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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID H. HOITSMA and STEPHEN J. ENGEL

Appeal 2014-003035
Application 12/501,542
Technology Center 2100

Before ALLEN R. MacDONALD, HUNG H. BUI, and
JON M. JURGOVAN, *Administrative Patent Judges*.

MacDONALD, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from a final rejection of claims 1, 4–12, and 15–20. Claims 2, 3, 13, and 14 have been cancelled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part and, pursuant to our authority under 37 C.F.R. § 41.50(b), enter a new ground of rejection for claims 1, 4–12, and 15–20 under 35 U.S.C. § 101 as being directed to ineligible subject matter.

Exemplary Claims

Exemplary claims 1, 4, and 6 under appeal read as follows (emphasis added):

> 1. A method comprising:
>
> receiving a plurality of values of an input variable at an input to a processor, wherein the input variable ***is representative of*** a physical characteristic of a component or system; and
>
> using the processor to implement a physics model to produce an estimate of an output for each of the input values;
>
> wherein the processor maps the output estimates to the input values by fitting the estimates to a plurality of curves; selects values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time; and outputs the probability density or cumulative distribution function.
>
> 4. The method of claim 1, wherein the physical characteristic comprises a crack length as a function of time or a time to failure as a function of crack length.
>
> 6. The method of claim 1, wherein the curves are equi-probability curves.

Rejections

1. The Examiner rejected claims 1 and 11 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Barajas et al. (US 2007/0179753 A1; August 2, 2007) and Zhang et al. (*Envelopes Around Cumulative Distribution Functions from Interval Parameters of Standard Continuous Distributions*; PROCEEDINGS, NORTH AMERICAN FUZZY INFORMATION PROCESSING SOCIETY 407–412 (NAFIPS 2003)).

2. The Examiner rejected claims 4–10, 12, and 15–20 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Barajas, Zhang, and Tryon, III (US 7,016,825 B1; March 21, 2006). [1]

Appellants' Contentions

1. Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> [W]hile Barajas et al. mentions the use of probability functions, it does not disclose or suggest any specific way to compute a probability function . . . .

App. Br. 5.

2. Appellants also contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> [T]he Office Action asserts on page 5 that Barajas et al. teaches curve fitting and "selects values from corresponding points on the curve to produce an output probability density or [sic] for the physical characteristic at a future time[]", citing paragraph [0063]. However, a review of Barajas et al. and particularly paragraph [0063] fails to find any such teaching. Paragraph [0063] of Barajas et al. lists a plurality of well known curve fitting techniques, but does not disclose or suggest that an

[1] Separate patentability is not argued for claims 5, 10, 12, and 15–20. Except for our ultimate decision, these claims are not discussed further herein.

> output probability density or [sic] for the physical characteristic at a future time can be produced by selecting values from corresponding points on ***a plurality of curves***.

App. Br. 5, emphasis added.

> Barajas et al. cannot possibly disclose the selection of corresponding points on multiple curves. Furthermore, Barajas et al. does not disclose or suggest that a probability density or cumulative distribution function for a physical characteristic at a future time can be produced by selecting values from corresponding points on ***a plurality of curves***.

App. Br. 6, emphasis added.

3. Appellants also contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> Zhang et al. does not disclose or suggest selecting values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time. The process of Zhang et al. starts by already knowing a family of cumulative distribution function.

App. Br. 6.

4. Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> [A] fuzzy interval is not equivalent to an output probability density or cumulative distribution function as set forth in claims 1 and 11. In column 2 of page 407, Zhang et al. states: "Thus we seek to obtain the left and right envelopes around the family of CDFs for a random variable whose distribution is expressed in closed form with interval parameters." The fuzzy interval of Zhang et al. relates to an ***envelope around a family of CDFs***. The ***envelopes*** of cumulative distribution function described in Zhang et al. are not equivalent to a probability density or cumulative distribution function as set forth in claim 1. There is no teaching or suggestion that the vertical slice of Zhang et al. can be used to identify points on multiple curves, wherein

> those points are subsequently used to produce an output probability density or cumulative distribution function for the physical characteristic at a future time.

