Vision-Based ADAS Project Documentation

Project Abstract

This project implements a real-time Advanced Driver Assistance System (ADAS) using computer vision and deep learning. The system analyzes a front-facing video feed to detect lane markings and vehicles, estimating collision risks and lane departure.

System Architecture

The system follows a linear pipeline: input video → preprocessing → lane detection & object detection → risk logic → visual output.

Lane Detection

Uses Canny Edge Detection, Region of Interest masking, and Hough Transform to detect and average left and right lane boundaries.

Object Detection

YOLOv8 nano model is used to detect vehicles. Tracking is handled via ByteTrack or BoT-SORT to maintain object IDs.

Safety Logic

Lane Departure Warning is triggered when lane center deviates from frame center. Forward Collision Warning is estimated using bounding box size and proximity zones.

Key Concepts

Hough Transform for line detection, Kalman Filter for smoothing, and IoU for bounding box evaluation.

Technology Stack

Python, OpenCV, YOLOv8, NumPy, Matplotlib.

Future Scope

Curved lane detection, bird’s-eye view transformation, speed estimation, and custom-trained YOLO models.