A recommendation system to promote local cultural heritage

Pierpaolo Di Bitonto, Maria Laterza, Teresa Roselli, Veronica Rossano

Università degli Studi di Bari "Aldo Moro", Dipartimento di Informatica - {dibitonto, marialaterza, roselli, rossano}@di.uniba.it

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The value of cultural heritage is widely recognised both at national and international level, because it allows the cultural roots, memories and identity of a territory to be discovered. For this reason it is not limited to historic sites, monuments or churches, but must necessarily include a knowledge of the traditions, legends and religious rites which are part of the culture of a place. Web portals for the promotion of tourism usually offer information limited to only one category of items and this information is not sufficient to gain a deeper knowledge of a place or event. Moreover, it is rare to find on the Net solutions that are able to support teachers choosing the sites to be visited in an educational tour. The paper describes a recommender system for cultural heritage that is able to support both tourists and teachers selecting items (tangible or intangible) to visit, and that is able to offer in-depth material, selected according to the interests of the target users, that can consolidate the knowledge of the places visited. The main features of

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the system are: the use of a user-centred and collaborative approach to promote knowledge; a set of metadata that allows the resources to be contextualised in the culture of a territory; the use of a recommender method that takes into account the user's preferences, multi-criteria user feedbacks and the semantic relationships among the items.

1 Introduction

Cultural heritage tourism allows people to discover places, artefacts and activities, which are the expression of the historical and artistic heritage of a country and represent its identity (Raimondi, 2009; CUEBC, 2000). To promote and spread the knowedge of the cultural heritage of a territory involves stimulating and motivating tourists to choose a place and supporting their discoveries of the cultural value of the trip. Cultural tourism, however, should not be perceived as limited to the discovery of tangible items (historic sites, monuments and artefacts of artistic value, etc..) but also as an investigation to discover intangible items (oral traditions and expressions, performing arts, rituals and festive events, etc..) that bear witness to the historical and cultural evolution of a territory. In this regard, in 2003 the UNESCO recognized the value of intangible items, stressing the importance of their role in the cultural and economic development of a country (UNESCO, 2003). However, the Web does not always provide information imparting a deeper knowledge of the cultural aspects of a place: it is easier to find information on the tourist services intended to make the stay more pleasant, and that are more profitable for the providers of such services. It is even rarer to find network solutions that are able to support the planning of an educational tour, starting from defined educational objectives. An optimal solution should, on the one hand, offer users a customized selection of items based on their preferences and, on the other hand, provide in-depth material which will extend their knowledge even if the visit does not follow. In addition, to encourage a broader spread of local culture, tourism promotion should be addressed not only to an adult audience, but also to the younger generations for whom cultural tourism is a source of precious knowledge of the culture, history and traditions of a territory. In this regard, in 2009 an agreement was signed between the Italian Ministry of Education, University and Research and the Ministry of Heritage and Culture for the activation of initiatives aiming to facilitate young people's access to culture: *the initiatives aim to encourage cultural exchanges, a knowledge of the national history and local culture, also through educational trips that foster the discovery of common roots* (MIUR MIBAC, 2009).

In this context, the paper describes an innovative recommender system for cultural heritage tourism that is able to suggest tangible or intangible items and in-depth material related to them, both selected according to the user profile.

The recommendation process could support the planning of both a tourist trip and an educational tour.

The work is structured as follows: the next section shows the potential and limitations of the current solutions for the promotion of cultural heritage tourism; in the third section a description of the defined recommendation system is supplied, paying particular attention to the metadata for the item descriptions and the main steps of the defined recommendation method; finally, an example of user-system interaction is detailed in order to make the recommendation process clearer.

