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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte RAMAKUMAR KOSURU, CHETAN KUMAR GUPTA, and CHOUDUR LAKSHMINARAYAN

Appeal 2014-005593
Application 13/406,478[1]
Technology Center 2100

Before ELENI MANTIS MERCADER, SCOTT B. HOWARD, and STACY B. MARGOLIES, *Administrative Patent Judges*.

MARGOLIES, *Administrative Patent Judge*.

DECISION ON APPEAL

This appeal arises under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1–20. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

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[1] According to Appellants, the real party in interest is Hewlett-Packard Development Company, LP. App. Br. 2.

SUMMARY OF THE INVENTION

The invention is generally directed to processing a data array using a Bloom filter to determine aggregate count, maximum, and minimum. *See* Abstract.

Claims 1 and 6 are illustrative of the subject matter on appeal and are reproduced below, with the disputed limitations emphasized:

> 1. A method for determining an aggregate value, the method comprising:
>
> providing an input file, the input file being stored on a computer readable storage medium;
>
> initializing a Bloom filter using at least the input file, the Bloom filter comprising a *m* number of bits and *m* counters;
>
> providing an input value;
>
> providing *k* counters;
>
> applying *k* number of hash functions with the Bloom filter;
>
> updating the *k* counters based on *k* bits of the Bloom filter;
>
> analyzing the *k* counters;
>
> determining a minimum value of *k* counters;
>
> providing an aggregate value based on the minimum value;
>
> determining a density for the Bloom filter; and
>
> *re-initializing the Bloom filter when the density is greater than a predetermined threshold value.*

> 6. A method for determining a maximum value, the method comprising:
>
> providing an input file, the input file being stored on a computer readable storage medium;
>
> initializing a Bloom filter using at least the input file, the Bloom filter comprising a *m* number of bits and *m* counters or accumulators;

providing an input value;
applying *k* hash functions with the Bloom filter;
determining *k* number of maximum values;
determining a mode of k maximum values; and
providing a maximum value based at least on the mode of the k maximum values.

REFERENCES AND REJECTIONS

The Examiner rejected claims 1–20 under 35 U.S.C. § 101 as encompassing unpatentable subject matter. Final Act. 3–4.

The Examiner rejected claims 1–5, 16, 17, 19, and 20 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit (US 2009/0228433 A1; publ. Sept. 10, 2009) and Papapetrou (Odysseas Papapetrou et al., *Cardinality estimation and dynamic length adaptation for Bloom filters*, DISTRIB PARALLEL DATABASES 28, 119–156 (Springer, 2010). Final Act. 4–9.

The Examiner rejected claims 6, 8–11, and 15 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit and Kukita (US 2010/0249615 A1; publ. Sept. 30, 2010). Final Act. 9–14.

The Examiner rejected claims 14 and 18 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit, Kukita, and Papapetrou. Final Act. 14–16.

The Examiner rejected claims 7, 12, and 13 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit, Kukita, and Cypher (US 2010/0332471 A1; publ. Dec. 30, 2010). Final Act. 16–18.

ISSUES

The issues are:

(i) whether the Examiner erred in rejecting claims 1–20 under 35 U.S.C. § 101 as encompassing unpatentable subject matter;

(ii) whether the Examiner erred in finding that the combination of Saborit and Papapetrou teaches or suggests "re-initializing the Bloom filter when the density is greater than a predetermined threshold value," as recited in claim 1; and

(iii) whether the Examiner erred in finding that the combination of Saborit and Papapetrou teaches or suggests "determining a mode of k maximum values," as recited in independent claim 6 and similarly recited in independent claim 11.

ANALYSIS

Section 101 rejection of claims 1–20

The Examiner rejected claims 1–20 under 35 U.S.C. § 101 as encompassing unpatentable subject matter. The Examiner concluded that claims 1, 6, and 11—each of which recite "the input file being stored on a computer readable storage medium"—cover both transitory and non-transitory media. Final Act. 3. The Examiner applied *In re Nuijten,* 500 F.3d 1346 (Fed. Cir. 2007), and rejected the claims under Section 101. *See* Final Act. 3–4; *see also In re Nuijten,* 500 F.3d at 1357 ("A transitory, propagating signal . . . is not a 'process, machine, manufacture, or composition of matter.' Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter.").

We do not sustain the Examiner's Section 101 rejection based on *In re Nuijten*. Unlike the claims at issue in *In re Nuijten*, each of the pending claims here recites a method—a series of acts or steps—and thus falls under the statutory category of "process." *See Nuijten,* 500 F.3d at 1351, 1354–1355; *see also* U.S. Patent & Trademark Office, *2014 Interim Guidance on Patent Subject Matter Eligibility*, pp. 6–7, *available at* http://www.uspto.gov/sites/default/files/documents/training%20-%202014%20interim%20guidance.pdf. We therefore do not sustain the Examiner's rejection of claims 1–20 under 35 U.S.C. § 101 based on *In re Nuijten*.

Obviousness rejection of claims 1–5, 16, 17, 19, and 20

Appellants argue that Papapetrou teaches adding blocks to a Bloom filter but not reinitializing the Bloom filter. *See* App. Br. 12. The Examiner responds that Papapetrou discloses reinitializing the Bloom filter in the following passage:

> The Dynamic Bloom filters approach proposes starting with a single small Bloom filter, and continuing to add elements in it until the number of hashed elements reaches a predefined threshold n_{thres}. Then, a new empty Bloom filter is constructed, with the same hash functions and the same length, and is attached to the data structure. The next n_{thres} elements are then added to the new Bloom filter. This process is repeated until all set elements are hashed.

