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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte SERGEY IOFFE and SAMY BENGIO

Appeal 2018-006648
Application 14/141,803
Technology Center 2100

Before JENNIFER S. BISK, JOYCE CRAIG, and JASON M. REPKO, *Administrative Patent Judges*.

REPKO, *Administrative Patent Judge*.

DECISION ON APPEAL

Under 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1–5, 7–19, 23, and 24. Appeal Br. 3.[2] We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] According to Appellant, the real party in interest is Google Inc. Appeal Br. 3.

[2] Throughout this opinion, we refer to the Non-Final Office Action ("Non-Final"), mailed June 13, 2017; the Appeal Brief ("Appeal Br."), filed November 13, 2017; the Examiner's Answer ("Ans."), mailed April 19, 2018; and the Reply Brief ("Reply Br."), filed June 12, 2018.

THE INVENTION

Appellant's invention relates to distance metric learning. Spec. ¶ 1. Distance metric learning attempts to define a distance between elements in a metric space. *Id.* ¶ 3. In this field, a distance function can be used to determine the distance between any two data points in a metric space or to find a data point closest to a specific input (i.e., a query). *Id.* There are multiple ways to define a distance function. *Id.* But some distance functions may have longer retrieval times than others in high-dimensional metric spaces. *Id.* The invention designs a distance function for these high-dimensional metric spaces so that retrieval can be accomplished in a time that is sub-linear to the space's size. *Id.* ¶ 19.

Claim 1 is reproduced below:

> 1. A computer-implemented method of determining similar images, comprising:
>
> receiving, at a computing device having one or more processors, training data that includes a set of non-matching pairs (x_1, y_1) and a set of matching pairs (x_2, y_2);
>
> calculating, at the computing device, a non-matching collision probability $p_1(x_1, y_1)$ for each non-matching pair of the set of non-matching pairs;
>
> calculating, at the computing device, a matching collision probability $p_2(x_2, y_2)$ for each matching pair of the set of matching pairs;
>
> generating, at the computing device, a machine learning model that includes a first threshold (T_1) and a second threshold (T_2), the machine learning model being configured to classify an unknown item as not matching a particular known item when a collision probability between the unknown item and the particular known item is less than the first threshold (T_1), and to classify the unknown item as matching the particular known item when the collision probability between the unknown item

> and the particular known item is greater than the second threshold (T_2),
>
> wherein the first threshold (T_1) and the second threshold (T_2) are selected based on: (i) a minimization of a sum of $max(0, p_1(x_1, y_1)-T_1)$ over the set of non-matching pairs, (ii) a minimization of a sum of $max(0, T_2 - P_2(x_2, y_2))$ over the set of matching pairs, and (iii) a maximization of $ln(1/T_1)/ln(1/T_2)$;
>
> receiving, at the computing device, a query corresponding to an unknown image;
>
> determining, at the computing device, an approximate nearest neighbor to the query based on the machine learning model, the first threshold (T_1) and the second threshold (T_2); and
>
> outputting, from the computing device, the approximate nearest neighbor corresponding to the unknown image.

Appeal Br. 31–32.

THE REJECTION

The Examiner rejects claims 1–5, 7–19, 23, and 24 under 35 U.S.C. § 101 as directed to patent-ineligible subject matter. Non-Final 2–4.

ANALYSIS

I. Principles of Law

Under § 101, patent-eligible subject matter is defined as "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." 35 U.S.C. § 101. But courts have long held that laws of nature, natural phenomena, and abstract ideas are not patentable. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70–71 (2012) (citing *Diamond v. Diehr*, 450 U.S. 175, 185 (1981)).

These ineligible concepts are implicit exceptions to the statutory categories. *Id.* at 71.

