

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,

Petitioner,

v.

HEALTH DISCOVERY CORPORATION,

Patent Owner.

IPR2021-00552

Patent No. 7,542,959 B2

REQUEST FOR REHEARING BY THE DIRECTOR

Mail Stop PATENT BOARD
Patent Trial and Appeal Board
P.O. Box 1450
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I. Introduction

Petitioner, with supporting testimony of its Expert, Dr. Evgeniou, established the challenged claims were unpatentable over the combination of Boser, Kohavi, and Hocking, presenting four separate motivation-to-combine rationales—three “*KSR*” rationales, and one rationale expressly motivated by both Kohavi and Hocking to reduce computations in Kohavi (the “teaching, suggestion or motivation” or “TSM rationale”). In a per curiam final written decision (“FWD”), the Board, addressing only the TSM rationale, found Petitioner had not sufficiently shown a motivation to combine Hocking with Boser and Kohavi. Judge Baer, however, dissented and would have found all challenged claims unpatentable for obviousness, agreeing “with Petitioner that the claimed invention is an obvious combination of known techniques applied to a known device, yielding only predictable results and thus obvious under *KSR*’s framework.” Paper 38, 41–42. The Board failed to address any of Petitioner’s *KSR* rationales in the FWD, including the rationale relied upon by the dissent. This failure alone justifies reversal of the FWD, or at least a remand to fully address Petitioner’s arguments.

Moreover, in its analysis of the TSM rationale, the Board committed two errors which each individually justify reversal of the FWD. First, the Board’s reasoning for rejecting Petitioner’s TSM rationale was never raised by Patent Owner (“PO”) during trial and was instead devised by the Board in the FWD, long

after Petitioner’s opportunity to respond had passed, in violation of the Administrative Procedure Act (“APA”). Further, in reaching its conclusion, the Board misapplied the law and ignored or misapprehended facts and arguments of record in the proceeding that supported Petitioner’s TSM rationale.

The Institution Decision agreed that the combination of Kohavi, Boser, and Hocking taught all claim limitations. Paper 21, 15–16. Correcting any of these errors therefore warrants reversal of the FWD because the claims are obvious.

Petitioner hereby respectfully requests Review by the Director of the FWD.

II. Background

Petitioner requested IPR of claims 1, 5–6, 10, 12, and 16 of U.S. Patent No. 7,542,959 B2 (“the ’959 patent”). The ’959 patent relates to a machine-learning data-classification technique that uses a Support Vector Machine (“SVM”) and performs Recursive Feature Elimination (“RFE”). Paper 3, 3, 15. The SVM algorithm is first “trained” with a known set of data to generate a decision function also known as a hypothesis. *Id.* at 15, 4–10. The decision function (hypothesis), outputted by the SVM algorithm, defines an equation for classifying data and includes feature weights assigned to the features of the data. *Id.* at 6–10. The resulting SVM decision function (hypothesis) can then be applied to “live” data. *Id.* at 16. But SVM techniques can be subject to overfitting, meaning the decision function does not perform well on live data, often because it relies on too many

features to make its classification. *Id.* at 5–6, 27–28. One method to reduce overfitting is to eliminate some of the features, e.g., through the use of RFE. *Id.* at 11–12, 14–15. An SVM-RFE algorithm trains the SVM to output a hypothesis, uses the feature-weight values of the hypothesis to eliminate features with the lowest weight, and repeats the process to yield a subset of features to use on live data. *Id.* at 14–17.

The Petition established the challenged claims would have been obvious to a skilled artisan (“POSITA”) in view of the combination of Kohavi, Boser, and Hocking. Relevant here, Kohavi described the genus of “wrapper” methods (of which RFE is a species) that select a feature subset using the hypothesis output by an induction algorithm. *Id.* at 21–22. Kohavi further disclosed a recursive backward feature elimination technique, wherein features to be eliminated are selected by calculating the induction algorithm’s performance for each possible iteration of the different feature subsets and selecting the subset with the highest evaluation. *Id.* at 21–24. Boser disclosed an SVM that generated a decision function (hypothesis) having feature weights assigned to each feature. *Id.* at 24–26. Hocking disclosed a computationally simple method for selecting an optimal subset of features in a decision function based on ranking feature weights. *Id.* at 26–27.

