Abstract

Understanding the complex underpinnings of how the human brain processes the environment around it is one of the most important goals of modern-day neuroscience. While the ability to communicate and speak is one of the most fundamentally unique aspects of being human, the mechanisms by which it is enabled on a neurological level are relatively unknown. Advancements in brain imaging technology such as electroencephalography and magnetoencephalography (EEG & MEG) have greatly empowered researchers to isolate neural activity at the various stages of speech processing. However, the unstandardised and proprietary nature of brain data collection stands as an inhibitor to the use of modern data-driven analytic techniques such as machine learning.

The work presented in this dissertation, aims to develop a web-based neural analysis platform for both expert and non-expert users to analyse neural data (e.g., brain signals measured using EEG) using publically available, high quality data to simulate experimental conditions. Such a platform will allow the rapid prototyping and development of experiments in a user friendly, graphical environment that enables the user to determine the optimal configuration of new experiments. The brain imaging data stored on the platform will use the Continuous-event Neural Data format (CND) in order to encourage standardisation and replicability of results. In turn, this will give create the opportunity to explore the potential for big data analysis and more advanced machine learning techniques on brain signals in the future.

Additionally, this dissertation begins the development of a framework for implementing MATLAB code within a lightweight web application. This framework utilises modern web technologies in order to interact with the MATLAB code-base and serves as a proof-of-concept for future applications.