UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/469,117	08/26/2014	Jing Sun	2115-005519-US	8963

27572 7590 03/18/2019

Harness Dickey (Troy)
P.O. BOX 828
BLOOMFIELD HILLS, MI 48303

EXAMINER	
PELTON, NATHANIEL R	

ART UNIT	PAPER NUMBER
2859	

NOTIFICATION DATE	DELIVERY MODE
03/18/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troymailroom@hdp.com
sto-ptomail@hdp.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JING SUN, HUEI PENG, and CAIHAO WENG[1]

Appeal 2018-002447
Application 14/469,117
Technology Center 2800

Before BRADLEY R. GARRIS, MONTÉ T. SQUIRE, and SHELDON M. MCGEE, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge.*

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1–19. We have jurisdiction under 35 U.S.C. § 6.

We REVERSE.

---

[1] Appellant is the Applicant, "The Regents of The University of Michigan," which is identified as the real party in interest (App. Br. 3).

Appellant claims a method for monitoring the state of health of a battery, that is, by determining the capacity of the battery comprising defining a model for the battery, where the model relates terminal voltage to charged capacity of the battery and is defined in accordance with support vector regression (independent claims 1, 10). The method further comprises measuring voltage of the battery, determining parameters of the model by fitting the voltage measures to the model, determining an incremental capacity curve for the battery by taking a derivative of the model, and quantifying a peak of the incremental capacity curve to determine a state of health or capacity of the battery (*id.*). Appellant also claims a battery monitoring device comprising a data store for storing the aforementioned model and a battery monitor for performing the aforementioned measuring, determining, and quantifying steps (remaining independent claim 15).

A copy of representative claims 1, 10, and 15, taken from the Claims Appendix of the Appeal Brief, appears below.

> 1. A method for monitoring state of health of a battery, comprising:
>
> defining a model for a battery, where the model relates terminal voltage of the battery to charged capacity of the battery and defined in accordance with support vector regression;
>
> measuring voltage of the battery through a range of states of charge, where the range excludes the battery being fully charged and fully discharged;
>
> determining parameters of the model by fitting the voltage measures to the model;
>
> determining an incremental capacity curve for the battery by taking derivative of the model; and
>
> quantifying a peak of the incremental capacity curve, thereby determining a state of health for the battery.

10. A method for determining capacity of a battery, comprising:

defining a model for a battery, where the model relates terminal voltage of the battery to charged capacity of the battery and is defined in accordance with support vector regression;

receiving a plurality of voltage measures of the battery, where the voltage measures were taken through a range of states of charge and the range excludes the battery being fully charged and fully discharged;

determining parameters of the model by fitting the plurality of voltage measures to the model;

determining an incremental capacity curve for the battery by taking derivative of the model; and

quantifying a peak of the incremental capacity curve to thereby determine a capacity of the battery, where the steps of determining the parameters, determining the incremental capacity curve and quantifying the peak are implemented by computer executable instructions executed by a computer processor.

15. A battery monitoring device, comprising:

a data store for storing a model for a battery, where the model relates terminal voltage of the battery to charged capacity of the battery and is defined in accordance with support vector regression;

a battery monitor interfaced with a battery to measure voltage of the battery through a range of states of charge, where the range excludes the battery being fully charged and fully discharged,

the battery monitor determines parameters of the model by fitting the voltage measures to the model, determines an incremental capacity curve for the battery by taking derivative of the model, and quantifies a peak of the incremental capacity curve to thereby determine a capacity of the battery, wherein the battery monitor is implemented by computer executable instructions executed by a computer processor.

The Examiner rejects claims 1–19 under 35 U.S.C. § 101 as being directed to a judicial exception without significantly more (Final Action 3). According to the Examiner, the claims "are directed to the abstract idea of defining a model for a battery relating terminal voltage to charged capacity of the battery and/or a data store for storing the model [and] . . . do not include additional elements that are sufficient to amount to significantly more than the judicial exception" (*id.*). In responding to Appellant's argument that the claims do not recite any mathematical concept or mental process, the Examiner states, "[a]nalyzing information by mathematical algorithms without more is treated as essentially mental processes within the abstract-idea category" (*id.* at 4).