The Supreme Court articulated a two-step subject-matter eligibility test in *Mayo* and *Alice Corp. v. CLS Bank International*, 573 U.S. 208 (2014). *Alice/Mayo* step one asks whether a claim is "directed to" a judicial exception. *Alice*, 573 U.S. at 217. In *Alice/Mayo* step two, we consider "the elements of each claim both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application." *Id.* (quoting *Mayo*, 566 U.S. at 79, 78). Step two is described as a search for an "inventive concept." *Id.*

The USPTO has published revised guidance on patent subject matter eligibility. 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019) ("Guidance"). Step 1 of the USPTO's eligibility analysis asks whether the claimed subject matter falls within the four statutory categories of invention. *Id.* at 53–54. Under Step 2A, Prong One of the Guidance, we determine if the claim recites a judicial exception, including particular groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human activity, or mental processes). *Id.* at 52–53. If so, we then analyze the claim to determine whether the recited judicial exception is integrated into a practical application under Step 2A, Prong Two of the Guidance. *Id.* at 53–55; MPEP §§ 2106.05(a)–(c), (e)–(h) (9th ed. Rev. 08.2017, Jan. 2018).

Only if the claim fails to integrate the exception and, thus, is "directed to" the judicial exception, do we then look to whether the claim adds a specific limitation beyond the judicial exception that is not "well-understood, routine, conventional activity in the field" or whether the claim

simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception. Guidance, 84 Fed. Reg. at 56.

II. Overview of the Examiner's Rejection and Appellant's Arguments

The Examiner determines that representative[3] claim 1 is directed to an abstract idea. Non-Final 3. The Examiner determines that the additional elements do not amount to significantly more than the abstract idea itself. *Id.*

Appellant argues that "aspects of the claimed technology provide improvements and enhancements over conventional systems." Appeal Br. 28. In Appellant's view, "the present claims are directed to a proposed solution to the technical problems associated with the computer-implemented task of identifying similar image(s) to an unknown image." *Id.* at 29; *see also* Reply Br. 2. According to Appellant, the claimed solution is "relatively efficient" and faster than conventional approaches. Appeal Br. 29 (citing Spec. ¶ 19); *see also* Reply Br. 2–3 (Spec. ¶¶ 3, 19).

For the reasons discussed below, we agree with the Examiner. As we explain in detail below, claim 1 recites an abstract idea that falls within the Guidance's mathematical-concept grouping. As for Appellant's argument about solving a technical problem, the analysis that follows explains that the image data is only nominally recited and merely links the mathematical formulas to a particular field of use.

[3] Appellant argues claims 1–5, 7–19, 23, and 24 as a group. *See generally* Appeal Br.; Reply Br. We select claim 1 as representative of claims 1–5, 7–19, 23, and 24. *See* 37 C.F.R. § 41.37(c)(1)(iv).

III. Does the claim recite a judicial exception?

A. Step 2A, Prong One of the Guidance

We first consider whether the claim recites a judicial exception. Guidance, 84 Fed. Reg. at 51. The Guidance synthesizes the key concepts identified by the courts as abstract ideas into three primary subject-matter groupings: mathematical concepts, certain methods of organizing human activities, and mental processes. *Id.* at 52. For the reasons discussed below, claim 1 recites an abstract idea that falls in the Guidance's subject-matter grouping of mathematical concepts. *Id.*

B. "calculating"

In particular, claim 1 recites, in part, (1) "calculating, at the computing device, a *non-matching* collision probability $p_1(x_1, y_1)$ for each non-matching pair of the set of non-matching pairs" and (2) "calculating, at the computing device, a *matching* collision probability $p_2(x_2, y_2)$ for each matching pair of the set of matching pairs." Appeal Br. 31 (emphasis added). Items are "matches" or "non-matches" when they share a measurement of similarity above or below a threshold. Spec. ¶ 25. The invention can use hash functions to determine a collision probability between items. *Id.* ¶ 26. The hash functions can be stored in a hash table. *Id.* ¶ 27. A query's hash values can be compared with the hash-table values to determine the collision probability with the known items. *Id.* Thus, the recited steps of calculating the collision probabilities encompass these mathematical calculations, which fall within the subject-matter grouping of mathematical concepts.

