Human Activity Recognition (HAR) Project

This project involves the development and evaluation of machine learning models to classify human activities using time-series sensor data. The models are tested across various class configurations (2-class, 4-class, 7-class), with and without regularization, and include grid search and visualization components.

📁 Model Training Notebooks

These notebooks serve as the **initial phase** of the pipeline, where various models are trained and evaluated to determine the best-performing one before proceeding to fine-tuning or deployment.

1. Project_research_2class.ipynb

- Trains a classifier to distinguish between two activity classes.
- Includes feature extraction using statistical and frequency-domain methods.
- Uses standard classification techniques (e.g., Random Forest, SVM, etc.).

2. Project_research_4class.ipynb

- Similar approach as the 2-class model, extended to four activity categories.
- Evaluates model performance on this more complex classification problem.

3. Project_research_7class.ipynb

- Full 7-class classification setup.
- Implements preprocessing, model training, and performance evaluation.

📁 Models Without Regularization

4. RF2Class.ipynb

- Improves accuracy of binary class model after utilizing 5 - fold cross validation and best parameters.
- Focused on identifying overfitting risks for 2-class classification.

5. RF4Class.ipynb

- Same as above, but for the 4-class model setup.

6. RF7Class.ipynb

- Same comparison setup for the full 7-class problem.

📁 Optimization & Testing

7. GridSearchHAR.ipynb

- Performs hyperparameter tuning using `GridSearchCV` and `RandomSearchCV` on the selected models.
- Helps identify the best combination of model parameters.

8. Test_7class.ipynb

- Conducts final testing on the 7-class model using unseen test data (HARTH).
- Includes accuracy, confusion matrix, and other performance metrics.

📁 Visualization

9. Visualization.ipynb

- Visualizes raw sensor signals and distribution.

Getting Started

Prerequisites

Ensure the following libraries are installed:

```
pip install numpy pandas matplotlib seaborn scikit-learn scipy
```