Reviewer’s report

Title: Ultra-short term HRV Features as Surrogate of Short term HRV. A Case Study on Mental Stress Detection in Real Life

Version: 0 Date: 04 Sep 2018

Reviewer: Reviewer 2

Reviewer’s report:

PEER REVIEWER COMMENTS: To view the full report from the academic peer reviewer, please see the attached file.

REVIEWER COMMENTS FROM REPORT: The main objective of this paper is to investigate the HRV features in short and ultra-short duration for detecting mental stress in students. The work is presented well and I do not find any major grammatical and typo error throughout the article. The authors have collected ECG signals from 42 subjects during resting and mental stressful conditions in a laboratory settings. The collected ECG signals are used to derive the HRV signal and they extracted the features from different duration of HRV signal for mental stress classification. Different statistical methods are used to evaluate the significance of the features in mental stress classification and used these methods for feature selection. Finally, the selected features are used to classify the stress and rest condition using four classifiers. The maximum mean classification rate of 94% for short duration (5 min) and 94%, 91% and 88% for 3 min, 2 min and 1 min duration using K Nearest Neighbor classifier. As a conclusion, the authors have proposed 3 features namely MeanNN, StdHR and HF are best surrogate of features for mental stress classification.

Conclusion: The authors have clearly described their methodology and results analysis without any ambiguity. I enjoyed the way the authors presented their results and experimental design in the paper. However, the paper needs some fine tuning for improving its quality.

REQUESTED REVISIONS:

My suggestions are:

1. Authors have not performed any preprocessing on acquired ECG signals? Why? Though, the experimental results give more than 90% accuracy without preprocessing, but still, the selection of best surrogate of features is questionable?. Hence, a most appropriate preprocessing method should be included for better analysis.

2. The author claimed that, KNN outperforms other classifiers and a k value of 2 achieved a best results. This is highly questionable to my knowledge is concern. Because, Its easy achieve a
good results by tuning the k value and also, the even value of k give more chances for the testing data to have die votes between two classes. So, its not recommended to have even values of k for reporting the accuracy.

3. I suggest the author to go for either 5 fold or 10 fold crossvalidation method to train and test the classifier rather than 60:40 ratio method. Besides, i do not understand the concept of 3 fold cross validation that the authors performed in training data (60% date in folder 1).

4. According to the literature, the minimum data length for computing ApEn and SaEn is 1000 samples in the sense that, 2 sec data is sufficient for computing the above entropies. Why the authors did not consider these features in ultra-short duration of HRV signal?

5. One of the major issues in methodology is loss of information in dataset. The author should include the following details in Section II A. (a) No of male and female students (b) Mean age and std deviation of students age (c) time of data acquisition in both rest and stress state (d) what type of electrode and the materials used in DAQ device? (e) what is the model number of the DAQ? (f) elaborate in detail about how the stress is induced in the subjects? (g) most importantly, how do you ensure that, the subject is in rest and also in stressful state while doing experiment? (h) what are the locations at which the electrodes are placed in the subjects?

6. The author should clearly distinguish the contribution of the present work with their earlier works in [39] in the paper for the better understanding of the reader.

7. Why the author did not consider the 4 min duration HRV for investigation?

8. Cite the reference in (a) Page no 8; Line no15. (b) Page no 3: Line no 16.

9. I would recommend the authors to change the title to "Mental Stress Detection using Short and Ultra-Short HRV Signals". Because, the present title does not fit to work on a whole.

10. The authors have identified the trend using only Mean and Std dev of the HRV signal. This should be investigated carefully again with some other approaches.

11. It would be good, if the authors present the accuracy of mental detection through confusion matrix.

ADDITIONAL REQUESTS/SUGGESTIONS:

One of the major issue is, lack of literature review discussion with the recent year papers. Very few papers only addressed in the discussion session in the year of 2016 and 2017 and there is no work is from 2018 is referred in the paper. It should be rectified in serious way.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.
No

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

No

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes

**Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?**
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

Not relevant to this manuscript

**Quality of written English**
Please indicate the quality of language in the manuscript:

Needs some language corrections before being published

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