4-9-2015

Brain Machine Interface for a Robotic Arm

Matthew Thomas Cusumano
*University of Dayton*, stander@udayton.edu

Mark J. Edmonds
*University of Dayton*, stander@udayton.edu

Daniel P. Prince
*University of Dayton*, stander@udayton.edu

Andrew J. Sutter
*University of Dayton*, stander@udayton.edu

Follow this and additional works at: [http://ecommons.udayton.edu/stander_posters](http://ecommons.udayton.edu/stander_posters)

Part of the [Arts and Humanities Commons](http://ecommons.udayton.edu/stander_posters), [Business Commons](http://ecommons.udayton.edu/stander_posters), [Education Commons](http://ecommons.udayton.edu/stander_posters), [Engineering Commons](http://ecommons.udayton.edu/stander_posters), [Life Sciences Commons](http://ecommons.udayton.edu/stander_posters), [Medicine and Health Sciences Commons](http://ecommons.udayton.edu/stander_posters), [Physical Sciences and Mathematics Commons](http://ecommons.udayton.edu/stander_posters), and the [Social and Behavioral Sciences Commons](http://ecommons.udayton.edu/stander_posters)

**Recommended Citation**


[http://ecommons.udayton.edu/stander_posters/640](http://ecommons.udayton.edu/stander_posters/640)

This Book is brought to you for free and open access by the Stander Symposium at eCommons. It has been accepted for inclusion in Stander Symposium Posters by an authorized administrator of eCommons. For more information, please contact frice1@udayton.edu, mschlangen1@udayton.edu.
**Brain Machine Interface for Robotic Arm**

**Purpose**

The purpose of this project was to expand the capabilities of an existing interface of controlling a static robotic arm with brainwaves. Brainwaves are collected with an Emotiv EPOC headset. The Emotiv headset utilizes electroencephalography (EEG) to collect the brain signals. This project makes use of the Emotiv software suites to classify the thoughts of a subject as a specific action. The software then sends a keystroke to the robotic interface to control the robotic arm. The team was to identify actions for mapping, implement these chosen actions, and evaluate the system’s performance. The actions chosen and their implementation would also test the limits of the interface, and provide groundwork for future research. This project is intended to aid those with disabilities.

**Data Collection**

1. 2 minute collection periods to focus on the transition between a neutral state and a single gesture
   a. Instance of gesture being tested every 5 seconds, held for 1 second
   b. User is in the neutral state between 5 second instances

**Signal Processing**

Signal processing is an incredibly important process in this problem. After collecting multiple data sets consisting of unique gestures (thinking left, right, neutral), the data is exported to MATLAB. Linear Feature Extraction is then run on the data to identify actions based on what may or may not be certain characteristics of the user’s brain activity. The current system allows for the recognition of two different actions, right and neutral. These actions are translated into movements for the robotic arm.

**Equipment**

The BMI system uses EEG to collect the brain signals. EEG is a non-invasive method for collecting electrical brain signals. It offers high temporal resolution, portability, and low cost. Other systems are not portable and are very sensitive.

MATLAB was used as the main signal processing software for signal classification. The current MATLAB signal processing occurs offline.

**Initial Results**

- System is able to separate two gestures
- Separating gestures means the system can classify thoughts
- These classified thoughts will be mapped to robotic arm movements

**Future Development**

Future goals for this project are:

- Research Linear Feature Extraction
- Implement into current system
- Help disabled individuals or workers to complete dangerous tasks
- Find deviations in brain waves of people with autism, depression, etc.
- Enable real time MATLAB processing