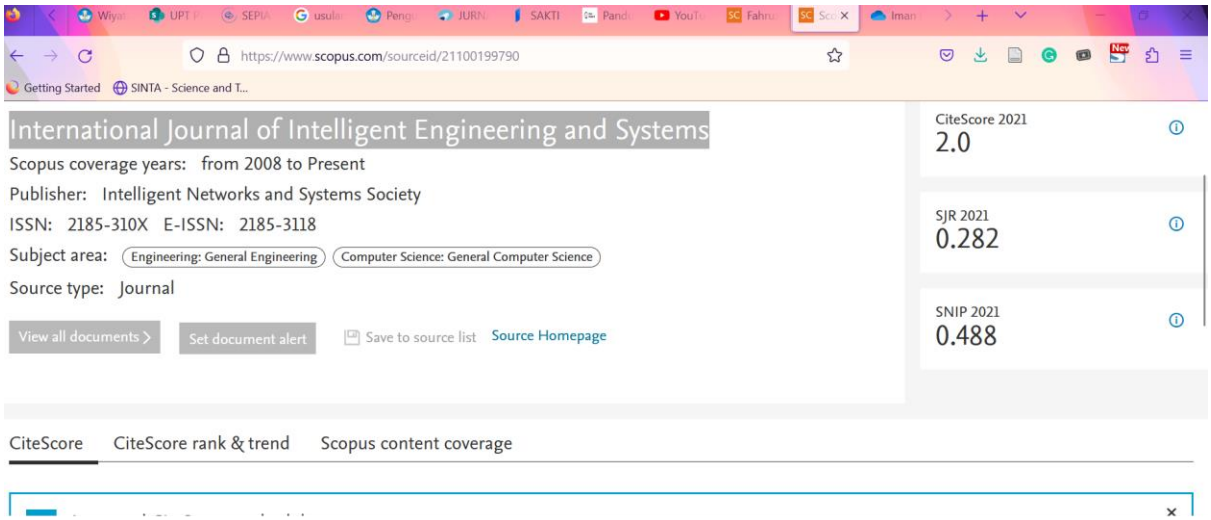
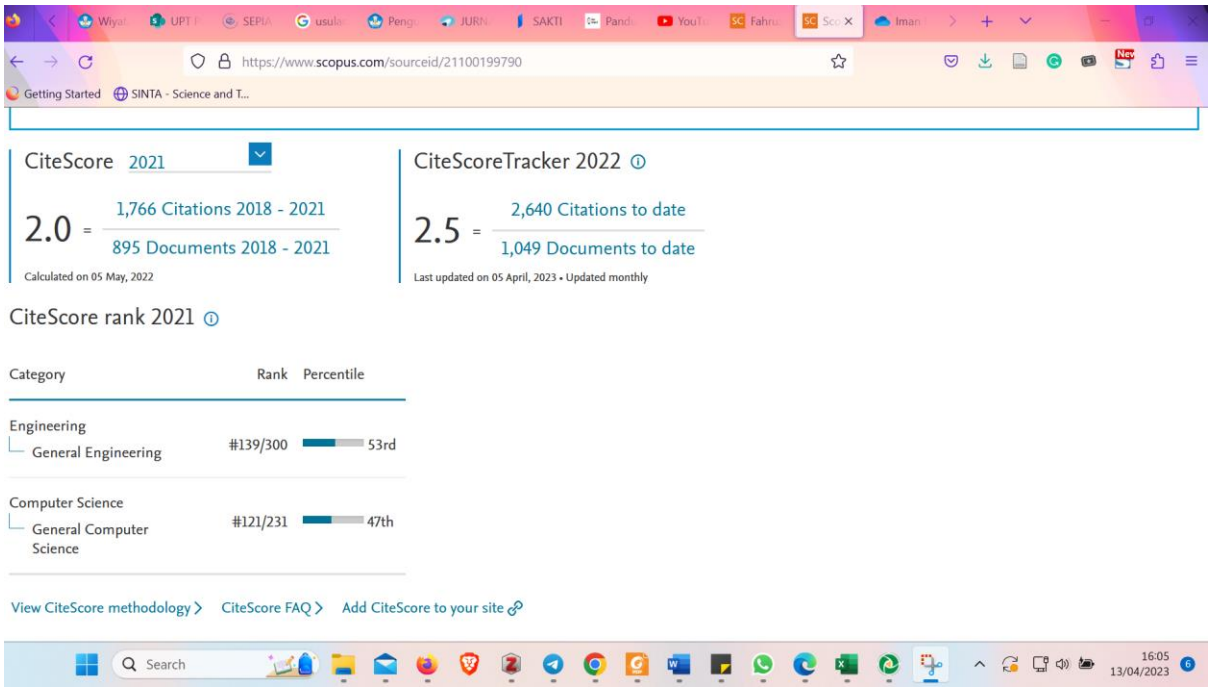
JURNAL INTERNASIONAL TERINDEKS SCOPUS 1

Status	Published
Nama Jurnal	International Journal of Intelligent Engineering and Systems
Terindeks	Terindeks Scopus: Q2 (H-index=11), indexed by SCOPUS, Scimago, Crossref, EBSCOhost, Ulrich's, OAJI; ISSN:2185-310X; E-ISSN:2185-3118, CiteScore 2019: 1.5; CiteScoreTracker 2020: 1.8; SJR 2019: 0.195; SNIP 2019: 0.448; Percentile: 56th.
Judul Manuskrip	A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine

