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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID LIU, SHAOHUA K. ZHOU, SASCHA SEIFERT,
DOMINIK BERNHARDT, and DORIN COMANICIU

Appeal 2018-000996
Application 12/728,315¹
Technology Center 3600

Before BIBHU R. MOHANTY, BRADLEY B. BAYAT, and
SHEILA F. McSHANE, *Administrative Patent Judges*.

McSHANE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants seek our review under 35 U.S.C. § 134(a) of the Examiner's final decision to reject claims 1–23. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE the Examiner's 35 U.S.C. § 101 rejection of claims 1–23. We enter NEW GROUNDS OF REJECTION of claims 12–17 under 35 U.S.C. § 112, second paragraph, pursuant to our authority under 37 C.F.R. § 41.50(b).

¹ According to the Appellants, the real party in interest is Siemens Aktiengesellschaft. Appeal Brief filed May 23, 2017, hereafter "App. Br.," 1.

BACKGROUND

The invention relates to imaging software for detecting vascular landmarks in a three-dimensional (3D) image volume by, for example, a computerized tomography (CT) or magnetic resonance imaging (MRI) scan volume. Abstract; Specification, hereinafter “Spec.,” ¶¶ 2–4. A node potential value for a landmark candidate is generated with error values determined using spatial histogram-based error regression, and edge potential values based on a bifurcation analysis of image volume using vessel tracing, and with the optimal landmark candidate determined using Markov random field model based on node potential values and edge potential values. *Id.* at ¶ 5.

Independent claims 1 and 12 are reproduced from pages 11 and 15–16 of the Claims Appendix of the Appeal Brief (Claims App’x) as follows:

1. A method for detecting target landmarks in an image volume, the method comprising:
 - detecting a set of landmark candidates for each of a plurality of target landmarks in an image volume;
 - generating a node potential value for each landmark candidate based at least in part on an error value determined using spatial histogram-based error regression;
 - generating edge potential values for pairs of landmark candidates based on a bifurcation analysis of the image volume using vessel tracing; and
 - determining an optimal landmark candidate for each target landmark, using a Markov random field model based on the node potential values and the edge potential values.

12. An apparatus for detecting target landmarks in an image volume, the method comprising:

means for detecting a set of landmark candidates for each of a plurality of target landmarks in an image volume;

means for generating a node potential value for each landmark candidate based at least in part on an error value determined using spatial histogram-based error regression;

means for generating edge potential values for pairs of landmark candidates based on a bifurcation analysis of the image volume using vessel tracing; and

means for determining an optimal landmark candidate for each target landmark, using a Markov random field model based on the node potential values and the edge potential values.

App. Br. 11, 15–16 (Claims App’x).

In a Final Rejection, the Examiner rejects claims 1–23 under 35 U.S.C. § 101 as directed to nonstatutory subject matter. Final Action mailed November 23, 2016, hereinafter “Final Act.,” 2–7; *see, also*, Answer mailed September 7, 2017 hereinafter “Ans.,” 3–7.

§ 101 REJECTION

An invention is patent eligible if it claims a “new and useful process, machine, manufacture, or composition of matter.” 35 U.S.C. § 101. However, the Supreme Court has long interpreted 35 U.S.C. § 101 to include implicit exceptions: “[l]aws of nature, natural phenomena, and abstract ideas” are not patentable. *E.g., Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, we are guided by the Supreme Court’s two-step framework, described in *Mayo* and *Alice*. *Id.* at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework,

we first determine what concept the claim is “directed to.” *See Alice*, 573 U.S. at 219 (“On their face, the claims before us are drawn to the concept of intermediated settlement, i.e., the use of a third party to mitigate settlement risk.”); *see also Bilski v. Kappos*, 561 U.S. 593, 611 (2010) (“Claims 1 and 4 in petitioners’ application explain the basic concept of hedging, or protecting against risk.”).