C. "generating"

Claim 1 further recites, in part,

> generating, at the computing device, a machine learning model that includes a first threshold (T_1) and a second threshold (T_2), the machine learning model being configured to classify an unknown item as not matching a particular known item when a collision probability between the unknown item and the particular known item is less than the first threshold (T_1), and to classify the unknown item as matching the particular known item when the collision probability between the unknown item and the particular known item is greater than the second threshold (T_2),
>
> wherein the first threshold (T_1) and the second threshold (T_2) are selected based on: (i) a minimization of a sum of $max(0, p_1(x_1, y_1)-T_1)$ over the set of non-matching pairs, (ii) a minimization of a sum of $max(0, T_2 - P_2(x_2, y_2))$ over the set of matching pairs, and (iii) a maximization of $ln(1/T_1)/ln(1/T_2)$;

Appeal Br. 31.

This step recites the mathematical formulas of (1) the sum of $max(0, p_1(x_1, y_1)-T_1)$, (2) the sum of $max(0, T_2 - P_2(x_2, y_2))$, and (3) $ln(1/T_1)/ln(1/T_2)$. *Id.* The recited thresholds are based on these formulas. *Id.* The machine-learning model classifies the unknown item, at least in part, by comparing a value to the thresholds. *Id.* Because the generating step includes the recited mathematical formulas and compares the calculated probabilities to determined thresholds, this step recites subject-matter that falls within the grouping of mathematical concepts.

D. "determining"

Claim 1 further recites, in part, "determining, at the computing device, an approximate nearest neighbor to the query based on the machine learning model, the first threshold (T_1) and the second threshold (T_2)." Appeal Br. 32. The recited determination uses the model and thresholds from the previous

step to determine a nearest neighbor. This step essentially performs a calculation on the query using the mathematical concept recited in the previous step. In this way, the determining step also recites a mathematical concept.

In sum, claim 1 recites steps that fall within the Guidance's subject-matter grouping of mathematical concepts. Thus, claim 1 recites an abstract idea.

IV. Is the claim "directed to" the recited judicial exception?

A. Step 2A, Prong Two of the Guidance

Because claim 1 recites an abstract idea, we now proceed to determine whether the recited judicial exception is integrated into a practical application. Guidance, 84 Fed. Reg. at 51. When a claim recites a judicial exception and fails to integrate the exception into a practical application, the claim is "directed to" the judicial exception. *Id.*

We use the term "additional elements" for claim features, limitations, or steps that the claim recites beyond the identified judicial exception. *See id.* at 55 n.24. In claim 1, the additional elements include (1) receiving the recited training data, (2) receiving the recited query, (3) outputting the recited approximate nearest neighbor, and (4) the computing device that is involved in these steps. We consider these elements individually and in combination in the sections that follow.

B. "receiving . . . training data" and "receiving . . . a query"

Claim 1 recites, in part, "receiving, at a computing device having one or more processors, training data that includes a set of non-matching pairs (x_1, y_1) and a set of matching pairs (x_2, y_2)." Appeal Br. 31.

Here, claim 1 does not purport to improve how the training data is created. Rather, "[t]he training data is known data in that each non-matching pair (x_1, y_1) is given and labeled as a non-matching pair and each matching pair (x_2, y_2) is given and labeled as a matching pair, e.g., by a human or other expert." Spec. ¶ 29. So the step of receiving the training data encompasses collecting known data.

Claim 1 further recites "receiving, at the computing device, a query corresponding to an unknown image." Appeal Br. 32. The Specification refers to a query as an input to a search to find the closest data point in the metric space. Spec. ¶ 3. The recited receiving step encompasses receiving this input at the computing device.