DETAIL JURNAL INTERNASIONAL BEREPUTASI





2. Pengiriman Makalah

From: IMAN FAHRUZI 07111760010015 <imanfahruzi.17071@mhs.its.ac.id>
Sent: Sunday, December 27, 2020 11:36 PM
To: ijies@inass.org
Cc: hery <hery@ee.its.ac.id>; imanfhz@gmail.com
Subject: IJIES Journal Submission

December 27, 2020

Dear, Prof. Dr. Kei Eguchi,
Editor in Chief, International Journal of Intelligent Engineering and Systems

I am pleased to submit a manuscript for consideration of publication in the International Journal of Intelligent Engineering and Systems. The manuscript is entitled "A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine". The manuscript is original. I confirm that this manuscript has not been published elsewhere and is not been submitted simultaneously elsewhere. The authors declare that there is no conflict of interest.
I am a hard worker and diligent, I am ready to improve the paper to the extent expected by the reviewer. We hope that this manuscript can be accepted and published in this journal. With this, we attach the manuscript and the cover letter.

Thank you very much for your consideration.

with my best regards,
Mauridhi Hery Purnomo and Iman Fahruzi,

Department of Electrical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
(mailto:hery@ee.its.ac.id; mailto:imanfahruzi.17071@mhs.its.ac.id)

ijies3930: IJIES Journal Submission Inbox x

EGUCHI Kei <eguti@fit.ac.jp> Mon, 28 Dec 2020, 06:30
to me

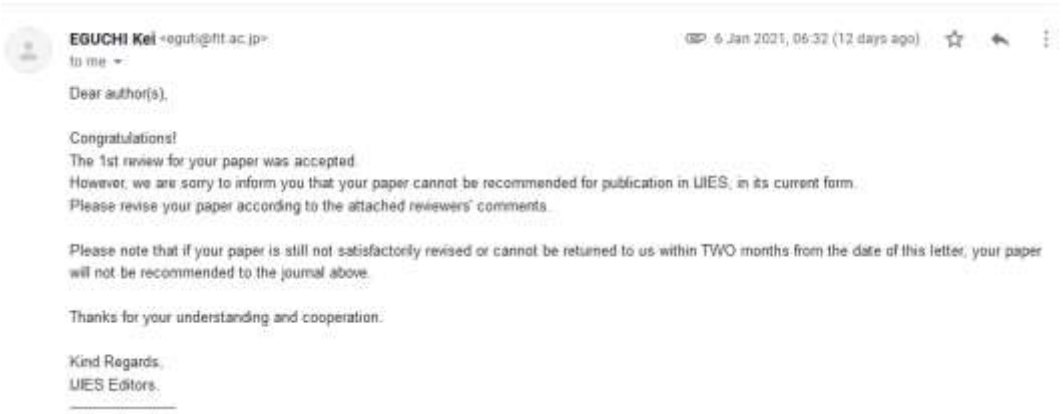
Dear author(s),

Thank you for your interest and support to IJIES.
I am hereby to confirm the delivery of your paper, Paper ID is " ijies3930".
It has been sent for reviewing.
The notification will be feedback within two weeks.
Appreciate your patiently wait.

If you have any question, please contact us with your paper ID.

Best regards,
IJIES Editors

3. Perbaikan Makalah: Revisi Minor



EGUCHI Kei <eguti@fit.ac.jp> 6 Jan 2021, 06:32 (12 days ago)
to me

Dear author(s),

Congratulations!
The 1st review for your paper was accepted.
However, we are sorry to inform you that your paper cannot be recommended for publication in IJIES, in its current form.
Please revise your paper according to the attached reviewers' comments.

Please note that if your paper is still not satisfactorily revised or cannot be returned to us within TWO months from the date of this letter, your paper will not be recommended to the journal above.

Thanks for your understanding and cooperation.

Kind Regards,
IJIES Editors.

Intelligent Networks and Systems Society

Review Form

International Journal of Intelligent Engineering and Systems (IJIES)

Paper ID	Ijies3930
Paper Title	A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine

Recommendation for Publication

~~□(Evaluation A:) Accept~~	□(Evaluation B:) Accept after Minor Revision
~~□(Evaluation C:) Accept after Major Revision~~	~~□(Evaluation D:) Reject~~

Comments from reviewers 1 & 2:

The mathematical presentation of this manuscript should be improved.

