Short communication

Improving airport services using sentiment analysis of the websites

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A B S T R A C T

Measuring the level of customer satisfaction of airport passengers provides a valuable feedback to airport managers. In fact, researchers and practitioners alike have recognized that measuring airport performance through purely operational approaches is not sufficient. In order to overcome such weakness a growing literature on airport performance measurement has focused its attention on models assessing passengers' needs and their perception of the airport service quality. The developed models vary according to the type of decisions supported, evaluation perspective, type of measurements, and evaluation approach used. Departing from the above literature, the present paper explores the possibility offer by data collected in the blogs and by the text extracting software for assessing the level of services perceived by airport customers. The paper identifies the strengths, weakness and synergies of the proposed approach in assessing users' perceptions of the quality of airport services.

1. Introduction

For more than two decades, there is a growing interdisciplinary interest in the measurement of airport performance in all its manifestations. Most of these studies examine performance measures relating to airport operational efficiency (Gitto & Mancuso, 2012a; Sarkis, 2000) and productivity (Gitto & Mancuso, 2012b; Oum, Adler, & Yu, 2006; Perelman & Serebrisky, 2010). Although these models are well suited for measuring the efficiency of airport operations based on resource input measures and performance output measures, they do not intend to address the effectiveness issue with respect to the overall quality level of airport passenger services. Departing from the above literature Seneviratne and Martel (1991, 1994) present a conceptual framework for evaluating the service quality of air terminals, with focus on the needs of airport users. In fact, customers' evaluation of airport facilities is of fundamental importance to airport managers and related administration (Yeh & Kuo, 2003; Correia & Wirasinghe, 2007; Correia, Wirasinghe, & de Barros, 2008a, 2008b; Fernandes & Pacheco, 2010; Zidarova & Zografos, 2011; De Nicola, Gitto, & Mancuso, 2013; Brida, Moreno-Izquierdo, & Zapata-Aguirrec, 2016). Moreover, the overall airports experience perceived and recollected by international travellers may have a significant impact in promoting or discouraging future international tourism and business activities in the corresponding country (Barros, 2014). The measurement of airport service quality is common within the airport industry but due to the complexity of the airport service environment, the validity and reliability of such measures are not easily achieved (Bezerra & Gomes, 2016).

Essentially the role of airport management company is now often seen as that of running a business with a focus on the better commercial orientation of the airport's operations and of their facilities (Carney & Mew, 2003; Chawla, 2014; Freathy, 2004). Outbound shopping for passengers is one of the most popular tourist activities that can satisfy human need for enjoyment and leisure (Timothy and Butler, 1995): it is closely related to the terminal environment, facility, products, and atmosphere. However, as noticed by Lin and Chen (2013, pag. 1): "airports are unique retailing environments in which travellers experience feelings of anxiety, stress and excitement, which can make them react in unusual ways, and thus they are unlike general shoppers in a high street situation". Moreover, Suárez-Alemán and Jiménez (2016) argue that passengers' assessments may also include implicit evaluation of features that are not directly observable regarding an airport's management and characteristics. Thomas (1997), analysing Heathrow airport, found that once passengers have their boarding passes, their tension is relieved and replaced by excitement, in what is called the opponent-process theory of emotion. Castillo-Manzano (2010), employing a sample of 20,000 passengers at seven Spanish airports, analyzed the factors that influence passenger's decision to make a purchase and the amount spent. In a study based on Taiwan' airport, Lin and Chen (2013) find that both time pressure and the impulse buying tendency are theoretically relevant constructs for understanding traveller's shopping behaviours within an airport. Finally, Pandey (2016) attempts to measure the service quality of the two gateway airports of Thailand by utilizing fuzzy expert system: he shows how the

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airport management can prioritize their resource allocation for enhancement of their service weaknesses.

In this paper, in line with Lubbe, Douglas, and Zambellis (2011), we claim that the main measure of assessment of airport operations is the opinion of passengers. Previous studies make use of questionnaire survey to identify the dimensions of satisfaction. These traditional research methods require researchers to seek an effective trade-off between the cost of sample collection and estimation performance (Guo, Barnes, & Jia, 2017). In this paper we measure the level of service quality using textual analysis (Villarroel Ordenes, Burton, Theodoulidis, Gruber, & Zaki, 2014) of a blog that contain passenger opinions on airport services.

In the Internet age, comments, feedback or critiques may be contained in online communities, societies and forums. Online reviews are important information sources of consumer experience towards products and previous research claimed that travellers consider the reviews of past tourists in deciding on their trips (Fang, Ye, Kucukusta, & Law, 2016). Sentiment analysis provides the capability to extract information and trends from textual data, giving an overview of the level of customers' satisfaction and it allows determining strategies to improve product quality (Prabowo & Thelwall, 2009). Xiang, Du, Ma, and Fan (2017) list 22 articles related to online reviews published within the field of hospitality and tourism.