App. Br. 6–7, emphases added.

5. Appellants contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> Barajas et al. and/or Zhang et al. do not disclose or suggest that their teachings can be used to process a variable for a ***stochastic*** process.

App. Br. 7, emphasis added.

6. Appellants also contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> Barajas et al. and/or Zhang et al. do not disclose or suggest a processor that is programmed to use a mapping function, which relates outputs to inputs, to produce an exact representation of an output distribution for the ***stochastic*** process.

App. Br. 8.

7. Appellants also contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> By using a processor to perform the mapping function, the Appellant has defined an apparatus in which the number of function evaluations needed to produce the approximation is much less than the number of function evaluations needed for the Monte Carlo method, (see the Appellant's specification, paragraphs [0041], [0045] and [0046]). Various techniques for implementing the mapping step are described in the Appellant's specification.

App. Br. 8.

8. Appellants also contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> [T]he Office Action asserts on page 5 that Barajas et al. teaches curve fitting and "selects values from corresponding points on the curve to produce an output probability density or [sic] for the physical characteristic at a future time[]", citing paragraph [0063]. However, a review of Barajas et al. and particularly paragraph [0063] fails to find any such teaching. Paragraph [0063] of Barajas et al. lists a plurality of well known curve fitting techniques, but does not disclose or suggest that an output probability density or [sic] for the physical characteristic at a future time can be produced by selecting values from corresponding points on ***a plurality of curves***.

App. Br. 8, emphasis added.

9. Appellants also contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> Zhang et al. does not disclose or suggest selecting values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time. The process of Zhang et al. starts by already knowing a family of cumulative distribution function.

App. Br. 9.

10. Appellants contend that the Examiner erred in rejecting claim 11 under 35 U.S.C. § 103(a) because:

> [A] fuzzy interval is not equivalent to an output probability density or cumulative distribution function as set forth in claims 1 and 11. In column 2 of page 407, Zhang et al. states: "Thus we seek to obtain the left and right envelopes around the family of CDFs for a random variable whose distribution is expressed in closed form with interval parameters." The fuzzy interval of Zhang et al. relates to an ***envelope around a family of CDFs***. The ***envelopes*** of cumulative distribution function described in Zhang et al. are not equivalent to a probability density or

> cumulative distribution function as set forth in claim 1 [sic]. There is no teaching or suggestion that the vertical slice of Zhang et al. can be used to identify points on multiple curves, wherein those points are subsequently used to produce an output probability density or cumulative distribution function for the physical characteristic at a future time.

App. Br. 9, emphases added.

11. Appellants also contend that the Examiner erred in rejecting claim 4 under 35 U.S.C. § 103(a) because:

> Tryon does not disclose that the step of mapping the output estimates to the input values is performed by fitting the estimates to a plurality of curves and selecting values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time.

App. Br. 10–11.

12. Appellants also contend that the Examiner erred in rejecting claim 4 under 35 U.S.C. § 103(a) because:

> By including the mapping and selection elements of claims 1 and 11, the Appellant has defined a method and apparatus in which the number of function evaluations needed to produce an approximation is much less than the number of function evaluations needed for the Monte Carlo method, (see the Appellant's specification, paragraphs [0041], [0045] and [0046]).

App. Br. 11.

13. Appellants also contend that the Examiner erred in rejecting claim 4 under 35 U.S.C. § 103(a) because:

> MPEP 2143.0l(VI), states that "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." In the present case, modifying the

> system of Barajas et al. and/or Zhang et al. to use the Monte Carlo method in Tryon would change the principle of operation of the prior art invention being modified.

App. Br. 11.

14. Appellants also contend that the Examiner erred in rejecting claim 6 under 35 U.S.C. § 103(a) because:

> The cited references do not disclose or suggest that corresponding points on equi-probability curves can be used to produce an output probability density or cumulative distribution function for the physical characteristic at a future time. The Office Action points to paragraph [0022] of Barajas as showing this feature. However, a review of paragraph [0022] of Barajas has failed to find any such teaching.

