Announcing the Final Examination of Allen Rahrooh for the degree of Master of Science

Time & Location: April 3, 2019 at 10:00 AM in Business Administration I 146

Title: Classifying and Predicting Walking Speed from Electroencephalography Data

Electroencephalography (EEG) non-invasively records electrocortical activity and can be used to understand how the brain functions to control movements and walking. Studies have shown that electrocortical dynamics are coupled with the gait cycle and change when walking at different speeds. Thus, EEG signals likely contain information regarding walking speed that could potentially be used to predict walking speed using just EEG signals recorded during walking. The purpose of this study was to determine whether walking speed could be predicted from EEG recorded as subjects walked on a treadmill with a range of speeds (0.5 m/s, 0.75 m/s, 1.0 m/s, 1.25 m/s, and self-paced). We first applied spatial Independent Component Analysis (sICA) to reduce temporal dimensionality and then used current popular classification methods: Bagging, Boosting, Random Forest, Naïve Bayes, Logistic Regression, and Support Vector Machines with a linear and radial basis function kernel. We evaluated the precision, sensitivity, and specificity of each classifier. Logistic regression had the highest overall classification rate, (76.6 ± 13.9%) and had the highest precision (86.3 ± 11.7%) and sensitivity (88.7 ± 8.7%). These classification rates are relatively good since the EEG data had only been high-pass filtered with a 1 Hz cutoff frequency and no extensive cleaning methods were performed. The Support Vector Machine with a radial basis function kernel has the highest specificity, (60.7 ± 39.1%). All of the classifiers had an overall classification rate of at least 68% except for the Support Vector Machine with a linear kernel, which had an overall classification rate of 55.4%. These results suggest that applying spatial Independent Component Analysis to reduce temporal dimensionality of EEG signals does not significantly impair classification of walking speed using EEG and that walking speeds can be predicted from EEG data.

Major: Biomedical Engineering

Educational Career:
Bachelor's of Biomedical Engineering, BS, 2017, University of Cincinnati

Committee in Charge:
Helen J. Huang, Chair, Mechanical and Aerospace Engineering
Hsin-Hsiung Huang, Department of Statistics
Mohtashem Samsam, Burnett School of Biomedical Sciences

Approved for distribution by Helen J. Huang, Committee Chair, on March 19, 2019.

The public is welcome to attend.