Petitioner’s combination uses Boser’s SVM as the induction algorithm in Kohavi’s wrapper method. *Id.* at 27–30. The combination then uses the weight

values output from Boser's SVM in its hypothesis (decision function) to select an optimal subset of features using ranked feature weight values (highest to lowest) as taught by Hocking. *Id.* at 30–33.

III. Identification of Particular Issues for Review

A. The Board Failed to Address Petitioner's *KSR* rationales.

The Petition, supported by Dr. Evgeniou's testimony, presented three separate *KSR* motivation-to-combine rationales: (1) "the combination of Hocking with Kohavi and Boser merely combines prior art elements according to known methods to yield predictable results" (*id.* at 32); (2) the combination "applies a known technique (Hocking's variable selection) to a known device (Kohavi's RFE method using Boser's SVM) which is ready for improvement to yield predictable results" (*id.*); and (3) the combination "uses the known technique of Hocking's classical statistical method to improve Kohavi's similar RFE method in the same way" (*id.* at 33). *See also*, INTEL-1003, ¶¶217–18. In the Institution Decision, the Board agreed with at least one of Petitioner's *KSR* rationales, finding "for purposes of this decision, we agree with Petitioner that its proposed combination amounts to the use of a known technique (Hocking's variable selection) to a known device (Kohavi's RFE method using Boser's SVM), yielding no more than the predictable combination of the three." Paper 21, 16 (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007)). During trial, PO did not dispute Petitioner's *KSR* rationales

or Dr. Evgeniou's supporting testimony. Thus, nothing in the trial record justifies the Board abandoning its finding from the Institution Decision.

Despite explicitly relying on one of Petitioner's *KSR* rationales in the Institution Decision, the Board did not address any of Petitioner's three *KSR* rationales in the FWD. This alone is an APA violation. Under the APA, a Board's decision cannot be "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law" or "unsupported by substantial evidence." 5 U.S.C. § 706. Thus, the Board must "set forth its findings and the grounds thereof, as supported by the agency record, and explain its application of the law to the found facts." *In re Lee*, 277 F.3d 1338, 1342 (Fed. Cir. 2002). This requires the Board to substantively address all arguments in the petition. *See, e.g., Vicor Corp. v. SynQor, Inc.*, 869 F.3d 1309, 1321, 1324 (Fed. Cir. 2017); *Ethicon LLC v. Intuitive Surgical, Inc.*, No. 2020-1528, 2021 WL 3716397, at *7 (Fed. Cir. Aug. 23, 2021) (reversing Board's finding of no motivation to combine where Board failed to address petitioner's un rebutted argument for making combination). The Board failed to do so here. Notably, Judge Baer's dissent likewise suggests the majority failed to properly consider Petitioner's *KSR*-based rationales. Paper 38, 41–42.

Further, due to its silence on Petitioner's *KSR* rationales, the Board failed to provide any explanation for its shift in position from finding at least one *KSR* rationale sufficient in the Institution Decision to finding that Petitioner's TSM

rationale failed to sufficiently establish a motivation to combine in the FWD. This change in theories is also an APA violation. *See* 5 U.S.C. §§ 554(b)(3), (c)(1); 5 U.S.C. § 556(d); *Belden v. Berk–Tek LLC*, 805 F.3d 1064, 1080 (Fed. Cir. 2015).

The FWD’s one paragraph using the words “known technique” does not cure this APA violation because it does not address the *KSR* rationales. Paper 38, 36–37. The paragraph concludes that there is “no persuasive basis to find a skilled artisan knew at the time of the invention that an SVM’s feature weights may be used to address the **computation burdens** associated with selecting an optimal subset of features.” *Id.*¹ Thus, the Board’s analysis is not tied to a *KSR* rationale, but is instead tied to the Board’s analysis of Petitioner’s TSM rationale.

Even assuming *arguendo* this paragraph was intended to address Petitioner’s *KSR* rationales, the Board’s analysis misapplies obviousness law. The Board finds in this paragraph that “Petitioner has not provided sufficient evidence or technical reasoning to demonstrate persuasively that the weight ranking criteria used in Hocking **would have been a known technique for selecting a feature subset in [the] Kohavi/Boser combination.**” Paper 38, 36. But, *KSR* does not require the “known technique” be the result of the combination (i.e., that it was already known to use Hocking’s weight ranking criteria in the combination of Kohavi and Boser). *KSR* only requires that an applied reference disclose a “known technique” (i.e., that

¹ All emphasis added unless otherwise noted.