App. Br. 11.

15. Appellants also contend that the Examiner erred in rejecting claim 7 under 35 U.S.C. § 103(a) because:

> While Barajas et al. describes curve fitting and Zhang et al. uses the phrase "vertical slice", the cited references do not disclose or suggest selecting values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time. Zhang et al. mentions the use of vertical slice through a graph of envelopes of a normal (Figure 5) or lognormal (Figure 6) distribution to yield "a fuzzy interval for the cumulative probability". However, the fuzzy interval of Zhang et al. is not equivalent to an output probability density or cumulative distribution function as described above with respect to claims 1 and 11.

App. Br. 11–12.

16. Appellants also contend that the Examiner erred in rejecting claim 8 under 35 U.S.C. § 103(a) because:

> There is no teaching or suggestion that the vertical slice of Zhang et al. can be used to identify points on multiple curves, wherein those points are subsequently used to produce an output probability density or cumulative distribution function for the physical characteristic at a future time. The cited references do not disclose or suggest computing a probability density or cumulative distribution function using points on a vertical slice of a plurality of curves.

App. Br. 12.

17. Appellants also contend that the Examiner erred in rejecting claim 9 under 35 U.S.C. § 103(a) because:

> The Office Action points to paragraph [0067] of Barajas as showing interpolation. However, while the references refer to Interpolation of points on a curve, the references do not disclose or suggest that a probability density or cumulative distribution function can be computed using interpolation of corresponding points from a plurality of curves.

App. Br. 12.

18. In the Reply Brief, further as to above contentions 1 and 2, Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> On page 2, paragraph 3 of the Examiner's Answer, the Examiner has misquoted the Appellant's argument. Appellant had argued that "while Barajas et al. mentions the use of probability functions, it does not disclose or suggest any specific way to compute a probability function, other than the following broad statement in paragraph [0037]: '"Moreover, fitting an analytic form to the empirical data may provide for estimation of parameters characterizing the CDF or a related probability density function (PDF)'." The Examiner's Answer removed the underlined portion of the Appellant's argument and asserts that Barajas ". . . computes both the claimed

> cumulative distribution function (CDF) derived from binned data **see paragraph [0036]** as well as the claimed probability density, **see paragraph [0037]**." The Examiner further refers to paragraph [0036] of Barajas as teaching, "Alternatively or in addition, an analytic form may be found by fitting an equation to the empirical data", as a basis for the Examiner's assertion that " . . . the act of "fitting" data requires computation". However, claim 1 specifies that the processor "selects values from corresponding points on the curves to produce an output probability density or cumulative distribution function for the physical characteristic at a future time". This feature is not disclosed or suggested by Barajas. If anything, Barajas teaches away for the Appellant's technique of producing an output probability density or cumulative distribution function by using binned data to compute a cumulative distribution function or a probability density.

Reply Br. 2–3.

19. In the Reply Brief, further as to above contention 4, Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> On page 6 of the Examiner's Answer, the Examiner asserts that "Zhang et al. provides a suggestion that after a CDF is generated, there can be conditions under which a single CDF is not specified, instead a family (i.e. multiple) CDF's are specified (i.e. an envelope)". Then the Examiner asserts that Barajas was relied upon for the initial generation of a CDF, after a curve fit has been performed. This is an incorrect interpretation of the teachings of Barajas.

Reply Br. 4.

20. In the Reply Brief, further as to above contention 4, Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> The Examiner further refers to Zhang et al. [Ans. 6] as showing that the generated CDF's are point values, without identifying where this is shown in Zhang et al.

Reply Br. 4–5.

21. In the Reply Brief, Appellants contend that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a) because:

> Any attempt to modify Barajas to change the method of producing an output probability density or cumulative distribution function would change the operating principle of Barajas. If Barajas teaches the initial generation of a CDF as asserted by the Examiner, there is no reason why one skilled in the art would modify Barajas to produce another CDF.
>
> MPEP 2143.01(VI), states that "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." In the present case, modifying Barajas to include completely different technique for determining a CDF (when Barajas already previously determined a CDF as asserted by the Examiner) would change the principle of operation of the prior art invention being modified.

