



# Synapse

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The Neuro-Tech Challenge

PARSEC 6.0 | IIT DHARWAD

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# Background

It is the Final Battle at Hogwarts. A malicious wizard materializes in front of you. You instinctively raise your wand—but so does he. You are locked in a duel. Yet this is no ordinary duel! The sparks shift in colour. **Golden streaks of light erupt**, surrounding you and illuminating the battlefield.

**It's Priori Incantatem!**

You share the same feather core as him in your wand.

You glance around as echoes begin to rise from the golden mesh—spectral remnants of the innocent victims claimed by your opponent's wand. The echoes encircle you both.

**Invisible waves crash against you**, carrying something more than sound. **They are communicating**—revealing a way to escape, **a way to fracture your opponent's will!**

You are receiving the **signals**!

But what do they mean? Can you interpret them and decode the message hidden within?

# Your Task!

**Design a gesture classification model capable of mapping 8-channel sEMG input windows to gesture class labels.**

Train the model using the provided training dataset only.

Submit the trained model and inference pipeline, following the specified submission format.

*The gestures hold the key to your victory and the weapon to break your opponent's will.*

# Dataset

The dataset contains **raw surface electromyography (sEMG) data of 5 different hand gestures** performed by 25 subjects across multiple days, stored in a CSV file for each subject.

Each file contains sEMG data of **8 sEMG channels** placed on the forearm for each gesture.

Each data sample corresponds to a **fixed-length temporal window** of synchronized sEMG signals from all eight channels, along with a single ground-truth gesture label.

Refer to the README attached in the dataset for further information.

Dataset Access Link: <https://drive.google.com/file/d/16iNEwhThf2LcX7rCOVM03MTZiwq7G51x/>

# Deliverables

## Executable Model & Code Artifacts

- **Readme file** - A Comprehensive readme file clearly detailing on approach, model design, file structure of submission and how to infer given saved model.
- **Complete codebase** - Jupyter notebooks or python scripts
- **Dependency specifications** - `requirements.txt` file
- **Trained model artefacts** -model save (.pth or other), configuration files and preprocessing parameters
- **Inference Scripts** along with usage instructions.

## Analytical Report: Signals, Model and Methods

- A **LaTeX-based technical report** detailing :
- The interpretation of the received signals - explain the **nature of the signals** and the **signal processing techniques** applied.
  - The **machine learning training approach** used and the chosen **model architecture** .

Emphasis should be placed on the rationale behind each methodological choice and the inferences drawn from the processed signals.

# Evaluation Protocol

The submitted models will be evaluated by the organizers on unseen test dataset.

**Primary ranking will be determined by performance on the hidden test dataset.**

**In case of closely matched scores**, higher weight will be given to:

- Model Accuracy
- F1 Score
- Model Complexity and number of parameters

**Evaluation weightage will be equally distributed** between the Technical Implementation submission and the Signal Interpretation & Methodology Report.

Any evidence of data leakage or use of unauthorized datasets will result in disqualification (yes, we will notice).