1. The authors should not use acronym without explanation, e.g. ECG, QSR, etc... All acronyms must be defined before use.
2. In the abstract part, the novelty and key idea of the proposed method should be described. The authors only described that "The new features set have been extracted, which are eventually being used as inputs space to a support vector machine (SVM). Through examining the feature set, we designed an optimum SVM model classifier to explore the usability of patterns to predict corresponding apnea and non-apnea events.". The novelty and key idea are not clear. What's "new features set" stand for?
3. The research survey is not enough. The articles listed in References are old. In SCOPUS, the papers published within 3 years are used to calculate CiteScore. The authors should survey past studies in detail.
4. In the Introduction part, strong points of this proposed method should be further stated and organization of this whole paper is supposed to be provided in the end.
5. Eq. (1) has editing problems. There is no "$" in the right-hand of Eq. (1).
6. Please unify the font style. In sentences/equations, mathematical expressions must be Italic font. (Some of them are Italic fonts and others are Roman font.) Otherwise, readers will be confused. e.g. see Eq. (1).
7. Eqs. (2) and (3) have editing problems. The authors should improve the mathematical presentation.
8. The meaning of Eq. (4) is not clear. There is no left-hand in Eq. (4).
9. The explanation about the mathematical formulas is not enough. Furthermore, the meaning of variables is not clear. Readers will be confused. To help readers' understanding, the authors should add a notation list.
10. What's "coef0" stand for?
11. Please use a clear image for Fig. 7.
12. In figures, letters are too small. Unify the font size of letters (more than 10pt). Enlarge or Redraw figures. e.g. Fig. 8.
13. This paper lacks in-depth discussions in Sect.5. The impact is lost by a short discussion of the findings. Readers will fail to understand the scientific contribution of this research. Show the theoretical reason why the proposed technique is better than existing techniques, because there is no theoretical explanation about compared existing techniques in previous sections. These existing techniques appeared suddenly in comparison. Explain the detail of the existing technique in previous sections.
14. The effectiveness of this work is not clear. Through simulations/experiments, the authors must justify the effectiveness of the proposed method by comparing with the other latest methods. Several articles are listed in references. However, no comparison is shown with these techniques. What's the research survey? Show

Review Form

comparison data.

15. The reference should be updated. Otherwise, this seems a well-behind article.

From Editor:

Please improve the reference format. This is very important for indexing service. If you did not follow the following format, your paper will be rejected automatically.

*Do not use "et al." in author names.

e.g.

[1] R. Ruskone, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", *International Journal of Intelligent Engineering and Systems*, Vol.1, No.1, pp.123-456, 2009.

(In the case of Journal Papers)

[2] R. Ruskone, L. Guigues, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", In: *Proc. of International Conf. On Pattern Recognition*, Vienna, Austria, pp.900-904, 1996.

(In the case of Conference Proceedings)

*Note: e.g. In the case of the author name:"John Doe", express as "J. Doe". ("John" is the first name and "Doe" is the family name.)

** Please send your revised manuscript with the response letter for the 2nd review. (Please highlight modifications and additions inside the paper by red font.)

Please add "Conflicts of Interest" and "Author Contributions". (see the IJIES format.docx)

Conflicts of Interest (Mandatory)

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results.

Author Contributions (Mandatory)

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used as follows: "conceptualization, XXX and YYY; methodology, XXX; software, XXX; validation, XXX, YYY, and ZZZ; formal analysis, XXX; investigation, XXX; resources, XXX; data curation, XXX; writing—original draft preparation, XXX; writing—review and editing, XXX; visualization, XXX; supervision, XXX; project administration, XXX; funding acquisition, YYY", etc. Authorship must be limited to those who have contributed substantially to the work reported.

Evaluation of Paper		
Contents	Innovation	□Highly Innovate □Sufficiently Innovate □Slightly Innovate □Not Novel
	Integrality	□Poor □Fair □Good □Outstanding
	Presentation	□Totally Accessible □Mostly Accessible □Partially Accessible □Inaccessible

Intelligent Networks and Systems Society

Review Form

	Technical depth	□Superficial □Suitable for the non-specialist □Appropriate for the generally knowledgeable individual working in the field □Suitable only for an expert
Presentation & English	□Satisfactory □Needs improvement □Poor	
Overall organization	□Satisfactory □Could be improved □Poor	

Reviewers' Comments, Authors Response and Authors Action

Paper ID	Ijies3930
Paper Title	A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine

Dear Prof. Dr. Kei Eguchi,

Editor in Chief, International Journal of Intelligent Engineering and Systems

We would like to thank the editor and the reviewers for careful and thorough reading of this manuscript, invaluable comments and constructive suggestions, which help to improve the quality of this manuscript. The corresponding changes and refinements made in the revised paper are summarized in our response below. In more detail, we included a point-by-point response.

Thank you for considering our revised manuscript.

Best Regards,
Iman Fahruzi

Reviewers comments:

Comment #1: The authors should not use acronym without explanation. e.g. ECG, QSR, etc... All acronyms must be defined before use.

Authors response:

Thank you for your correction on all acronyms.

Authors action:

We have rechecked and corrected all acronyms in the manuscript, and we have ensured that it's all acronyms come with full term before used for the first time. We also have added the term of QRS wave acronyms in the figure form as shown in Figure 1.

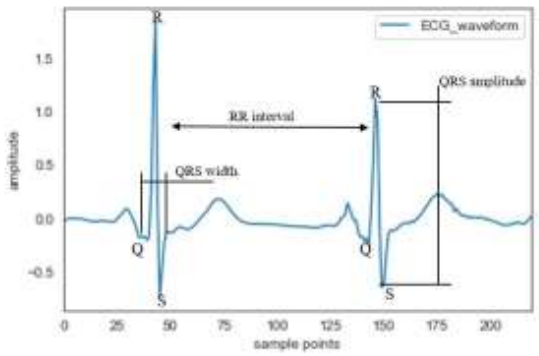


Figure. 1 ECG waveform, QRS morphologies and various of RR interval

---

Comment #2: In the abstract part, the novelty and key idea of the proposed method should be described. The authors only described that "The new features set have been extracted, which are eventually being used as inputs space to a support vector machine (SVM). Through examining the feature set, we designed an optimum SVM model classifier to explore the usability of patterns to predict corresponding apnea and non-apnea events.". The novelty and key idea are not clear. What's "new features set" stand for?