Appellant argues that the Examiner does not explain why the claims are patent ineligible (App. Br. 11–12). In addition, Appellant argues that the claims address the problem of extracting an incremental capacity curve from voltage measurement data, namely, the problem wherein "extracting an incremental capacity curve directly from the V-Q data is not a viable option because of measurement noise" (*see, e.g.*, *id.* at 12–13). Appellant explains that the recited model and other claim elements enable an incremental capacity curve to be extracted from V-Q data (*id.*). Appellant argues that "the pending claims recite a process that effects an improvement in a technical field by more accurately monitoring the state of health of a battery" (*id.* at 14).

OPINION

The PTO recently published revised guidance on the application of § 101. *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50 (Jan. 7, 2019) ("Guidance").[2] Under the Guidance, we first look to whether the claim recites:

> (1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human activity such as a fundamental economic practice, or mental processes); and
>
> (2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)).[3]

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look to whether the claim:

> (3) adds a specific limitation beyond the judicial exception that is not "well-understood, routine, conventional" in the field (*see* MPEP § 2106.05(d)); or
>
> (4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

See Guidance.

In applying step (1) of the Guidance to the claims on appeal, we determine that the independent claims recite an abstract idea by defining a model relating terminal voltage to charged capacity of a battery wherein the

---

[2] Neither the Examiner nor Appellant had benefit of this Guidance when advocating their respective positions concerning subject matter eligibility.
[3] The Examiner determines that certain claim elements are routine and common in the industry (Ans. 4–7). This determination is not relevant to steps (1) and (2) of the Guidance analysis. *See* Guidance.

model is defined in accordance with support vector regression. Appellant's criticism of the Examiner's similar determination (i.e., that the claims are directed to the aforementioned abstract idea) is not well taken. As previously indicated, the Examiner explicitly identifies the abstract idea as being the recited model wherein information is analyzed via mathematical algorithms. Moreover, Appellant's Specification expressly discloses performing the desired analysis by using support vector regression (SVR) and defines the SVR model as a mathematical formula (i.e., a mathematical concept or algorithm) (Spec. ¶¶ 32–33).

However, our assessment of Guidance step (2) reveals that the independent claims recite additional elements that integrate the abstract idea of the recited SVR model into a practical application.

As correctly argued by Appellant, the claims address the problem of extracting an incremental capacity curve from voltage measurement data. According to the Specification, this problem manifests in an existing incremental capacity analysis that transforms voltage plateaus on a V-Q curve into peaks on an incremental capacity curve (Spec. ¶ 7). These peaks lie within a voltage plateau region of the V-Q curve that is relatively flat and more sensitive to measurement noise whereby calculating the peaks directly from the data set is difficult (*id.*). Therefore, "[b]ecause of measurement noise, performing the ICA [(i.e., incremental capacity analysis)] directly from the *V-Q* curve has proven to be not a viable option" (*id.* ¶ 31). As a solution to this problem, Appellant teaches that "[t]he use of support vector regression (SVR) to represent the *V-Q* relation and then using analytic derivative to obtain the IC [(i.e., incremental capacity)] curve provides the

most consistent identification results with moderate computational load" (*id.* ¶ 32).

These Specification disclosures evince that the recited SVR model in combination with the other independent claim elements (i.e., the measuring, determining and quantifying elements) solve the measurement noise problem of an existing incremental capacity analysis technique. In this way, the abstract idea recited in the independent claims improves the technical field of monitoring or determining battery health or capacity. *See* MPEP § 2106.05(a). The independent claims integrate the abstract idea of the recited model into a practical application by expressly defining the model in accordance with support vector regression whereby voltage measures are fitted to the model in order to determine model parameters and thereby determine the health or capacity of a battery. As a result, Appellant's claims do not attempt to monopolize the abstract idea of an SVR model itself but rather define a specific method or device that employs the abstract idea to achieve an improvement in the technical field of determining battery health or capacity.

To summarize, each of the independent claims as a whole applies, relies on, or uses the abstract idea of an SVR model in a manner that imposes a meaningful limit on the abstract idea and integrates the abstract idea into a practical application of determining the health or capacity of a battery. For this reason, we do not sustain the Examiner's rejection of claims 1–19 under 35 U.S.C. § 101 as directed to a judicial exception without significantly more.

DECISION

The decision of the Examiner is reversed.

REVERSED