

AI Driving Intelligence Engine - Project Documentation

1. Introduction

The AI Driving Intelligence Engine is a real-time AI-powered driving risk monitoring system developed using Python and PyTorch. The system simulates vehicle telemetry, evaluates risk using both rule-based and neural network models, and visualizes live analytics through an interactive dashboard.

2. System Architecture

The system follows a layered architecture:

- Vehicle Simulation Engine (Digital Twin)
- Rule-Based Risk Evaluation Module
- Neural Network Risk Predictor (PyTorch)
- Explainable AI Layer
- Driver Behavior Profiling Module
- Real-Time Dashboard Visualization

3. Vehicle Simulation (Digital Twin)

The vehicle engine simulates speed, RPM, engine temperature, fuel consumption, and acceleration using discrete-time dynamic modeling. The relationships between variables are designed to reflect realistic physical behavior rather than random values.

4. Neural Network Model

A supervised learning neural network implemented in PyTorch predicts driving risk. Input features include speed, RPM, engine temperature, and acceleration. The model is trained using backpropagation and gradient descent optimization.

5. Real-Time Inference

During execution, live telemetry data is processed by the trained model to generate continuous risk predictions. The results are updated on the dashboard every second.

6. Dashboard & Visualization

The dashboard is built using Tkinter and Matplotlib. It displays real-time telemetry, risk levels, driver behavior classification, and a continuously updating risk trend graph.

7. Future Enhancements

- Integration with real OBD-II vehicle data
- Time-series modeling using LSTM/GRU networks
- Cloud-based deployment and remote monitoring
- Advanced anomaly detection algorithms