

EPARA Classify (R3.0) How-To Guide

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1 Introduction

EPARA Classify (R3.0) is an open-source EEG classification tool designed to classify EEG data as normal, epilepsy, or Parkinsons-like using logistic regression, leveraging features extracted from EEG signals. 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 EPARA Classify.

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 EPARA Classify binary from <https://titan-si.com>.
2. Extract the .zip file to your desired directory (e.g., ~/Desktop/openmm_env):

```
unzip EPARA_Classify_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  
./EPARA_Classify_R3.0
```

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

```
pip install mne numpy scipy matplotlib pywavelets scikit-learn  
python EPARA_Classify_R3.0_Standalone_GUI.py
```

3 Usage

3.1 Loading EEG Data

1. Launch EPARA Classify 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., "Normal 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 classifies the EEG as "Normal," "Epilepsy," or "Parkinson's" using a pre-trained logistic regression model.
3. Results are displayed in the GUI, including feature values and the classification result.

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.
- **Classification:** Predicted state ("Normal," "Epilepsy," or "Parkinson's") based on logistic regression.
- Plots show raw/processed EEG, classification result, and frequency spectrum.

3.4 Saving Results

- Results are saved to `output_epara_classify/` as:
 - `features_[filetype]_[filename]_[channel].npz`: Extracted features.
 - `processed_[filetype]_[filename]_[channel].npz`: Processed EEG signal.
 - `epara_eeg_plots_[filetype]_[filename]_[channel].png`: Visualization plots.
 - `features_[filetype]_[filename]_[channel].csv`: Feature values and classification result.

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_classify/epara_classify.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 EEG classification. 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.