Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
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TRANSMITTAL FORM

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Total Number of Pages in This Submission	14

Application Number	15/405,118
Filing Date	January 12, 2017
First Named Inventor	Jobin WILSON
Art Unit	3688
Examiner Name	Eric R. NETZLOFF
Attorney Docket Number	1038.FLYTXT003US1

ENCLOSURES (*Check all that apply*)

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
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- ☐ Petition to Convert to a Provisional Application
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- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	MANNAVA & KANG, P.C.		
Signature	/Vinay Malik/		
Printed name	Vinay Malik		
Date	December 10, 2019	Reg. No.	59,751

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Confirmation No.: 1910
Jobin WILSON et al.	:	Group Art Unit: 3688
Serial No.: 15/405,118	:	Examiner: Eric R. NETZLOFF
Filed: January 12, 2017	:	

For: METHODS AND SYSTEMS FOR PROVIDING MULTIVARIATE TIME SERIES CLUSTERING FOR CUSTOMER SEGMENTATION

AMENDMENT AND RESPONSE

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Non-Final Office Action dated September 11, 2019, please consider the remarks that follow.

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of the claims of the application.

Listing of Claims

1. (Deleted)

2. (Deleted)

3. (Deleted)

4. (Deleted)

5. (Deleted)

6. (Deleted)

7. (Deleted)

8. (Deleted)

9. (Deleted)

10. (Deleted)

11. (Deleted)

12. (Deleted)

13. (Deleted)

14. (Deleted)

15. (New) A computer-implemented method comprising steps of:

representing, using a user management unit that is operatively coupled with a data server and a user device, time-varying preferences of a plurality of users as corresponding and respective plurality of Multivariate Time Series (MTS);

randomly allocating, through the user management unit, each MTS of the plurality of MTS to a cluster that is selected from 'k' clusters;

learning, at the user management unit, 'K' vector auto-regression (VAR) models corresponding to the 'k' clusters based on estimation of model parameters of each of the said 'K' VAR models;

allocating, using said user management unit, said each MTS of the plurality of MTS to one of the 'K' VAR models that accurately explains said MTS, said allocation being made based on average prediction Root Mean Squared Error (RMSE) on said each MTS;

re-estimating, using a time variant clustering (TVC) module of the user management unit, model parameters of each of said 'K' VAR models based on expectation-maximization (EM) technique;

performing, using said time variant clustering (TVC) module, re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models based on re-estimated model parameters of each of said K VAR models, wherein the steps of re-estimating the model parameters, and performing re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models are performed iteratively and simultaneously till a convergence criterion is met.

16. (New) The computer-implemented method as claimed in claim 15, wherein said method further comprises the step of performing association rule mining on said cluster based on at least one discretized service usage parameter to arrive at, at least one campaign design strategy that is specific to the cluster.

17. (New) The computer-implemented method as claimed in claim 15, wherein said time variant clustering (TVC) module discretizes service usage parameters through a user device into

arbitrary number of discrete levels by aggregating at a temporal granularity and performing a percentile based segmentation.

18. (New) The computer-implemented method as claimed in claim 17, wherein said time variant clustering (TVC) module, through the user device, identifies an optimal number of clusters that are temporal using at least one cluster quality measure.

19. (New) The computer-implemented method as claimed in claim 17, said time variant clustering (TVC) module, through said user device, applies said clustering to short time series that are not stationary.

