Optimisation of timetables in integrated public transport planning

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In order for public transport to be attractive, it has to be properly integrated

This PhD project is part of the larger IPTOP project (Integrated Public Transport Optimisation and Planning) which addresses the coordination between separate transport providers in an attempt to increase accessibility, reliability and attractiveness of public transport to travelers. Recent years’ fast technological changes allowed large amounts of data to be available, which motivate a renewed look at large scale optimisation methods and the integration of transport services using innovative data analysis and mathematical optimisation.

Can timetables for public transport be better integrated in order to provide a better service for passengers?

Research will be aimed at optimising timetable problems for public transport (both buses and trains), some of them defined in collaboration with the IPTOP partners. The objective is that the optimisation of timetables takes into account passenger considerations (consumer surplus), the costs of operation, and also the punctuality of the transport services. Integrated approaches are to be considered, where the timetables are expected to be synchronized in order to facilitate transfers for passengers.

The four research tasks within the project

Four main research tasks compose the project. First, bus timetables will be addressed and optimised by considering small departure shifts for each trip and flexible dwell times. In a second task, the findings from the first task will be used to address a similar problem in the train domain. Timetable robustness will be taken into account in the third task, where solutions with trains running close to each other are penalized. Finally, in the final research task earlier steps of the planning process will be integrated, such as line planning and frequency setting.

Operations research techniques to create better timetables

Both exact and approximation algorithms will be developed to address the research tasks described above. State-of-the-art ideas from Operations Research will be used, such as Mixed Integer Programming, Column Generation, Metaheuristics, or combinations of these. The project will aim at creating fast algorithms for solving large-scale instances of the problem and also exact algorithms for solving smaller instances of the problems.

Better timetables can be a reality

Besides the contribution to the state of the art in research, the PhD project is expected to provide better knowledge in the timetabling integration and optimisation. It will also potentially develop better timetables, which can attract more passengers. Reduction of travel times can also be achieved by improving passenger transfers.

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