

Non-invasive versus invasive BCI: decoding and stimulation

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Research Question

Brain computer interfacing involves three steps – recording brain signals using a large number of sensors, processing them in real-time to decode some variable (such as motor intention), and then using this output to control an external device such as a wheelchair or to stimulate the brain for restoration of lost function or rehabilitation. However, both decoding and stimulation can be done using a variety of non-invasive (such as EEG and transcranial current stimulation) as well as invasive (microelectrode recordings and micro-stimulation) approaches. How much improvement do invasive implants offer compared to non-invasive techniques, in both recording and stimulation paradigms? **The main goal of this project is to compare the performance of invasive versus non-invasive decoders/stimulators.** We will use invasive implants (Eg: Utah arrays) and EEG recording system while non-human primates and human subjects are engaged in identical stimulus and behavioral paradigms, which will allow us to assess the improvement in doing invasive recordings. We will also stimulate the brain, both using non-invasive versus invasive techniques. Then we will use state-of-the-art decoding algorithms to compare the performance of these recording and stimulation paradigms.

Preferred background

Electrical Engineering, Signal Processing, Computer Science, Mathematics, Neuroscience.

For more information, see:

<https://www.cns.iisc.ac.in/sray/>

<https://ece.iisc.ac.in/~cmurthy/>