Authors response:

We highly appreciate the positive feedback for us to elaborate on detail of the novelty and key idea in abstract.

Authors action:

We have added the additional information to describe key idea, novelty and new feature set in part of abstract as follow:

"The complexity of records obtained from electrocardiogram (ECG) recordings requires manual inspection by experienced medical practitioners. Meanwhile, ECG records are still widely used to diagnose heart problems during sleep. To resolve the issue, the fractal analysis is a promising means to help identify the characteristics of non-overlapping apnea and non-apnea events based on signal scaling behaviour and QRS wave morphologies. Therefore, we propose a new approach to develop automatic sleep disorder classification to minimalize visual inspection and manual scoring. We employed the monofractal and the multifractal analyses to generate new features such as alpha1, residue1, alpha2, residue2, Dqmin, Dqmax, hqmin, hqmid, hqmax, and hqmaxhqmin. To improve the proposed method's performance, we used the ten new features that have been extracted, which are eventually being used as inputs space to a support vector machine (SVM)…".

Comment #3: The research survey is not enough. The articles listed in References are old. In SCOPUS, the papers published within 3 years are used to calculate CiteScore. The authors should survey past studies in detail.

Authors response:

Thank you for your concern about our references. We did not provide enough references for depth research survey on past studies in detail.

Authors action:

We have updated some of the references to support research survey using the new one references on Page 2, Section 1 (The third and fourth paragraph). We have updated of the references in Section 2, sub section 2.5 on Page 6. We also added the reference of Table 5 in Section 4 on Page 14. However, some of them still used to support the proposed method.

We have updated references below according to the reviewer comments as follow.

OLD:

[4] A. Jafari, "Sleep apnoea detection from ECG using features extracted from reconstructed phase space and frequency domain," *Biomedical Signal Processing and Control*, vol. 8, no. 6, pp. 551–558, Nov. 2013.

[5] N. A. Eiseman, M. B. Westover, J. E. Mietus, R. J. Thomas, and M. T. Bianchi, "Classification algorithms for predicting sleepiness and sleep apnea severity," *J Sleep Res*, vol. 21, no. 1, pp. 101–112, Feb. 2012.

[25] B. Xie and Hlaing Minn, "Real-Time Sleep Apnea Detection by Classifier Combination," *IEEE Transactions on Information Technology in Biomedicine*, vol. 16, no. 3, pp. 469–477, May 2012.

UPDATE:

To support Introduction in Section 1 on Page 2:

[4] H. Yoon, S. H. Hwang, J.-W. Choi, Y. J. Lee, D.-U. Jeong, and K. S. Park, "Slow-Wave Sleep Estimation for Healthy Subjects and OSA Patients Using R–R Intervals," *IEEE Journal of Biomedical and Health Informatics*, vol. 22, no. 1, pp. 119–128, **Jan. 2018.**

[5] M. Sharma, M. Raval, and U. R. Acharya, "A new approach to identify obstructive sleep apnea using an optimal orthogonal wavelet filter bank with ECG signals," *Informatics in Medicine Unlocked*, p. 100170, **Mar. 2019.**

[10] M. Shahbakhti, H. Bagheri, B. Shekarchi, S. Mohammadi, and M. Naji, "A New Strategy for ECG Baseline Wander Elimination Using Empirical Mode Decomposition," *Fluct. Noise Lett.*, vol. 15, no. 02, p. 1650017, **Jun. 2016.**

[12] M. Radha *et al.*, "Sleep stage classification from heart-rate variability using long short-term memory neural networks," *Scientific Reports*, vol. 9, no. 1, Dec. 2019

[13] N. Banluesombatkul, T. Rakthanmanon, and T. Wilaiprasitporn, "Single Channel ECG for Obstructive Sleep Apnea Severity Detection Using a Deep Learning Approach," in *TENCON 2018 - 2018 IEEE Region 10 Conference*, **Oct. 2018.**

To support Description and Methods in Section 2, sub section 2.5 on Page 6:

[23] S. Chatterjee, S. Pratiher, and R. Bose, "Multifractal detrended fluctuation analysis based novel feature extraction technique for automated detection of focal and non-focal electroencephalogram signals," *IET Science, Measurement Technology*, vol. 11, no. 8, pp. 1014–1021, **2017.**

[24] K. Philippopoulos, N. Kalamaras, C. G. Tzanis, D. Deligiorgi, and I. Koutsogiannis, "Multifractal Detrended Fluctuation Analysis of Temperature Reanalysis Data over Greece," *Atmosphere*, vol. 10, no. 6, p. 336, **Jun. 2019.**

[25] X. Tang, X. Yang, and F. Wu, "Multifractal detrended fluctuation analysis parallel optimization strategy based on openMP for image processing," *Neural Computing and Applications*, **Mar. 2019.**

To support Discussion in Section 4, for Table 5. Performance comparison of various works on classification of apnea ECG physionet on Page 14:

[33] K. Li, W. Pan, Y. Li, Q. Jiang, and G. Liu, "A method to detect sleep apnea based on deep neural network and hidden Markov model using single-lead ECG signal," *Neurocomputing*, vol. 294, pp. 94–101, **Jun. 2018.**

Comment #4: In the Introduction part, strong points of this proposed method should be further stated and organization of this whole paper is supposed to be provided in the end.