20. (New) A system comprising:

a user management unit that is operatively coupled with a data server and a user device, said user management unit comprising time variant clustering (TVC) module and a processor that executes one or more computer-implemented instructions to:

represent time-varying preferences of a plurality of users as corresponding and respective plurality of Multivariate Time Series (MTS);

randomly allocate each MTS of the plurality of MTS to a cluster that is selected from ‘k’ clusters;

learn ‘K’ VAR models corresponding to the ‘k’ clusters based on estimation of model parameters of each of the said ‘K’ VAR models;

allocate, using said user management unit, said each MTS of the plurality of MTS to one of the ‘K’ VAR models that accurately explains said MTS, said allocation being made based on average prediction Root Mean Squared Error (RMSE) on said each MTS;

said time variant clustering (TVC) module, through said processor, execute one or more computer-implemented instructions to:

re-estimate model parameters of each of said ‘K’ VAR models based on expectation-maximization (EM) technique;

perform re-allocation of said each MTS of the plurality of MTS to one of the ‘K’ VAR models based on re-estimated model parameters of each of said K VAR models, wherein the re-estimation of the model parameters and re-allocation of said each MTS of

the plurality of MTS to one of the 'K' VAR models are performed iteratively and simultaneously till a convergence criterion is met.

21. (New) The system as claimed in claim 20, wherein said user management unit performs association rule mining on said cluster based on at least one discretized service usage parameter to arrive at, at least one campaign design strategy that is specific to the cluster.

22. (New) The system as claimed in claim 20, wherein said time variant clustering (TVC) module discretizes service usage parameters through a user device into arbitrary number of discrete levels by aggregating at a temporal granularity and performing a percentile based segmentation.

23. (New) The system as claimed in claim 20, wherein said time variant clustering (TVC) module, through the user device, identifies an optimal number of clusters that are temporal using at least one cluster quality measure.

24. (New) The system as claimed in claim 20, said time variant clustering (TVC) module, through said user device, applies said clustering to short time series that are not stationary.

REMARKS

Status of the Claims

At the time of receipt of the Office Action, claims 1-14 were pending. Claims 1-14 have been withdrawn, and claims 15-24 have added. Support for the new claims can be found in the specification, as filed, at least in paragraphs [15], [16], [21], [22], [26], and [28]. The amendments submitted herein do not introduce any new matter.

In view of the foregoing and following, the Applicant requests the Examiner for reconsideration and allowance of all the pending claims of the present application.

Claim Rejections – 35 USC §101

Claims 1-14 are rejected under 35 USC 101 as being unpatentable because the claimed invention is directed to an abstract idea without providing a practical application and significantly more.

Applicant respectfully *traverses*.

The Supreme Court in *Mayo* laid out a framework for determining whether an applicant is seeking to patent a judicial exception itself, or a patent-eligible application of the judicial exception. See *Alice Corp.,* 134 S. Ct. at 2355, 110 USPQ2d at 1981 (citing *Mayo*, 566 U.S. 66, 101 USPQ2d 1961).

The first part of the *Mayo* test is to determine whether the claims are directed to an abstract idea, a law of nature or a natural phenomenon (i.e., a judicial exception). *Id.* If the claims are directed to a judicial exception, the second part of the *Mayo* test is to determine whether the claim recites additional elements that amount to significantly more than the judicial exception. *Id.* citing *Mayo,* 566 U.S. at 72-73, 101 USPQ2d at 1966). The Supreme Court has described the second part of the test as the "search for an 'inventive concept'". *Alice Corp.,* 134 S. Ct. at 2355, 110 USPQ2d at 1981 (citing *Mayo*, 566 U.S. at 72-73, 101 USPQ2d at 1966). While the machine-or-transformation test is an important clue to eligibility, it should not be used as a separate test for eligibility, but instead should be considered as part of the "significantly more" determination in the *Alice/Mayo* test. *Bilski v. Kappos,* 561 U.S. 593, 605, 95 USPQ2d 1001, 1007 (2010).

In the interest of expediting prosecution, Claims 1-14, to which the 101 rejections have been directed to, have been withdrawn, and therefore, Applicant respectfully submits herein as follows that newly added claims 15-24 are patentable under 35 USC 101.

Regarding the newly added independent claims 15 and 20, Applicant respectfully submits that the claims are patentable under 35 USC 101 at least for the reasons mentioned below.

