Computing Science

TODO TITLE

Karlis Venters

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TODO FINALISE Honours Project

Department of Computing Science
University of Aberdeen
King's College
Aberdeen AB24 3UE

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Karlis Venters

Department of Computing Science
University of Aberdeen

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Abstract goes here

1 Introduction

2 Literature survey

This is where it all starts.

2.1 Taxis

Taxis (also known as *taxicabs*) are an important part of public transportation. Because of their prevalence worldwide and importance in transportation a wide range of literature has been produced on taxis. For this project, the most relevant area of this literature is economical modelling of taxi markets, an overview of which is given by Salanova et al. (2011). A major topic in the research and discussion on taxis is taxi market regulation, and parts of it are relevant and will be considered in some detail. Three different taxi markets can be distinguished: cruising taxi market when a passenger hails the taxi no the street, phone-order taxi market, and taxi ranks where multiple taxis wait for passengers.

Taxi Modelling was first done by Douglas (1972) according to Salanova et al. (2011). He investigated a regulated cruising-taxi market (where a customer hails a taxi on the street on visual contact) and defined the fundamental taxi problem to be finding an equilibrum of an optimal level of service matching an optimal price. His limited model has been used as reference by all the later authors cited by Salanova et al. (2011) that have extended it to other taxi markets and factored in more environmental influences.

The most recent publications are sophisticated models based on the network model for cruising-taxi market by Yang and S. Wong (1998). This network was modelled as a graph and assumed constant taxi demand and supply, passenger demand was represented as origin-destination matrices. Finally, this paper suggests an algorithm to find an equilibrum for the optimal number of taxis in a market and equations to calculate taxi utilisation and customer waiting time. In contrast, Yang, Lau, et al. (2000) focuses on supply and demand to recommend optimal policies for taxi regulation in Hong Kong and base their model on various data sources. A number of exogenous and endogenous variables affecting taxi market are identified, and equations are suggested to calculate them: passenger waiting time, percentage of occupied taxis, vacant taxi headway, daily taxi passenger trips and taxi waiting time. This model can be used to forecast taxi demand, taxi utilization and service quality, although the authors warn that it does not take in account the complex supply-demand relationships in taxi market. and finally extended to multiple vehicle and user classes by K. Wong et al. (2008), researching taxi-customer finding behaviour by Yang, Leung, et al. (2010) and investigating the possible introduction of nonlinear fare structure by Yang, Fung, et al. (2010). All of these models are based on the taxi market of Hong Kong which has regulated fares. However, these models specify passenger demand functions that are relevant for all kinds of markets.

Regulation????? is a sensitive topic for taxi research as no general consensus has been reached on whether it is recommended. OECD (2007), cited by (Salanova et al. 2011) lists arguments both for and against regulation as observed in different countries. The approach suggested by this project is not compatible with a market where fares are regulated, at least in the current form of regulation that specifies a formula to calculate fares based on some variables, usually time and distance. Other ways

of regulation, for example, entry conditions, are compatible with the suggested approach and are not investigated any further. It is important to note that some markets considered *deregulated* still have some form of fare regulation, for example, taxis in New Zealand are required to list their maximum fares based on time and distance (Gaunt 1995), but are not forced to follow them.

2.2 Reinforcement learning

3 Software and simulation design

4 Implementation and results

5 Evaluation and discussion

6 Conclusion

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