Here, claim 1's receiving steps do not add meaningful limitations to the computing process because these steps add only insignificant pre-solution activity and are only nominally related to the invention. *See, e.g.*, *OIP Techs., Inc. v. Amazon.com, Inc.*, 788 F.3d 1359, 1363–64 (Fed. Cir. 2015) (determining that recited data gathering did not meaningfully limit the abstract idea), *cited in* MPEP § 2106.05(g). Also, the recited computing device does not contribute in a meaningful way to the data collection to render the claims patent eligible. For example, the Federal Circuit has explained that sending and receiving information over a network without further specification may not be sufficient to render the claims patent eligible. *See buySAFE, Inc. v. Google, Inc.*, 765 F.3d 1350, 1355 (Fed. Cir. 2014). In the recited receiving steps, the computing device simply receives the data. The claim only limits what the data includes (e.g., non-matching and matching pairs and an image query).

Thus, the receiving steps, considered individually and in combination with the other limitations, do not indicate that the judicial exception has been integrated into a practical application.

C. "a computing device"

As discussed in § III.B, the computing device performs the mathematical calculations. To be sure, the recited computing device may perform the calculations faster than a human. Using the computing device to achieve a solution more quickly, though, may not be sufficient to show an improvement to computer technology. *See Versata Dev. Grp., Inc. v. SAP Am., Inc.*, 793 F.3d 1306, 1335 (Fed. Cir. 2015); *see also* MPEP § 2106.05(a)(II) (instructing examiners that a "commonplace business method being applied on a general purpose computer" may not be sufficient to show an improvement). Here, the computing device is used as a tool in its ordinary capacity—i.e., for its calculating function.

A particular machine or manufacture that is integral to the claim indicates that the abstract idea has been integrated into a practical application. Guidance, 84 Fed. Reg. at 55. But a general-purpose processor that merely executes the judicial exception—as is the case here—is not a particular machine. *Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709, 716–17 (Fed. Cir. 2014), *cited in* MPEP § 2106.05(b)(I). For instance, the Specification discloses that the method "can be performed by any computing device." Spec. ¶ 39. Essentially, the recited computing device is a general-purpose computer that executes the abstract idea. *See id.*

Thus, the claimed method does not use the computing device in a way that indicates that the judicial exception has been integrated into a practical application.

D. "outputting . . . the approximate nearest neighbor"

Claim 1 recites, in part, "outputting, from the computing device, the approximate nearest neighbor corresponding to the unknown image." Appeal Br. 32.

This step is similar to others that were not sufficient to integrate a recited abstract idea into a practical application. For example, the Federal Circuit determined that displaying accessed data on a user's device without more may not be sufficient to render a claim patent eligible. *Interval Licensing LLC v. AOL, Inc.*, 896 F.3d. 1335, 1347 (Fed. Cir. 2018). Here, the outputting step merely adds insignificant extra-solution activity to the recited mathematical concept. This step merely reports the result of the previous calculations. Apart from reporting the result, the outputting step is not related to how the approximate nearest neighbor is determined. In fact, the claim does not recite using this result in any way.

Thus, the outputting step, considered individually and in combination with the other limitations, does not indicate that the claim integrates the abstract idea into a practical application.

E. The Combination

Appellant argues that the claims are directed to an improvement to computer functionality. Appeal Br. 28–29; Reply Br. 2. It is true that an improvement to technology or a technical field, for example, indicates that the claim may have integrated the judicial exception into a practical application. Guidance, 84 Fed. Reg. at 55. But that is not the case here.

The invention addresses the problem of designing a distance function for use with high-dimensional metric spaces. Spec. ¶ 19. According to the Specification, there are many ways of defining a distance function. *Id.* ¶ 3.

But some "distance functions may result in unacceptably long retrieval times for high-dimensional metric spaces." *Id.* That is, the focus here is the distance function itself—i.e., the mathematical formula in the abstract. The recited image data merely provides the value for the mathematical calculations.

A claim to a judicial exception cannot be made eligible "simply by having the applicant acquiesce to limiting the reach of the patent for the formula to a particular technological use." *Diehr*, 450 U.S. at 192 n.14, *quoted in* MPEP § 2106.05(h) ("Field of Use and Technological Environment"). For instance, *Flook* noted that a formula may not be patentable by only indicating that it could be usefully applied to existing surveying techniques. *Parker v. Flook*, 437 U.S. 584, 593–95 (1978), *cited in* MPEP § 2106.05(g).