2 Related works

In the last years, thanks to the interest and value attributed to cultural heritage tourism, recognized at international level, numerous technological solutions have been offered on the Web. Nevertheless, the current solutions, both national and international, are not sufficiently complete since some of them are able only to filter the items according with the user's criteria without any personalisation, others supply only service information without any kind of material that could enhance the value of the tourist trip, while others, although they are recommendation systems, are able to make predictions only about a single category of items (i.e. events, locations, etc.). For example, the Web portal *PugliaEvents* (Apulia Region, 2011), one of the latest national solutions for the promotion of events in Apulia region, allows those interested to look up specific events, using time and space criteria inserted by the user, as well as the kind of event (tradition, art, theatre, etc.) and the target tourist (family, adults, children, etc.). The portal supplies, for each event, a detailed description, followed by some service information, but does not propose any kind of information that could allow the history and tradition to be investigated in order to make the attendance at the event more interesting to the tourist. For example, for the event "Federico II and Fiorentino's historical parade", that will be held in Torremaggiore (FG) on August the 6th and 7th, the in-depth material could supply information related to the history and the reasons why this event represents an important tradition for that location. Moreover, the portal does not supply suggestions about tangible cultural items, nor intangible items that are not events, such as dialects, recipes or legends, which are an important aspect of the local culture. In the context of national solutions to support teachers arranging an educational tour, there is the project *Sulle Orme di…*(Ministry of Education, 2007), that is promoted by the tour operator Zainetto Verde and the Ministry of Education, University and Research. The main aim of the project is to promote the traditions, local handicrafts, and the traditional tastes of the Italian regions by means of educational tours planned for primary school pupils. The portal

visualizes a catalogue containing some study trip proposals, and can provide a cost estimation of the travel or ask expert tour operators for help in planning the travel. However, in this solution, no personalisation can be realised by the teacher according to particular educational benefits or preferences because the portal offers only pre-arranged trips. Also in this case, in-depth material is not supplied and the suggestions concern only tangible items.

A solution that is closer to the proposal in this paper is the recommendation system *MacauMap* (Biuk-Aghai *et al.*, 2008), that is able to suggest points of interest in Macau city (China). The selection of the points of interest to be recommended is done on the basis of the user's preferences and, unlike the previous solutions, the service information is enriched with multimedia content illustrating the item. These contents are aimed at supporting users selecting items to visit, since the recommendation is not personalised on the basis of the target user. In other words, the systems supporting cultural heritage tourism, both recommendation systems and not (Ricci *et al.*, 2011), have two main limitations: they are able to suggest only one kind of cultural items (usually tangible items and in some cases events), and for each item they supply mainly the information (inserted in the system by the administrator or by experts) considered useful to make the trip pleasant. Unlike these solutions, the proposed recommendation system is able to suggest both tangible and intangible items that are not limited to events but include legends, cooking traditions, and so on. For each of them, moreover, the service information is enriched by in-depth material that is suggested according to the target user. Furthermore, the system is able to suggest not only items for a general tourist but also for teachers intending to arrange an educational tour for their students. In this case, the in-depth material could be used in educational activities before the trip (Di Bitonto *et al.*, 2011).

Moreover, the proposed recommendation system is entirely created by users for users, using a user-centred and collaborative point of view aiming to promote the local cultural heritage. The users, in fact, can describe the resources, becoming promoters of the items and sharing their knowledge of them, they can assess the resources, thus providing their contribution to the review process of the knowledge, and they are the final users of the system recommendations.

3 A system to promote cultural heritage tourism

The proposed recommendation system is able to suggest a set of tangible (such as castles, museums, churches, etc.) and intangible (festivals, religious parades, etc.) items and, for each of them, to supply in-depth materials selected according to the target users. From the technological point of view, the innovative aspects of the proposed system are represented, on one hand, by

the definition and use of a set of metadata that allows the resources to be contextualised in the different educational areas and to be sought on the basis both of the target users and of their relationships with the other items; on the other hand, by the definition of a recommendation method that selects the resources on the basis of the user's preferences, orders the items using users multi-criteria feedbacks, and enriches the set of suggestions using the semantic relationships among the items.

3.1 Contextualised metadata

In the current recommendation systems for cultural heritage tourism the points of interest are usually described using a set of metadata that are able to define the space-time dimensions, the category of the item, the type of item, the services offered, and so on. In order to recommend tangible and intangible items and thereby promote the knowledge of a local cultural heritage, also among the younger generations, these dimensions are not sufficient. It is necessary, in fact, to consider dimensions that are able to contextualise each item on the basis of the relative fields of knowledge, to represent the relationships among the items, that are the associations with their history and traditions, to define the cultural significance of the item at local, national or international level, and to define the adequacy of the item to the target users. For these reasons the metadata defined herein are able to describe both the usual dimensions and those that are able to relate the item to a specific cultural context. In Table 1, the main metadata used in the proposed recommendation system are summarised.

TABLE 1
Metadata for describing the items

Name	Meaning	Example
`<category>`	Category of item	Tangible item, Intangible item
`<tipology>`	Type of item in the category	Tangible Items Castle, museum, church, etc. Intangible items dialect, legend, religious parade, etc.