With regards to the claim 15, the claim involves a number of steps and the steps are performed through various physical entities. The step of "*representing time-varying preferences of a plurality of users as corresponding and respective plurality of Multivariate Time Series (MTS)*" is performed using a user management unit that is operatively coupled with a data server and a user device. First of all, these are physical entities and are not associated with human mental steps whatsoever. One end result, as given in the specification, is that of segmenting customer preferences based on temporal variations of user preferences. Even if, in theory, it may be alleged that it might be possible to perform this step mentally, Applicant respectfully submits that an examination of the instant claim limitation reveals the impossibility of such a feat partly owing to the scale and complexity in performing the step. Applicant therefore, respectfully submits that the user management unit that is operatively coupled with a data server and a user device is a structure that is unique to this step and as a consequence cannot be performed by a mere user's mental step. As a result, at least for this limitation, claim 15 is patentable under 35 USC 101.

It is further submitted that none of the steps of method claim 15 can, in any manner whatsoever, be performed mentally, and that functional execution of these steps clearly enables a computationally efficient mechanism of identifying which VAR model is suitable for which MTS cluster, which without iterative re-estimation of model parameters cannot be determined. Applicant fails to understand how exemplary US Patents 10,452,510, 10,237,420, 9,984,334, among many others have been issued post Alice on similar subject matters. Merely because the claimed subject matter of the instant application applies mathematical techniques to enable time-efficient and computationally-accurate mechanism for customer segmentation problem does not mean that the subject matter does not have a practical application. Applicant wonders if the instant application would have been patentable if the same technique would have been applied for selecting an appropriate sensor from a set of sensors merely because sensors are more physical entities/objects and customer segmentation is not.

It is respectfully submitted that the office action oversimplifies the invention by stating that it falls within an organized human activity in the areas of sales and marketing and hence an Abstract idea. If so be the case, how were applications such as US 9,037,998, and US 9,984,334 granted at all. It is also to be appreciated that customer segmentation is not a method of organizing human activity but in fact segmenting/dividing customers and not their activities per se, and therefore such wrong interpretations can surely lead to an incorrect interpretation of the claimed subject matter.

Even under the Prong 2, merely because the specification of the instant application does not disclose a novel hardware cannot lead to a conclusion that the invention does not have a practical application or is simply Abstract in nature, as by that logic, every Applicant would be required/mandated to incorporate a novel hardware in their claims/specification in order to become patent eligible, which in sum, would make the invention a hardware patent itself.

Under Step 2B, the step of performing, using said time variant clustering (TVC) module, re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models based on re-estimated model parameters of each of said K VAR models, wherein the steps of re-estimating the model parameters, and performing re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models are performed iteratively and simultaneously till a convergence criterion is met, is clearly beyond the judicial exception as such steps of iteratively being able to re-estimate the model parameters alongside performing re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models till a convergence criterion is met is not possible mentally, or through a simple set of mathematical equations as is being contemplated in the office action.

Furthermore, the mentioned technique wherein temporal variations are represented in the MTS has a clear practical application in the domain of customer segmentation, and as can be seen perceived, in any other behavioural segmentation problem, making the claimed subject matter clearly technical and non-abstract in nature and hence not a judicial exception under the 2A-2B test.

Applicant, in the end, would only respectfully submit as to how come, for US 9,984,334 of Mitsubishi Electric Research Laboratories, Inc., no 35 USC 101 was even raised in the first place even when the claims include mathematical constructs and, like the present

invention, solve a clear practical problem through a much more efficiently and computationally better technique of iteratively being able to re-estimate the model parameters alongside performing re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models till a convergence criterion is met is not possible mentally, or through a simple set of mathematical equations as is being contemplated in the office action.

With regards to claim 20, Applicant respectfully submits that this is a system directed to the steps enumerated in claim 15 and as such the above remarks for the claim 15's patent eligibility apply here as well. Applicant respectfully submits that claim 20 is also patentable under 35 USC 101.