Here, Appellant argues that the recited formulas are patentable because they can be used to match images. Appeal Br. 28–29; Reply Br. 2. But, at most, the Specification states that "nearest neighbor searches are useful for many machine learning functions, such as pattern recognition and/or identifying duplicate (or near duplicate) data points (web pages, *images*, etc.)." Spec. ¶ 18 (emphasis added). The Specification does not disclose any other image-specific processing or analysis. Nor does the claim. Instead, claim 1's mathematical concept is broadly applicable to many types of data and computers. Indeed, the method "can be performed by any computing device." *Id.* ¶ 39. In this way, the image data here merely limits the calculations to a particular field of use and data type.

Thus, we are unpersuaded that the claims are directed to an improvement to computer functionality. Appeal Br. 28–29.

F. Other Indicia of Integration

Claim 1 does not recite the other indicia of integration listed in the Guidance. Guidance, 84 Fed. Reg. at 55. For instance, "[t]ransformation and reduction of an *article* 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines." *Bilski v. Kappos*, 561 U.S. 593, 604 (2010) (emphasis added), *quoted in* MPEP § 2106.05(c). Yet "not all transformations . . . infuse an otherwise ineligible claim with an 'inventive concept.'" *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1256 (Fed. Cir. 2014). Unlike the transformations found in some eligible claims, claim 1's method does not transform a physical object or substance. *See, e.g.*, *Diehr*, 450 U.S. at 184 (a process that transforms rubber). Rather, the recited method performs mathematical calculations on intangible data.

G. Conclusion

After evaluating all the considerations in the Guidance's Step 2A, we agree with the Examiner that claim 1 is directed to the identified abstract idea. *See* Non-Final 2.

V. Does the claim provide an inventive concept?

A. Step 2B of the Guidance

To determine whether a claim provides an inventive concept, the additional elements are considered—individually and in combination—to determine whether (1) they add a specific limitation beyond the judicial exception that is not well-understood, routine, and conventional in the field or (2) they simply append well-understood, routine, and conventional activities previously known to the industry, specified at a high level of

generality, to the judicial exception. Guidance, 84 Fed. Reg. at 56. Also, we reevaluate the conclusions about the additional elements from Step 2A, Prong Two. *Id.*

B. "receiving . . . training data" and "receiving . . . a query"

Claim 1 recites, in part, "receiving, at a computing device having one or more processors, training data that includes a set of non-matching pairs (x_1, y_1) and a set of matching pairs (x_2, y_2)." Appeal Br. 31. Claim 1 further recites "receiving, at the computing device, a query corresponding to an unknown image." *Id.* at 32.

In *OIP*, the Federal Circuit determined that, in the claims at issue, "sending a first set of electronic messages over a network to devices" encompassed well-understood, routine, and conventional activity. 788 F.3d at 1363. Also, the MPEP instructs examiners that courts recognize that receiving or transmitting data over a network may be well-understood, routine, and conventional activity when claimed generically. MPEP § 2106.05(d)(II)(i) (collecting cases).

Here, the receiving steps are claimed generically. Apart from the limitations to the data type, claim 1 does not recite how the data is received. Thus, we agree with the Examiner that claim 1 merely uses a computer to receive data in a well-understood, routine, and conventional way. Ans. 3.

We also reevaluate our conclusions about whether the receiving steps integrate the abstract idea into a practical application. *See supra* § IV.B. Because the steps add nothing more than well-understood, routine, and conventional activities, those conclusions stand. Considering both our previous conclusions and the findings about well-understood, routine, and

conventional activity, we determine that the claimed receiving steps do not indicate that the claim provides an inventive concept.

C. "a computing device"

Claim 1 recites that the calculations are performed "at a computing device." Appeal Br. 31.

