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EEG Action Encoding

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**EEG Action Encoding**

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## Emotion Recognition

Develop methods to incite emotional responses in detecting unique brainwave signatures through electroencephalograph (EEG) recordings

Optimize various noise-reduction, feature extraction, and classification algorithms

Create a real-time brain-computer interface compiling all methods and algorithms for emotion detection and recognition

## Data Acquisition

**EPOC neuroheadset by Emotiv**
- TestBench software
- Complete software for gathering, displaying, and analyzing electroencephalograph (EEG) data.
  - The Expressiv Suite is used to detect a user’s facial expression
  - The Affectiv Suite can be used to detect a user’s emotional state
  - The Cognitiv Suite can be used to read and interpret a user’s thoughts
- 16-channel EPOC neuroheadset
- Windows 7 64-bit data acquisition computer

## Procedure

The procedure is as follows:

1. Identify a set of simple actions that can be applied to the manipulation of a robotic arm.
2. Obtain EEG data corresponding to test subject’s thinking of performing each of the simple actions defined in the set.
3. Analyze the variations in source locations in each case with respect to the normal case.
4. Establish a metric of source locations and variations in locations for each of the simple actions in the set.
5. Obtain the source locations and variations with the new set of EEG test data.
6. Classify the action that created the new set of EEG data into an action based on the source locations and variations in locations.

## Various Actions to Map

- Lift/Lower
- Move (Left/Right)
- Rotate (Clockwise/Counterclockwise)
- Grab/Release

## Applications and Future Research

- Assist handicapped workers
- Communicate with coma patients
- Track a user’s emotional state
- Respond to a user’s feelings
- Use thoughts to run applications

## General Flow of Data

1. **Brain Thinking**
   - "Lift"
   - Action is classified as "Lift"
2. **Encoding of the command "Lift" sent to a robot**

## Data Acquisition Procedure

Setting up the system requires several minutes of preparation, including setup on the participant.

- **System startup**
- **Experimental acquisition setup**
- **Participant setup**
  - Soaking Sensor Sponges in contact solution
  - Application of the headset on participant
  - Proper contact of electrodes to system
- **Final System Check**
  - This is to ensure correct and valid results for our data acquisition. We will commence preliminary checks in the place of acquisition to make sure electrical noise will be at a minimum. We will also need a preliminary check of system data acquisition to correct noise from movement of the subject and/or the environment during the experiment.