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The BCI Pipeline

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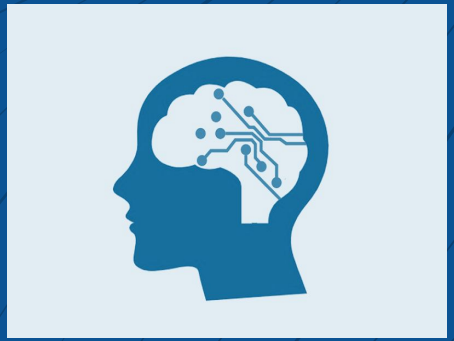

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Ice Breaker Activity

Say your name and an artist that you've been listening to non-stop recently or a song you really like right now!

Questions

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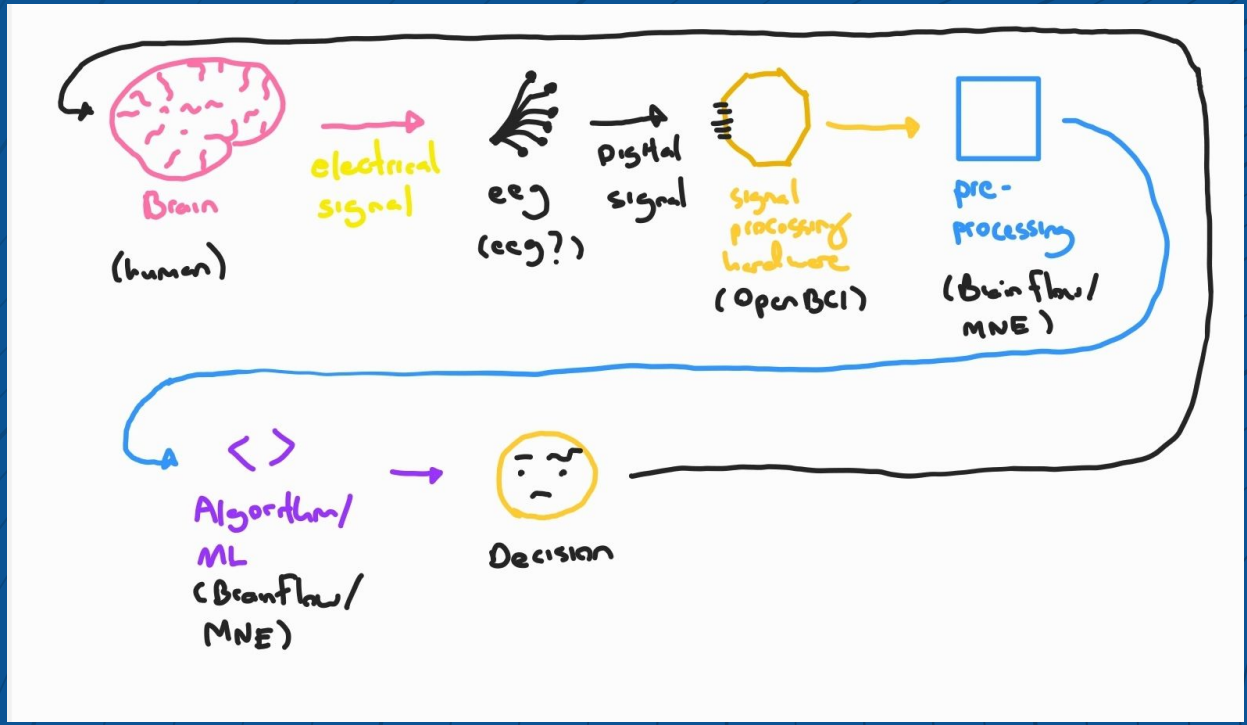
1. Could you clarify the resources that we have available for the projects if we get on to the teams?
2. I know that you aim to build a BCI to interpret action potentials, but specifically what are you trying to accomplish with the interpreted signals?
3. I'm fairly new the BCI and EEG concepts so I did have a small question about the Muse vs Open BCI. I noticed that the muse went around the front of your head (the forehead area) while the Open BCI had electrodes on the top/back of your head. Is there any difference in signals that are received between the two or a reason why the locations were different in the demo?

