Online Ride-Hailing Platform

Project for Algorithm: Design and Analysis

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Abstract. This project introduces a new ride-hailing platform. It includes the brief introduction, background and advantages of this platform. Finally, it lists all the requirements and rules for each group. Please read this document carefully and complete the corresponding tasks.
Keywords: Ride-Hailing, Order Dispatch, Fleet Management

1 Ride-Hailing Platform

In the ride-hailing platforms such as Didi chuxing and Uber, millions of orders and thousands of vehicles need to be matched with each other. In a general view, there are two major decision-making tasks for such ride-hailing platforms, namely (i) order dispatching, i.e., to match the orders and vehicles in real time to directly deliver the service to the users, and (ii) fleet management, i.e., to reposition the vehicles to certain areas in advance to prepare for the later order dispatching.

For the purposes of this problem, we have a look for current and future situation in ride-hailing task. Apparently, most drivers today are human, which mainly corresponds to order dispatching since it is difficult to assign a human driver to certain areas without any pay. However, unmanned vehicles are expected to be the majority of components in vehicles, which makes fleet management an available choice in online ride-hailing platform. The online ride-hailing platform which can joint consider order dispatching and fleet management is significant and expected.

Your team is assigned to design an algorithm to tackle this challenge which is important but paid a little attention. To do so, you will have to consider many questions. At a minimum, address the following: What is the latent correlation between order dispatching and fleet management? How to address large-scale orders and vehicles in the real-world scenario? How to make assignment that joint considers order dispatching and fleet management?

2 Tasks and Requirements

2.1 Task 1

You are required to study some situations of a ride-hailing problem. In general if you add too many constraints to a single problem it will become NP-hard. You can set many criterions on a ride-hailing algorithm, like the overall profit, the total waiting time, or the total travel distance to pick up passengers. In which situations a polynomial time algorithm is possible? How to make it an NP-hard problem?

2.2 Task 2

Now you are required to design the kernel of this ride-hailing platform. To simplify the problem, Suppose you have known all orders and vehicles in advance. Please design a (approximation) dispatching algorithm for it. To seek the optimal strategy, you may need to make some additional assumptions. As you address the problem requirements, it should be clear how you assumptions are related to the challenge. Also, be clear about what factors you are considering when addressing these questions.

2.3 Task 3

You are now in the future when unmanned vehicles have finally become available. To take the full advantage of this exciting new technology you need a better algorithm for your platform.

1. If you don't make any assumptions on the future orders, the best strategy for your unmanned vehicles would simply be move randomly. Suppose you have a fixed number (the actual number is up to you) of unmanned vehicles. Based on the real data, design a system to

process the historical data and correlate the order dispatching and your fleet on the second day. Show your simulation result and the performance of your system.

2. (Optional) Another 10 years have passed and now humans are banned from driving. How many unmanned vehicles do you need to serve your customers? It would be better to draw a diagram to show the replacement ratio with the number of unmanned vehicles.

2.4 Data and Resources

The real-world data supported by Didi Chuxing is accessible via GAIA open plan:
https://outreach.didichuxing.com/research/opendata/en/.
If you have problems requesting the data, you can find other alternatives, for example:
https://github.com/toddwschneider/nyc-taxi-data.
To simulate the real-world ride-hailing scenario, there is open simulator code:
https://github.com/illidanlab/Simulator.

3 Report Requirements

You need to submit a report for this project, with the following requirements:

1. Your report should have the title, the author names, IDs, email addresses, the page header, the page numbers, figure for your simulations, tables for discussions and comparisons, with the corresponding figure titles and table titles.

2. Your report is English only, with a clear structure, divided by sections, and may contain organizational architecture like itemizations, definitions, or theorems and proofs.

3. Please include reference section and acknowledgement section. You may also include your feelings, suggestion, and comments in the acknowledgement section.

4. Please define your variables clearly. If needed, a symbol table is strongly recommended to help readers catch your design.

5. Please also include your latex source and simulation codes upon submission.

Reference

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