Authors response:

We are grateful for paying attention to the strong points of the proposed approach. We have mentioned in this manuscript. We also added the structure of this paper.

Authors action:

The strong point of the proposed method has been stated on Page 2, in the paragraph 5.

"Therefore, a tool is needed for a more in-depth analysis of ECG morphology, QRS intervals and periodic patterns of ECG signals ….".

and in the paragraph 6.

"Throughout this research, we merged two methods from nonlinear fractal analysis to obtained the fractal scaling behaviour features that correspond to the ECG signal pattern throughout…".

and the contribution of this study has been stated on Page 2 in paragraph 7.

"The contributions of this study are: (1). The investigation of ECG recordings robustness and complexity is…"

While the structure of this manuscript has been added on Page 2, in the paragraph 8.

"This paper is structured as follows. We describe the sleep disorder, previous study and related work in Section 1. Section 2 describes….".

Comment #5: Eq. (1) has editing problems. There is no "*k*" in the right-hand of Eq. (1).

Authors response:

Thank you for your useful feedback. As suggested by the reviewer, we have corrected the "k" parameter.

Authors action:

We have edited the Equation 1 (Eq.1) in section 2, sub section 2.4 on Page 6 for step by step the DFA process.

Comment #6: Please unify the font style. In sentences/equations, mathematical expressions must be Italic font. (Some of them are Italic fonts and others are Roman font.) Otherwise, readers will be confused. e.g. see Eq. (1).

Authors response:

Thank you for your suggestion of our sentences/equations and mathematical expressions to correction them by changing its fonts to italic font.

Authors action:

We have rechecked and corrected the sentences/equations and mathematical expressions for Eq.1 to Eq.11 with italic font.

Comment #7: Eqs. (2) and (3) have editing problems. The authors should improve the mathematical presentation.

Authors response:

Thank you for your useful feedback. As suggested by the reviewer, we have correction the equations symbol to improve the mathematical presentation.

Authors action:

The correction of mathematical presentation and the equations has been made. We have tried to improve the equation problems on Page 6, section 2, sub section 2.4 for step by step the DFA process. We have added the explanation of each equations symbol.

Comment #8: The meaning of Eq. (4) is not clear. There is no left-hand in Eq. (4).

Authors response:

Thank you for your detailed attention to the meaning of the equation 4.

Authors action:

The equation 4 (Eq.4) is to describe the scaling behavior. It will increase since the deviations from the fitting

process will become larger for larger segments.

Equation 4: $F(t) \sim t^{h(q)}$

The explanation of the equation in Section 2, sub section 2.5 on Page 7.

"These processes are the basis of the experiment by multifractal analysis. In order to determine $F(t)$ how depends on the time scale t, it is obvious that $F(t)$ …."

Comment #9: The explanation about the mathematical formulas is not enough. Furthermore, the meaning of variables is not clear. Readers will be confused. To help readers' understanding, the authors should add a notation list.

Authors response:

Thank you for your suggestion to adding for the explanation about the mathematical formulas and the meaning of variables.

Authors action:

We have added some of explanation to clarify the mathematical formulas and the meaning of variables for Eq. 1 to Eq. 6.

Comment #10: What's "coef0" stand for?

Authors response:

We are grateful for paying attention to the "coef0" parameter. We should explain the meaning of the "coef0" parameter.

Authors action:

We have corrected to clarify "coef0" stand for in Section 2, sub section 2.6 on Page 7.

"Where coef0 parameter as independent term in kernel function of polynomial when we optimizing training model. It controls how much high-degree polynomial kernel" and

We have revised the explanation of c parameter in Section 2, sub section 2.6 on Page 7.

before:

"Where c is coef0 parameter…"

after:

"Where c is the regularization parameter to control the trade-off between margin and error of classification…"

Comment #11: Please use a clear image for Fig. 7.

Authors response:

Thank you for your suggestion of our Figure to make it more clearly. We apologize if our original Fig. 7 did not show clearly image.

Authors action:

We have redrawn Fig. 7 in Section 3, sub section 3.3 on Page 10 (revised to Fig. 8) and hope that it is now clear.

Comment #12: In figures, letters are too small. Unify the font size of letters (more than 10pt). Enlarge or Redraw figures. e.g. Fig. 8.

Authors response:

Thank you for your suggestion of our figures to make it more clearly by changing its fonts to a font larger than 10pt.

Authors action:

We have redrawn and enlarged of the Figure 4, 5, 6, 7, 8, 9 with larger fonts.

Comment #13: This paper lacks in-depth discussions in Sect.5. The impact is lost by a short discussion of the findings. Readers will fail to understand the scientific contribution of this research. Show the theoretical reason why the proposed technique is better than existing techniques, because there is no theoretical explanation about compared existing techniques in previous sections. These existing techniques appeared suddenly in comparison. Explain the detail of the existing technique in previous sections.

Authors response:

Thank you for your useful feedback. The authors are grateful appreciate positive comment from the reviewer. We have reorganized the flow of the discussion section on Page 11.

Authors action:

We have re-arranged the discussion section that it make a meaningful paragraph related to the contribution of this study in Section 1, paragraph 7 on Page 2.