The Pipeline



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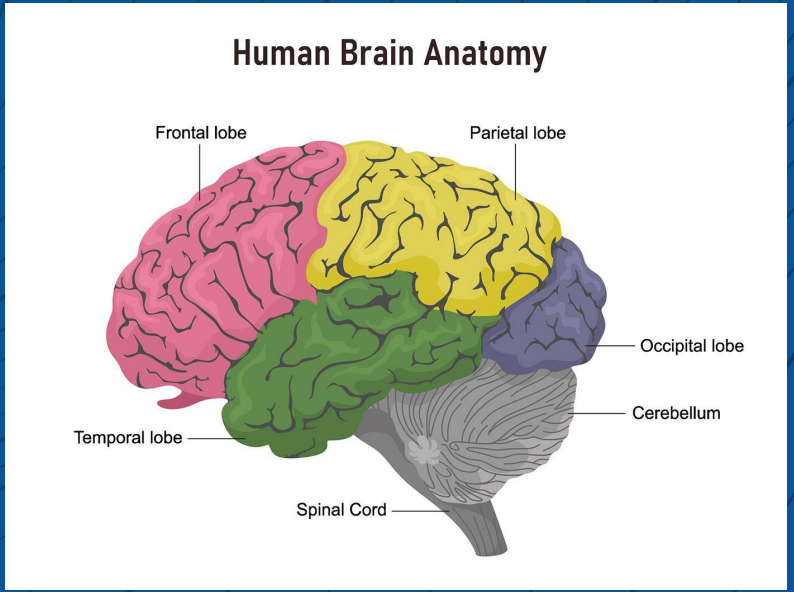
The Brain:

- Produces electrical signals internally that are picked up from the scalp by the EEG



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EEG: electroencephalogram

- The EEG is neuroimaging device we use to record brain waves
- A very popular choice for BCI's due to simplicity and ease of use
- EEG (analog signal) -> OpenBCI (digital signal)

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Pop Quiz

Where will the signal travel next 🤨

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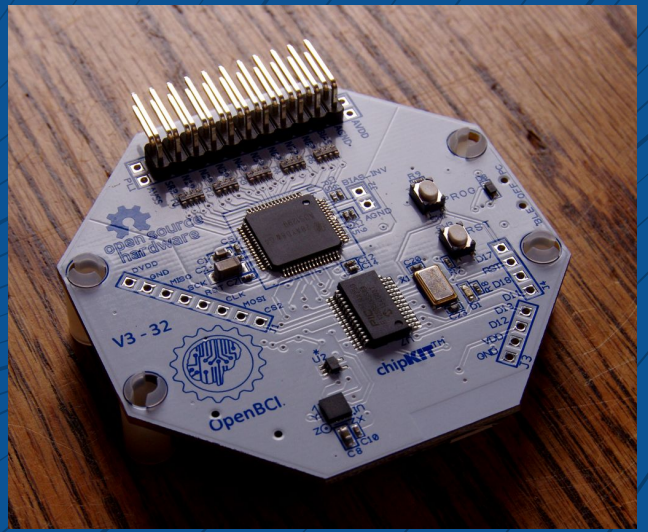
Signal Processing Hardware: OpenBCI

- The signal processing hardware is a crucial step of the process
- The OpenBCI is a prime candidate for our use case because of its open source nature and high compatibility
- Sampling frequency
- OpenBCI (digital signal) -> Preprocessing (digital signal to be read by the computer)



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Pop Quiz

What methods are we using for signal acquisition 🤨

What is the purpose of the OpenBCI hardware an intermediary between the EEG and the computer 🤨

How is the signal being converted from OpenBCI to the next step in the pipeline 🤨

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Preprocessing: Brainflow/MNE

- Brainflow and MNE are both highly advanced python libraries designed to take, read, and process brain activity data
- Preprocessing mainly consists of filtering the data such that it is in a usable state to feed into the next step of the process
  - Bandpass filter
  - High Pass
  - Low Pass
- Preprocessing occurs in both hardware and software
- Preprocessing (digital EEG signal) -> Processing (internal python data structures)

Brainflow logo

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Pop Quiz

Where will the signal travel next 🤨

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Algorithm/Processing: Brainflow/MNE

- The algorithm/processing stage of the process consists of processing the data to tell us what we want
- In most cases, this will be to the end of creating some sort of classifier
- Processing (internal python data structures) -> Decision

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What is a Classifier

A classifier is a model that is able to discriminate between different types of inputs. In our case we want out BCI to be able differentiate between different types of signals and artifacts.

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Decision

- The decision phase of the pipeline where the BCI makes a judgement regarding the data it has been given
- For example, in the BCI we were working on last year, the BCI looked for changes in brain activity based on two different frequencies and rendered a binary decision based on that
- It is important to note that this will loop back to the the first step

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Any Questions?

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NEXT MEETING:

INTRO TO MACHINE LEARNING

Thank you for coming!
Don't forget to sign in before you leave :]

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