Feedback on the project: Brain Computer Interface (BCI) using fNIRS I

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Feedback + Bi Notes (page 2)

Your project on using functional near-infrared spectroscopy (fNIRS) for Brain-Computer Interface (BCI) development is highly commendable. It tackles a pressing issue in healthcare — improving the quality of life for patients with traumatic brain injuries (TBIs) and disorders of consciousness (DoC). The project's strength lies in its comprehensive approach, which spans from the historical context of fNIRS in BCIs to the exploration of modern applications and challenges in clinical settings. You've done an excellent job summarizing the state-of-the-art, which provides a solid foundation for the work. The detail in describing the methods for artifact removal and feature extraction demonstrates a deep understanding of the subject matter and a thoughtful approach to overcoming the challenges inherent in fNIRS data processing.

And for your research question in part 1.0.2, a clearer articulation would strengthen the study. This means the word "optimal" in research question 1 might be too ambitious to achieve. For both research questions 1 and especially 3, it could be helpful to use an expression like *how can*. Using *can* can be answered with a "yes/no" statement. It could also be beneficial for your project to first clarify what CUH stands for, but more importantly, clarifying the role of Copenhagen University Hospital in your project could provide a better understanding and relevance of the collaborative efforts.

An in-depth description and visual representation (such as a table or figure) of the Rob Luke (and CUH dataset when you have it available) dataset could enhance understanding, particularly details like participant right/left-handedness, gender, specific wavelengths (760.6,850.0) used in Rob Luke's dataset, and the importance of "sampling frequency." Aligning these last two parameters with the new dataset from CUH might be crucial for consistency and comparison.

In your preprocessing part for adaptive filtering, an explicit explanation of what the filter weights and S-D1 measurements are and clarify if you decide to use these assumptions.

Project equation 2.4 and section 2.4.1 mention $\Delta[HbO_2]$ but when I looked up the scientific paper by Hong et al., it states the equation as $\Delta[HbO]$; this might be an error. The methodological choice for calculating signal slope, as mentioned in section 2.4.2, would benefit from clarification if you plan to use the start and end points and why not use the curve-fitting method as the scientific paper by Hong et al. [34 in your project] states *it might be more*

preferable to use the other method which is using a curve-fitting approach.

The collaborative aspect of the project with Copenhagen University Hospital (CUH) and the inclusion of a pipeline to process signals from previous experiments are particularly noteworthy. These elements not only highlight the practical application of your research but also underscore the project's potential impact on patient care. The thoughtful consideration of ethical and practical challenges associated with BCI implementation in clinical settings is another strong point, demonstrating the project's commitment to responsible and patient-centered research. This project undoubtedly contributes valuable insights to the field and has the potential to inform future innovations in healthcare technology.

BI NOTES:
In section 2.3.2 Band-pass filtering, you forgot to remove a few lines with Danish text.

In part "Short-channel regression[19]" has the line *idk man this paper is difficult to understand*, which probably should be removed.

The section "Independent Component Analysis (ICA)" mentions "*..components of s are mutually statistically independent..*"; not sure what component s is.

After reading through your report, the word "assumption" is used heavily; could this be an issue in terms that you wanted to find the "optimal" solution, and "how accurately.." in your research questions? Also, in section 2.4, it mentions that there are other feature extraction methods which are outside your scope, which might be useful to write under your research question section to make the project scope more precise.

BONUS MIGHT BE HELPFUL

I read a bit in this scientific paper by Ja et al. `https://www.mdpi.com/2306-5354/10/12/1393` (10.3390/bioengineering10121393) from December 2023, and it gives a great review of what can be done (you could think about) in section 4 data pre-processing and 4.1.2 "Channel Selection and Feature Extraction". I hope this might be a help for you guys and girl :-)