Ans. 5 (quoting Papapetrou at 128).

The Examiner finds that because the Bloom filter is made up of individual block-partitioned Bloom filters, this dynamic growth corresponds to reinitializing the Bloom filter. Ans. 5.

We are not persuaded that the Examiner erred. We agree with and adopt the findings of the Examiner. *See* Ans. 4–5; Final Act. 5–6.

Papapetrou discloses creating a dynamic Bloom filter by starting with a small Bloom filter and, upon reaching a threshold, repeatedly adding a new empty Bloom filter to the data structure until all set elements are hashed. Papapetrou 128. Papapetrou explains that once the Bloom filter is built, query processing is performed on "*the* Dynamic *Bloom filter.*" *Id.* (emphasis added). We agree with the Examiner that because Papapetrou's dynamic Bloom filter is made up of each individual block-partitioned Bloom filter, the adding of new empty filters to the data structure is re-initializing the dynamic Bloom filter. We thus sustain the Examiner's obviousness rejection of claims 1–5, 16, 17, 19, and 20 in view of Saborit and Papapetrou.

Obviousness rejection of claims 6, 8–11, and 15

Independent claim 6 recites a method for determining a maximum value which includes the steps of "determining a mode of k maximum values" and "providing a maximum value based at least on the mode of the k maximum values." Independent claim 11 similarly recites a method for determining a minimum value which includes the steps of "determining a mode of k minimum values" and "providing a minimum value based on the mode of the k minimum values." Each claim also recites applying k hash functions with the Bloom filter.

Appellants argue that the Examiner erred in relying on Kukita for teaching these limitations because Kukita does not teach determining a maximum value, determining a mode of a maximum value, or providing a minimum value based on the mode of k minimum values. App. Br. 16. Appellants also argue that Kukita is unrelated to the operation of Bloom filters and thus is non-analogous art. *Id.*

The Examiner responds that although Saborit does not disclose determining a mode of k maximum values and providing a maximum value based at least on that mode, "it is common knowledge" to one of ordinary skill in the art that "mean, median and mode are the three most common ways to determine an average number among a group of numbers." Ans. 6. The Examiner finds that "[i]t is a designer's choice to decide which calculation to use." *Id.* The Examiner also explains that Kukita teaches the specific mathematical calculation of using a mode value to identify the most frequent number among a group of numbers for output. *Id.* The Examiner finds that Kukita "solves the same problem" of "using mode to identify a representative value among a group [of] values." *Id.*

Appellants argue in reply that the Examiner erred in relying on common knowledge because "Saborit fails to teach or suggest determining any mathematical outcome for '*k* maximum values' including mean, median, or mode" and thus "it is improper for the Examiner to assert designer's choice with respect to the Saborit reference when Saborit fails to teach this subject matter entirely." Reply Br. 11.

We are persuaded that the Examiner erred. First, the Examiner erred in relying on Kukita. Kukita is not reasonably pertinent to the particular problem with which the inventors were involved. *See In re Klein,* 647 F.3d 1343, 1348 (Fed. Cir. 2011). Kukita is directed to a blood pressure monitor and the problem of different postures affecting blood pressure readings. Kukita ¶¶ 10–12. Kukita discloses a blood pressure monitor capable of adjusting a subject's posture for measurement so that the subject takes the same posture as taken in the past. Kukita ¶ 12. For example, Kukita discloses determining the most frequent (i.e., mode) inclination level so that

the subject can adjust her posture to come close to the most frequently taken posture for measurement. Kukita ¶¶ 159, 165. Kukita is not directed to data processing, Bloom filters, or obtaining aggregate values from a large set of data, as is the claimed invention. *See* Spec. ¶¶ 1, 2, 13, 14. We therefore disagree with the Examiner that Kukita solves the same problem with which the inventors were involved.

Second, while we agree with the Examiner that it was common knowledge to a skilled artisan that mean, median, and mode are the three most common ways to determine average number among a group of numbers, we find that the Examiner has not cited sufficient evidence showing that the limitations of "determining a mode of *k* maximum values" and "providing a maximum value based at least on the mode of the *k* maximum values" (claim 6) or "determining a mode of *k* minimum values" and "providing a minimum value based on the mode of the *k* minimum values" (claim 11) would have been obvious in view of Saborit alone. *See* Ans. 5–7; Final Act. 10–11, 12–14.

We therefore do not sustain the Examiner's obviousness rejection of claims 6, 8–11, and 15 in view of Saborit and Kukita or the obviousness rejection of dependent claims 7, 12–14, and 18.

DECISION

We reverse the Examiner's rejection of claims 1–20 under 35 U.S.C. § 101 as encompassing unpatentable subject matter.

We affirm the Examiner's rejection of claims 1–5, 16, 17, 19, and 20 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit and Papapetrou.

We reverse the Examiner's rejection of: (i) claims 6, 8–11, and 15 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit and Kukita; (ii) claims 14 and 18 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit, Kukita, and Papapetrou; and (iii) claims 7, 12, and 13 under 35 U.S.C. § 103(a) as being unpatentable in view of Saborit, Kukita, and Cypher.

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