Concepts determined to be abstract ideas include certain methods of organizing human activity, such as fundamental economic practices (*Alice*, 573 U.S. at 219–20; *Bilski*, 561 U.S. at 611); mathematical formulas (*Parker v. Flook*, 437 U.S. 584, 594–95 (1978)); and mental processes (*Gottschalk v. Benson*, 409 U.S. 63, 69 (1972)). Concepts determined to be patent eligible include physical and chemical processes, such as “molding rubber products” (*Diamond v. Diehr*, 450 U.S. 175, 191 (1981) (“*Diehr*”)); “tanning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting ores” (*id.* at 182 n.7 (quoting *Corning v. Burden*, 56 U.S. 252, 267–68 (1854))); and manufacturing flour (*Benson*, 409 U.S. at 69 (citing *Cochrane v. Deener*, 94 U.S. 780, 785 (1876))). In *Diehr*, the claim at issue recited a mathematical formula, but the Supreme Court held that “[a] claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula.” *Diehr*, 450 U.S. at 176; *see also id.* at 192 (“We view respondents’ claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula.”), *see also, e.g., id.* at 187 (“It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.”).

If the claim is “directed to” an abstract idea, we turn to the second step of the *Alice* and *Mayo* framework, where “we must examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application.” *Alice*, 573 U.S. at 221 (quotation marks omitted). “A claim that recites an abstract idea must include ‘additional features’ to ensure ‘that the [claim] is more than a drafting effort designed to monopolize the [abstract idea].’” *Id.* (quoting *Mayo*, 566 U.S. at 77). “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.*

The USPTO recently published revised guidance on the application of § 101, in accordance with judicial precedent. *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50, 52 (Jan. 7, 2019) (“2019 Guidance”). Under the 2019 Guidance, a claim is “directed to” an abstract idea if the claim recites any of (1) mathematical concepts, (2) certain methods of organizing human activity, and (3) mental processes—without integrating such abstract idea into a “practical application,” i.e., without “apply[ing], rely[ing] on, or us[ing] the judicial exception in a manner that imposes a meaningful limit on the judicial exception, such that the claim is more than a drafting effort designed to monopolize the judicial exception.” *Id.* at 52–55. A claim so “directed to” an abstract idea constitutes ineligible subject matter, unless it recites an additional element (or combination of elements) amounting to significantly more than the abstract idea. *Id.* at 56.

With this context in mind, we evaluate the Examiner’s § 101 rejection of claims 1–23, using independent claim 1 as representative.

The Examiner finds that representative claim 1 is directed to a judicial exception without significantly more. *See* Final Act. 4–7. The Examiner finds that the claim is “directed to at least the abstract idea of [] determining, by using a mathematical model an optimal landmark candidate based on node and edge potential.” *Id.* at 4. The Examiner finds that this abstract idea corresponds to the abstract idea identified by the court in *In re Grams*. *Id.* (citing *In re Grams*, 888 F.2d 835 (Fed. Cir. 1989)). The Examiner further finds

[w]hile the claims do not explicitly recite the court identified abstract idea (A), the concepts are described by the claimed “detecting a set of landmark candidates”, “generating a node potential value”, “generating edge potential values”, and “determining an optimal landmark candidate”. The concepts of *In re Grams* relate to mathematical concepts such as mathematical algorithms, mathematical relationships, mathematical formulas, and calculations. The concept described in claims 1, 12, and 18 are not meaningfully different from the concepts found by the courts to be abstract ideas.

Id. at 4–5.

