Predicting dangerous driving behavior

Aggressive driving is strongly associated with fatal crashes, accounting for >50% of deadly crashes in one analysis of a recent 4-year period. This makes early detection useful for safety intervention and for future autonomous driver coaching.

Use a machine learning model (based on one of the models that we learn in class) that can classify driving behavior as SLOW / NORMAL / AGGRESSIVE.
This is a supervised multi-class classification problem.

Dataset:

Download dataset from: https://www.kaggle.com/datasets/outofskills/driving-behavior?resource=download

Features:

- Accelerometer: accel_x, accel_y, accel_z (m/s^2)
- Gyroscope: rot_x, rot_y, rot_z (°/s)
- timestamp (s)

Target label:

- driving_style ∈ {SLOW, NORMAL, AGGRESSIVE}

Evaluation Metrics:

Metric	Meaning	Why it's useful
Accuracy	The proportion of total predictions that are correct across all classes.	Provides an overall sense of model performance.
Precision	Of all samples predicted as a given class (e.g., AGGRESSIVE), how many are correct?	High precision means fewer false alarms and more reliable positive predictions.
Recall (Sensitivity)	Of all true samples of that class, how many did the model detect?	High recall means fewer missed aggressive events (important for safety-critical detection).
F1-Score	Harmonic mean of Precision and Recall.	Balances false positives and false negatives; especially important when classes are imbalanced.
Loss	Measures how confident the model is in its predictions; penalizes overconfident wrong ones.	Helps track training progress and detect overfitting or underfitting; lower loss means better calibration.

Required Deliverables:

1. **Technical Report (4 pages)**
    - Methods (all models tried)
    - Results (tables/plots of metrics)
    - Optimization recommendations
2. **Code Notebook**
    - Clean, commented
    - Shows data prep, model training, validation, tuning, and evaluation
3. **Slide Presentation for presentation**
    - High-level motivation
    - Best model
    - Safety recommendations based on findings

Please upload these items as a zip file on asUlearn.

Grading:

Grading will be ordered based on the obtained scores of students' models.