Reply Br. 5.

Issues on Appeal

Did the Examiner err in rejecting claims 1, 4, 6–9, and 11 as being obvious?

ANALYSIS

We have reviewed the Examiner's rejections in light of Appellants' Appeal Brief arguments that the Examiner has erred.

As to Appellants' above contention 14 covering claim 6 (and claim 16), we agree because the Examiner's Final Action (and Answer 14) does not provide an sufficient articulated reason as to why the use of equi-probability curves would have been obvious to one of ordinary skill in the art.

As to Appellants' above contentions 1–13 and 15–21 covering all other claims, we disagree with Appellants' conclusions. Except as noted herein, we adopt as our own (1) the findings and reasons set forth by the Examiner in the action from which this appeal is taken and (2) the reasons set forth by the Examiner in the Examiner's Answer (2–15) in response to Appellants' Appeal Brief. We concur with the conclusions reached by the Examiner. We highlight the following.

As to Appellants' above contention 1, we disagree for the reasons set forth by the Examiner. Ans. 2. Further, Appellants' argument that Barajas "does not disclose or suggest any specific way to compute a probability function" is not commensurate with the scope of the claim which does not require "compute" and instead more broadly recites "selects values." *Id.*

As to Appellants' above contentions 2, 3, 8, and 9, we disagree for the reasons set forth by the Examiner. Ans. 3–7, 11–12.

As to Appellants' above contention 18 (related to contentions 1 and 2), we disagree. We find no merit to Appellants' position that "the Examiner has misquoted the Appellant's argument" for the simple reason that the

Examiner did not quote the portion of Appellants' argument which Appellants argue was misquoted. App. Br. 2. Rather, the Examiner merely (and properly) summarized Appellants' position. Further, as to Appellants' assertion that "Barajas teaches away for the Appellant[s'] technique . . ." (Reply Br. 2–3), we disagree. As the United States Court of Appeals for the Federal Circuit has counseled:

> A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. . . . [I]n general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant.

In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994). Beyond stating that "Barajas teaches away," Appellants have not attempted to persuade us that as to the argued limitation, the Barajas reference suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the Appellants. At most, Appellants have simply argued that Barajas alone does not teach the argued limitation. Even if we agree, that is not sufficient to "teach away" from using the limitation. Unsupported attorney argument, is entitled to little probative value. *See In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997); *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

As to Appellants' above contentions 4 and 10, we disagree for the reasons set forth by the Examiner. Ans. 6–7. Further, Appellants' own Specification (¶ 28) states the desire ("we wish") to intersect plural curves to generate plural values within a maximum and a minimum. An artisan would

understand Zhang also teaches determining the maximum and minimum curves at page 408, first two lines of the first column, and vertically slicing those curves (and other curve within the max/min envelope) at page 412, first 6 lines of the first column, to get plural values within those maximum and minimum.

As to Appellants' above contention 20 (related to contention 4), we disagree. The abstract of Zhang was specifically cited by the Examiner at page 7 of the Final Action. Zhang's abstract states (emphasis omitted):

> Closed form expressions for important CDFs have parameters, such as mean and variance. If these parameters are not point values but rather intervals, sharp or fuzzy, then a single CDF is not specified. . . . We investigate the bounds on families of CDFs implied by interval values for their parameters.

An artisan would understand "are not point values" to be "are not [single] point values" and "intervals" or "interval values" to be "plural interval point values." Further Zhang states at the last paragraph of page 407 that "a parameterized CDF" is represented as "a vector of one or more parameters" where the vector "can be an interval" (i.e., plural point values).