The Examiner finds that claim 1 correlates “to the abstract idea of collecting information, analyzing it and displaying certain results of the collection and analysis since the claim collects data by detecting a set of landmark candidates, then performs certain analysis in the ‘generating a node potential value, generating edge potential value and determining an optimal landmark candidate for each target landmark.’” Ans. 4. The Examiner finds that the specification “analyzes data for its own sake.” *Id.*

We agree with the Examiner’s findings that the recited steps of claim 1 of “detecting a set of landmark candidates,” “generating a node potential value,” “generating edge potential values” and “determining an optimal

landmark candidate . . . using a Markov random field model” are accurately characterized as the use of a mathematical model that mathematically analyzes data. The specification supports that the generation of node potential and edge potential values and the use of a Markov random value field model employ mathematical concepts. *See e.g.* Spec. 45–49, 51–61. In this way the claims are similar to claims analyzed in *Parker v. Flook*, 437 U.S. 584, 594–595 (1978). Because representative claim 1 recites mathematical concepts, we find that it recites the judicial exception of an abstract idea under the first prong of the revised Step 2A. *See* 2019 Guidelines, 84 Fed. Reg. at 51–52.

The next issue under the second prong of step 2A is whether representative claim 1 not only recites, but is more precisely directed to the concept itself or whether it is instead directed to some technological implementation or application of, or technological improvement to, the concept, such as integration into a practical application.²

In the rejection, the Examiner finds that the “focus of the claims is not on such an improvement in computers as tools, but on certain independently abstract ideas that use computers as tools.” Final Act. 5. The Examiner further finds that the claimed elements do not add meaningful limitations to the identified abstract idea claimed beyond generally linking the judicial exception to a particular technological environment, that is, implementation via computers. *Id.* at 6. The Examiner refers to the specification that states “the landmark detection unit may be a computer implemented using well

² *See, e.g., Alice*, 573 U.S. at 223, discussing *Diamond v. Diehr*, 450 U.S. 175 (1981).

known computer processors, memory units, storage devices, displays, computer software, and other components.” *Id.* at 5–6 (citing Spec. ¶ 10).

Appellants argue that the claims do not recite an abstract idea because the claimed method detects target landmarks in an image volume by specific steps. App. Br. 5. Appellants assert that similar to the claims in *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016) (“*Enfish*”), the claims here are directed to an “improvement in the computer-related technology of computer-based detection of target landmarks in image volumes,” and not where general purpose computer components are added post-hoc to a fundamental economic practice or mathematical equation. *Id.* at 7–8. Appellants contend that the Examiner has provided no evidence that the present claims are directed to the use of conventional or generic technology. *Id.* at 8. Appellants cite to *McRO, Inc. v. Bandai Namco Games America Inc.*, 837 F.3d 1299 (Fed. Cir. 2016) (“*McRO*”) as support that the Federal Circuit has found that an improvement to computer-related technology is not limited only to improvements in the operation of a computer itself. *Id.*

Appellants further argue that the Examiner errs in improperly characterizing and oversimplifying the claim at a high level of abstraction untethered from the language of the claim. Reply Brief filed November 7, 2017, hereafter “Reply Br.,” 3–4, 6. Appellants allege that Examiner’s findings that the claim 1 method merely “us[e] an algorithm” and collect, analyze, and display results is a mischaracterization. *Id.* at 3. For instance, Appellants assert that the claimed method of node potential value generation for each landmark candidate based on an error value determined using spatial-histogram error regression, edge potential values generation based on

a bifurcation analysis of the image volume using vessel tracing, and optimal landmark determination for each target landmark using a Markov random field model cannot, as the Examiner finds, be reduced to “perform[ing] certain analysis.” *Id.* at 5. Rather, Appellants allege that the claimed methods represent a specific improvement of computer-based detection of landmarks, which have limited accuracy and result in errors, as described in paragraph 27 of the specification. *Id.* at 7.