"The contributions of this study are: (1). The investigation of ECG recordings robustness and complexity is only from single lead ECG…."

And we have added explanation in Section 4, paragraph 2 on Page 12.

"In order to describe in more depth of the proposed approach, the scientific contributions of this study are described. The scientific contributions of this…."

And we also have highlighted passage to show the proposed technique is better than existing techniques in Section 4, paragraph 1 on Page 11.

"To carry out an in-depth description on preprocessing stage, feature extraction stage, and classification method, this study more exploits sleep scoring with…"

And to support the explanation of contribution, we have highlighted passage in Section 4, paragraph 3 on Page 12, and paragraph 4 and paragraph 6 on Page 13.

paragraph 3 on Page 12:

"The first and second contributions are related to the number of features and the feature extraction method chosen..."

paragraph 4 on Page 13:

"To explain the third contribution, fractal analysis based on monofractal and multifractal analyses are frequently adopted to nonlinear behaviour of ECG…"

paragraph 6 on Page 13:

"A whole other contribution is how the optimization effects for various kernels on the SVM improve…"

Comment #14: The effectiveness of this work is not clear. Through simulations/experiments, the authors must justify the effectiveness of the proposed method by comparing with the other latest methods. Several articles are listed in references. However, no comparison is shown with the techniques. What's the research survey? Show comparison data.

Authors response:

Thank you for your useful feedback. We highly appreciate your review about the effectiveness of this work.

- In previous studies, the ECG recording assessment process focused more on methods that used statistical analysis based on changes in the RR interval called heart rate variability (HRV) that occurred in the time domain, frequency and the combination of both. On the other hand, no one has used another approach like the one we offer, which is to assess the ECG record based on the trend of a signal based on fractal analysis.
- To determine the effectiveness of this works, we carry out experiments at each stage, especially the feature extraction process which is a new approach to studying the behavior of a signal. Our study offers a new approach by assessing ECG records using fractal analysis to determine the fractal structure of a signal.
- The technique uses a combination of monofractal analysis and multifractal analysis. Monofractal analysis method to obtain the fractal structure of a signal in the form of a fractal scaling function or fluctuation function, namely features alpha1, residue1, alpha2 and residue2. Meanwhile, the multifractal analysis method is to obtain a multifractal spectrum, namely Dqmin, hqmin, hqmid, Dqmax, hqmax, and hqmaxhqmin.

- Based on the experimental results, the assessment of the ECG record using fractal analysis achieved very promising results with an accuracy of 92.16%. In comparison, to determine the effectiveness of our proposed approach, we explain it in depth in the discussion section. The explanation focuses on the number of leads and the duration of the record, the number of features, the extraction method, the classification method and the performance evaluation.

Authors action:

We have added an information to support those explanations as follow:

- The proposed framework and feature extraction methods used have been described in Section 2 of the Data Description and Methods, sub section 2.3 on Page 5.

  "the new proposed approach is an assessment of best practice to combine the fractal structure based on a short and long ranges of sleep disorder ECG signals…"

  And sub section 2.4

  "The DFA approach is strongly related to the value of approximation error and successively attained the value…"

  And sub section 2.5.

  "The multifractal parameters in the form of slope and width are extremely helpful in certain studies in the analysis or determination of signal differences. In order to achieve features that are important…"

- Meanwhile, the experimental process and its results are described in a structured manner in Section 3 of the experiment results, sub section 3.1 on Page 8.

  "The local trending signal is basically to obtain the feature value of slope and feature value of residue fluctuation for each segment…"

  And sub section 3.2 on Page 8.

  "This section describes MFDFA to the analysis of the signal. The MFDFA approach is used to learn more about structure fractals…"

- Furthermore, to determine the effectiveness of the proposed approach, in Section 4 of the Discussion section, we compared several previous studies on the same dataset, namely the ECG-apnea Database. The comparison refers to Table 5 with the criteria being compared including the number of leads, feature extraction method, classification method and the resulting performance of classification.

  "To carry out an in-depth description on preprocessing stage, feature extraction stage, and classification method, this study more exploits sleep scoring with the examination single lead ECG with complexity and

robustness in more than ten minutes length…"

And the performance comparison with other work and latest method in Section 4, paragraph 1 on Page 12. "A performance comparison with respect for the existing literatures that report various works for classification on apnea ECG physionet is presented in Table 5". We have stated in Table 5 on Page 14.

- and the results in the discussion section have explained the comparison of research results as follow.

We have added an explanation to comparison with other related works with the recent study. The explanation in Section 4, paragraph 3 on Page 13 is based on Ref [29].

"The other studies have presented to obtain performance improvements, the method utilized deep learning to learn feature based 5 criteria. Finally, a decision fusion method was quite successful …"

We also have stated the other comparison with related studies.

In section 4, paragraph 3 on Page 12 is based on Ref [8].

"In addition, through HRV, many features can be used such as analysis of the energy and fuzzy entropy feature of intrinsic band function with total features of…"

and section 4, paragraph 3 on Page 13 is based on Ref [5].

"In addition, a direct comparison to identify OSA based on orthogonal wavelet to employing 12 feature set…"

and section 4, paragraph 3 on Page 13 is based on Ref [30].

"Other studies with significant improvements in the three evaluation parameters were found to be in…"

and section 4, paragraph 3 on Page 13 is based on Ref [28].