As to Appellants' above contention 19 (also related to contention 4), we disagree. Appellants' arguments fail because they misstate the Examiner's position. Appellants argue "[t]hen the Examiner asserts that Barajas was relied upon for the initial generation of a CDF, after a curve fit has been performed." App. Br. 4. This argument misstates the Examiner's position as the "after a curve fit has been performed" is a condition on "the initial generation of a CDF." *Id.* A proper reading the Examiner's full sentence shows that "after a curve fit has been performed" is a condition on the second half of the full sentence "*Zhang et al.* was relied upon for a

teaching of the special case where the generated CDF's are point values, in which case CDF envelopes have to be analyzed, i.e. a ***plurality*** of curves." Ans. 6.

As to Appellants' above contentions 5 and 6, we disagree for the reasons set forth by the Examiner. Ans. 9–10. Stochastic means (emphasis added) "of or relating to a process involving a ***randomly determined sequence of observations*** each of which is considered as a sample of one element from a probability distribution."[2] The Examiner correctly points out that "*Zhang et al.* expressly teaches a collection of random variables." Ans. 10. Zhang was also cited for teaching "random variables" at page 7 of the Final Action.

As to Appellants' above contentions 7 and 12, we disagree for the reasons set forth by the Examiner. Ans. 11, 13–14. The Examiner correctly points out that the argued improvement over the Monte Carlo method is "unclaimed." *Id.* That is, Appellants' argument is not commensurate with the scope of the claim. Stated differently, Appellants' Specification sets forth two alternative embodiments, and we find both covered by the scope of Appellants' claim. The first embodiment described at paragraphs 20–38 of Appellants' Specification would be recognized by an artisan as some form of the Monte Carlo method, and the second at paragraphs 39–60 of Appellants' Specification is the improvement (¶ 41) now argued by Appellants.

As to Appellants' above contention 11, we disagree for the reasons set forth by the Examiner. Ans. 13. Further, Appellants are attacking the references singly (Tyron) for lacking a teaching that the Examiner relied on

[2] Dictionary.com Unabridged; Based on the Random House Dictionary, © Random House, Inc. 2016.

a combination of references (Barajas-Zhang-Tryon) to show. We conclude that Appellants' argument ignores the actual reasoning of the Examiner's rejections. It is well established that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Appellants are raising and then knocking down a straw man rejection that was never made by the Examiner. As the Examiner relied on Barajas and Zhang, and not Tyron, for the argued limitations, Appellants are arguing Examiner findings that were never made. This form of argument is unavailing to show Examiner error.

As to Appellants' above contentions 13 and 21, we disagree for the reasons set forth by the Examiner. Ans. 14. Further, beyond mere assertion, Appellants fail to explain how they believe there is a change in the principle of operation of the prior art invention being modified. Appellants quote the first sentence of MPEP § 2143.01(VI), but do not cited or comply with the remaining implicit requirements to actually show the change in the principle of operation (e.g., prior art "requires" not plural curve, claimed invention "requires" plural curves).

> If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious. *In re Ratti*, 270 F.2d 810, 813, 123 USPQ 349, 352 (CCPA 1959) (Claims were directed to an oil seal comprising a bore engaging portion with outwardly biased resilient spring fingers inserted in a resilient sealing member. The primary reference relied upon in a rejection based on a combination of references disclosed an oil seal wherein the bore engaging portion was

> reinforced by a cylindrical sheet metal casing. ***Patentee taught the device required rigidity for operation, whereas the claimed invention required resiliency***. The court reversed the rejection holding the "suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate.").

MPEP § 2143.01(VI), reproduced in full, emphasis added.

As to Appellants' above contention 15 and 16, we disagree for the reasons set forth by the Examiner. Ans. 15. Further, as noted above, Zhang teaches determining the maximum and minimum curves at page 408, first two lines of the first column, and vertically slicing those curves (and other curve within the max/min envelope) at page 412, first 6 lines of the first column, to get plural values within those maximum and minimum.

As to Appellants' above contention 17 (covering claim 9), we disagree for the reasons set forth by the Examiner. Ans. 15. Further, computing by interpolation is routine in the art as shown throughout Barajas (e.g. ¶ 67, last sentence).

