Investigating characteristics of Cortical Activity using Deep Brain Stimulation (DBS)

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Introduction

> Parkinson's disease
  - Degradation of dopamine producing neurons in Substantia Niagra
  - Cause is unknown, Less dopamine is produced
  - Symptoms
    > Loss of smooth movement and postural stability
  - 10 million have Parkinson’s Disease
  - 100,00 treated by DBS

> DBS
  - Decrease symptoms
  - Negative Side Effects
  - Globus Pallidus
  - Electrical Stimulation
  - Future
Electrocorticography (ECoG)

- Electrode is put on surface of brain
  - tracks electrical potentials
- Brainwaves
  - Delta, Theta, Alpha, Beta, Gamma
  - 0.25-250 Hz
- Goal to clean and analyze data
- Motor Cortex
How does deep brain stimulation affect the motor cortex?
Data collection

- Used DBS to stimulate and ECoG to collect data
- DBS placed near the Globus pallidus
- ECoG near motor cortex
- **Stimulation protocol**
  - 4 minutes control test
  - 0.5 seconds stimulation
    - 60 pulses total at 144 Hz
  - 1.5 seconds rest
  - 1, 2, 3, or 4 mA
  - Recorded on ECoG

Figure (1) Example of pulse duration
Cleaning Data

> Filters

- Re-referenced
- De-spike
- High Pass, Low Pass (0.5-250 hz)
- Notch Filters (60,120,180 hz)
Results

Figure (2) Neural data from channels before and after cleaning
Results

Figure (3) Power Spectrum
Conclusion

What do the results mean?
- Increased brain activity in motor cortex
- Side effects

Future paths
- Activity in rest of cortex
- Precision and decrease side effects
- Other systems
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