"The other studies with a higher number of features, 32 features derived from the combination of time domain analysis of HRV…"

Comment #15: The reference should be updated. Otherwise, this seems a well-behind article.

Authors response:

Thank you for your suggestion to update our reference with the recent article's references.

Authors action:

We have updated some of the references to support research concerning more recent publications.

UPDATE:

To support Introduction in Section 1 on Page 2:

[4] H. Yoon, S. H. Hwang, J.-W. Choi, Y. J. Lee, D.-U. Jeong, and K. S. Park, "Slow-Wave Sleep Estimation for Healthy Subjects and OSA Patients Using R–R Intervals," *IEEE Journal of Biomedical and Health Informatics*, vol. 22, no. 1, pp. 119–128, **Jan. 2018.**

[5] M. Sharma, M. Raval, and U. R. Acharya, "A new approach to identify obstructive sleep apnea using an optimal orthogonal wavelet filter bank with ECG signals," *Informatics in Medicine Unlocked*, p. 100170, **Mar. 2019.**

[10] M. Shahbakhti, H. Bagheri, B. Shekarchi, S. Mohammadi, and M. Naji, "A New Strategy for ECG Baseline Wander Elimination Using Empirical Mode Decomposition," *Fluct. Noise Lett.*, vol. 15, no. 02, p. 1650017, **Jun. 2016**.

[12] M. Radha *et al.*, "Sleep stage classification from heart-rate variability using long short-term memory neural networks," *Scientific Reports*, vol. 9, no. 1, **Dec. 2019**

[13] N. Banluesombatkul, T. Rakthanmanon, and T. Wilaiprasitporn, "Single Channel ECG for Obstructive Sleep Apnea Severity Detection Using a Deep Learning Approach," in *TENCON 2018 - 2018 IEEE Region 10 Conference*, **Oct. 2018**.

To support Description and Methods in Section 2, sub section 2.5 on Page 6:

[23] S. Chatterjee, S. Pratiher, and R. Bose, "Multifractal detrended fluctuation analysis based novel feature extraction technique for automated detection of focal and non-focal electroencephalogram signals," *IET Science, Measurement Technology*, vol. 11, no. 8, pp. 1014–1021, **2017.**

[24] K. Philippopoulos, N. Kalamaras, C. G. Tzanis, D. Deligiorgi, and I. Koutsogiannis, "Multifractal Detrended Fluctuation Analysis of Temperature Reanalysis Data over Greece," *Atmosphere*, vol. 10, no. 6, p. 336, **Jun. 2019.**

[25] X. Tang, X. Yang, and F. Wu, "Multifractal detrended fluctuation analysis parallel optimization strategy based on openMP for image processing," *Neural Computing and Applications*, **Mar. 2019.**

To support Discussion in Section 4, for Table 5. Performance comparison of various works on classification of apnea ECG physionet on Page 14:

[33] K. Li, W. Pan, Y. Li, Q. Jiang, and G. Liu, "A method to detect sleep apnea based on deep neural network and hidden Markov model using single-lead ECG signal," *Neurocomputing*, vol. 294, pp. 94–101, **Jun. 2018.**

From Editor:

Please improve the reference format. This is very important for indexing service. If you did not follow the following format, your paper will be rejected automatically.

*Do not use "et al." in author names.

e.g.

[1] R. Ruskone, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", *International Journal of Intelligent Engineering and Systems*, Vol.1, No.1, pp.123-456, 2009.

(In the case of Journal Papers)

[2] R. Ruskone, L. Guigues, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", In: *Proc. of International Conf. On Pattern Recognition*, Vienna, Austria, pp.900-904, 1996.

(In the case of Conference Proceedings)
*Note: e.g. In the case of the author name:"John Doe", express as "J. Doe". ("John" is the first name and "Doe" is the family name.)

Authors response:

Thank you for your concern about our reference format.

Authors action:

We have rechecked each reference format carefully. The "et al." term only used in the Table 5 for the comparison of this work to existing works on Page 14. There are no "et al." term in the list of references.

---

* * Please send your revised manuscript with the response letter for the 2nd review. (Please highlight modifications and additions inside the paper by red font.)

Authors response:

Thank you for the guidance. The modification and additions information have been highlighted in the red color text for our revised manuscript document.

Please add "Conflicts of Interest" and "Author Contributions". (see the IJIES format.docx)

Authors response:

Thank you for the guidance. We have stated that "The authors declare no conflict of interest." on Page 14.

Author Contributions (Mandatory)

Authors response:

Thank you for the guidance. We have added the information of authors contribution on Page 14.

Thank you very much for your constructive comments.

We appreciate your kind guidance and valuable comments.

