Personalisation Systems for Cultural Tourism

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Abstract This paper makes a review on personalisation systems specialised for cultural tourism. Tourists interested in cultural heritage have different requirements from tourist recommendation systems than other users. Therefore, emphasis is given on recommendation systems for city tours and museum guides. More specifically, systems for PC, PDAs and mobile phones are discussed as well as the methods and the technologies used.

1 Introduction

Nowadays people do not travel only for resting on a beach and enjoy the sun but to combine rest with their interests in culture, religion or the environment. This result in different kinds of tourism: cultural tourism, religious tourism or ecotourism. The tourists with such interests use the Information and Communication Technologies (ICTs) for searching information about their destination or taking information on site. Indeed, ICTs enable tourists to access reliable and accurate information as well as to undertake reservations and plans in a fraction of time, cost and inconvenience that may be required by conventional methods [37].

These services were further influenced by the Internet and related technologies. However, ICTs and the Internet have increased the number of choices so dramatically that is very difficult for the consumers to find what they are looking for. An effective solution for reducing complexity when searching information over the Internet has been given by recommendation systems [1]. Recommendation systems have been used for finding books [34], movies [56], tv-programs [61], music [53], etc. The main characteristic of the recommender systems is that they can

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personalize their interaction to each individual user. Personalization involves the design of enabling systems to capture or infer the needs of each person and then to satisfy those needs in a known context [45].

Personalized recommendation systems have been gaining interest in tourism to assist users during their city tours [29, 47] or museum tours [46, 59]. The users that make a city tour or a museum tour have different interests and needs. A remedy for the negative effects of the traditional 'one-size-fits-all' approach is to develop systems with an ability to adapt their behavior to the goals, tasks, interests and other features of individual users and groups of users [55].

Therefore, these recommendation systems use information about the user to personalize the interaction with each individual user. A personalization system is based on three main functionalities: content selection, user model adaptation and presentation of results [14, 15, 36]. By content selection, one may refer to selecting destination, tourist attractions, museum "artifacts" or all the above for planning a whole trip. By user model adaptation, one may refer to techniques used for maintaining updated user models. Finally the presentation of results involves the technologies used (e.g. multimedia, GIS etc.) for improving the interactivity of the systems and, therefore, human–computer interaction.

In view of the above, different approaches have been proposed for helping the user during his/her cultural pursuit. Ellis, Patten and Evans [16] explore a variety of more or less social museum media, and point to the continuing need to "target personalised offerings at specific users." Such media involve guidance systems for mobile phones or PDAs, multimedia, etc. More innovative approaches include robots that guide users through museums [54]. However, these are not appropriate for individual use and are difficult to adapt to different environments.

2 Personalising City Tours

New technologies are used for organizing different aspects of a trip, e.g. selecting destination, accommodations, restaurants, routes or all the above for planning a whole trip. Among others, new technologies and the Internet are used for selecting the tourist attractions and sights that the tourists are planning to visit, if they are interested on the cultural heritage of the area. Indeed, many researchers support that tourist attractions are often the reason driving travelers to visit destinations [21, 27, 33, 44]. In view of this, Traveller [52] takes into account the touristic sites that may be of interest of the particular user to suggest package holidays and tours.

Interesting work is also that of [25], who have developed a recommendation system for suggesting specific tourist attractions over the Internet. The proposed system combine a multi-criteria decision making theory, the Analytic Hierarchy Process (AHP), with a Bayesian network for finding over the Internet which is the tourist attraction that would interest the user interacting with the system.

On a different basis, AVANTI [18, 19] personalizes the presentation of information about specific touristic sites. In this case, the user is not only proposed with

touristic sites that may interests him/her but the information provided about each sight is adapted to his/her interests and knowledge. These systems usually help the user by personalizing interaction with the personal computer while surfing on the Internet to locate information about the cultural heritage of a city or a country. Indeed, many users search on the Internet about cultural sights of a city or a country that may visit prior to their visit. Other systems such as the INTRIGUE guide recommends sightseeing destinations by taking into account the preferences of heterogeneous tourist groups [3].

Table 1 refers to some systems that personalizing information about sights and attraction.

However, another way to find out information about the cultural sights of a city or a country is to have mobile Internet, either with a palmtop or a mobile phone and search information about it while you are on sight. Such systems are Speta [20], PinPoint [47], m-ToGuide prototype [29] and UMT [58].

Additionally to promoting touristic sights' CRUMPET [40] uses advertisements to promote shops, restaurants, entertainment places, events as well as information, reservation, booking and payment services that may be helpful to any tourist. [39] (CATIS) and [11] propose systems that take into account the physical location of the user to provide a set of request-related services in the surrounding area.

