CONCERTO: Coherence & Functional Connectivity Graph Network

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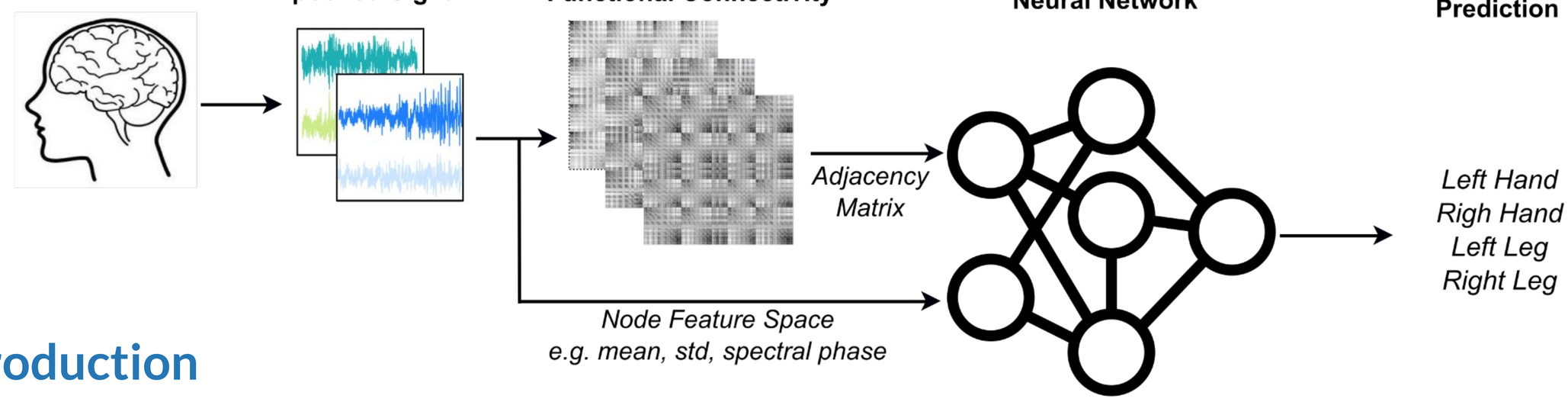
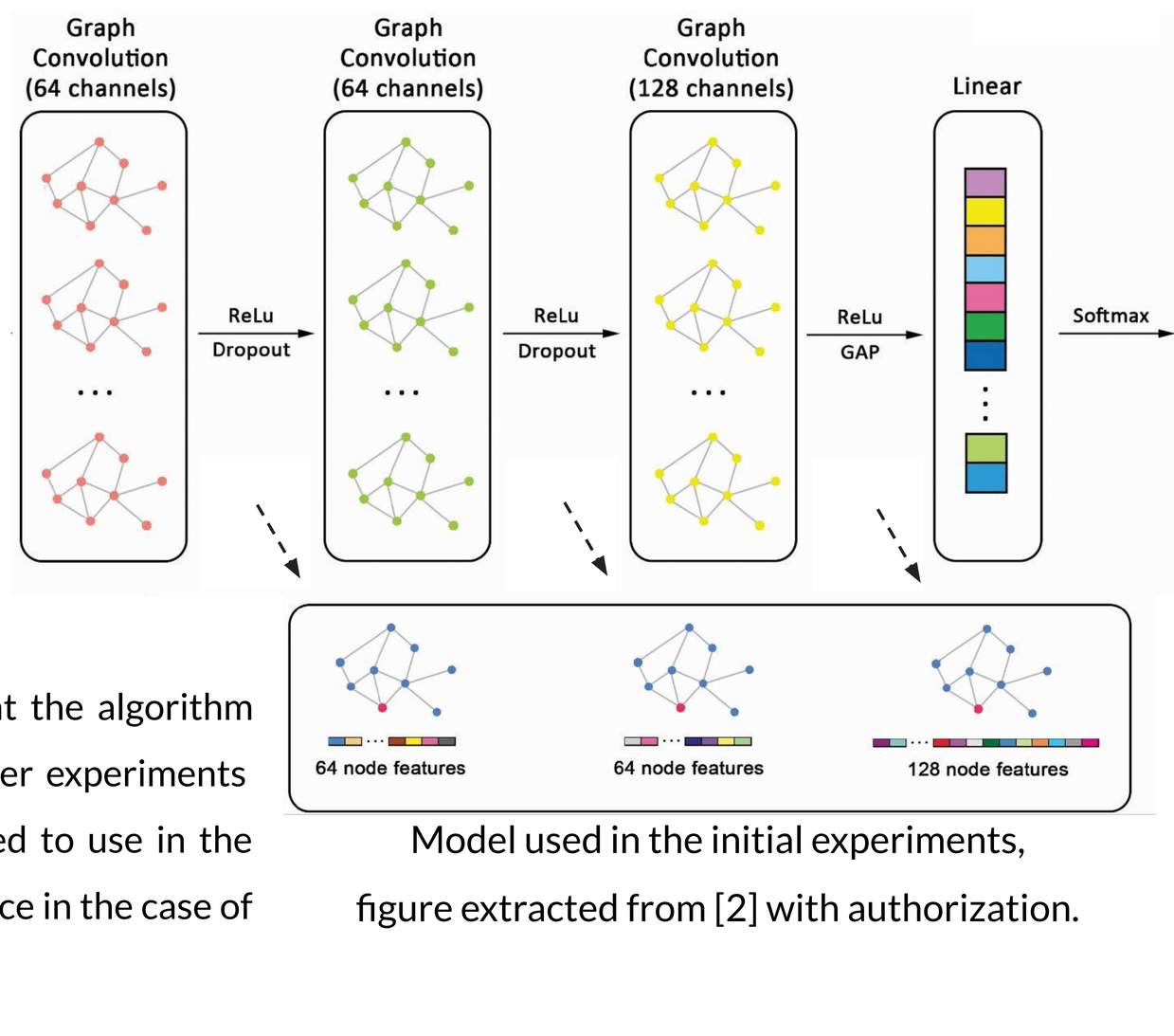


Introduction

Electroencephalography (EEG) is the most common non-invasive technique for measuring brain activity. It uses electrodes to capture the electric fields with high temporal resolution. However, analysing this data with machine learning presents several challenges, the most prominent one being the high inter/intra-subject variability (*i.e.* BCI inefficiency). One solution to tackle this challenge is to explore alternative features that capture additional types of information and help to better discriminate the subjects' mental state. For instance, complementary features that reflect ***interactions between brain areas***, rather than relying solely on local measurements has proven efficient [1].

Methodology

This study proposes a GNN classifier [2] method that combines FC information from various estimators like the Covariance, Instantaneous and Imaginary Coherence with traditional feature space such as raw EEG features, trial mean and standard deviation, and spectral phase for each electrode. The core feature of this network is **capture invariant spatial activation patterns**.



Model used in the initial experiments, figure extracted from [2] with authorization.

Preliminary Results

Preliminary results obtained with the High Gamma Dataset [3] show that the algorithm could successfully classify MI movements (above chance). However, further experiments are necessary to evaluate the trade-off of how much information we need to use in the node feature. At the moment, we are still on a journey to find the best balance in the case of BCI decoding.

References

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