

Experimental Design Proposal - Team 2

1. Can we create a brain-computer interface (BCI) that controls the movement of a model car successfully navigate the car through a maze?
2. We can create a BCI that controls the movement of a model car through EEG processing and machine learning.
3. Response time, false activation rate (how accurately can we predict that user is looking at the right option), error rate, mission time, concentration time, correct signal classification rate
4. a. All these can be reliably and accurately measured. These are all well-defined metrics that

b. Methods of evaluating metric:

- Response/concentration: time (how fast can we get response from BCI)
- False activation rate: activated even though user did not intend to
- Error rate: if wrong option is selected
- Classification rate: how accurately can we predict that user is looking at the right option
- Car is able to move

c. Variability may result from: person being tested, EEG noise

5. a. **How the experiment will test the hypothesis:**

- Test subjects: Group members and potentially other participants
- We will be able to classify forward, backward, forward+left, forward+right, backward+left, backward+right signals
- If the brain signals can be classified such that the car moves according to the user's desire, the experiment will be successful
- Maze sets an objective and measurable "intention" for each test subject

b. Possible outcomes:

- Successful (arbitrarily chosen 70% minimum classification rate) or unsuccessful classification of brain waves for each direction => possible successful navigation of the maze => successful experiment

c. Confounding factors, biases, etc:

- False positives in training classifier

Data Flow:

- What is eliciting a signal from the subject?

The option they look at on screen

- How are you physically collecting the signal from the subject?

The EEG headset

- How/what is communicating the signal digitally?

SSVEP

- Is the signal filtered? Digitally? Physically?

Digitally, through ML

- How is the signal being organized/restructured? What is doing it?

Machine Learning - the signal is being organized through an analysis of which brain wave responds to which option and it's being restructured through signal processing, filtering, and SSVEP. The signal's output is the movement of the car.

- What is processing the signal? How is it being processed?

We will use statistical signal processing techniques to process the signal that is collected from the BCI

- Is the signal stored for any reason? How is the stored signal structured? Is it raw or processed?

Processed, because we need to decode the wave that

Collected by and stored in user interface - signal associated with a particular input (option on menu) is stored for the next time that same option is selected?

- Is the signal part of a feedback loop?

NO