Spatio-temporal methods for EEG analysis in cognitive neuroscience

Electroencephalography (EEG) records electrical activity from the brain by measuring the resulting potential differences across the scalp. It has a long tradition in both a clinical and neuroscientific setting, and recently it has also started being used for consumer-oriented applications. While EEG can be a useful tool, it can be difficult to decipher information from its raw signals. In this thesis I will present three projects with the common goal of analysing EEG in ways that both extract meaningful information and visualise it in intuitive ways. The first project describes how we took neuroscience out of the laboratory and into the classroom. We reproduced an attention-tracking paradigm in a classroom and simultaneously recorded the neural activity of up to nine people. We had a focus on using equipment that was wireless and portable as well being relatively low-cost and computational methods in a setup that is feasible to extend into everyday scenarios. The second project revolved around creating a toolbox for the research field of microstate analysis, with a focus on open access and transparency of the applied methods. The toolbox is followed by a methodological guide that reviews the most commonly applied algorithms in microstate analysis. In the final project I investigated the feasibility of using the complexity of EEG as a neural marker of conscious processing. This project spans two studies investigating the capability of EEG complexity in two different scenarios; while people are sleeping, and while navigating a helicopter simulator.

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