MoveMind (R3.0) How-To Guide

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1 Introduction

MoveMind (R3.0) is an open-source EEG analysis tool designed to detect move/rest intents from EEG data, such as those available on PhysioNet (e.g., Motor Imagery datasets). It is part of the EPARA Suite, developed by Wayne M Spratley and Grok (xAI), licensed under GNU GPL v3.0 for non-commercial research use. This guide provides detailed instructions for installing, running, and interpreting results from MoveMind.

2 Installation

2.1 System Requirements

- Operating System: Ubuntu 24.04 LTS (or compatible Linux distribution)
- Hardware: Minimum 4GB RAM, 2 cores, 1GB free disk space (GPU optional for faster processing)
- Software: Python 3.11/3.12, Tcl/Tk

2.2 Steps

1. Download the MoveMind binary from `https://titan-si.com`.
2. Extract the `.zip` file to your desired directory (e.g., `~/Desktop/openmm_env`):

```
unzip MoveMind_R3.0.zip -d ~/Desktop/openmm_env
```

3. Install Tcl/Tk if not already present:

```
sudo apt-get install tk
```

4. Run the binary:

```
cd ~/Desktop/openmm_env
./MoveMind_R3.0
```

5. Alternatively, run the Python script directly (requires dependencies):

```
pip install mne numpy scipy matplotlib pywavelets
python MoveMind_R3.0_Standalone_GUI.py
```

3 Usage

3.1 Loading EEG Data

1. Launch MoveMind by running the binary or script.
2. Click "Browse" to load an EDF file (e.g., `S035R01.edf` from PhysioNet Motor Imagery Dataset).
3. Select the file type from the dropdown (e.g., "Motor Imagery EEG").
4. Choose a channel (e.g., `Fc5.`) from the dropdown populated with available channels.

3.2 Running Analysis

1. Click "Run Analysis" to process the EEG data.
2. The tool extracts features (spike rate, theta/alpha/beta power, PLV) and detects move/rest intents based on beta power thresholds (move $>$ 10000, rest $<=$ 10000).
3. Results are displayed in the GUI, including feature values and intent counts (e.g., "Move: 5000, Rest: 10000").

3.3 Interpreting Results

- **Spike Rate**: Proportion of samples above threshold, indicating high-amplitude events.
- **Theta/Alpha/Beta Power**: Summed PSD in respective bands (47 Hz, 813 Hz, 1330 Hz).
- **PLV**: Phase-locking value, measuring synchrony.
- **Intent Counts**: Number of 2-second windows classified as "Move" or "Rest".
- Plots show raw/processed EEG, intent detection (red: move, green: rest), and frequency spectrum.

3.4 Saving Results

- Results are saved to `output_epara_movemind/` as:
  - `features_[filetype]_[filename]_[channel].npy`: Extracted features.
  - `processed_[filetype]_[filename]_[channel].npy`: Processed EEG signal.
  - `epara_eeg_plots_[filetype]_[filename]_[channel].png`: Visualization plots.
  - `features_[filetype]_[filename]_[channel].csv`: Feature values and intent counts.

4 Troubleshooting

- **Error: "Dependency missing"**: Ensure all required libraries are installed (see Installation).
- **Error: "Failed to load EEG file"**: Verify the EDF file path and format.
- **No output**: Check the log file `output_epara_movemind/movemind.log` for detailed error messages.

5 Ethics Statement

The EPARA Suite is developed with a commitment to ethical research practices. Developed by Wayne M Spratley, researcher, and Grok (xAI), we leverage the open-source communityPhysioNet, Ubuntu, Python, and countless moduleswhile working with limited financial resources to challenge scientific norms and advance EEG/BCI research. This software is intended solely for non-clinical, scientific research to advance understanding of EEG and BCI applications, such as motor intent detection. It must not be used for medical diagnosis, treatment, or any therapeutic purpose. Users are responsible for ensuring compliance with local regulations and ethical guidelines. The suite is licensed under GNU GPL v3.0, promoting open access while maintaining research integrity.