Special requirements are also addressed by systems that are designed to assist specific types of tourists during their tours. Such systems that provide personalized information on specific cities and their cultural sights, Lancaster, Heidelberg,

Table 1 Some systems that personalize information about attractions and sights

Attractions—Sights
• Huang and Bian [25]
• Gunn [21]
• Lew [33]
• Jafari [27]
• Richards [44]
• *WebGuide* [17, 63]
• *MastroCARonte* [12]
• *CRUMPET* [40]
• *Traveller* [52]
• *Travel Planner* [10]
• *AVANTI* [18, 19]
• *INTRIGUE* [3]
• Hinze and Voisard [22]
• *Speta* [20]
• *Gulliver's Genie* [23, 38]
• *MobiDENK* [32, 6]
• *PinPoint* [44]
• *m-ToGuide prototype* [29]
• *UMT* [58]
• *ITR* [41]

Oldenburg and Vienna, are the GUIDE system [9], WebGuide [17, 62], Sightseeing 4U [51] and LoL@ [2], respectively.

In order to personalize interaction, these systems use specific criteria for evaluating the different alternatives. The criteria used for evaluating the packages and tours are summarized in Table 2.

3 Personalising Museum Tours

Roes et al. [46] have identified four types of museum tours: human-guided tours, audio tours, online/virtual tours, and multimedia tours. Several museums, e.g. Tate Modern, Science Museum Boston, already explored the potential of bridging the Web and the physical museum spaces. Indeed, several technologies such as multimedia, mobile and web technologies have been used for this purpose. However, the main problem with such approaches is that a human tour may be more interesting as it is live and it can be adapted to the audience. A solution to this may be given with the incorporation of personalization services in museum guides in order to enhance the tourist experience in the museum. A context-aware system for intelligent museum collects information of visitors and surroundings, recognizes visitors' purposes, and then assists visiting, while striving to be minimally intrusive through this process [49]. A visitor may enter the system by any device, desktop computer or mobile devices.

In view of this, [59] propose a context-aware intelligent museum system, namely iMuseum, that provides visitors with customized relic context usage through an underlying context server. IMuseum uses interests, to adapt the context presented to users. The user interests are also taken into account in the approach of [48], which personalizes user interaction in a semantically annotated museum collection. More characteristics of the user and not just his/her interests are taken into account in the Rijksmuseum project [5], which personalizes users' museum experiences within the virtual and physical collections.

However, the above mentioned approaches do not emphasize much in simulating the live experiences in a museum. The value of multimedia for a museum guide in order to simulate better the live experience is discussed by Proctor and Tellis (2003) who present an extended user study conducted at the Tate Modern in

Table 2 Criteria used for recommending tours

	Intrigue [3]	Traveller [52]
Destination	√	√
Duration	√	√
Season		
Price	√	√
Category/Type	√	√
Historical or artistic value	√	

2002. However, this study emphasizes just on mobile museum guides. Some projects that have taken place towards this direction include the Multimedia Tour [57] and the Interactive Museum Guide Bay et al. [7]. The latter is not addressed to mobile museum guides. More specifically, it uses a PC with a touch screen, a webcam and a bluetooth receiver. The guide recognizes objects in the museum based on images of particular artifacts and provides additional information on the subject.

A rather interesting and complete work on the subject of museum guides is the Cultural Heritage Information Personalization (CHIP) project, which demonstrates how Semantic Web technologies can be deployed to provide personalized access to digital museum collections. More specifically, CHIP personalizes the selection of artworks for the museum visitor based on their underlying semantic relations, e.g. related styles, artists, themes, or locations and the strength of the user interest in those semantically enriched properties [46].

4 Technology

The systems used for supporting cultural tourism use different methods of personalisation or intelligence to become useful and, therefore, attract users. To this direction, many systems are developed for mobile phones or PDAs. However, the problems addressed in such technology are quite different due to the limited space in the screen. For this purpose, the MoMo project [26] proposes a mechanism for browsing large collections of explanatory items on PDAs. This project aims at providing users with social interaction within museums, but has not achieved to make services intelligent enough. Cheverst, Davies and Mitchell [9], on the other hand, propose personalized and, therefore, in a way intelligent, tours for PDA users during his/her physical visit in the sight of interest. A quite different approach is used in the Exploratorium [24] and Peabody Essex Museum's ART scape [28] allows a visitor to bookmark an exhibit during the physical visit and then later search related information about this exhibit from the website.

