



## Using big data from Customer Relationship Management information systems to determine the client profile in the hotel sector



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### ABSTRACT

Client knowledge remains a key strategic point in hospitality management. However, the role that can be played by large amounts of available information in the Customer Relationship Management (CRM) systems, when addressed by using emerging Big Data techniques for efficient client profiling, is still in its early stages. In this work, we addressed the client profile of the data in a CRM system of an international hotel chain, by using Big Data technology and Bootstrap resampling techniques for Proportion Tests. Strong consistency was found on the most representative feature of repeaters being *traveling without children*. Profiles were more similar for British and German clients, and their main differences with Spanish clients were in the *stay duration* and in *age*. For a vacation chain, these results suggest further analysis on the target orientation towards new market segments. Big Data technologies can be extremely useful for analyzing indoor data available in CRM information systems from hospitality industry.

### 1. Introduction

Customer knowledge is vital for the hospitality industry, and it plays a crucial role in improving the offer with better quality services (i.e., more adapted and customized), the relationship with customers, and the approach of marketing strategies (Adomavicius & Tuzhilin, 2001; Min, Min & Emam, 2002). All of them result in better customer satisfaction that increases the loyalty and ensures repeating customers, as well as higher profitability (Tseng & Wu, 2014). Over the last several years, this information has been mainly managed in many hotels by proactively gathering and recording customer preferences into the so-called Customer Relationship Management (CRM) systems (Sarmaniotis, Assimakopoulos, & Papaioannou, 2013). CRMs have become a key strategy for improving customer satisfaction and retention, especially in hotels (Padilla-Meléndez & Garrido-Moreno, 2013), and they are remarkably beneficial to those organizations by generating large amounts of valuable information about their customers (Chadha, 2015; Kotler, 2002; Nguyen, Sherif, & Newby, 2007).

Nevertheless, it has been recently pointed out (Dursun & Caber, 2016) that even advanced analysis techniques, such as data mining, are

not yet being adequately used in the hotel industry for the purpose of effectively profiling the customers by using the comprehensive data that are routinely collected with hotel CRM systems. A large amount of information is available nowadays in hotel companies, either internal and structured (from the Property Management and the CRM systems), or external and unstructured (such as opinion platforms, social networks, or geolocalization, among many others). This brings the need to consider powerful tools available from Big Data technologies, which have already been successfully used in other fields such as bioinformatics, healthcare, or finance (George, Haas, & Pentland, 2014), to name just a few.

Big Data technologies are providing unprecedented opportunities for statistical inference on massive analysis, but they also bring new challenges to be addressed, especially when compared to the analysis of carefully collected smaller data sets. In Sivarajah, Kamal, Irani, and Weerakkody (2017), a systematic and illustrative review is presented on the state-of-art analysis of the literature on Big Data techniques and Big Data Analytics, which highlights the key challenges in terms of different data types, data processing, and data management. As pointed therein, descriptive statistics are the simplest form of Big Data analytic

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methods, and they involve the summarization and description of knowledge and patterns by using simple statistical tests, such as mean, median, mode, variance, or proportions. When scrutinizing the usefulness of Big Data technologies in a new application field, it is necessary to establish well the behavior and scope of basic statistics, before going into more sophisticated analytics such as data mining or advanced machine learning.

In the present work, our main practical objective was to determine the client profile in an international hotel chain by exploiting the overall information in its CRM system. For this purpose, we identified the relevant variable groups, and we analyzed their practical meaning by using Big Data analytics on proportion tests from ratios between repeaters and first-timers. The use of robust and reliable proportion tests in this scenario has been tackled by using Bootstrap resampling techniques, which provides us with clear cut-off tests for decision making even in massive analysis conditions. It was possible for us to obtain two types of implications, namely, those related with the application of Big Data techniques to CRM exploitation, and those related with the results derived from the specific application to this hotel chain.

The scheme of the paper is as follows. In the next section, we introduce the relevance of CRM systems and their applications in the hotel sector, the basics on Big Data techniques and their scope in current analytics for hotel clients, and some relevant studies dealing with client profiling in terms of their repeating behavior. Then, we present the theoretical foundations of the methods to be used in our client profiling study, consisting of proportion tests and on bootstrap resampling. We then present the results on a real database from a large-scale hotel chain. Discussion is established on our and others' results, and finally, concise conclusions are drawn.

## 2. Literature review

Our main objective in the present work was to determine the repeater client profile by exploiting CRM systems in hotel chains and using Big Data technologies. For this purpose, we start by presenting a review of the state of art focused on the three main topics developed here, and the CRM system concept is first scrutinized. Recent applications on Big Data technologies are then summarized, both of them in the hotel industry, and finally, we present recent studies analyzing the repeaters versus first-timers profiles.