Hocking discloses a known weight ranking technique). Both the Petition and Dr. Evgeniou established Hocking's technique was known long before the '959 patent. *See* Paper 3, 2, 13–14, 32; INTEL-1003, ¶¶69, 217. PO did not dispute this fact.

Moreover, under any motivation-to-combine rationale, the Board imposed too high a standard for obviousness when it required Petitioner to prove that “it was known” in the prior art to use an SVM's feature weights as ranking criteria to select feature subsets in an RFE method. The Board's reasoning amounts to a requirement that a Petitioner show an explicit **teaching** in the prior art to establish obviousness, harkening back to the pre-*KSR* requirement to meet the teaching-suggestion-motivation test for any obviousness finding. The Supreme Court rejected such a rigid application of that requirement, replacing it with a more “expansive and flexible approach.” *See KSR*, 550 U.S. at 415–16. And, the requirement of proof that every claim limitation was “known” in the prior art is a requirement of anticipation, not obviousness. *See, e.g.*, 35 U.S.C. § 102; *Hakim v. Cannon Avent Grp., PLC*, 479 F.3d 1313, 1319 (Fed. Cir. 2007). Obviousness is more flexible—rather than requiring a showing that the claim elements were known in the art in the claimed combination, Petitioner instead must only show that the claim **would have been obvious** to a POSITA at the time of invention. *See, e.g.*, 35 U.S.C. § 103; *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 3, 14 (1966). Petitioner made the requisite showing.

For these additional reasons, the FWD should be reversed.

B. The Board Erred in Rejecting Petitioner’s TSM Rationale.

The Petition, supported by Dr. Evgeniou’s testimony, separately argued that a POSITA would have been motivated to combine Hocking with Boser and Kohavi because using the feature weight values of the hypothesis output by the induction algorithm (Boser’s SVM) with Hocking’s simple ranking technique obviates the significant computational burdens expressly recognized by Kohavi, namely, performing accuracy estimation calculations for each of a likely large number of possible feature subsets. Paper 3, 30–31; INTEL-1003, ¶216; INTEL-1007, 285. The Board, however, determined it had “no persuasive basis to find that a skilled artisan would have viewed Hocking’s ‘ranking based on weight values’ to be a simple or computationally efficient ranking criteria in Kohavi’s wrapper method used with an SVM.” Paper 38, 32. Specifically, the Board was “not persuaded that adapting a wrapper method to the specific algorithm of an induction algorithm in order to rank the features according to their corresponding weight values would have been viewed by skilled artisans to be simpler than (or even as simple as) rank[ing] the features according to the results provided by an induction algorithm and evaluating its performance.” *Id.* at 33–34. The Board made two fundamental errors when reaching this conclusion: it relied on a rationale that neither party put forth during the IPR proceedings, and it misapprehended or overlooked a number of facts and

arguments and misapplied the law.

1. Board devised its own reasoning for rejecting the TSM rationale.

First, the Board devised its own rationale for rejecting Petitioner's TSM argument. PO never disputed during trial that a POSITA would have found Hocking's weight-value ranking criteria simpler than Kohavi's accuracy-estimation method. Instead, PO argued applying Boser's feature weights to Kohavi in accordance with Hocking would change Kohavi's principle of operation—a notion that the Board did not adopt. *See id.* at 33–34. The Board's reasoning for rejecting Petitioner's rationale—that it would not be simpler to adapt Kohavi's RFE to Boser's SVM and feature-weight values—was first introduced by the Board in the FWD. *Compare* Paper 21, 12–13, *with* Paper 38, 32–35.

The Board's substitution of its own rationale for PO's arguments is another APA violation because Petitioner never had an opportunity to address it during trial. *See* 5 U.S.C. §§ 554(b)(3), (c)(1); 5 U.S.C. § 556(d); *Belden*, 805 F.3d at 1080. Contrary to the Board's conclusion, the record shows Petitioner provided evidence, which was uncontested, supporting its TSM rationale.

2. The Board misapplied the law and overlooked or misapprehended facts and arguments to reach its conclusion.

Second, the Board misapplied the law and overlooked or misapprehended substantial facts of record in the proceeding showing support for Petitioner's TSM rationale. Petitioner established that a POSITA would have been motivated to use

Boser's already-calculated weight-values in the simple ranking technique taught by Hocking (highest to lowest) in Kohavi's RFE method. Paper 3, 30–32.

