Electrode Optimization for Home-Based Health Monitoring EEG Acquisition

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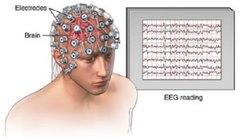
7th International Conference on Neurology and Epidemiology
19-20 March 2021
ICNE 2021 Virtual Conference

Introduction

- Epilepsy is the fourth most common neurological disorder with approximately 50 million cases worldwide, according to the World Health Organization[1].
- In Malaysia, an estimated 1% of overall population is epileptic patients, with 230000 diagnosed cases.
- Electroencephalogram (EEG) aids to detect abnormal activity in the brain and distinguish between generalized or focal seizures[5].
- Present EEG tests are often a laborious and time-consuming process as practitioners are required to attach numerous electrodes on the scalp of subjects and determine the electrodes that are necessary to obtain results with desired accuracy.
- These devices are neither conducive for home-based monitoring nor user-friendly.
- The proposed solution matches the current needs especially amidst the recent pandemic which has restricted travelling and emphasized social distancing.



A picture showing the main components of an electroencephalograph (EEG)
Source: http://somatosphere.net/2019/staging-seizure-the-chronic-contingency-of-epilepsy-diagnosis.html/

Objective

- This research is to optimize and validate the number of electrodes for EEG monitoring while establishing a potential home-based EEG recorder with mobile application enabler.

Method

- A literature search was conducted to identify the best optimization method used in EEG channel selection for portable EEG monitoring device development.
- The main inclusion criteria for the search results were limited to original journal articles published in the English language with abstracts and full texts that discuss the EEG electrode optimization among human subjects.
- Articles were filtered in three stages before being selected for the review.
- In the first stage, any article that did not meet the inclusion criteria based on the article title was removed. In the second stage, abstracts of the remaining articles were screened again, and papers that did not meet the selection criteria were discarded. Finally, the remaining articles were read carefully by two independent readers to remove articles that did not meet the selection criteria.
- Any conflicts of opinions between the reviewers were resolved through rationally mutual discussions.
- All data searching was done independently using a data search form. The search found five articles potentially related to the search criteria, of which three articles met the inclusion criteria.

Results

- All the three selected paper has used two-fold approach where the first step is to identify the features through signal decomposition, thresholding or obtaining sequence of observation using Gibbs sampler.
- The second step was to classify the identified features using machine learning classifiers such as non-dominated sorting genetic algorithm (NSGA) or naïve Bayes classifier.
- The result of the selected studies concludes that EEG electrode optimization is subject to the specific user requirement rather than one size that fit multiple needs.

An ideal EEG monitoring device with optimized channels.
Source: https://www.pinterest.com/pin/327003622922494326/

Conclusion

- In conclusion, this study proposes a personalized data driven modeling approach in EEG electrode optimization for the epilepsy patient home-based monitoring device development.

Acknowledgement

This poster was possible because of the work of Mohd Syakir Fathillah on Computerized Recognition of Epileptic Discharge algorithm and its clinical application. This work was funded by CREST R&D Grant under code CREST-2021-002.

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For more information about our group and to explore the prospect of a collaboration please visit our website @ http://www.ukm.my/pkas/creed/index.php