Analytics on Mobility Data from new technologies: a Simulation-based Assessment

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# Introduction

Analytics on mobility data are proliferating due to the low-cost wireless data communications and the pressures of traffic authorities for reducing deployment and maintenance costs of traditional sensors. Several new sources of data from Information and Communication Technologies (ICT) can be used to derive traffic and mobility data, such as Bluetooth measurements of travel times between detection antennas, GPS measurements locations, timestamps for large samples of vehicles GPS equipped (Tom-Tom, INRIX, HERE could be examples of that) or Call Detail Records (CDR) from cellular phone tracking. This paper presents a particular case study that analyzes and evaluates by microscopic traffic simulation how the use of data provided by probe vehicles can provide travel times estimates from network segments and how navigation strategies can be defined based on those estimates for a set of connected cars. A set of city scale KPIs (Key Performance Indicators) and driver’s KPI are presented for different scenarios defined by an experimental design.

The case study adopts a microscopic simulation approach to emulate real size fleets of probe data cars providing positions and speed data every simulation step. As a remarkable modeling behavior, drivers are segmented according to network conditions knowledge as experts, regular drivers and tourists. The paper discusses the modeling approach and experimental design for simulation in a medium size traffic simulation model of Barcelona CBD. Emulated ‘real-time’ probe car data for the evaluation of connected car guidance under different levels of probe car penetration and navigation strategies is the aim of the current work, a reduced set of sensors for probe cars has been assumed allowing data for vehicle position and speed at each simulation step.

AIMSUN [1] is the simulation platform that supports the case study. Factors considered in the design of the simulation experiments are: Driver Type (drivers are split into six groups according to the knowledge of network and traffic conditions and guidance availability), Guidance Penetration, Congestion Level (referred to basic historical demand), Probe Vehicle fleet Size and Interval length for segment travel time estimation.

A factorial design leading to identify non aliased factor main effects is considered. The average trip travel time is the target KPI used to select the number of replications that fulfils on the base scenario a global 5% relative precision at 95% confidence for any driver type.

A set of 15 network KPIs are collected, these are numeric variables with different scales and internal correlation, Data Science procedures are applied to understand the underlying structure of network KPIs and to reveal hidden variables. Drivers’ KPI are also defined. One of the objectives of the study is to show how network KPIs are affected by design factors, either when gross effects or net effects are considered. The same applies to drivers’ KPIs.

The research contribution relies of a detailed simulation of driver classes, travel time estimates from new ICT probe vehicle data and the implementation off several navigation strategies that have been shown to be advantageous for guided and non-guided cars up to a certain level around 30% of guided vehicles. Nevertheless, increasing the level of service by introducing guidance advice is done at expense of increasing trip lengths (trip travel time remains stable) and fuel consumption, so definitively, assessment of mobility services has to consider several KPI due to the dependencies among network KPIs.

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**References**

[1] AIMSUN. Aimsun Microscopic Simulator (v 8.0). http://www.aimsun.com.

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