Petitioner and Dr. Evgeniou explained that Kohavi and Hocking both provide express teachings, suggestions, and motivations that support Petitioner's motivation to combine. Paper 3, 31–32; INTEL-1003, ¶216; *see* INTEL-1007, 285; INTEL-1009, 531, 533. Namely, Hocking's method "identifies the optimal subset of variables 'with a **minimum of computation**,'" whereas Kohavi's RFE method using numerous accuracy estimates "was known to be **computationally complex**." Paper 3, 31; INTEL-1003, ¶216; INTEL-1007, 285; INTEL-1009, 531, 533; *see* Paper 37, 21:13–24:7, 26:14–27:4. In addition to the express teachings, suggestions, and motivations in the references themselves, Petitioner, supported by Dr. Evgeniou's testimony, showed that using Hocking's weight-value ranking would be computationally more efficient than Kohavi's method of iteratively calculating the estimated accuracy of a large number of feature subsets to determine which features to eliminate. *See* Paper 3, 30–32; INTEL-1003, ¶216; INTEL-1007, 285; Paper 37, 21:13–24:7, 26:14–27:4. Again, PO did not dispute that Hocking's method was computationally more efficient for feature selection.

The Board did not address the express teachings, suggestions, and motivations in Kohavi and Hocking. Instead, the Board misapplied the law and overlooked or misapprehended crucial facts, making its conclusion erroneous.

a. The Board erroneously found Kohavi must be unaware of the variables produced by an induction algorithm.

Although the Board “[s]et[] aside whether Petitioner’s proposed modification changes Kohavi’s *principle* of operation,” it nonetheless determined “the proposed modification would indeed change the operation (principle or not) of Kohavi’s wrapper method to one that is **dependent upon knowledge of the algorithm that an induction algorithm uses** because the wrapper method would have to have **knowledge of what variables are computed** in the process of providing a classifier.” Paper 38, 34 (italics in original). But, contrary to the Board’s understanding, Kohavi teaches that for its wrapper method to perform cross-validation, the wrapper method **does** know the type of induction algorithm used and the variables produced in the outputted hypothesis. What is unknown in Kohavi are the details of the underlying algorithm used to produce that output.

Importantly, PO never argued that Kohavi does not know the identity of the induction algorithm. In fact, as Petitioner repeatedly stressed during trial, Kohavi taught that “we define an optimal feature subset with respect to **a particular induction algorithm, taking into account its heuristics, biases, and tradeoffs.**” INTEL-1007, 276; *see* Paper 27, 2–6; Paper 37, 14:8–15:19. The Board overlooked this fact. Additionally, it is undisputed that Kohavi’s induction algorithm outputs a hypothesis which is used by its feature-evaluation process. *See* INTEL-1003, ¶199; INTEL-1007, 274. Kohavi shows this clearly in Figure 1. INTEL-1007, 274. It is

also undisputed that Kohavi uses the variables included in this hypothesis (e.g., the feature weights in the decision function) for feature evaluation. *See* INTEL-1007, 274; INTEL-1003, ¶200; Paper 3, 21–23. PO never argued to the contrary. Finally, the Board agreed that a POSITA would have been motivated to combine Boser and Kohavi which, as established by Petitioner and Dr. Evgeniou, necessarily results in the output of a hypothesis having feature weight values for feature evaluation and selection. Paper 38, 29–30; Paper 37, 15:2–19, 20:17–21:2, 22:23–23:7.

Petitioner’s combination does not change the operation of Kohavi. Boser’s SVM outputs its hypothesis (decision function) which includes feature weights. Paper 27, 6–7; Paper 37, 22:16–24:12. Features are selected by ranking these feature weights, as taught by Hocking. *Id.*

b. The Board required bodily incorporation of Hocking’s equations and legally erred in dismissing the reference.

