

LFP Data Analysis Project

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1 Introduction

Welcome to the LFP Data Analysis project! This project involves analyzing Local Field Potential (LFP) data collected from an experiment with a rat. The data consists of 120 trials recorded from 3 different brain regions. Each trial contains 6000 samples, with a sample rate of 2000 Hz, resulting in 3 seconds of data per trial. The data includes both the recorded neural activity (`channelData`) and information about trial timing (`digitalByte`).

2 Overview

This project includes the following steps:

1. **Data Loading and Exploration:** - Load the LFP data file. - Print the size of the `digitalByte` vector and `channelData` matrix. - Plot the `digitalByte` vector to visualize trial timing.
2. **Preprocessing Techniques:** - Apply preprocessing techniques such as filtering, artifact removal, and baseline correction to the LFP data.
3. **Power Spectral Density (PSD) Analysis:** - Compute the PSD of Event-Related Potentials (ERPs) for each brain region. - Compare the PSD results to Event-Related Spectral Perturbations (ERSPs) to understand frequency dynamics.
4. **Weighted Phase Lag Index (WPLI) Calculation:** - Calculate the WPLI to analyze the phase synchronization between different brain regions.

3 Usage

To use this project:

1. **Data Preparation:** - Ensure the LFP data file (`sessionData.mat`) is available in the project directory.

2. **Running the Code:** - Run the Python scripts corresponding to each step in the analysis process.

4 Dependencies

This project requires Python 3.x and the following libraries:

- numpy
- scipy
- matplotlib
- mne (for EEG/MEG data analysis)
- mayavi (for 3D plotting)

You can install these dependencies using pip:

```
pip install numpy scipy matplotlib mne mayavi
```

5 Contributing

Contributions are welcome! If you'd like to contribute to this project, please fork the repository, make your changes, and submit a pull request.

6 Contact

For any questions or feedback, feel free to reach out to adel.mov1382@gmail.com.