Name	Meaning	Example
<original_ location>	Place and Time of location of the item at its origin. The Place is the geographical point in the world, known or estimated, where the tangible item is created or retrieved, or where an intangible item (event) took place. The Time is the date or the interval of dates, known or estimated, in which the item can be situated. In case of intangible items it indicates the time when it started (for example: the first edition of the historical parade of S. Nicholas in Bari was held in 1000 A.D.)	Place Scavi Lattanzi di Egnazia - Fasano (BR) - Italy, Athens (Greece), etc. Time 1200 B.C.,1300 A.D., 29 January 1240 A.D., 1200-1050 B.C., 1240-1250 A.D., etc.
<location>	Place and Time of the item at the moment of the user's request.	Place Archaeological Museum of Bari, Andria (BT) - Italy, etc. Time April 2-5 2011, always, etc.
<educational_ field>	Educational field in which the item could be contextualised	History, Art, Science, etc.
<theme>	Topic within the educational field..	History Middle Age, Renaissance, etc. Art Impressionism, etc.
<cultural_ significance>	Item's cultural significance	Local, National, International
<semantic_ relationship>	Relationship among items	Is composed of, is inside in, etc.
<target>	Type of user for which the item is suited	Adults, primary school students, secondary school students, etc.

3.2 The recommendation method

The functional architecture of the system (Figure 1) shows that the recommendation component is composed of three sub-components: selection, ranking, and semantic enrichment.

The *Selection Component* (CS) selects the items (and the related in-depth material) that could be interesting to the user on the basis of both the user preferences and the item metadata. The characteristic of this selection is that it first selects the items considering the space-time range defined by the user, then the range is increased by 30% and the component checks if in this range

there are items that should be considered for their cultural significance and/or for a positive evaluation supplied by users of the system that visited them in the past. If these conditions are verified, those items are added to the selected set of items.

The *Ranking Component* (RC) receives as input the selected set of items (and related in-depth material) and orders it using the multi-criteria feedbacks provided by users on each item. The advantages of the ranking process used are both the use of multi-criteria feedbacks that allow the resources to be assessed according to different points of view, unlike what happens in a traditional collaborative recommendation system, in which only one value can be expressed for each item, and to the use of metrics that are able to detect similarities among the users of the system more accurately.

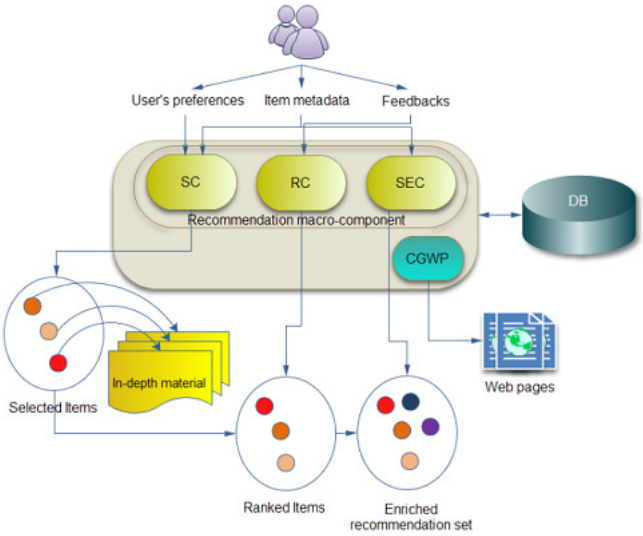

Fig. 1 - Recommendation System Architecture

The *Semantic Enrichment Component* (SEC) uses the relationships among the items in order to add to the recommendation set those items (and the related in-depth material) that have not been considered during the selection process but that are interesting because they are semantically correlated with those already selected. The semantic relationships used in the enrichment process are both those defined by the user in the metadata (Table 1) and those inferred by the system by analysing the properties common to two or more items of the recommended set. In particular, the relationships defined by the user allow the previously selected recommended set to be integrated with those items in the system that have the specified relationships with the item set, whereas the rela-

tionships inferred by the system allow the recommendation set to be enriched with those items that have common properties discovered by the system. For example, the set of items selected by the first two components of the system verifies the property: "Federico II's Castles", while the semantic enrichment will add to the selected set all those items that are related to Federico II but that have not been considered in the previous two phases of the recommendation process.

In addition, the system uses a Component for the Creation of Web Pages (CCWP) that uses some of the metadata inserted by the user in order to dynamically create Web pages. Those Web pages will present the item, supplying both service information and the related in-depth material.

In order to clarify the recommendation process, a user interaction example is described in the next section.