Another way to attract users by using different technologies are incorporating multimedia into the systems. Such projects include 3D virtual reality representations of galleries and other geographical areas of cultural interest [60]. A more innovative approach is proposed by [31] who personalize content into a tourist's mobile in a Multimedia Messaging Service (MMS). Additionally, to the profile of the user, this approach also takes into account the physical location of the user. For this purpose, in other systems, researchers use agents to monitor the transportation of cultural assets. In one scenario, users visit Villa Adriana, an archaeological site in Tivoli, Italy and the agents discover users' movements via a Galileo satellite signal [13]. The agents elicit users' habits and preferences and personalize interaction according to the information that has been extracted implicitly.

5 User Modeling

For a system to be able to provide personalized recommendations it should make inferences about the users' preferences. Such information as well as information about the users' previous experiences is stored in a user model [20, 52]. Indeed, as Schafer et al. [50] point out, recommender systems offer guidance based on users' profiles or visiting background. Therefore, every recommender system builds and maintains a collection of user models [35].

A recommender system may maintain an individual user model or some user models that represent classes of users [42, 43]. When commercializing complex customizable products online, there may be various classes of users of the configurator that differ in properties such as skills, needs and knowledge level [4]. These classes are called stereotypes. Stereotypes [30, 42, 43] are used in user modeling in order to provide default assumptions about individual users belonging to the same category according to a generic classification of users that has previously taken place. This method has the advantage of providing personalized recommendations from the first interaction of the user with the system. However, a main disadvantage of this approach is that users may be similar in some characteristics but differentiate in many others. Furthermore, a user's characteristics may change over time. Some systems that use stereotypical techniques for personalizing the presentation of cultural sights to tourists are AVANTI [18, 19], INTRIGUE [3] and UMT [58]. However, a main problem that such systems encounter is that each user differentiates from all the others in many ways. Therefore, many systems use individual user modeling (e.g. Sightseeing4U [51], PinPoint [47], m-ToGuide prototype [25, 29]. Individual user modeling has many advantages it can not be used before the user has to interact with the system for a long time without any personalization so that the system collects adequate information. This disadvantage is addressed in many systems by using a combination of the two methods (e.g. WebGuide [17, 63], MastroCARonte [12], Traveller [52], Speta Garcia-Crespo et al. [20]).

Systems can also be categorized taking into account the way of information acquisition for the user model. Information about the user may be acquired explicitly or may be inferred implicitly from the user's previous interactions (e.g. WebGuide [17, 63], AVANTI [18, 19], INTRIGUE [3], Gulliver's Genie [23, 38], m-ToGuide prototype [29], UMT [58] or both (TravelPlanner [10], MastroCARonte [12], Speta [20], [25]). Enabling consumers to develop their online profile and to include personal data that indicate their reference can support tourism organizations to provide better service [8]. The main problem with explicit user models is that users may have to answer too many questions. Furthermore, users may not be able to describe themselves and their preferences accurately. In this respect, implicit user modeling has been considered as more reliable and non-intrusive than explicit user modeling. However, one main problem of this approach is that the hypotheses generated by the system for each user may not be accurate. Furthermore, there may not be sufficient time for the system to observe the user for producing accurate hypotheses about him/her. In view of the above advantages and

disadvantages, some systems, such as TravelPlanner [10], MastroCARonte [12], Speta [20, 25], use a combination of explicit and implicit user modeling. More specifically, TravelPlanner selects the most useful queries to present to the user and all the other information is acquired implicitly. Similarly, in SPETA [20], in the beginning the user provides explicitly information about his/her interest, the kind of places s/he prefer to visit, and the ratings given to attractions. Additionally, a huge amount of information can be extracted from the social networks they belong to and the user behavior.

Finally, the last dimension that is taken into account user modeling systems involves short-term versus long-term user models. Almost all recommender systems maintain long-term user models as the previous interactions of the particular user or other users with similar characteristics are essential for content-based, collaborative or demographic filtering.

6 Discussion

There are many tourists that do not prefer to travel in groups with guides as they choose to have their own pace in a museum or a city. For this purpose, many tourists use guide books or other systems. More specifically, different kinds of hardware equipment using specialised software systems or the Internet have been used into the museum environment such as PDA's, mobile phones, tablet PC's or even robots. However, a main problem with the above means is that the books have limited information while Internet has so many links to visit that a user may be frustrated. Software systems for a city or a museum, on the other hand, they are usually static and difficult to use. These are the main problems addressed by adaptive recommender systems for museums or city tours.

The main focus of the paper is to make a state-of-the-art on the adaptive systems for tourists interested in cultural heritage. More specifically, emphasis is given on the adaptive systems as well as the hardware technology used. In order to make their interaction adaptive, system use user modeling techniques for capturing and using the users' interests and background knowledge. The complexity of such systems makes it difficult and time consuming to implement. Therefore, in this paper we refer to the problems of the systems implemented and the special requirements of each hardware device used for this purpose.

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