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Cluster analysis for diminishing heterogeneous opinions of service quality public transport passengers

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Abstract

One of the principal measures that public transport administrations are following for reaching a sustainable transportation in the cities consists on attract a higher number of citizens towards the use of public transport modes, by offering high quality services. Collecting users opinions is the best way of detecting where the service is failing and which aspects are been provided successfully. The main problem that has to be faced for analyzing service quality is the subjective nature of its measurement, offering heterogeneous assessments among passengers about the service. Stratifying the sample of users on segments of passengers which have more uniform opinions about the service can help to reduce this heterogeneity. This stratification usually is conducted based on the social and demographic characteristics of the passengers. However, there are more advance techniques that permits to identify more homogeneous groups of users. One of these techniques is the Cluster Analysis, which is a data mining technique that can be used for segmenting the sample of passengers on groups that share some common characteristics, and that have more homogeneous perceptions about the service. This technique has been applied in other fields of transport engineering but it has never been applied for searching homogeneous groups of users with regards to service quality evaluation in a public transport service. For this reason, the aim of this work is to find groups of passengers that perceive the quality of the service in a more homogeneous way, and to apply to this clusters a suitable statistic technique that permit us to discover which are the variables that more influence the passengers' overall evaluation about the service. The comparison among the results of each cluster will show considerable differences among them and also with the results obtained using the global sample.

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Keywords: Service Quality; Public transportation, Cluster analysis, Pearson correlation

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1. Introduction

As the use of public transport modes represents a solution to the cities' environmental and social problems generated by the citizens'mobility (pollution, traffic congestion, noise, etc.), the definition and measurement of service quality in public transportation becomes essential as a tool for increasing the attractiveness of this more sustainable alternative. For individuals, car travel is generally perceived as more comfortable, flexible and faster for supporting busy lifestyles (Jakobsson Bergstad et al., 2011).That is why public transport services have to prove themselves their competition with private vehicle and become the support for the movement of passengers, instead of act only as a possible alternative.

Thus, Transport Authorities are focused on impose strong incentives for guaranteeing effective and high quality public transport services. Due to passengers are who suffer poor services or high levels of performance, it seems logical that their opinions will be crucial for analyzing the service. In fact, the Transit Capacity and Quality of Service Manual (Transportation Research Board, 2004) considers the customer point of view the fundamental perspective for service assessment.

Therefore, Customer Satisfaction Surveys (CSSs) are usually used for collecting and process passengers' opinions in order to design and formulate adequate interventions and strategies (de Oña et al 2012; 2013a; 2014b). The main problem up until now of the analysis is the fuzzy and heterogeneous assessment among passengers. One solution to help to reduce this heterogeneity can be to stratify the sample of users on segments of passengers more homogeneous. Dell'Olio et al. (2010) developed this stratification in order to propose specific models for analyzing service quality. Likewise, de Oña et al. (2014a) stratified the sample of a railway service operating in the north of Italy for the same purpose. The base used for conducting this stratification was the social and demographic characteristics of the passengers (i.e. models for men or women, for the younger, according to income level, etc.), or their travel habits profiles (i.e. type of the day of the journey, time of the day, frequency of use, etc). However, using this methodology, the heterogeneity among users could still be presented.

There are more advance techniques, such as Cluster Analysis (CA), which permit to reduce this heterogeneity, by segmenting the sample of passengers on groups that share some common characteristics, and that have more homogeneous perceptions about the service. This technique has been applied in other fields of transport engineering with satisfactory results (Karlaftis & Tarko, 1998; Ma & Kockelman, 2006; Pardillo-Mayora, 2010; Depaire et al., 2008; de Oña et al., 2013b). The main purpose of this study will be to apply a cluster analysis technique for stratifying the sample of users of a public transport service in the city of Granada (Spain), in order to analyze passengers' opinions under more homogeneous conditions. Data from four Customer Satisfaction Surveys developed from 2008 to 2011 in the metropolitan public bus service of Granada are used, and the most important variables affecting service quality are determined using a Pearson Correlation. Furthermore, the differences found among the key factors influencing the service quality evaluation of the identified groups of passengers are displayed and discussed.

The paper is structured as follows: section 2 shows the methodology used for stratifying the sample and for evaluating service quality. Section 3 describes data used for the analysis. Next, the results obtained with the cluster analysis and the Pearson correlation will be explained, and finally the conclusions are reported.

2. Techniques and procedures

2.1. Analysis cluster

Analysis cluster may be defined as statistical classification technique in which cases, data, or objects (events, people, things, etc.) are sub-divided into groups (clusters) such that the items in a cluster are very similar to one another and very different from the items in other clusters.

Latent Class Clustering (LCC) is a particular method to build cluster, which permits use frequencies, categorical and metric variables. In addition, LCC does not need a prior standardization of the data that could have a bearing on the results. (Magidson & Vermunt, 2002; Vermunt & Magidson, 2005).

A model of LCC can be expressed as follow: given a data sample of N cases, measured with a set of observed variables, Y1,…,Yj , which are considered indicators of a latent variable X; and where these variables form a Latent