Anomaly Detection in Electroencephalography signals

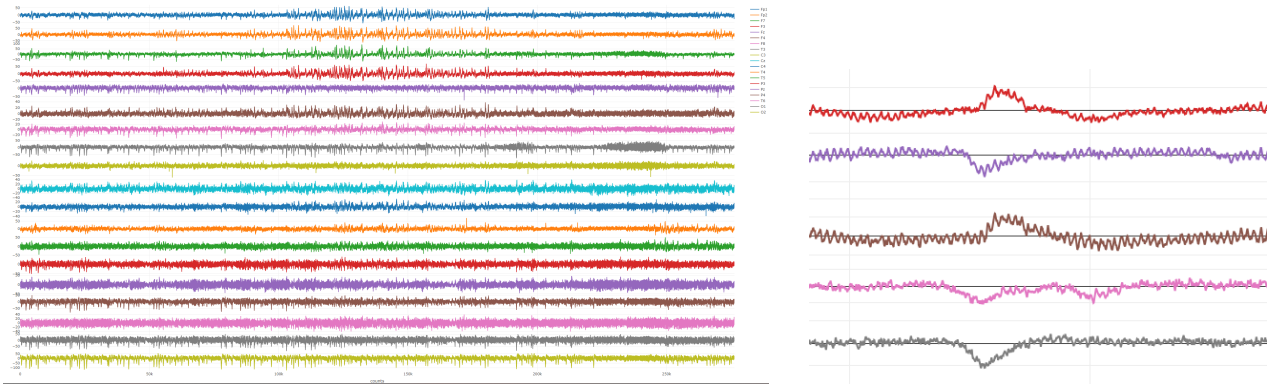

Figure 1: Full-scale graph of all 19 EEG signals and a region which might contain some changes.

Electroencephalography (EEG) plays a crucial role in understanding the intricate dynamics of brain activity. With the increasing volume and complexity of EEG data, the need for robust anomaly detection methodologies has become paramount. This research focuses on the development of a robust anomaly detection framework for all 19 EEG signals, emphasizing the critical consideration of change-point problems. Recognizing the dynamic nature of brain activity, we employ advanced statistical testing methods to detect significant deviations within the EEG data.

Our approach involves initial preprocessing steps, including noise reduction and normalization, followed by a systematic application of statistical tests to identify change-points indicative of abnormal brain patterns. Leveraging both univariate and multivariate techniques, our methodology aims to capture subtle variations in EEG signals that signify anomalous events (see [1], [2], [3], [4]). The approach has to be applied to EEG data of meditating Tibetan monks with the goal to detect up to 8 meditation phases.

References

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[2] D. Dresvyanskiy, T. Karaseva, V. Makogin, et al. Detecting anomalies in fibre systems using 3-dimensional image data. *Stat Comput*, 30:817–837, 2020.

[3] P. Kora, K. Meenakshi, K. Swaraja, A. Rajani, and M. Raju. Eeg based interpretation of human brain activity during yoga and meditation using machine learning: A systematic review. *Complement Ther Clin Pract*, 43, 2021.

[4] M. Libenson. *Practical Approach to Electroencephalography*. Elsevier Health Sciences, 2009.