Claim Rejections – 35 USC §103

Claims 1, 3-8, and 10-14 are rejected under 35 USC 103 as being unpatentable over Kubota et al. (US 2006/0269144 A1; hereinafter, "Kubota") in view of Sismeiro, Catarina, Mizik, Natalie and Bucklin, Randolph E., Modeling Co-Existing Business Scenarios with Time Series Panel Data (February 2006) (hereinafter, "Sismeiro").

Claims 2 and 9 are rejected under 35 USC 103 as being unpatentable over Kubota, in view of Sismeiro, and further in view of Liao, T.W. (2005) Clustering of Time-Series Data-A survey. Pattern Recognition, 38, 1857-1874 (hereinafter, "Liao").

Applicant respectfully *traverses*.

In the interest of expediting prosecution, Claims 1-14, to which the 103 rejections have been directed to, have been withdrawn, and therefore, Applicant respectfully submits herein as follows that the newly added claims 15-24 are patentable under 35 USC 103.

Regarding Independent Claim 15

To establish a prima facie case of obviousness, the Examiner must, among other things, determine the scope and content of the prior art and ascertain the differences between the claimed invention and the prior art. *See* MPEP 5 2144.08(11)(A), 8th Ed., Rev. 6 (September 2007). Furthermore, the Examiner must make findings with respect to all of the claim limitations and must make "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *See* MPEP §§ 2143.03 and 2141(111).

The Applicant respectfully submits that it is well-established that, for a proper rejection of a claim under 35 U.S.C. §103 as being obvious based upon a combination of references, the cited combination of references must disclose, teach, or suggest, either implicitly or explicitly, all elements/features/steps of the claim at issue. *See, e.g., In re Dow Chemical*, 5 U.S.P.Q. 2d 1529, 1531 (Fed. Cir. 1988), and *In re Keller*, 208 U.S.P.Q. 871, 881 (C.C.P.A. 1981).

In the instant case, Kubota either alone or in view of Sismeiro does not render obvious the newly added claim 15 as the two references do not disclose, teach, or suggest, either implicitly or explicitly all elements or features of the claim. Kubota is generally directed towards a data division apparatus, data division method and program that can conduct data division (clustering) on a point set in an n-dimensional space. The instant case, on the other hand, is directed towards data analytics and more particularly to clustering techniques based on multivariate time series, and this particular is

Claim 15, as newly added, recites in part:

"...learning, at the user management unit, 'K' VAR models corresponding to the 'k' clusters based on estimation of model parameters of each of the said 'K' VAR models;

...;

re-estimating, using a time variant clustering (TVC) module of the user management unit, model parameters of each of said 'K' VAR models based on expectation-maximization (EM) technique;...".

Kubota does not teach learning models based on estimation parameters. Rather, Kubota teaches learning models corresponding to clusters and based on data associated with the clusters in stark contrast to estimation parameters in the instant invention. [57], Kubota. As a consequence, Kubota cannot even implicitly teach the step of "*re-estimating model parameters of 'K' VAR models based on expectation*-maximization (EM) technique."

It is also respectfully submitted that Kubota reference discloses conducting data division (clustering) on multi-dimensional data where multi-dimensional data is divided into a plurality of clusters based on division plane candidates, and then models respectively corresponding to clusters are generated. Division plane candidates are then evaluated on the basis of the models generated such that evaluation values respectively corresponding to the division plane candidates are compared, and a division plane candidate having a highest evaluation value is selected. The multi-dimensional data is then finally divided by using the selected division plane candidate. In complete