NEW GROUNDS OF REJECTION

Pursuant to our authority under 37 C.F.R. § 41.50(b), we reject claims 1, 4–12, and 15–20 under 35 U.S.C. § 101, as being directed to ineligible subject matter.

Legal Principles

A patent may be obtained for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." 35 U.S.C. § 101. The Supreme Court has held that this provision

contains an important implicit exception: laws of nature, natural phenomena, and abstract ideas are not patentable. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354 (2014); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) ("Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work."). The Supreme Court has also held that a mathematical formula is like a law of nature. *Parker v. Flook*, 437 U.S. 584, 589 (1978) ("Reasoning that an algorithm, or mathematical formula, is like a law of nature, *Benson* applied the established rule that a law of nature cannot be the subject of a patent.").

Notwithstanding that a law of nature or an abstract idea, by itself, is not patentable, the application of these concepts may be deserving of patent protection. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1293–94 (2012). In *Mayo*, the Court stated that "to transform an unpatentable law of nature into a patent-eligible *application* of such a law, one must do more than simply state the law of nature while adding the words 'apply it.'" *Mayo*, 132 S. Ct. at 1294 (citation omitted).

In *Alice*, the Supreme Court reaffirmed the framework set forth previously in *Mayo* "for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts." *Alice*, 134 S. Ct. at 2355. The first step in the analysis is to "determine whether the claims at issue are directed to one of those patent-ineligible concepts." *Id.* If the claims are directed to a patent-ineligible concept, then the second step in the analysis is to consider the elements of the claims "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*, 132 S. Ct. at 1298, 1297). In other words, the second step is to "search for an 'inventive concept'– *i.e.*, an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" *Id.* (brackets in original) (quoting *Mayo*, 132 S. Ct. at 1294). "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.* at 2357 (brackets in original) (quoting *Mayo*, 132 S. Ct. at 1297). The prohibition against patenting an abstract idea "cannot be circumvented by attempting to limit the use of the formula to a particular technological environment or adding insignificant post-solution activity." *Bilski v. Kappos*, 561 U.S. 593, 610–11 (2010) (citation and internal quotation marks omitted). The Court in *Alice* noted that "'[s]imply appending conventional steps, specified at a high level of generality,' was not '*enough*' [in *Mayo*] to supply an 'inventive concept.'" *Alice*, 134 S. Ct. at 2357 (quoting *Mayo*, 132 S. Ct. at 1300, 1297, 1294).

Rejection Analysis

We apply the framework as set forth by the Court in *Mayo* and reaffirmed by the Court in *Alice* for determining whether claims 1, 4–12, and 15–20 are directed to patent-eligible subject matter.

Step one: Are the claims at issue directed to a patent-ineligible concept?

We conclude that they are: Claims 1, 4–12, and 15–20 are directed to a mathematical algorithm in the form of a probability distribution mapping function.

> In one aspect, this invention provides an exact representation of the output distribution for a stochastic process in terms of an input probability distribution and a mapping function (which can be defined by a physics model) relating the output to the input. For the purposes of this description, a mapping function is described by an equation or procedure that relates the output of a physics model with its inputs. An example physics model is a software application that calculates the crack (defect) length as a function of time given inputs of an initial crack size, material parameters, and loads.
>
> FIG. 1 is a schematic diagram of a system 10 that can be used to implement an embodiment of the invention. The system includes a processor 12 that includes one or more inputs 14 for receiving input data, which can be represented by one or more random variables, and an output 16 for delivering a computed result. The processor implements a physics model to calculated output values. The output values of the physics model are mapped to the input variables to produce a probability distribution function or a cumulative distribution function related to a physical characteristic represented by the input variables.

Spec. ¶¶ 18–19. *See also* Spec. ¶¶ 20–38, 39–60 (The mathematical algorithms encompassed by the alternative calculation methods).

