# cdl1 concept

# Sensor Based Activity Recognition Challenge Concept

Authors:

- Nils Fahrni
- Noah Leuenberger
- Dominik Filliger

## Goal

The objective is to classify activities based on movement data from a mobile device, aiming to recognize 5 movement profiles:

- Standing
- Sitting
- Walking
- Running
- Climbing stairs

### Accuracy

The target is an accuracy (F1-Score Macro) of 95%, chosen due to similar results in related studies. The F1-Score Macro is preferred for its equal weighting across all classes.

Sources:

- Performance Analysis of Smartphone Sensor Behavior for Human Activity Recognition
- Related ScienceDirect Article

## Project Scope

### Objectives

- Develop at least one Machine-Learning model and one Deep-Learning model.
- Implement MLOps using wandb.
- Utilize DVC and S3 Storage for data management.
- Collect data using sensors: Accelerometer, Gravity, Gyroscope, Orientation sensor.

# Milestones

| Task | Deadline |
|---|---|
| Concept planning, data collection, and initial processing | 2024-03-15 |
| Pipeline and data engineering | 2024-03-25 |
| Prototype ML and DL models | 2024-04-10 |
| Model evaluation and tuning | 2024-05-15 |
| Model comparison report | 2024-05-25 |
| Codebase finalization and submission preparation | 2024-06-13 |
| Project submission | 2024-06-14 |
| Presentation | TBD |

# Data Management

## Backup and Labeling

- Data collection via Sensor Logger.
    - Metadata
        - OS Platform (Android and iOS)
            - Device (specific phone model)
        - Sample Rate
        - Label (title)
- Data exported as zipped CSVs into structured cloud storage.

## Processing and Modeling

### Approach to Tracking

- Using the Sensor Logger, there are clear instructions on how we will record the data:
    - Device has always to be in a pants/jeans pocket.
        - For this teams recordings, we will exclusively use the front side pockets.
        - To prevent too much bias, multiple different orientations are recorded.

### Preprocessing

- Crop recordings to eliminate noise from setup activities.
- Resample data for consistency across devices if necessary.
- Segment data into uniform sequences/windows.
- Interpolate missing data.

### Feature Engineering

- Utilize Frequency Domain-Transformation (FFT, STFT etc.) for frequency extraction.
- Apply simple aggregations and smoothing for feature generation.

### Modeling

- Train and evaluate various ML and DL models (at least one each).
- Perform hyperparameter tuning.
- Compare model performances.

## Deliverables

- A Git repository.
- The collected dataset.
- A presentation detailing findings, methodologies, and learnings.