Proposal for the 2nd International Workshop

Automated Data Collection Systems: A New Foundation for Urban Public Transport Planning and Operations

COMBINING SMART CARD, AUTOMATED PASSENGER COUNT AND GTFS DATA TO VISUALIZE TRANSIT NETWORK USE

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Foreground

Even though smart card automated fare collection systems have become increasingly popular among transit authorities, there is still a need to develop methods and tools to process and value transaction data on a regular basis. Numerous research works have shown the potentialities of exploiting such data source (Pelletier et al. 2011). Unfortunately, not all smart card systems were correctly designed at first to support such analyses. In some cases, the destination of the trips is unknown; methods were developed to impute the alighting stop (Tranchant et al. 2007) and have been improved since (Munizaga and Palma 2012). Moreover, in other cases, the location of the boarding transaction is unknown. Here, we need to combine data from other sources to be able to overcome the lack of information. In addition, it is not enough to have complete data: we need to have adequate data analyzers. The use of business intelligence (BI) cubes and other tools is not suitable for the transportation analyses that are conducted by transit operators: there is a need to have transit-adapted tools that will show trip sections and itineraries, and not only cross-tabulate variables.

Objectives

The aim of this paper is twofold:

- first, it proposes a data fusion method aimed to complete transactional data from smart card (SC) systems, adding data from automated passenger counting systems

(that give the location of vehicles in time) and General Transit Feed Specifications file (that describes the network geometry and schedule); the method being used to determine the origins and destinations of card transactions;

- second, the paper presents a visualization interface that was developed for a transit operator in order to present the analyses done from this data in a "transit-planner-acceptable" way.

Methodology

The case study is the *Réseau de transport de Longueuil (RTL)*, a mid-size authority located in the south shore of Montréal, Canada. The RTL is a 350-bus network connected to the Montreal subway and the Montreal Central Business District. At the time of the analyses, only a third of the buses were equipped with an automated passenger counting (APC) system that locates the buses over space and time. APC-buses are randomly assigned to the different routes to ensure a maximum coverage.

The data fusion method is decomposed into three phases:

- SC transactions are linked to APC using the bus identification and the time of the transaction, with different thresholds, to be able to locate the boarding stops;
- SC history is scanned to impute stop locations to boarding that occur on the same route and at the same time than spatially-located boarding stops;
- SC transactions are also associated with GTFS (scheduled) data to complete stop locations (assuming that there is no major disruption in schedules).

After, a destination estimation algorithm developed by Li et al. (2015) is applied to the dataset to retrieve the alighting stops. Finally, the SC transaction logfile is converted into transit sections (one route taken) and transit trips (from first stop to the last, including transfers), and imported into the visualization tool.

Experiments

For the experiments, we used one complete month of data from the RTL: March 2013 (3.1 millions transactions). Only bus transactions were analyzed. From this number, up to 2.5 millions boarding locations were found from the data fusion algorithm. At last, the destination estimation algorithm found a destination for 79.2% of these boardings. At the end, a total of 1.9 million trips were imported into the visualization tool (86% without transfer). The following figures give an idea of the features of the tool.