The Board further misapprehended the purpose of Hocking in the Kohavi-Boser combination. The Board found PO’s “expert credibly and persuasively explains why a skilled artisan *would not have recognized* Hocking’s linear regression model to be reducible to the computationally efficient form that Petitioner’s expert suggests.” Paper 38, 34 (emphasis in original). But the Board fundamentally misunderstood Petitioner’s combination. Petitioner’s combination does not require the bodily incorporation of Hocking’s equations into the Kohavi-Boser combination. Paper 27, 9. Instead, the combination merely requires a

POSITA to apply the ranking principles taught in Hocking (highest to lowest) to the weight values output from Boser's SVM. *Id.* Moreover, the finding is legally erroneous because bodily incorporation is not a requirement for establishing obviousness. *See Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016).

Even if the Board's finding were relevant to Petitioner's TSM rationale (which it is not), the Board overlooked the totality of facts related to the use of Hocking in the Kohavi-Boser combination when finding "it credible that a skilled artisan would not have known at the time of the invention that the estimated variance values of the combined Hocking's Equations (5) and (6) could be treated as a constant and, as a result, canceled out of the equations." Paper 38, 34. The Board ignored testimony from PO's expert confirming Petitioner's expert's opinion that error and error variance variables in Hocking's equations are not relevant to SVMs. *See* Paper 3, 47–48; INTEL-1003, ¶249; INTEL-1095, ¶¶23–24; INTEL-1094, 56:19–57:21 (PO's expert acknowledging that error variance is not an SVM output). The record evidence thus established that a POSITA would have reasonably disregarded error and error variance when considering Hocking's teachings in the context of SVMs.

The Board further erred in discounting use of Hocking with Kohavi-Boser because it relied on "different objectives" in a "different application" than Boser's

SVM. Paper 38, 33, 36. References in the same field can be combined “regardless of the problem addressed,” and even if the reference is in a different field, it can be combined so long as it is “reasonably pertinent to the particular problem with which the inventor is involved.” *Donner Tech. v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359–61 (Fed. Cir. 2020). The relevant problem in the ’959 patent is optimizing feature selection with a SVM (statistical machine learning algorithm), and it would have been reasonable to look to Hocking, which is expressly directed to feature selection in the same field (computerized classical statistics models including regression). *See* Paper 3, 3, 13, 26, 30–33; INTEL-1001, 15:51–62; INTEL-1003, ¶217. The Board also erred in rejecting the combination because it found the feature subset selected using Hocking’s method may not provide accurate results. Paper 38, 36–37. But a combination need not be the “*best* option, only ... a *suitable* option.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021) (internal quotation marks and citation omitted).

c. The Board misapprehended Kohavi’s teaching regarding trivial substitution of cost functions.

The Board misapprehended the record in rejecting Petitioner’s argument that Kohavi’s reference to trivial substitution of a cost function in place of an accuracy estimation motivated the combination with Boser and Hocking, finding instead that Kohavi referred only to “misclassification costs” as part of accuracy estimation, and not to cost functions more generally. Paper 38, 35. But PO never argued

Kohavi's reference to substituting cost functions was limited to misclassification costs. PO also never disputed Dr. Evgeniou's testimony that Boser's feature weight values were estimated by optimizing a cost function. Paper 3, 24–26, 30–32, 66; INTEL-1003, ¶¶35-51, 202–03, 215–16, 288; Paper 27, 6–7. Nor did PO rebut or discredit Dr. Evgeniou's testimony that Kohavi's reference to cost functions encompassed the feature-weight values produced by an SVM induction algorithm.

The Board's contrary finding relied entirely on its own interpretation of Kohavi, not that of either expert. Paper 38, 35 (analyzing Kohavi without citation to any PO evidence or explanation). Thus, the Board again raised a new argument to justify its decision in the FWD, thereby depriving Petitioner of any opportunity to correct the Board's misunderstanding.

The evidence, including testimony from Dr. Evgeniou, further establishes that Kohavi contemplated more than just the use of accuracy estimation in its technique. Kohavi expressly states “[w]e have focused on accuracy above, **so other criteria merit some consideration.**” INTEL-1007, 309. And, as Petitioner established in the Petition, Kohavi expressly mentions “use [of] a cost function instead of accuracy as the evaluation function for the wrapper.” *Id.*

IV. Conclusion

Petitioner respectfully requests the Director review the issues identified above in the FWD and reverse the Board's patentability finding.

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that I caused to be served a true and correct copy of the foregoing: PETITIONER'S REQUEST FOR REVIEW BY THE DIRECTOR by email to the electronic service addresses for Patent Owner:

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