4 User-system interaction: an example

The system is accessible by three different user profiles: promoter, tourist and teacher. If the user is recognised as a "promoter" s/he can promote one or more cultural items, describing them using the metadata schema presented in Table 1; if the user is recognised as a "tourist" or a "teacher" s/he can ask for a recommendation for the arrangement of a trip, tourist or educational, and leave multi-criteria feedback both on the items visited and on the in-depth material used. Let us suppose that some promoters describe the following items in Apulia region: "S. Nicholas Basilica", "Norman Castle", "S. Mark Church" and "S. Nicola Relics" (all these items are located in Bari), "Castle of Gioia del Colle" (in Gioia del Colle near to Bari), "S. Maria Amalfitana Basilica" (in Monopoli near to Bari), "Castel del Monte" and "Federico II Historical Parade" both in Andria (province of Barletta-Andria-Trani). On the basis of those items and the related relationships among them (S. Nicola Relics "are inside" the S. Nicholas Basilica), the promoters can upload the in-depth material and define the target user for which it is suited. After the items are inserted, a tourist can request a recommendation for items to visit in Apulia, specifying a particular geographical area, a particular time period and a specific type of items to visit. Supposing that s/he would wish to spend some days in Bari with her/his family (adults and children aged 7-13 years) from April the 2nd to 5th and that s/he is interested in discovering the architecture of the Middle Ages and s/he can travel within an area of 50 km. The SC component uses a subset of the metadata that describe the items in order to identify which items in the system are best suited to the user's request. In this case the following items are selected: "S. Nicholas Basilica", "Norman Castle", "S. Mark Church", all these items are situated in Bari (the starting city); also the "Castle of Gioia del Colle" (in Gioia del Colle

43 km far from Bari), and "S. Maria Amalfitana Basilica" (in Monopoli 44 km far from Bari) are selected. At the same time, the in-depth material for each item is selected according to the user profiles: adults and children aged 7-13 years. Afterwards, the SC component selects all the items situated around Bari within a 65 km radius (distance from the starting point increased by 30%) and in the period from April the 2nd to the 6th (time interval extended by 30%). In this new range, the SC component finds "Castel del Monte" (60 km from Bari), it is added because of its cultural significance at International level as a UNESCO world heritage site (also of note, it is depicted on the euro 1 cent Italian coinage).

The next step is aimed at ranking the items according to the multi-criteria feedback left by users that have previously visited the items selected. The RC component will present in the top positions of the ordered list those items that have been evaluated as most interesting by users. In the illustrated interaction scenario, for example, the ordered list could be the following:

1. "Castel del Monte"
2. "S. Nicholas Basilica"
3. "Norman Castle",
4. "S. Mark Church"
5. "Castle of Gioia del Colle"
6. "S. Maria Amalfitana Basilica"

After the selection and the definition of the ordered list, the SEC component enriches the set of items to be recommended. In this case, the component points out that three castles ("Castel del Monte", "Norman Castle", and "Castle of Gioia del Colle") have a common property: they are all related to the Emperor Federico II. Since in the system the item "Historical parade of Federico II" is catalogued, this item is added to the recommendation list. Moreover, the item "S. Nicholas Relics" is also described in the system and since the promoter user has indicated that it "is inside" the "S. Nicholas Basilica", it is added to the ordered list. Finally, the suggestion is visualised to the user as an ordered list of Web pages links, which have been built using the item metadata.

Conclusions and future works

The value of cultural heritage tourism, recognized both at National and International level in the last years, has led to the spread of several solutions aimed at promoting local cultural heritage. The current solutions are usually able to filter the information on the basis of the user's search criteria, but to suggest items belonging only to a single category (tangible or intangible), or to supply only service information. The proposed recommendation system,

instead, is able to suggest a list of both tangible and intangible items using a recommendation method based on the user's preferences and, thanks to using multi-criteria feedbacks and the semantic relationships among the items, it is able to improve the association among items and their stories and traditions.

There are various innovative aspects of the proposed recommendation system: it is able to contextualise the item from the point of view of the knowledge that can be transferred to the visitor; it supplies a ranked list of items and related in-depth material, selected according to the target users type; it uses a collaborative and user-centred approach to promote the knowledge and the culture of even the smallest area; it supplies suggestions to both the tourist and the teacher interested in arranging an educational tour; it allows the knowledge to be acquired even if the visit does not take place. Currently, an experimentation of the system, aimed at evaluating the effectiveness of the suggestions, is under execution.

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