mutually Similar Portions In One-Dimensional Sequences In Molecules And/Or Three-Dimensional Structures Of Molecules," which claims the foreign filing priority benefit of Japanese Application 4-21012, filed February 6, 1992, and Japanese Application 4-331703, filed December 11, 1992.

This is a decision on appeal under 35 U.S.C. § 134 from the final rejection of claims 31-37.

We reverse.

BACKGROUND

The invention is directed to a method and apparatus for determining the longest common subsequence (LCS) between two chains of atomic groups, such as amino acid sequences. The apparatus is shown in figure 1. The steps performed by the method and apparatus of independent claims 31 and 35 are described with respect to the example of figures 5 and 6. As illustrated in the example of figures 5 and 6, the LCS does not have to be consecutive characters; i.e., a character sequence I = "ABCBDAB" and a character sequence II = "BDCABA" have an LCS length of 4 with an LCS = "BDAB."

Claim 31 is reproduced below.

> 31. A computer-implemented method of analyzing sequences of atomic groups, said method comprising the steps of:
>
> a) inputting, into a gene information survey apparatus, a plurality of sequences including a first sequence of characters a_1 to a_m corresponding to a sequence of atomic groups in a first chain of atomic groups and a second sequence of characters b_1 to b_n corresponding to a sequence of atomic groups in a second chain of atomic groups, wherein m and n are integers, wherein said gene information survey apparatus comprises

a longest common subsequence detection unit and said second sequence of characters b_1 to b_n are input to the longest common subsequence detection unit from one of an amino acid sequence data base and a motif data base;

b) generating, by the gene information survey apparatus, an occurrence table indicative of occurrence positions of the characters a_1 to a_m in the first sequence;

c) preparing, by the gene information survey apparatus, a memory element array having memory elements S_0 to S_m, said memory elements S_1 to S_m corresponding to said characters a_1 to a_m, respectively;

d) initializing, by the gene information survey apparatus, all memory elements S_0 to S_m to zero and initializing an integer j to 1;

e) determining, by the gene information survey apparatus, an occurrence position r of a character a_r that is the same as a character b_j by referring to the occurrence table;

f) adding, by the gene information survey apparatus, 1 to each memory element S_i where i$r and S_i is equal to the memory element S_{r-1} when the memory element S_r is equal to the memory element S_{r-1}, wherein the adding step is repeated in decreasing order of the occurrence position r when there is more than one occurrence position r;

g) adding, by the gene information survey apparatus, 1 to the integer j;

h) repeating, by the gene information survey apparatus, the steps e) to g) until the integer j exceeds n;

i) obtaining, by the gene information survey apparatus, a length of a longest common subsequence between the first and the second chains of atomic groups

from a value of the memory element S_m after the integer j exceeds n in step h);

j) analyzing, by the gene information survey apparatus, the sequences of atomic groups in the first and second chains of atomic groups using the length of a longest common subsequence; and

k) displaying the longest common subsequence and results of the analyzing step on a display device.

The Examiner relies on the following prior art:

The Student Edition of MATLAB (Prentice-Hall, Inc. 1992),
Chapter 7 - Matrix Operations, pp. 55-60,
Chapter 14 - Graphing, pp. 107-118, and
Chapter 15 - Control Flow, pp. 119-123.

Claims 31-37 stand rejected under 35 U.S.C. § 101 as being directed to nonstatutory subject matter as a "mathematical algorithm."

Claims 31-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over MATLAB.

We refer to the Final Rejection (Paper No. 29) and the Examiner's Answer (Paper No. 35) (pages referred to as "EA__") for a statement of the Examiner's position, and to the supplemental Appeal Brief (Paper No. 34) and the Reply Brief (Paper No. 36) for a statement of Appellants' arguments thereagainst.

OPINION

35 U.S.C. § 101

The § 101 "mathematical algorithm" rejection maintained in the Examiner's Answer entered October 24, 1997, is based on the U.S. Patent and Trademark Office's Examination Guidelines for Computer-Related Inventions (Guidelines), 1184 Off. Gaz. Pat. & Trademark Office 87 (March 26, 1996).[2] Since then, the U.S. Court of Appeals for the Federal Circuit has issued two decisions clarifying the application of § 101: State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 47 USPQ2d 1596 (Fed. Cir. 1998) and AT&T v. Excel Communications, Inc., 172 F.3d 1352, 50 USPQ2d 1447 (Fed. Cir. 1999). We conclude that the § 101 rejection must be reversed under the recently enunciated principles of State St. and AT&T.

