🚗 پروژه پایانی درس شبکه های مخابراتی

Deep Reinforcement Learning-Based Collision Avoidance for Autonomous Vehicles 📌
Project Overview

This project presents a Deep Reinforcement Learning (DRL) framework for collision avoidance in autonomous driving systems, with a special focus on Vulnerable Road Users (VRUs) such as pedestrians.

The system is designed to enable an autonomous vehicle to make real-time, safe, and adaptive decisions in complex urban scenarios by learning directly from interaction with a simulated environment rather than relying on predefined rules.

The implementation is inspired by recent research in DRL-based autonomous driving safety and is fully compatible with simulation-generated data.

🎯 Objectives

Develop a DRL-based collision avoidance strategy for autonomous vehicles

Minimize collision risk while maintaining driving comfort

Handle critical scenarios such as sudden pedestrian appearance

Provide a reproducible and extensible research framework

🧠 Methodology 🔷 Reinforcement Learning Framework

The problem is formulated as a Markov Decision Process (MDP):

State (Observation):

Vehicle longitudinal and lateral velocity

Relative position of pedestrians

Distance to obstacles

Environment occupancy information

Action:

Steering angle

Throttle

Brake

Reward Function:

Large penalty for collision

Positive reward for safe goal achievement

Comfort penalty for harsh braking or steering

🧪 Simulation Environment

Simulator: CARLA (open-source autonomous driving simulator)

Scenarios:

Crosswalk pedestrian crossing

Sudden pedestrian entry from blind spots

Urban driving environments

All training data are generated online during simulation, meaning no pre-collected dataset is required.