Requirements Specification

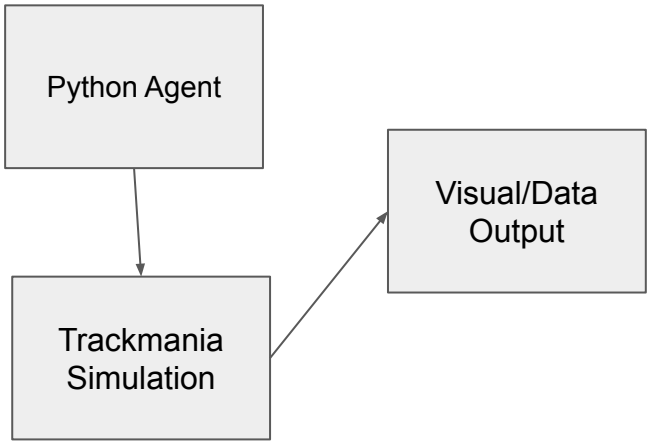
Alex Rus CS 288 Master's Capstone
Reinforcement Learning Self-Driving Car Simulation

Goals, Target Audience, Purpose

- The goal of this project is to build a reinforcement model that can control a simulated car to perform various tasks that prove the ability to self drive and complete speed tests
- The target audience are individuals who are interested in understanding reinforcement agents in simulated environments, individuals interested in full self-driving, and individuals interested in simulated car racing or time trials
- This project seeks to answer questions about how well a reinforcement model can learn to control and car, how well can it perform in a simulated environment, and how can this simulation help us understand full-self driving in the real world.

Basic Engineering Design

- The simulation will be in the racing game Trackmania (free modern racing simulation video game)
    - Other simulations considered were CARLA or Gymnasium
- Create python agent to interface with car in game, model will have basic control of movement and speed, as well as sight (LiDAR view).
- Form basis of reward function, penelization, completion and more.
- Train agent using Q learning, evolutionary/genetic training of multiple agents, any other specialize reinforcement techniques.
- Increase complexity of race course, improve on time to complete course



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Items to Accomplish

Basic Goals:

- Understand interface with game simulation, create basic python model
- Train agent, use checkpoints to lead car on simple course to completion
- Continue to train agent, experiment with hyper parameters, different reinforcement learning methods, evolutionary/genetic methods
- Increase complexity of race track, give more options for agent in completing course, test differences between optimizing speed vs safety

Stretch Goals:

- Test agent with varied controls (speed is more/less sensitive, left/right reversed)
- Compare performance to traditional AI racer, how does it compare?
- Employ adversarial model that constructs race tracks, one model will try to always complete a race, one model will try to make courses that are difficult to beat
- Modify reaction time of agent