Although, as discussed above, we agree that claim 1 employs mathematical concepts, we find, however, that the Examiner errs by failing to sufficiently address the issue of whether claim 1 provides a technological improvement. Claim 1 recites “determining an optimal landmark candidate” in “target landmarks in an image volume.” As we view the method of claim 1, and considering the specification, there is technology, and more specifically, computer-based image processing employed in the steps of claim 1. As Appellants argue, and the specification supports, the steps of the claim are specifically directed to the computer related technology of computer-based landmark detection in image volumes. *See* Reply Br. 7, 10; Spec. ¶¶ 3–5, 15 (“virtual manipulations [for detecting vascular landmarks in 3D image data] [are] accomplished in the memory or other circuitry/hardware of a computer system.”). The claimed “image volume” is generated by imaging technology such as a computerized CT scan or MRI imaging. Spec. ¶ 3. The claimed landmark candidates are identified by further computerized image processing of the three dimensional image volume using guide slices. *Id.* ¶¶ 5, 15, 30, 33, Fig. 3 (steps 320, 330). The claimed analysis is further performed by image processing; for instance,

determination of node potential values is by spatial histogram-based error regression which uses pixel-by-pixel comparisons. *Id.* ¶¶ 41–42. Edge potential values are determined by analysis of data derived from image processing using vessel tracing. *Id.* ¶¶ 52–61, Fig. 5.

The specification states that the existing methods for identification of landmarks in a three dimensional image volume had limited accuracy and resulted in errors without considering the relative locations of other landmarks. *Id.* ¶ 27. Thus, there is support for Appellants’ allegation that the claimed method steps use a non-conventional, non-generic method (utilizing specific spatial analysis which considers other landmark candidates) that provides a technological improvement to the computer related technology of computer-based landmark detection in image volumes. *See Reply Br. 10.* We agree that representative claim 1 addresses problems with the computer-related technology of computer-based landmark detection in image volumes, and, therefore, the claim is directed to a technological improvement. *See McRO*, 837 F.3d at 1314–16 (claim improving a computer-automated process, but not the operation of a computer itself); *Diehr*, 450 U.S. at 185–91 (observing “an application of a . . . mathematical formula to a known . . . process may well be deserving of patent protection” (quoting *id.* at 187)).

Because we conclude that representative claim 1 is not directed to a judicial exception, and thus is patent-eligible, this ends the patent-eligibility inquiry, and we need not proceed to an analysis of whether the claim amounts to significantly more than the abstract idea.

Accordingly, we reverse the Examiner's decision to reject representative claim 1 as directed to patent ineligible subject matter. We also reverse the rejection of claims 1–11 and 18–23, which were rejected on similar grounds, for the above reasons. As addressed below, because claims 12–17 fail to satisfy the definiteness requirements of 35 U.S.C. § 112, second paragraph, we also reverse, *pro forma*, the Examiner's rejection of these claims, to the extent applicable. *See In re Steele*, 305 F.2d 859, 862 (CCPA 1962) (A rejection cannot be sustained if the hypothetical person of ordinary skill in the art would have to make speculative assumptions concerning the meaning of claim language.).

NEW GROUNDS OF REJECTION

The method of claim 12 includes “means for” steps. When a claim uses the term “means” to describe a limitation, a presumption inheres that the inventor used the term to invoke § 112, sixth paragraph. *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1375 (Fed. Cir. 2003); *Personalized Media Commc'ns, LLC v. Int'l Trade Comm'n*, 161 F.3d 696, 703–04 (Fed. Cir. 1998). “This presumption can be rebutted when the claim, in addition to the functional language, recites structure sufficient to perform the claimed function in its entirety.” *Altiris*, 318 F.3d at 1375. In *Aristocrat Techs. Austl. Pty Ltd. v Inter. Game Tech.*, 521 F.3d 1328 (Fed. Cir. 2008), the court set forth that for a claim to a programmed computer, a particular algorithm may be the corresponding structure under § 112, sixth paragraph:

For a patentee to claim a means for performing a particular function and then to disclose only a general purpose computer as the structure designed to perform that function amounts to pure functional claiming. Because computers can be programmed to perform very different tasks in very different ways, simply

disclosing a computer as the structure designated to perform a particular function does not limit the scope of the claim to “the corresponding structure, material, or acts” that perform the function, as required by section 112 paragraph 6.