Our conclusion, that claims 1, 4–12, and 15–20 are directed to a patent-ineligible concept, is reinforced by Appellants' arguments directed to the Examiner's rejection of claims 1 and 11 under 35 U.S.C. § 103. Appellants' arguments are focused solely on the probability density or cumulative distribution function (mathematical algorithm) encompassed by claims 1 and 11. For example, Appellants argue "Barajas et al. does not disclose or suggest that a probability density or cumulative distribution function for a physical characteristic at a future time can be produced by selecting values from corresponding points on a plurality of curves." App. Br. 6.

Step two: Is there something else in the claims that ensures that they are directed to significantly more than a patent-ineligible concept?

As we noted above, according to *Alice*, the question to be settled next is whether claims 1, 4–12, and 15–20 recite an element, or combination of elements, that is enough to ensure that the claim is directed to significantly more than the mathematical algorithm (the "ineligible concept") itself.

We conclude that claims 1 and 11, which merely require a generic "processor" (claims 1 and 11, line 2 of each) and an "input variable [which] is representative of a physical characteristic of a component or system" (claim 1, line 3), fail to transform that mathematical algorithm into a patent-eligible invention.

Taking the claim elements separately, the processor (i.e., computer element) is purely conventional. The processor is well-understood, routine, conventional elements previously known to the industry. As to the input variable representative of a physical characteristic of a component or system, it might be tempting to argue that Appellants' claims are statutory because they are directed to predicting a real-world physical characteristic at a future time based on inputs of real-world measured values of a component or system. However, the claims are not so limited, and they encompass purely theoretical (made-up) input values to produce theoretical predictions of a theoretical component or system. Further, even if so limited, it not clear under the *Alice-Mayo* framework that the claims would be directed to a patent-eligible application absent real-world measuring steps and/or measuring means being claimed. In summary, the claims do no more than require generic computer elements to perform generic computer functions to perform a mathematical algorithm.

Considered as an ordered combination, the processor and input variable of Appellants' claims add nothing that is not already present when these elements are considered separately. Viewed as a whole, Appellants' claims simply recite the concept of a mathematical algorithm as performed by a generic computer processor. The claims do not, for example, purport to improve the operation of the computer itself, e.g., an inventive processor being used. Nor do they effect an improvement in any other technology or technical field, e.g., a computer program for performing inventive functions is executed by the generic processor. Instead, the claims at issue amount to nothing significantly more than an instruction to apply a mathematical algorithm using some unspecified, generic computer element. That is not enough to transform a mathematical algorithm into a patent-eligible invention.

None of the hardware recited by the claims offers a meaningful limitation beyond generally linking the use of the mathematical algorithm to a particular technological environment, that is, implementation via computers. Simply appending a conventional "processor," specified in general terms, is not enough to transform a mathematical algorithm into a patent-eligible invention. *See Alice*, 134 S. Ct. at 2357–60. These recitations are similar to the recitation of a conventional "computer" discussed in *Alice*.

37 C.F.R. § 41.50(b)

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

37 C.F.R. § 41.50(b) also provides that Appellants, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new grounds 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 proceeding will be remanded to the examiner. . . .
>
> (2) *Request rehearing*. Request that the proceeding be reheard under § 41.52 by the Board upon the same Record. . . .

CONCLUSIONS

(1) The Examiner has not erred in rejecting claims 1, 4, 5, 7–12, 15, and 17–20 as being unpatentable under 35 U.S.C. § 103(a).

(2) Appellants have established that the Examiner erred in rejecting claims 6 and 16 as being unpatentable under 35 U.S.C. § 103(a).

(3) We reject claims 19 and 20 as being directed to ineligible subject matter under 35 U.S.C. § 101.

(4) Claims 1, 4–12, and 15–20 are not patentable.

DECISION

The Examiner's rejections of claims 1, 4, 5, 7–12, 15, and 17–20 are affirmed.

The Examiner's rejection of claims 6 and 16 as being unpatentable under 35 U.S.C. § 103(a) is reversed.

Claims 1, 4–12, and 15–20 are newly rejected under 35 U.S.C. § 101.

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-IN-PART
37 C.F.R. § 41.50(b)