

An integrated case-based reasoning and MCDM system for Web based tourism destination planning

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ABSTRACT

The accelerating interaction between technology and tourism has changed radically the efficiency and effectiveness of tourism organizations, as well as how consumers interact with organizations. In this study, a Web based intelligent framework for travel agencies is proposed that offers customers a fast and reliable response service in a less costly manner. The proposed framework integrates case-based reasoning (CBR) system with a well-known multi criteria decision making (MCDM) technique, namely Analytic Hierarchy Process, to enhance the accuracy and speed in case matching in tourism destination planning. The integration of two techniques enables taking advantages of their strengths and complements each other's weaknesses. A case study is performed to demonstrate how this framework can facilitate intelligent decision support by retrieving best-fitted responses for customers.

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1. Introduction

A revolutionary transformation accelerated by technological developments has shaped the world economy during the 20th century. The fast development of information and communication technologies (ICTs) and the global spread of the Internet and the electronic business have changed industry structures around the world. This transformation has affected tourism sector as it has affected all sectors of economy (Buhalis, 2003; Buhalis & Law, 2008; Hanna & Millar, 1997; Kim, Kim, & Han, 2007). The accelerating and synergistic interaction between technology and tourism has brought fundamental changes by creating new opportunities to tourism companies in marketing, tourism destination planning and advertising (Jakkilinki, Georgievski, & Sharda, 2007). ICTs have changed radically the efficiency and effectiveness of tourism organizations, the way that businesses are conducted in the marketplace, as well as how consumers interact with organizations (Buhalis, 2003; Buhalis & Law, 2008; Michopoulou, Buhalis, Michailidis, & Ambrose, 2007). It is clear that the benefits of an online travel community extend to both individual travelers and tourism marketing organizations (Law, Leung, & Wong, 2004; Niininen, March, & Buhalis, 2006; Wang & Fesenmaier, 2004).

For tourism suppliers, the Internet provides a way to globally sell their products to potential travelers at any time. These suppliers can remotely control their servers to display information on

products/services at a high speed. For travelers, the Internet allows them to communicate directly with tourism suppliers to request information, and to search and purchase products/services at any time and any place online (Heung, 2003). Despite the advantages of the Internet for both travel suppliers and travelers, there are several problems in strategic and frequently operational planning. These problems are characterized by their complexity, often being non-transparent, individualistically dynamic and requiring the achievement of multiple goals (Michopoulou et al., 2007). The vast amount of information and/or the complex relationships among them present an insurmountable problem to be solved by human resources. Hence, this paper aims at showing the impact of an integrated intelligent case-based reasoning (CBR) and multi criteria decision making (MCDM) system in the tourism destination planning processes. Throughout the paper, a travel agency is assumed to refer a retail business that sells travel related products and services to customers. A travel agency is a professional service company that possesses extensive knowledge and expertise on local and international tours, hotels, activities, transportation possibilities, and offers the most suitable travel package according to customers' requirements.

CBR, which consists of retrieving, reusing, revising, and retaining cases, has been proved effective in retrieving information and knowledge from prior situations (Aamodt & Plaza, 1994). In order to find the best matching situation, CBR collects and organizes the existing problem cases in its database. On the other hand, MCDM aims at solving decision problems by evaluating and comparing a number of alternatives in respect to several conflicting criteria with the goal of selecting the best alternatives. CBR and

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MCDM have common grounds. They are both problem-solving methodologies involving the selection, ranking and aggregation of best alternatives. Another common point is that both techniques consist of an evaluating phase: MCDM has a tool that evaluates alternatives in respect to multiple criteria and CBR has a reasoning mechanism to support adaptation of best alternatives. Although CBR is skilful when retrieving relevant information from the past data, it requires that these data are kept in a systematic way. MCDM enables representing the historical data in a flexible and systematic way; nevertheless, it necessitates a large number of calculations. Analytical Hierarchy Process is one of the most widely-utilized MCDM techniques. It is essentially a formal way of understanding a complex problem using a hierarchical structure. It enables ranking decision alternatives and selecting the best one when the decision maker has multiple criteria. The integration of AHP and CBR enables therefore taking advantages of their strengths and complements each other's weaknesses. The rest of this paper is organized as follows: Section 2 describes the proposed evaluation framework and involving methodologies. The implementation of the framework into the tourism destination planning is given in Section 3. The application steps of the methodology are presented in Section 4, and the results of the empirical study are discussed in the concluding part of the paper.

