Abstract

Data Representation for Motor Imagery Classification

Andrew Festa, MSc

Rochester Institute of Technology

April, 2020

Supervisor: Jeremy Brown

While much progress has been made towards the advancement of brain-controlled interfaces (BCI), there remains an information gap between the various domains involved in progressing this area of research. Thus, this research seeks to address this gap through creation of a method of representing brainwave signals in a manner that is intuitive and easy to interpret for both neuroscientists and computer scientists. This method of data representation was evaluated on the ability of the model to accurately classify motor imagery events in a timely manner.

The proposed data representation of electroencephalographic signals in the form of signal images was found to be able to perform adequately in the task of motor-imagery. However, the amount of time to record enough samples was on the scale of a fifth of a second following the onset of an input from the user. This time delay represents the minimum window size needed to classify the event, meaning that to reduce this delay would require a fundamental shift in the data that is acted upon to perform classification or to generate the signal images. Furthermore, the system performed better than expected, even in the face of random data, suggesting that the system may be relying on some external factor or undesired artifact present in the data in order to perform its task.

The strength of this approach came from its ability to be understood, visually examined, and altered in near-real-time in order to explore the data captured during a

recording session. This was done after data had been recorded and involved altering sets of configuration parameters that affect the computations that go into generating a signal image. Namely, this included the window size, the function used to interpolate between two adjacent data points, and the amount of overlap of the windows. Effectively, this allows a researcher to playback the signal in an intuitive manner, watching for large shifts or edges in the images in order to detect large changes in the underlying data stream. Thus, while this approach may be unsuited for the task of classification, it would be an effective tool for conducting exploratory data analysis.