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Representation Learning Methods for EEG Cross-Subject Channel Selection and Trial Classification

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Abstract

EEG is a non-invasive powerful system that finds applications in several domains and research areas. At the moment, most EEG systems require subjects to wear several electrodes on the scalp. However, a large number of channels might include noisy information, redundant signals, induce longer preparation times and increase the computational times of any automated system trying to classify EEG recordings. One way to reduce the signal-to-noise ratio and improve the classification accuracy is to combine channel selection with feature extraction. However, when dealing with EEG channel selection most of the efforts have been focused on identifying the most relevant channels in a subject-dependent fashion. In this paper we introduce a novel algorithm for subject independent channel selection of EEG recordings. In particular, the algorithm (i) exploits channel-specific Representation Learning Methods to compress signals from various channels, (ii) builds a unique representation of each trial by concatenating the channels' representations into a unique low-dimensional vector and (iii) selects from these vectors the most relevant channels to perform classification. After training, the algorithm can be exploited by (iv) transferring the parametrized subgroup of selected channel-specific RLMs to new signals and (v) obtain novel trial vectors to be fed to any kind of classifier. We tested the algorithm on a case study attaining extremely promising results when considering the complexity of subject independent channel selection.

Keywords: EEG Channel Selection, Representation Learning Methods, Cross-subject Channel Selection

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