Thus, we offer the first attempt to measure the level of services perceived by passengers in the airport industry by employing blog and text mining techniques. The rest of the paper is organized as follows. In Section 2, the existing body of knowledge on sentiment analysis and its application to analyse unstructured documents is discussed. Section 3 describes the process of gathering data. Section 4 examines the results of the sentiment analysis for the measurement of level of service in five European airports. Finally, Section 5 summarizes the research findings and provides directions for future research.

2. Sentiment analysis: a brief overview

In 2020 internet will reach 26 billion connected devices, with an exponential growth of 30 times the installed base in 2009, when connected devices in the web were just 900 million (Kar, 2013). In this environment, online data usually grows in an exponential explosive fashion. The majority of these web data is in unstructured text format that is difficult to decipher automatically (Dash & Liu, 1997; Li & Wu, 2010). As efficient business intelligence methods, data mining and machine learning provide alternative tools to dynamically process large amounts of data available online. One of the most data mining technique employed to extract opinion from web is the sentiment analysis, which tries to determine consumer emotional polarity or consumer attitude from her\his posts on a specific topic (Wang & Wan, 2011). The attitude can be any forms of judgment or evaluation, the emotional state of the author when writing, or the intended emotional communication. According to Nasukawa and Yi (2003), sentiment analysis involves the identification of sentiment expressions, polarity and strength of the expressions, and the relationship to the subject or topic. Current software identify the opinion of sentences in documents or of complete documents and classify these as positive, negative or neutral. We can distinguish two main techniques for sentiment analysis of texts: symbolic and machine learning techniques. The symbolic approach employ a priori rules and lexicons, whereas the machine learning approach uses supervised or weakly supervised learning to individuate a model from a large training corpus (Boiy & Moens, 2009).

We employ two open sources software to identify passengers' perceptions of the airport level of service: KNIME[1] and Semantria.[2] KNIME is designed to the analysis of web forums and social media. Semantria uses a dictionary-based and machine learning technique, i.e. using data found in lexicographical resources, to assign sentiments

to a large number of words: it conducts an automated sentiment analysis of the dataset based on algorithms developed to extract sentiment in a similar manner as human beings. Sentiment phrases are identified and scored considering the rate of appearance of the phrase near a set of known good or bad words (Serrano-Guerrero, Olivas, Romero, & Herrera-Viedma, 2015). These scores are computed for a concrete document; the sentences are divided into pieces referred to an entity with an associated sentiment, and this sentiment is scored as well. Therefore, sentiments are computed at entity level rather than sentence level.

3. Data collection

We conduct our analysis on the data available from SKYTRAX,[3] which each year awards the best airport of the world. The web site of the company offers the blog named "Airport Reviews" which provides real-time checked and independent reviews by real passengers on airport services.

The services provided by airports can be divided into two groups, namely, aviation and non-aviation services. Examples of aviation services could be the provision, maintenance and operation of the infrastructure required for the aircraft to take off, land, and stand, the provision and maintenance of the equipment and information technologies required for baggage handling and check-in of passenger, aviation safety services, etc. Aviation services also include ground handling services, such as preparation of the aircraft for flight, luggage loading, passenger transport, etc. Meanwhile, non-aviation services include car parking, commercial activities at the airport (catering, commerce), business lounges, rent, advertising, and so on.

In the present study, we conduct an exploratory analysis in order to understand the potential benefits stemming from the use of sentiment analysis in determining the passengers perceived level of service and we consider the five bigger international European airports: Amsterdam Schiphol, Frankfurt, London Heathrow, Madrid Barja and Paris Charles de Gaulle. The passengers' evaluations of the airport services cover the period from September 2013 to February 2014.

The information collected on the blog for each airport are stored in a table where the names of the airports and URL links are contained. We employ KNIME to extracts all information in further processable XML format. In order to separate the sentences related to the aviation services from those related from the non-aviation ones, we consider different keywords as reported in Table 1.

Following Ashford, Stanton, and Moore (1997), we consider as aviation services all the services related to the activities of embarking and disembarking passengers and their baggage in an airplane. The choice to include the lounge among the aviation services derive by the fact that the services offer in this area are directly provided by the airline company and are usually reserved in Europe to the business or the frequent flyer passengers.

The sentiment analysis at the document level is conducted by employing Semantria (Pang, Lee, & Vaithyanathan, 2002; Serrano-Guerrero et al., 2015; Turney, 2002). The software breaks the document into basic parts of speech, which identify the structural elements of a sentence (e.g. nouns, adjectives, verbs, and adverbs). Then, it attributes a score based on logarithmic scale, which allows to identify the sentiment polarity of a document and to classify it in "negative", "neutral" or "positive" (Liu & Zhang, 2012).

4. Results

In what it follows, we present the results of the analysis. The first part relies on the distributions of the passenger opinions by airports

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