Waymo Fleet Profitability Optimizer

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Problem Statement

One of the most promising and revolutionary applications of reinforcement learning is in the domain of autonomous robots, specifically self-driving cars. The challenges facing the autonomous car community span multiple dimensions: including intellectual, ethical, financial, and technical hurdles. For our project, we narrow our focus on optimizing the profitability of robo-taxi fleets.

Monitoring, maintaining, and optimizing a large fleet of self driving cars is a complex problem, and one can quickly think of many dimensions that the problem takes on. Predicting demand, scheduling maintenance, recharging vehicles, setting competitive prices, maximizing coverage, minimizing wait times, and more are all separately non-trivial problems. Jointly optimizing across all of these dimensions and adapting to distribution shifts is an even more challenging problem, and the interactive nature of the problem makes it a natural fit for reinforcement learning and agentic approaches.

We plan to simulate a fleet of self-driving cars as a Markov Decision Process (MDP), and develop reinforcement learning algorithms to optimize the fleet's operations and profitability.

Interest and Relevance

This is an area of active research and development, with many companies investing heavily in self-driving technology. For this technology to reach the market, it is critical to resolve the safety and reliability challenges that currently exist; however, the economic viability must also be solved for self-driving to reach its full potential.

For the purposes of this course, we believe that the interactive nature of the ride-sharing environment, the high dimensionality of the state and action spaces, the data and research publicly available, and the potential of performing far better than a heuristic algorithm make the robotaxi optimization challenge a good fit for our semester project.

Data

Ride-sharing in general is an active area of research in the reinforcement learning community [5]. There are existing data sets and open simulation environments.

We base our research on publicly available datasets. We need to model crowd behavior, weather conditions and seasonal effects. For crowd behavior

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