4. Pengiriman Makalah Hasil Revisi

From: IMAN FAHRUZI 07111760010015 <imanfahruzi.17071@mhs.its.ac.id>
Sent: Tuesday, January 12, 2021 7:26 AM
To: ijies@inass.org
Cc: hery <hery@ee.its.ac.id>; iman@polibatam.ac.id
Subject: ijies3930: IJIES Journal Submission

Dear Prof. Dr. Kei Eguchi,
Editor in Chief, International Journal of Intelligent Engineering and Systems

We would like to thank you for giving us the opportunity to revise our manuscript with paper ID "Ijies3930" and the title "A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine".
We are very thankful for the corrections and revisions that the reviewers and editor have given to our manuscript. We have revised the manuscript according to the reviewer's comments.
We also have carefully checked point by point to all valuable feedbacks from editor and reviewers improved the quality of writing, re-phrasing some part of the sentence, changed some figure to readability, correction the equations added some references for support explanation and grammatical changes based on official proofreading. Hereby, we send our manuscript that has been highlighted using red font for our revision in "Ijies3930-revised manuscript.docx", along with our response letter in " Ijies3930-response letter.docx".
Thank you for accepting our revised manuscript. We hope the revised manuscript version is now suitable for publication. We shall look forward to hearing from you at your earliest convenience.
with my best regards,
Iman Fahruzi,
Department of Electrical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
(mailto:imanfahruzi.17071@mhs.its.ac.id)

EGUCHI Kei <eguti@fit.ac.jp> 12 Jan 2021, 08:41 (6 days ago)
to me

Dear author(s),

Thank you for your interest and support to IJIES.
We received your revised version.
It has been sent for reviewing.
The notification will be feedback within two weeks.
Appreciate your patiently wait.

If you have any question, please contact us with your paper ID.

Best regards,
IJIES Editors

EGUCHI Kei <eguti@fit.ac.jp> 07:16 (9 hours ago)
to me

Dear Author(s),

Paper ID: ijies3930

It is our great pleasure to inform you that the contribution referenced above, for which you are listed as the corresponding author, has been accepted for the 2nd review of the IJIES journal.
Congratulations!

*Important:
Please send your "signed" copyright and the payment proof of your publishing fee within one month.
Otherwise, your paper will be withdrawn.
The payment method will be sent from paypal. (Please check your mailbox carefully.)

*Publication fee: USD550 (tentative 16 pages: USD250 + USD50*6)
We'd like to discount USD100.
So, your final fee is USD450.

After we received these documents, the camera-ready version of your paper will be sent to you within a few weeks.
After your confirmation, the acceptance letter and receipt will be sent to you.

Best regards,
IJIES Editors
---

5. **Keputusan: Accepted**

Intelligent Networks and Systems Society

Acceptance Letter

International Journal of Intelligent Engineering and Systems (IJIES)

January 19, 2021

Dear Mauridhi Hery Purnomo,

Manuscript Title: A New Approach to Predict Potential Sleep Disorder based on Fractal Analysis from Non-overlapping Single Lead ECG using Support Vector Machine

Author(s): Iman Fahruzi, I Ketut Eddy Purnama, Kayo Yoshimoto, Hideya Takahashi, Mauridhi Hery Purnomo

Thank you for submitting your paper to the International Journal of Intelligent Engineering and Systems (IJIES). Based on double blind review process, we are pleased to inform you that our Review Committee has accepted your paper.

The paper will be included in the IJIES, which will be published with ISSN (ISSN: 2185-3118) in online on the website (http://www.inass.org/publications.html).
We are looking forward to your further contribution to our journal.

Kind regards

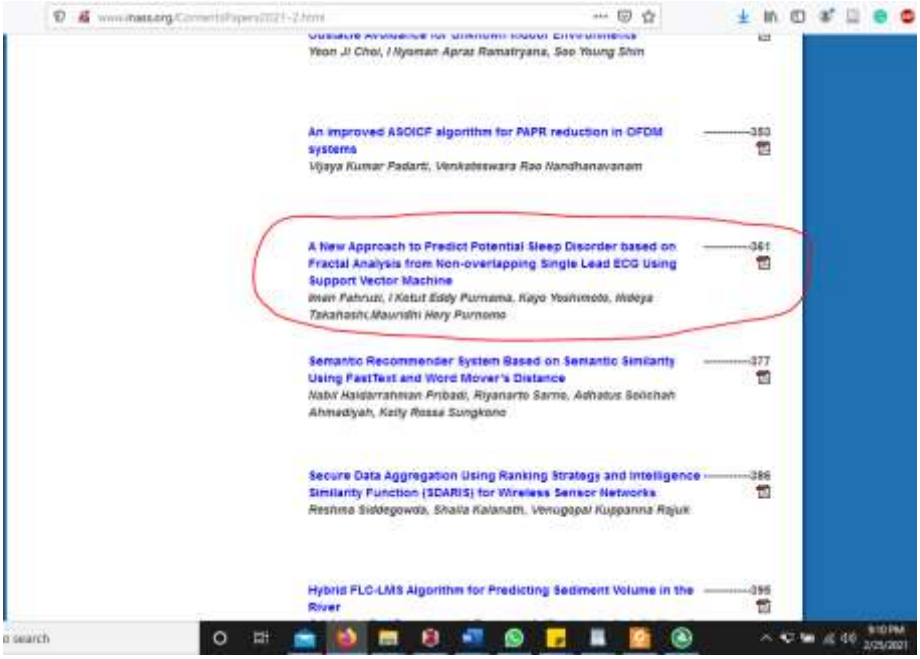
Prof. Dr. Kei EGUCHI
Editor-in-Chief, International Journal of Intelligent Engineering and Systems

Department of Information Electronics
Fukuoka Institute of Technology

kei Eguchi

E-mail: ijies@inass.org

6. **Bukti terbit online: Published (http://www.inass.org/2021/2021043033.pdf)**



7. **Makalah dibagian lampiran**