Master Project

Learning Drivers' Preferences in Delivery Route Planning through Inverse Optimization

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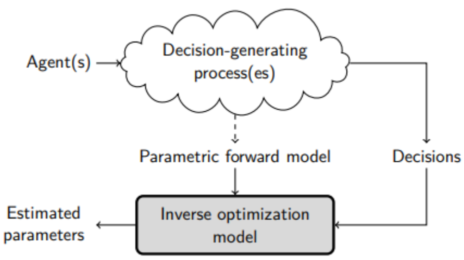
Context

Last mile delivery is the last stage of post/package delivery in which drivers bring the packages from the depots to the homes. A lot of research has been conducted into the optimization of this process but most of those approaches focus on minimizing the time or distance of the proposed route. In reality however, the real route of the drivers seems to differ from the proposed route. This has to do with numerous preferences of the driver, for example: good parking spots and avoiding narrow streets or streets with slow traffic. In traditional optimization strategies it is hard to account for those preferences. Amazon proposed a challenge which aims to tackle this problem by incorporating the information of experienced drivers to create safer and more efficient routes. This challenge with the provided data set is the main application of this thesis (https://routingchallenge.mit.edu/).



A possible way to tackle this problem could be the use of Inverse Optimization. In inverse optimization a learning agent aims to copy the behaviour of an expert agent by approximating the cost function of the expert agent which is unknown. This approach can also be applied to the delivery route planning in which the experienced drivers are seen as the expert agents. This way a route is calculated which is based on the drivers preferences as well as the originally proposed route based.

Project tasks

During this master project the aim is to develop a tool which solves the last mile delivery optimization problem, while incorporating preferences of drivers based on real life data provided by Amazon. The relevant research consists of:

1. Research which state of the art methods are used to solve the problem
2. Reformulate the inverse optimization problem statement to make it applicable to the last mile delivery problem
3. Derive a tool to solve the problem using inverse optimization
4. Evaluate the computational complexity/scalability and investigate reformulations to improve those (think about sparse regression or parallel computing)
5. Possibly add stochasticity to the model due to the uncertainty of travel times (caused by congestion) which influences drivers decisions