Ontology-based Web service to recommend spare time activities

Luis Martínez Marina
Universidad Rey Juan Carlos
c/Tulipán s/n, Móstoles
Madrid, 28933, Spain
+34 669162655
luis.comunio@gmail.com

Juan Antonio Calles García
Universidad Rey Juan Carlos
c/Tulipán s/n, Móstoles
Madrid, 28933, Spain
+34 622057192
juanantonio.calles@urjc.es

Estefanía Martín Barroso
Universidad Rey Juan Carlos
c/Tulipán s/n, Móstoles
Madrid, 28933, Spain
+34 914888266
estefania.martin@urjc.es

ABSTRACT

The number of people that use Internet as a source of information increases continuously. Internet provides a great amount of heterogeneous information. When interacting with the Web, not all the users have the same goals, interests or needs. This paper presents a recommender system for spare time activities (such as visiting museums, restaurants, conferences, etc.). It suggests the most suitable options taking into account the personal features of each user, that is, his/her preferences, economic resources, available time and disabilities. Furthermore, it provides the means of public transport to arrive at the place where the activity will be performed. The results of a case study focused on Móstoles city are presented too.

Categories and Subject Descriptors
H.3.5 Web Services, J.m Computer Applications – Miscellaneous

General Terms
Design, Experimentation, Human Factors.

Keywords
Recommender systems, ontologies, expert systems.

1. MOTIVATION

Internet provides a great amount of heterogeneous information. Inexpert users can feel disoriented if they find many options. When interacting with the Web, not all the users have the same goals, interests or needs. It is well known that aspects such as background, goals, available time, or users’ preferences, can influence the way in which they interact with information. Therefore, there is a need to adapt both the options and the information presented to each user taking into account his/her personal needs. With this goal, Adaptive Hypermedia arose to the beginnings of the 90s. Brusilovsky presented the first classification of AH methods and techniques in 1996 [2]. Recommender systems are a type of adaptive systems, which are focused on modeling the user’s interests and preferences.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

HetRec ’10, September 26, 2010, Barcelona, Spain.
Copyright 2010 ACM 978-1-4503-0407-8/10/09...
$10.00.

A recommender system is able to produce individualized recommendations as output or to guide the user in a personalized way to interesting and useful objects in a large space of possible options (i.e. films, music, books, places, activities, images, etc.). Specifically, recommender systems have i) background data, the information that the system has before the recommendation process begins, ii) input data, the information that user must communicate to the system in order to generate a specific recommendation, and iii) an algorithm that combines background and input data to do suggestions. A recommender system usually combines the features of the user with some main characteristics taken into account by the system to give a personal suggestion. Many recommender systems try to classify a certain user using information of similar users [1].

The recommender systems increase the fidelity of the clients and the quality of the results improving the user experience. Furthermore, they help to inexpert users, providing relevant information and reducing the possible options. Users can take an easy decision with their help. Nowadays, recommender systems are increased in areas such as criminology profile finding [6] or music recommendation [15].

Burke presented a review with different recommendation techniques to perform suitable suggestions: collaborative, content-based, knowledge-based, and demographic techniques, among others [3]. Different techniques to implement the recommendation mechanisms are Markov chains [14], collaborative filtering [4], fuzzy ranking [9], heuristics based on the popularity of the items [5], bayesian networks [8], neural networks [13], and ontologies [17], etc.

Expert systems transform the knowledge of an expert in the knowledge of the system and the corresponding rules. Some recommender systems are based on the implementation of expert systems that allow suggesting different items depending on the information stored in the system.

This paper presents a recommender system for spare time activities (such as visiting museums, restaurants, sport centers, conferences, etc.) in section 2. The recommender system suggests the most suitable options taking into account the personal features of each user, that is, his/her preferences, economic resources, available time and disabilities. Furthermore, it provides the means of public transport to arrive at the place where the activity will be performed. Next, the results of a case study done are detailed in section 3. Finally, conclusions and future work are presented.
2. RECOMMENDER SYSTEM

This section presents the design and the implementation of a recommender system that suggests the most suitable spare time activities. First, the user model stores the characteristics that the recommendation process will be taken into account. Next, the expert system and the Web service developed are presented.

2.1 User model and activity model

The user model contains the main features of the user that the recommender system will take into account in order to suggest the most suitable activities. These features can be classified into three groups: personal features, preferences and contextual features. The first group includes personal features of the user such as age or if the user has a specific disability. These aspects are the most relevant for recommending activities to a specific user. For example, if the user is a teenager, the recommender system does not recommend activities related to discotheques or films inappropriate because it is required that he/she has more than 18 years old. The second group considers different preferences of the user. These are related to the grade of interest in different hobbies such as going to museums, watching movies or theatre, playing sports, shopping at malls, and nightlife activities. The preferences are taking into account in the recommendation process too. Finally, the last group considers contextual features such as the time availability (available days and hours) and the budget to do activities.

With the goal to provide recommendations, it is needed to store information related to the available activities that can be performed by the users. This information constitutes the activity model and includes the following data:

- The name of the activity.
- Category of the activity: museums, sports, shopping, catering, theatre, cinemas or night live.
- If it is adapted to a certain disability or not.
- The minimum age to do it (i.e., the activities that allows drinking alcohol will not be recommended to persons under eighteen years old because it is not allowed).
- The available days when users can do the activity and the available hours (available time slot).
- The place of the activity including the neighbour and the public transports to arrive there.
- The price of the activity.
- If there is a reduced price depending on the day (e.g. cinemas have special price on Wednesdays).
- Interest of the users for this activity (1-5).