FULL PAPER WILL GIVE MORE DETAILS

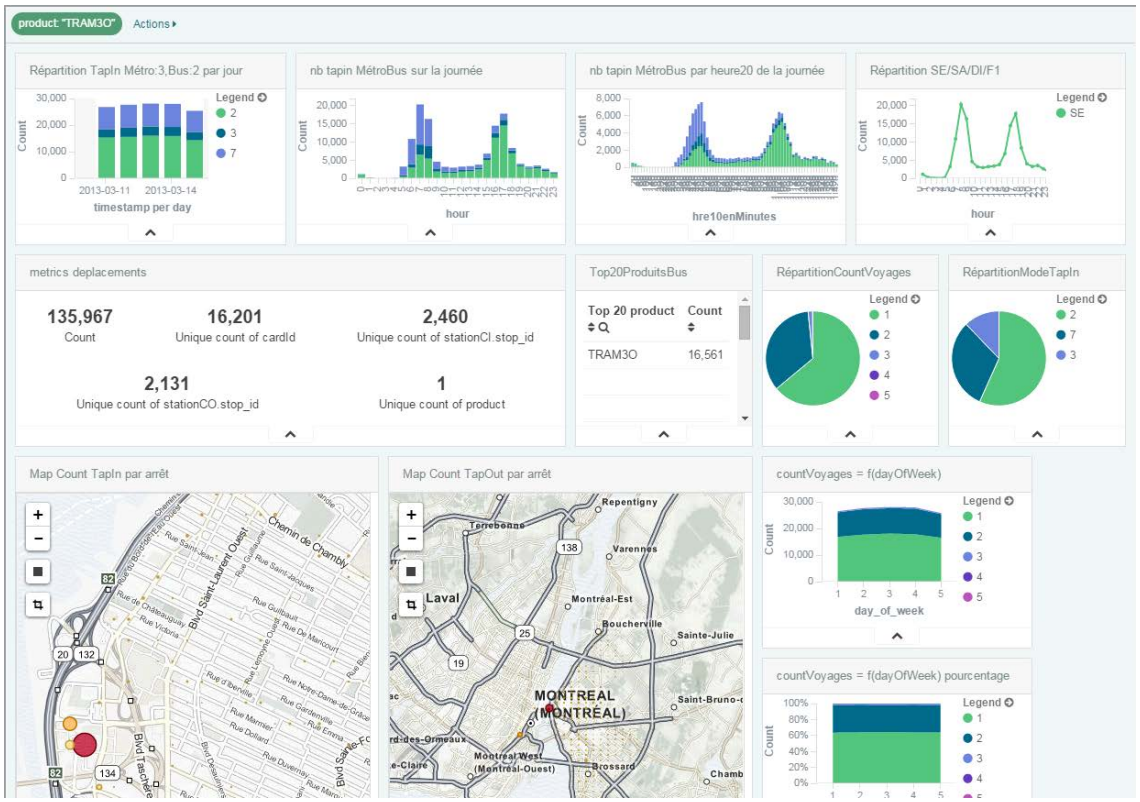

Figure 1. Part of the web screen of the interactive tool showing charts, tables and maps for a given filtered sample of the data (here: regional pass only, second week of March 2013)

Figure 2. Web-based map showing the interactions between two zones on the RTL network

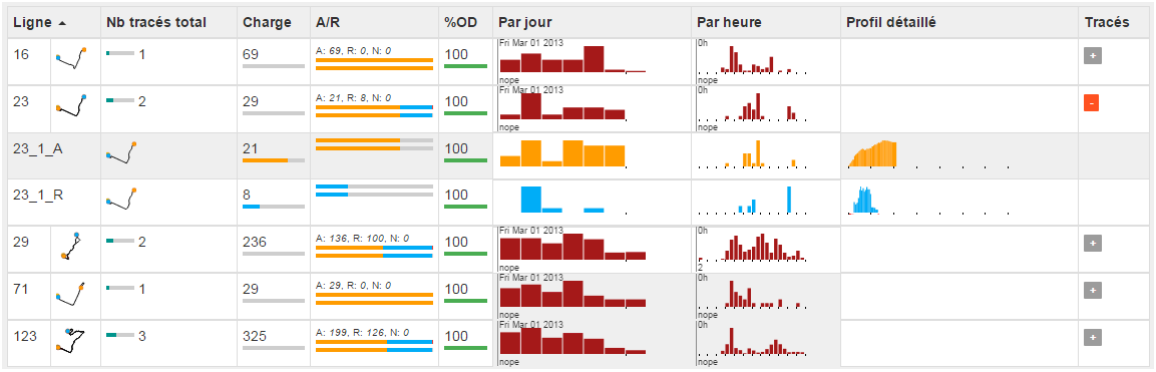

Figure 3. Interactive transit routes load profile filtered for route serving between the zones shown at Figure 2

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