

Answers for the review of Prof. Benyo

PhD Thesis

Novel Methods for Removing EEG Artifacts and Calculating Dynamic  
Brain Connectivity

My deep thanks to Prof. Benyo for his careful comments. These are my answers for his questions:

**Q1:** The functional connectivity biomarkers suggested in Thesis III and in chapter 6 are demonstrated to reflect the changes in the recovery process after the stroke. However, their concrete clinical interpretation and the benefits are just briefly introduced. Can you explain their clinical benefits and the potential research challenges to be solved for their use in clinical practice?

**A1:** The efficiency of the stroke treatment is difficult to be evaluated without monitoring quantitative stroke metrics since the MRI does not show information about brain reorganization, re-modelling and brain plasticity. The clinical benefit of my method is that it can be used as an effective and easy tool for monitoring stroke status during the treatment. It provides greater insight to the rewiring and plasticity of the brain after acute stroke and could improve patient monitoring and therapeutic interventions. Hopefully, in the future it can be used for predicting stroke severity on the population having a high risk of stroke. The importance of quantitative EEG for stroke screening and predication is highlighted in the following recent publication.

*Wilkinson, Cassandra M., et al. "Predicting stroke severity with a 3-min recording from the Muse portable EEG system for rapid diagnosis of stroke." Scientific Reports 10.1 (2020): 1-11*

Accurate, quick and automatic artifact removal is one of the challenges since the EEG recordings are not stationary signals which have wide range of frequency components match with the frequency of the noise, and this led to many validations and testing before approving the method to be used on clinical

dataset. These advanced methods require a long time to execute, new computational methods are needed to make usable in clinical practice.

Another challenge is that the method has to be validated on large patient population which can be solved in the future by recruiting more subjects.

**Q2:** A brief discussion of the achieved results' limitations would enhance the result's evaluation and help define potential directions for further research. Can you make your comments on the limitations of your results?

**A2:** One of the limitations of my work is that in the artifacts removal process, I did not include muscle noise artifacts, and I will continue the work in this area in the future. Another limitation is related to the connectivity graphs. Comparing brain graphs with one another is an active research since we do not have reference graphs for reliable comparisons. Therefore, the interpretation of these networks must be performed cautiously. Finally, my methods works in the sensor space, so we do not have anatomical information.,



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