Id. at 1333.

In *Aristocrat*, the only portion of the specification that described the structure corresponding to the three functions performed by the claimed “game control means” was a statement that it is within the capability of a worker in the art “to introduce the methodology on any standard microprocessor base [sic] gaming machine by means of appropriate programming.” *Id.* at 1334. The court found that the reference to “appropriate programming” imposed no limitations, as any general purpose computer must be programmed. *Id.*

Independent claim 12 recites a series of steps that include “means for detecting a set of landmark candidates . . .,” “means for generating a node potential value . . .,” “means for generating edge potential values . . .,” and “means for determining an optimal landmark candidate for each target landmark, using a Markov random field model based on the node potential values and the edge potential values.” The presumption arises that Appellants used the term “means” in claim 12 to invoke 35 U.S.C. § 112, sixth paragraph. Because the claim itself does not recite any specific structure, short of a general “apparatus” performing these claimed functions, the presumption applies.

Here, the specification discloses the use of a non-specialized computer implementing the invention. *See e.g.* Spec. ¶¶ 10, 11, 14, 22, 24, 26, 39, 50, 64 (the methods may be implemented on implemented on a computer using well-known computer processors, memory units, storage devices, computer

software, and other components), Fig. 10 (depicting only processor 1004, network interface 1006, input/output devices (I/O) 1008, memory 1010, and storage 1012). The specification discusses the use of software programs and computer code for implementation. *See e.g. id.*, ¶¶ 17, 22, 24, 26, 39.

Appellants direct us to various portions of the specification related to the means plus function steps. App. Br. 2–3.

For the step of “means for determining an optimal landmark candidate for each target landmark, using a Markov random field model based on the node potential values and the edge potential values,” Appellants direct us to paragraph 37 of the specification for algorithms. App. Br. 3. Here, we find that the specification merely states that the Markov Random Field Model Analyzer “analyzes landmark candidates” to determine optimal landmark candidates based on the node potential values and edge potential values, but fails to disclose any algorithm for the analysis or how the optimal landmark candidate is determined. Thus, the specification fails to disclose algorithms that transform the general purpose processor to a special purpose computer programmed to perform the disclosed function of the “means for determining an optimal landmark candidate” step of the claim 12.

Appellants have failed to disclose an algorithm, and thus has failed to adequately describe sufficient structure, for performing the functions of claim 12. Accordingly, claims 12, and claims 13–17 depending therefrom, are unpatentable under 35 U.S.C. § 112, second paragraph, as indefinite. *Aristocrat*, 521 F.3d at 1333.

SUMMARY

We reverse the Examiner's rejection of claims 1–23 under 35 U.S.C. § 101.

We enter a NEW GROUND OF REJECTION for claims 12–17.

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 41.50(b). “A new ground of rejection pursuant to this paragraph shall not be considered final for judicial review.” 37 C.F.R. § 41.50(b).

Section 41.50(b) also provides:

When the Board enters such a non-final decision, the appellant, within two months from the date of the decision, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

(1) Reopen prosecution. Submit an appropriate amendment of the claims so rejected or new Evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the prosecution will be remanded to the examiner. The new ground of rejection is binding upon the examiner unless an amendment or new Evidence not previously of Record is made which, in the opinion of the examiner, overcomes the new ground of rejection designated in the decision. Should the examiner reject the claims, appellant may again appeal to the Board pursuant to this subpart.

(2) Request rehearing. Request that the proceeding be reheard under § 41.52 by the Board upon the same Record. The request for rehearing must address any new ground of rejection and state with particularity the points believed to have been misapprehended or

overlooked in entering the new ground of rejection and also state all other grounds upon which rehearing is sought.

Further guidance on responding to a new ground of rejection can be found in the Manual of Patent Examining Procedure § 1214.01.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

REVERSED; 37 C.F.R. § 41.50(b)