2. The main concepts of the evaluation framework and methodologies

Customer requirements, technological aspects and market competition, altogether changed economical structure and pushed companies to redefine their strategies, processes and products. Furthermore, the astonishing developments in the information technologies raised the number of individuals who make use of them. According to the World Internet User Statistics updated on June 2008, the total number of the Internet users around the world is 1,463,632,361. This revolution affected the operational activities of travel agencies, their communication tools; moreover the way that the customers look for information and buy tourism products/services. There is a growing reliance on the Internet Web sites for promotion of tourism. Tierney (2000) revealed that a travel agency can increase its efficiency with a low-cost, automated and Internet-based survey methodology. Indeed, some travel agencies have begun to use computerized reservation systems and electronic selling points where the Internet is being utilized as the most fundamental tool. According to the report of the World Tourism Organization Business Council, in the forthcoming years, the major part of the traveling expenses will be realized online. Hence, travel agencies should offer the most appealing and also the less costly services in order to attract customers in highly competitive tourism markets.

The literature has significant number of research on the Internet and its applications on tourism sector. One of the first studies is the paper of Hanna & Millar. They discussed the development of a prototype tourist information service established on the World Wide Web by giving the issues on page design, managerial issues and information content (Hanna & Millar, 1997). Palmer and McCole (2000) examined the role of electronic commerce in creating “virtual tourism destination” over the Internet. Ricci and Werthner (2002) proposed a general architecture and function of an intelligent recommendation system which supports a leisure traveler in the task of selecting a tourist destination, bundling a set of products and composing a plan for the travel.

Heung (2003) identified the levels of usage of the Internet by international travelers as an information source and product-purchasing tool across seven countries. They showed that approximately 30 percent of travelers use the Internet for reservation

and purchase of any travel products or services. Wang and Fesenmaier (2004) evaluated a model of an online travel community using structural equation modeling. In their study, they discussed the implications for the development of a dynamic and sustainable online travel community. The same year, Law et al. (2004) revealed some experimental results about the travelers in Hong Kong. They discovered that travelers in Hong Kong generally do not have a clear-cut preference for purchasing either on travel agencies' Web sites or at travel agencies. Following their findings, they suggested that both online and traditional travel agencies can coexist in the future. A comprehensive survey on the context of Internet applications to tourism can be found in the research of Buhalis and Law (2008). An expert travel agent is proposed by Schiaffino and Amandi (2009). The agent combines collaborative filtering with content-based recommendations and demographic information about customers to suggest them package holidays and tours. Another recent study proposed a system that provides with personalized recommendations of tourist attractions in an unfamiliar city (Huang & Bian, 2009). Their methodology is based on Bayesian network technique and the Analytic Hierarchy Process method.

Keeping these ideas in mind, we have built a framework for travel agencies to assist travelers while planning their journey. The objective is to take advantage of past experiences of the travel agencies and to decrease necessary manpower which will decrease the costs.

The proposed framework involves two main sub-systems: a multi criteria decision making sub-system and a case-base reasoning sub-system. Travelers define the key properties of their journeys through this integrated CBR and MCDM approach. The schematic information flow is given in Fig. 1. The initial input of both the framework and the MCDM sub-system is the information request coming from the customer, namely a new case. The MCDM sub-system aims at eliminating the unnecessary information, which is not valuable for the request. The usefulness of data is determined by looking at its similarities with the customer request. Thus, the framework primarily identifies the main attributes of a case and related priority weights. This step makes use of one of the well-known MCDM approach, the Analytical Hierarchy Process (AHP). The importance weights of the attributes are determined by using the linguistic assessments of the tourism sector experts and travelers. In the following sub-system, the CBR sub-system, the framework utilizes these importance weights to calculate the distances among the new coming case and each case in the case base by considering the statistical data. Distance values are used as a

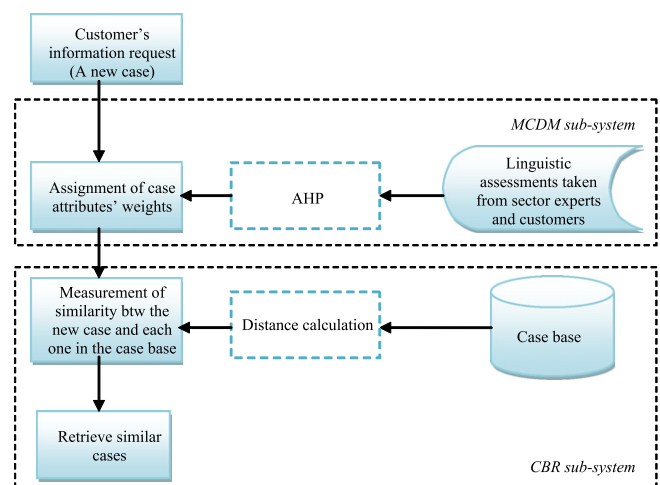


Fig. 1. Evaluation framework of the integrated framework.

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