

Reply to Reviewer's Comments on "EEG Waveform Analysis of P300 ERP with applications to Brain Computer Interfaces"

We are grateful to the reviewer for pointing out relevant issues in our manuscript.
In the following, we discuss how we dealt with each raised issue.

REVIEWER #1 TRANSCRIPT:

The paper is an interesting research paper and presents an analysis of the P300 ERP. The authors provide a literature review of the current methods used to detect EEG patterns and conduct three experiments to identify the P300 ERP in EEG recordings. The paper is well-organized. The paper should incorporate the following comments before its acceptance for publication:

1. The major concern is that the experiments have been conducted with only one participant. The authors should collect more data in this study. In other studies cited in the paper by authors, two and 16 participants were recruited.

2. It is strongly recommended that the authors should re-check some paragraphs of the manuscript, correct any grammatical and syntactic errors and improve the scientific language. In some cases, it was hard to follow the meaning. (e.g. Page 2, Paragraph 4, Line 51-54, Page 11, Paragraph 3, Line 343-345)

3. In the Introduction section the authors refer to BCI applications; however, no scientific studies are reported. Also, the literature section should be revised with recent publication. Below are some scientific studies that is suggested to be included for BCI applications:

a. Cruz, A., Pires, G., & Nunes, U. J. (2018). Double ErrP Detection for Automatic Error Correction in an ERP-Based BCI Speller. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 26(1), 26-36.

b. Tzimourta, K.D., Tsoulos, I., Bilerio, T., Tzallas, A., Tsipouras, M., Giannakeas, N. (2018). Direct Assessment of Alcohol Consumption in Mental State Using Brain Computer Interfaces and Grammatical Evolution. *Inventions*, 3(3), 51.

c. Kevric, J., & Subasi, A. (2016). The impact of Mspca signal de-noising in real-time wireless brain computer interface system. *Southeast Europe Journal of Soft Computing*, 4(1).

and for sleep studies:

d. Boostani R, Karimzadeh F, Nami M (2017) A comparative review on sleep stage classification methods in patients and healthy individuals. *Computer methods and programs in biomedicine* 140: 77-91.

e. Dimitriadis, S. I., Salis, C., & Linden, D. (2018). A novel, fast and efficient single-sensor automatic sleep-stage classification based on complementary cross-frequency coupling estimates. *Clinical Neurophysiology*, 129(4), 815-828.

4. In the literature section, Table I briefly presents the proposed methods followed by other authors; however, there is no text describing the table. The authors should include a paragraph describing each method and the recent findings concisely, in order to present better the literature review.

5. In Figure 2 please insert the y-axis title to clearly present ERP template.

6. The Results section is not well-presented. The authors are advised to include a paragraph before Table 2, Table 3 and Fig. 6-8 presenting the obtained results (best/worst channel performance and algorithm performance for each experiment) and then discuss the results in the Discussion section. Please revise excessive descriptions in the captions of Table 2, Table 3 and Fig. 6-8.

7. the obtained character identification rate is above theoretical chance level, and for some algorithms close to the usable threshold of 70% (Page 19, Paragraph 2, Line 465-466) What is the obtained character identification rate in other scientific studies? Is the obtained result (70%) of this study comparable to others?
8. In the Discussion section a table presenting the statistical analysis results would present better the results and would facilitate the reader.

General Comments

The paper is an interesting research paper and presents an analysis of the P300 ERP. The authors provide a literature review of the current methods used to detect EEG patterns and conduct three experiments to identify the P300 ERP in EEG recordings. The paper is well-organized. The paper should incorporate the following comments before its acceptance for publication:

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Thank you for your comments and for this high quality and detailed review. We have modified several points according to your recommendations, we hope the article is now better suited for publication.

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1. The major concern is that the experiments have been conducted with only one participant. The authors should collect more data in this study. In other studies cited in the paper by authors, two and 16 participants were recruited.
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We have now included more participants to this experiment.

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2. It is strongly recommended that the authors should re-check some paragraphs of the manuscript, correct any grammatical and syntactic errors and improve the scientific language. In some cases, it was hard to follow the meaning. (e.g. Page 2, Paragraph 4, Line 51-54, Page 11, Paragraph 3, Line 343-345)
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Thank you very much for your comment. We published in (?) the application of the same method to identify rhythmic EEG events like Visual Occipital Alpha Waves and to classify Motor Imagery. We are also working on unpublished material where we are analyzing the same approach for the detection of K-Complexes and classification of SSVEP patterns but the results are in progress. We added this information on the article (Introduction and Conclusion, section 3). We hope this new information enriches the article and clarifies this point.

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3. In the Introduction section the authors refer to BCI applications; however, no scientific studies are reported. Also, the literature section should be revised with recent publication. Below are some scientific studies that is suggested to be included for BCI applications:
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Absolutely thank you very much for providing

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4. In the literature section, Table I briefly presents the proposed methods followed by other authors; however, there is no text describing the table. The authors should include a paragraph describing each method and the recent findings concisely, in order to present better the literature review.

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We have modified the text highlighting the connections with the information provided in this table and rearranged the way the information was being shown.

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5. In Figure 2 please insert the y-axis title to clearly present ERP template.

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Our applogize for this mistake. We have corrected it and revised all the other figures.

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6. The Results section is not well-presented. The authors are advised to include a paragraph before Table 2, Table 3 and Fig. 6-8 presenting the obtained results (best/worst channel performance and algorithm performance for each experiment) and then discuss the results in the Discussion section. Please revise excessive descriptions in the captions of Table 2, Table 3 and Fig. 6-8.

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We have included the best/worst channel which is much better for the understanding of the performance obtained for the algorithm. We have modified the captions of the tables and figures, thank you very much for raising this issue. With this, we hope we have full addressed your point.

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7. the obtained character identification rate is above theoretical chance level, and for some algorithms close to the usable threshold of 70% (Page 19, Paragraph 2, Line 465-466) What is the obtained character identification rate in other scientific studies? Is the obtained result (70%) of this study comparable to others?

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Studies on this dataset reported performance values of perfect classification though they used handcrafted algorithms aimed to this dataset.

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8. In the Discussion section a table presenting the statistical analysis results would present better the results and would facilitate the reader.

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We have added a new table explaining all the statistical tests performed, including the information provided for the new experiments.