Both the user model and the activity model are modelled using the Protégé [16] by means of an ontology.

2.2 Expert system and Web service

The next step was created an expert system from the ontology to generate the recommendation rules that use the Web service. This step creates the rules that use the recommendation mechanism of the Web service. These rules are generated automatically by Clips. All the information of the activities are defined by means of rules. The recommender system checks what activities are more suitable for a specific user depending on the information stored in the user profile and the rules. For example, if a teenager is looking for a night live activity, there is not available any recommendation because this type of activities is not suitable for people under 18 years old and it is specified in the rules.

The next step is to use the library ClipsNET. It contains a set of classes that allow the interaction with the expert system. With this library, new information can be added to the expert system. So, it has been used to add the information of the users who provided their features using the interface of the tool. The Web service is developed with ASP.NET and Ajax [15]. This framework allows integrating the expert system using the ClipsNET library. This service takes in mind the characteristics included in the user model, the recommendation rules and the collaborative filtering technique in order to provide recommendations for each user.

When the user wants a recommendation, he should fill the information required for giving a recommendation. An example of a screenshot can be observed in figure 1.

![Figure 1. Example of screenshot for the recommender system.](image)

The interface presented in figure 1 is structured in three steps. The user has to provide their personal features such as age, current physical location, disabilities and available budget in the first step. The second step is to fill the user preferences and interests (e.g. theatre, cinema, museum, sports, among others). Finally, the user selects the available days and time.

When the user has filled the information of the figure 1, he presses the button "Recommend". The recommender looks for the most suitable recommendations based on the information provided by the user and the information related to the available activities and recommendation rules. An example of a specific recommendation is presented in figure 2. The calendar is situated in the upper area. Buttons annotated with “V” mean that the recommender system has a suggestion for this user.
that day and time. The results obtained are ranked using the information of previous interactions with the system (collaborative filtering). Next, the system provides a certain recommendation below “Information” titled. Let us to suppose that the user wants a recommendation about restaurants to lunch. He has 30 euros and he does not have any disability. The system recommends “La taberna el Bribón” to lunch.

A CASE STUDY

A case study has been done to test the Web recommendation service detailed in the previous section. In the case study, people who live in Mostoles city have participated. The recommender system included information about the available activities in Mostoles and the use of public transport of this city.

The users who participate in this case study were 13 people: 5 users were under 25 years old, 3 users were between 25 and 50 years, and finally 5 users were over 50 years old.

The users of this case study included people both with disabilities (23% of the users) and without them (77% of users). Few users were disabled with the rapeseed oil syndrome with important consequences in mobility aspects. It will be useful that the recommender system will take into account the physical difficulties when it will suggest the activities to the user.

Before starting the study, the general goal of the recommender system was explained to the users. Then, the users interacted with the system and performed a set of tests with the tool to receive suggestions about the most suitable activities, depending on their personal features that were already included in the user model.

After interacting with the tool, users answered an anonymous survey regarding their satisfaction during the interaction with the tool, the utility of the recommendations provided by the system, the use easiness, and so on. The goal of this survey was to detect the advantages and disadvantages of the recommender system. It was composed of 31 questions. Some of them were tests based on Likert scale. Others were open-ended questions where users gave more detailed feedback about the use of the recommender system.

Each aspect of the survey could be scored between 0 and 5 points by users. The mean of scores for each aspect are presented in figure 3. The aspects in this figure are the following: overall rating, easy to learn, effective recommendation, clear information, simplicity, help, comfort, layout, appearance.

As it can be seen, the final mean score of the recommender system is 4.15 over 5. The users are satisfied with the system in general. The poor scores are the appearance (3.84), the layout (3.84) and the comfort (3.61). An important aspect to be in mind is that five users out of 13 were over 50 years old (see figure 3). They had some difficulties with computers and they spent more time than other users. This could be the reason for these poor scores, specially the comfort aspect. The best rated aspects are the easiness to learn using the system (4.46), the clear information provided by the recommender system (4.38), the simplicity of the tool (4.23), and the helps provided to users (4.38). The scores obtained in aspects such as the usefulness, the simplicity and the helps provided indicate that users can use this system although some of them do not use computers.

Apart from general scores presented, it is important to emphasize the scores obtained in the question number 10. This question was the following “Imagine you visit Mostoles city and you do not know this city, would it be useful to the recommender system suggest the most important activities taking into account your available time and personal features?”. 8 people answered that they are strongly agree, 4 users were agree. Only one person was strongly disagreeing.
Figure 3. Summary of the mean scores obtained in this study.

The last question to emphasize is the following "the list of the possible types of activities (theatre, cinema, sports, etc.) is appropriate or do you miss something?". 10 people were agreed and 3 people were strongly agreed.

4. CONCLUSIONS AND FUTURE WORK

The work presented in this paper presents a recommender system that is able to do suggestions about spare time activities. It is easy to use and efficient. This system helps to choose the most suitable activities according to the personal features of a specific user, their hobbies and their disabilities (if any). This recommender system has been useful in the real city, Móstoles. Users have been able to use without help. It is important to emphasize again that the age of many users were between 50 and 65 years old. They had not studies and they had not used the computer in their life. The most important aspects of the recommender system were the usability of the system, easiness and facility to learn its use. In general, it is important to take into account not only the personal features of the users and their available time but the possible disabilities helping to the inclusion of all.

We are working on a Web service to help town council to add new activities in an easy way. In this way, many activities could be included in the system, and many users could benefit from it and obtain recommendation of activities from different cities.

5. ACKNOWLEDGMENTS

This work has been supported by the Spanish Ministry of Science and Education, project number TIN2007-64718.

6. REFERENCES