contrast, with respect to model generation, in the present invention, VAR models corresponding to the 'k' clusters are learnt **based on estimation of model parameters** of each of said 'K' VAR models using, for instance, expectation-maximization (EM) technique, whereas, in the Kubota reference, as explained in Para [0057], for instance, the models are generated solely based on data that forms part of the respective clusters i.e. the *"model generator 45 generates the model A by using input data belonging to the cluster A, and generates the model B by using input data belonging to the cluster B".* Kubota therefore makes no reference whatsoever of estimation of model parameters for each of the VAR models, per se. Kubota reference also does not, in any manner, disclose allocating each MTS to one of the 'K' VAR models that accurately explains said MTS, **wherein the allocation is made based on average prediction Root Mean Squared Error (RMSE) on said each MTS**. Para 57 of Kubota merely discloses how models can be generated based on data of each cluster, but does not make any disclosure whatsoever of allocation of MTS to a VAR model such that the respective VAR model accurately explains said MTS, wherein the allocation is made based on average prediction Root Mean Squared Error (RMSE) on said each MTS.

Additionally, the Kubota reference completes fails to teach and/or suggested re-estimation of model parameters of each of the 'K' VAR models based on expectation-maximization (EM) technique, and in complete contrast, in Paras [0064-0067] merely discloses recursively repeating the steps to identify/select the division plane that assists in dividing input data for error minimization but completely fails to disclose re-estimation of model parameters of the models. **Therefore the key problem being solved by the Kubota reference is to identify an ideal/suitable division plane that can help in accurately dividing the input data across clusters, whereas the present invention aims to identify/select an appropriate VAR model that can be used to represent each MTS. Due to this very fundamental difference, there is also no disclosure by Kubota of** performing re-allocation of each MTS one of the 'K' VAR models based on re-estimated model parameters of each VAR model, wherein the steps of **re-estimation of the model parameters and re-allocation of MTS of the plurality of MTS to one of the 'K' VAR models are performed iteratively and simultaneously till a convergence criterion is met**.

Claim 15, as newly added, further recites in part:

"*...performing re-allocation of said each MTS of the plurality of MTS to one of the 'K' VAR models are performed iteratively and simultaneously till a convergence criterion is met.*"

With regards to the Sismeiro reference, nowhere does it teach "*iteratively and simultaneously till a convergence criterion is met*" with regards to forming data clusters and analysing the same to optimize a given set of specific business process, the analysis being associated with time series.

Further, Applicant respectfully submits that the Examiner misconstrues the reference. In addition to being starkly different from Kubota, a person skilled in the art would not combine Sismeiro with Kubota to arrive at the instant invention since both references are directed to different fields of endeavor. While Kubota is directed towards a data division apparatus that can conduct data division (clustering) on a point set in an n-dimensional space, Sismeiro is directed towards finding an approach to optimize a business process based on time series analysis.

Regarding Independent Claim 20 along with Dependant Claims

All arguments made above for claim 15 are equally applicable to claim 20 as well, and hence the arguments are not being repeated for brevity of the response, and non-repetition of the same arguments.

As regards the dependant claims 16-19 and 21-24, due to fundamental differences between the claimed subject matter and Sismeiro in combination with Kubota, limitations of the dependant claims are clearly not anticipated and/or taught by the cited references, and hence such claims are being argued to be novel and inventive by virtue of their dependence on the corresponding independent claims alone. Even otherwise the limitations of such dependent claims are not suggested and/or taught by any of the cited references in any manner. For instance, with respect to claim 16, the cited portions of Kubota merely disclose evaluation of models and performing of data division based on the selected/most optimal model, wherein the present dependent claim 16, in complete contrast claims **performing associating rule mining on the cluster.** No such **mining action on any cluster is being disclosed by Kubota in the first place itself, and hence the cited portions clearly don't disclose the limitations of claim 16 and hence are incorrect mapped and cited.**

Conclusion

The Applicant respectfully submits that all claims are now in condition for allowance. Before taking any adverse decision on this case and should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is respectfully requested to contact the undersigned Applicant's Attorney of Record, to facilitate advancement of the present application. Early and favorable indication of allowance is courteously solicited. Please grant any required extensions of time and charge any fees due in connection with this request to Deposit Account No. 50-3290.

Respectfully submitted,

Dated: December 10, 2019 By /Vinay Malik/

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