The MPEP instructs examiners that the courts have recognized that performing repetitive calculations can be a well-understood, routine, and conventional function when claimed generically. MPEP § 2106.05(d)(II)(ii) (citing *Flook*, 437 U.S. at 594 (recomputing or readjusting alarm limit values); *Bancorp Servs. v. Sun Life Assurance Co.*, 687 F.3d 1266, 1278 (Fed. Cir. 2012) ("The computer required by some of Bancorp's claims is employed only for its most basic function, the performance of repetitive calculations, and as such does not impose meaningful limits on the scope of those claims.")).

Here, claim 1 uses the computing device for repetitive calculations. There is no indication that the claimed calculations require any specialized computer function. In fact, the method "can be performed by any computing device." Spec. ¶ 39. Thus, we agree that the claimed computing device is well-understood, routine, and conventional. Non-Final 3.

We also reevaluate our conclusions about whether the computing device integrates the abstract idea into a practical application. *See supra* § IV.C. Because the device adds nothing more than well-understood, routine, and conventional activities, those conclusions stand. Considering both our previous conclusions and the findings about well-understood, routine, and conventional activity, we determine that the claimed device does not indicate that the claim provides an inventive concept.

D. "outputting . . . the approximate nearest neighbor"

Claim 1 recites, in part, "outputting, from the computing device, the approximate nearest neighbor corresponding to the unknown image." Appeal Br. 32.

As discussed above, this step merely reports the result of the previous calculations. In fact, the claim is not limited to a particular way of reporting the result, such as displaying, printing, or the like. Courts recognize that storing information in memory may be well-understood, routine, and conventional activity when claimed generically. *Versata*, 793 F.3d at 1334; *OIP Techs.*, 788 F.3d at 1363, *cited in* MPEP § 2106.05(d)(II)(iv). Here, the recited outputting at least encompasses the well-understood, routine, and conventional activity of storing data to memory.

We also reevaluate our conclusions about whether the outputting integrates the abstract idea into a practical application. *See supra* § IV.D. Because the outputting step adds nothing more than well-understood, routine, and conventional activities, those conclusions stand. Considering both our previous conclusions and the findings about well-understood, routine, and conventional activity, we determine that the claimed outputting step does not indicate that the claim provides an inventive concept.

E. The Combination

Appellant does not identify any inventive concept in the recited combination of steps or any specific arrangement of computing components. *See* Appeal Br. 28–29; Reply Br. 2. Nor do we find any.

At most, the described improvement is to a distance function, which is part of the abstract idea. In particular, the Specification states, "Although there are many ways of defining a distance function, such distance functions

may result in unacceptably long retrieval times for high-dimensional metric spaces." Spec. ¶ 3. The Specification further explains that "it would be desirable to define a distance function that is designed for use with high-dimensional metric spaces." *Id.* ¶ 19. So the claimed invention addresses this issue with the recited mathematical calculations. *See, e.g.*, Appeal Br. 28–29 (discussing Spec. ¶ 19). Yet "[w]hat is needed is an inventive concept in the non-abstract application realm." *SAP Am., Inc. v. InvestPic, LLC*, 898 F.3d 1161, 1168 (Fed. Cir. 2018). "[A] claim for a *new* abstract idea is still an abstract idea." *Synopsys, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1151 (Fed. Cir. 2016).

On this record, claim 1's limitations—considered individually and in combination—do not provide an inventive concept.

F. Conclusion

Appellant has not persuaded us that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 101. Thus, we sustain the rejection of representative claim 1 and claims 2–5, 7–19, 23, and 24, which are not argued separately. *See supra* n.3.

CONCLUSION

We affirm the Examiner's decision to reject claims 1–5, 7–19, 23, and 24.

Claims Rejected	Basis	Affirmed	Reversed
1–5, 7–19, 23, and 24	§ 101	1–5, 7–19, 23, and 24	None
Outcome		1–5, 7–19, 23, and 24	None

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

AFFIRMED