"[T]he judicially-defined proscription against patenting of a 'mathematical algorithm,' to the extent such a proscription still exists, is narrowly limited to mathematical algorithms in the abstract." AT&T, 172 F.3d at 1356,

[2] The Guidelines are now incorporated into the Manual of Patent Examining Procedure (MPEP) § 2106, except that MPEP § 2106 incorporates the footnotes of the Guidelines into the body of the text and changes some wording, such as "non-functional" in the Guidelines to "nonfunctional."

50 USPQ2d at 1450 (citing State St., 149 F.3d at 1374-75, 47 USPQ2d at 1602). The key to statutory subject matter is whether the claimed subject matter is applied in a "useful way" or directed to a "practical application," which the Federal Circuit has said requires "a useful, concrete and tangible result." State St., 149 F.3d at 1375, 47 USPQ2d at 1602. It is not required that there be a "physical transformation" or conversion of subject matter from one state into another for there to be statutory subject matter. AT&T, 172 F.3d at 1358-59, 50 USPQ2d at 1452-53. As stated in State St., 149 F.3d at 1373, 47 USPQ2d at 1601:

> Today, we hold that the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces "a useful, concrete and tangible result"--a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.

Thus, it is clear that computer-implemented operations that produce a practical application of a mathematical algorithm constitute statutory subject matter even though there is no transformation of subject matter outside the computer.

In this case, the claims define a practical application of a computer algorithm because they recite finding the longest common subsequence of atomic groups between two sequences of atomic groups (a specific practical use) using a gene information survey apparatus (i.e., this is not an abstract mental process), which result is displayed. The claims are not to a longest common subsequence detection algorithm in the abstract. The claims define "a useful, concrete and tangible result" and, hence, the rejection of claims 31-37 under § 101 is reversed.

35 U.S.C. § 103(a)

The Examiner admits that MATLAB does not disclose the specific steps of claims 31 and 35, but finds that MATLAB is capable of performing the recited operations and concludes that "one skilled in the chemical arts, specifically sequencing, at the time of the invention would [have] know[n] that the specific conditional statements are design, program and conditionally dependent and would [have] know[n] how to program MATLAB with the statements such that optimal results were achieved" (EA15).

Appellants argue that MATLAB does not disclose the features of claims 31 and 35 and there is no suggestion or motivation to modify to achieve a gene information survey apparatus and method as recited in claims 31-37.

We conclude that the Examiner has failed to establish a prima facie case of obviousness. The Examiner provides no factual evidence for the assertion that one skilled in the art would have known how to program MATLAB to produce the claimed subject matter. The fact that a computer was capable of being programmed with MATLAB to perform the claimed algorithm does not make the subject matter obvious unless one skilled in the art knew what steps to program. See In re Prater, 415 F.2d 1393, 1406, 162 USPQ 541, 551 (CCPA 1969) ("Assuming the existence, at the time of the invention, of general-purpose digital computers as well as typical programming techniques therefor, it is nevertheless plain that appellants' invention, as defined in apparatus claim 10, was not obvious under 35 U.S.C. § 103 because one not having knowledge of appellants' discovery simply would not know what to program the computer to do."). See also In re Mills, 916 F.2d 680, 682, 16 USPQ2d 1430, 1432 (Fed. Cir. 1990)

("While Mathis' apparatus may be capable of being modified to run the way Mills' apparatus is claimed, there must be a suggestion or motivation in the reference to do so."). If a generic longest common subsequence algorithm were known in the computer algorithm art, e.g., in the string searching art, we might agree that it would have been obvious to apply such an generic algorithm to analyzing chains of atomic groups. However, because the Examiner has not provided any evidence that a generic LCS algorithm was known to those of ordinary skill in the art, the Examiner has failed to establish a prima facie case of obviousness. The rejection of claims 31-37 is reversed.

CONCLUSION

The rejections of claim 31-37 under 35 U.S.C. §§ 101 and 103(a) are reversed.

REVERSED

ERROL A. KRASS)
Administrative Patent Judge)

JERRY SMITH Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
LEE E. BARRETT Administrative Patent Judge	)	

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