Optimizing Public Transport Infrastructures With Analytics

Innovation in analytics, modeling and visualization capitalizes on your existing data to simulate and thereby predict the effects of network changes.

Introduction

Xerox research is helping public transport operators optimize network infrastructures to increase their use and capacity while improving quality of service. The optimization relies on ridership and user profile simulation engines based on individual behaviour. These tools capitalize on existing ticketing data for the accurate prediction of the effects of network changes. Data analytics and probabilistic modeling are at the heart of the transportation choice models that underlie this innovation.

Key challenges

Public transport operators play a key role in urban planning. They strive to provide competitive and environmentally friendly means of transport to as many people as possible, often working within tight budgets. In collaboration with transportation authorities, they constantly work to improve services and optimize the network infrastructure which includes routes, stop locations, multimodal travel options and frequency of services.

To correctly simulate the impact of infrastructure changes on travelers, Operators must consider the large number of factors that influence a person’s decision to use public transport. These include journey time, price, comfort, available transport information, weather, proximity of stations, purpose of the trip and alternative means of transport.

Innovation Areas

In collaboration with our Public Transport team and transport operators and agencies, Xerox researchers are engaged in two major innovation projects:

- The User Profiling Engine makes sense of anonymous ticket validation sequences to infer the nature of journeys. Typically, each passenger’s first ticket validation of the day gives their origin or home. Their second validation might be their destination or it might correspond to a change of vehicle, such as a change of bus or a move from bus to tram. By analyzing the locations and times of successive validations, a detailed picture of travellers’ origins and destinations emerges. When combined with survey data, this analysis can even tell us if a trip was a commute from work or school, or a shopping trip. This information is particularly useful in identifying potential user needs.

- The Ridership Simulation Engine simulates traveller’s decisions under different scenarios to better predict the effects of transport infrastructure changes. The engine includes a visualization component to support decision makers’ interaction with the simulation. The simulations are based on probabilistic travel decisions computed from the User Profiling Engine and other available data that can impact network usage such as demographics, weather or availability of alternative means of transport.
Expected Benefits

Capitalization on existing data and systems. The innovation engines are being integrated with the Xerox Atlas®, ticketing system. Tomorrow, the Atlas ticketing system will not only manage fare policy, network equipment and ticket validation, but it will also model traveller behaviour and predict demand, making the optimization of transport infrastructures simpler and more reliable.

Permanent analysis of massive amounts of data. Simulation and profiling engines can be activated upon demand and updated as often as required providing continuous insight into how the transportation network is being used. Field surveys can be better targeted and data fusion techniques used to merge the survey output with other information sources such as data on fare collection.

Accurate predictions and representations of the impact of Infrastructure change that take individual behavior into account. Simulations give transit agencies the means to integrate all relevant factors that influence a traveller’s choice between a departure place and final destination. Operators can hence determine the most pertinent developments to be made or the best way to serve a new district.

Core Technologies

Our transport innovation uses leading-edge technologies:

- Large scale data mining/data analytics: cross-analysis of data patterns from different sources (ticketing systems, demographics, etc.), data anonymization and privacy policy compliance.
- State-of-the-art stochastic modeling, prediction, simulation and optimization techniques.

Xerox Research Expertise

A leader in document management, we manage several million printing devices installed in its customer sites. To optimize the print fleet management services it provides, the corporation has invested heavily in research on user behaviour and information extractions.

Managed print services and transportation network operations have, surprisingly, many things in common e.g. user interaction analysis, remote device management. Data collection and network optimization.

These similarities mean that our expertise in data analysis and simulation can be easily leveraged to provide public transport operators with the tools they need to manage, optimize and evolve their network infrastructure.

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