### 2.1. CRM in the hospitality industry

In the last several years, CRM has grown in relevance both in the operational and in the strategic points of view. Two of the major reasons for this are the increasing market competitiveness and the lower cost for client retention than for new client recruiting (Petrick, 2004; Yoo & Bai, 2013). Hence, CRM has become a key strategy for personalizing the client experience and for increasing their satisfaction.

The present work deals with CRM systems. A CRM system is a “firm tool that is technology-based for developing and leveraging consumer knowledge to nurture, maintain, and strengthen profitable relationships with consumers” (Elfving & Lemoine, 2012). According to Buttle (2004), a CRM system is a crucial part of a global CRM strategy. Soltani and Navimipour (2016) stated that CRM systems provide the infrastructure that facilitates the construction of long-term relationships with customers. Some examples of the functionality of CRM systems are sales force automation, data warehousing, data mining, decision support, and reporting tools (Hendricks, Singhal & Startman, 2007; Katz, 2002; Soltani & Navimipour, 2016).

For the hospitality sector, several studies consider CRM as one of the best strategies for improving a company's results and for ensuring long-term survival (Abu Kasim & Minai, 2009; Keramati, Mehrabi, & Mojir, 2010; Kim & Choi, 2010; Sigala, 2005; Wu & Li, 2011). Accordingly, CRM systems are nowadays a fundamental tool in the hotel sector, especially when properly implemented, due to the large amount of data

that hotels integrate from their clients. These data could be turned into useful knowledge (Chadha, 2015; Dev & Olsen, 2000; Kotler, 2002; Lin & Su, 2003; Nasution & Mavondo, 2008; Nguyen et al., 2007), and the implementation of CRM systems allows us to identify the host behavioral patterns and to retain them in the long term (Chadha, 2015; Papastathopoulou, Avlonitis, & Panagopoulos, 2007; Verdugo, Oviedo-Garcia, & Roldan, 2009).

It is evident that customer loyalty and profitability are correlated (Payne & Frow, 2005). Therefore, one of the main assumptions of CRM systems is that satisfying and creating long-term relationships with profitable customers enhances the business success of the company (Wu & Lu, 2012). However, the role that large amounts of information currently available in CRM systems can play in efficient client profiling has not been studied enough yet, even for simple and well known statistical descriptions. In addition, there is evidence that advanced analysis techniques are not yet being properly used in the hotel industry to effectively profile customers from comprehensive data collected via hotel CRM systems (Dursun & Caber, 2016). Hotels are not fully exploiting the potential of CRM systems, but there is strong interest and ongoing work towards their successful implementation (Padilla-Melendez & Garrido-Moreno, 2013). This way, both the CRM-effort efficiency and a company's competitiveness could be dramatically increased.

### 2.2. Big data in the hospitality industry

Big Data is drastically changing the hotel sector management and the client-to-business relationship, by making the decision-making process from large amounts of data easier (Fox & Do, 2013). Nowadays, the technological bases of both the tourism organizations and the hoteliers make relevant that marketers and managers improve their access to data intelligence to make the best use of it (Peter, 2014). These professionals have invested heavily in recent years in organizing strong scientific teams and including statisticians and database experts who are well equipped to build and analyze the contents of their Data Warehouses (Ramos et al., 2017). Though human analysis is often required, today Big Data can enhance the decision making and increase the organizational output from five possible approaches, namely, descriptive analytics, inquisitive analytics, predictive analytics, prescriptive analytics, and preemptive analytics. Most Big Data analytics are descriptive and exploratory in nature, but even simple descriptive statistics allow businesses to discover simple and clear patterns that become extremely useful for decisions.

The hospitality industry has become an information intense sector, where large data volumes have been stored with practical applications which are not so widespread. With the arrival of Big Data, it is possible to manage such data to achieve the objectives and to transform the information into knowledge (Xiang, Schwartz, Gerdes & Uysal, 2015). Data are stored in very different formats, and their analysis becomes a complex task due to their heterogeneity, going from structured data in conventional databases (from Property Management Systems and CRM systems) to semi-structured and unstructured data. Furthermore, the available information systems often can include meta-search generated data, e.g., Tripadvisor, Kayak, Trivago, or social networks such as Facebook, Twitter, or LinkedIn (Ramos et al., 2017; Santana-Cerdeña, Ramos, & Bobur, 2014).

The hotel industry is starting to use Big Data technologies mainly in product sales, social media and online behavior of customers, as well as offline data retrieval and analysis (Zhang, Shu & Wang, 2015). Some examples are tourist's location (Hjorth, 2012; Silva & Mateus, 2003; Vu, Li, Law, & Ye, 2015), blogs (Litvin, Goldsmith, & Pan, 2008; Tseng, Wu, Morrison, Zhang, & Chen, 2015), photography (Balomenou & Garrod, 2014), internet behavior (Rong, Vu, Law, & Li, 2012), search engines (Pan & Li, 2011), and Online Travel Agencies (Ramos et al., 2017), to cite just a few. There is a growing interest in the hospitality field to exploit user-generated data and gain insight into research problems that

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