State of Art Survey of Travel based Recommendation System

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Abstract: Recommendation systems are software agents that can predict preference or interest of individual customers and recommend items accordingly. Online recommender system have been improved systematically in the last decade. With the booming of location sharing services, travel recommendation systems are also improving. Users share their geo-spatial dataset in social networks, inspired development of novel techniques and features in recommendation systems. Travel recommender system are emulation of offline travel agents. Travel based recommendation system provide users travel suggestions which helps in their decision making. This paper is a state-of -art survey of travel recommendation approaches. The merits and demerits of selected work is summarised and presented.

Keywords: recommendation system, social network, LBSNs, point-of-interest, mobile-crowd-source.

I. INTRODUCTION

Recommendation system are a subclass of information filtering system that seek to predict the "rating and "preferences" that a user would give to an item. Recommendation Systems have become increasingly popular. Recommendation systems are utilized in variety of areas including user recommendation, movies, music, travel, books, financial services, twitter pages and many more.

To form recommendation system, social networks are used to collect the information. This has turned out to be an effective way of collecting information. People use to share all the information on social networks. This contains photos, status, check-in by which information about user's interest can be filtered out.

While planning a vacation, people used to ask their friends or family for suggestions. This trivial way was inconcise and focused on friend's individual choices. To solve this problem, the solution is one of the various recommendation systems, that is travel recommendation system.

Travel recommendation system is one of these recommendation systems which provide better solutions of travelling to users, based on their interest and preferences. Different approaches have been provided by researchers to provide the better results on travelling based recommendation system. Initially ,the travel recommendation system used intelligent agents to extract the better results of recommendations. User interest is also necessary to provide better results of recommendation. So further, researchers used the approaches that extract the user information and their interests and incorporated in the recommendation system.

Since most of the people share their interest on social networking sites so, most of the researches have used social networking sites to form the recommendation system using different factors of user interest. Some of the content based travelling recommendation system used these sites to form the user profile and provide the results based on user profile. Collaborative filtering has also been used by researchers to provide better results. Check-in is also a factor which gave the information about user interest and features of various places. These check-in details have been used by researchers to form better results.

Here is the literature survey which discusses various travel recommendation approaches to give better way of finding travelling routes and locations. Many researchers had further worked in this direction. Next section is an effort to provide the survey of all the major works that has been done in travel recommendation system.

II. LITERATURE REVIEW

This paper is the survey which describes the various approaches given by researchers to make recommendation system in effective manner. Recommendation Systems have been classified, according to the way in which they analyze the information of the user and filter the list of items, into content based, collaborative, hybrid system and various related approaches.

A. *Multi-agent based recommendation system*

[1] **Wang et.al.** elaborated, that arranging travel schedule was a classical method. It's structure, was uncertain, and had dynamic complexity. Hence, this paper proposed an intelligence travelling recommender(ITR) system based on intelligent agents and commonsense reasoning algorithm. ITR consists of three intelligent agents and three automatic mechanisms. It enables user to constantly refine and revise suggested travelling-schedule .

[2]**Correa et.al** describes a multi-agent recommender system where agents maintain local knowledge bases and collaborates exchanging information stored in their local bases. A request for a travel recommendation is decomposed by the system into sub tasks, corresponding to travel services. Agents select tasks autonomously, and accomplish them with the help of knowledge derived from previous solutions.

[3]**Ana Lucia et.al.** presented a multi-agent recommendation system according to user needs. The system includes two types of agents that share a common goal and assign a separate individual goal. These agents communicate with each other by exchanging messages. But knowledge base is centralized in this system.

[4]**Lorenzi** proposed a new multi-agent recommendation approach based on distributed knowledge. Resources can be distributed to several agents who works as experts, cooperate

with each other by exchanging information stored in their knowledge base.

B. Collaborative filtering based recommendation system

[4] **Lakshmanan** et.al. proposed a recommendation system based on the central idea. The usual recommender systems provide users with a list of recommendations without any assessment about target user's interest. Hence this system recommends top-k packages for users to choose from. The recommended packages consists of items in the form of sets or sequences based on user preferences like budget , location etc. The system uses rating information from underlying recommender systems, allows flexible package configuration and incorporates users cost budgets on both time and money. It had good graphical user interface which could let users to customize the returned composite recommendations and took into account external local information.

[5]**Jiang, et.al.** proposed User-based Collaborative Filtering for Tourist Attraction Recommendations. It describes the way of recommendation by using number of visits and takes it as feedback to generate the results.

C. Content filtering based recommendation system

As discussed earlier, collaborative filtering methods used the approaches which is based on the feedback and number of visits but had not any prior information about the user. To improve the recommendations , content based filtering came into picture.

[6] **Romeo et.al.** explained a framework which uses the prior knowledge and generates result what the users expect from a recommendation task. Recommendation system used Page Rank-style method with respect to target user's preferences for personalization. Because of the emerging trend in research on recommender systems to design a system which could recommend packages instead of single items. It seem to be a little complicated task because the base data was not easily available. Data collected from various social networking sites is used to get the prior knowledge about the user and then generated the result.

D. Hybrid filtering based recommendation system

As discussed To provide the recommendations which are based not only on user profile but also having extra suggestions hybrid recommendation approaches had been used.

In [7] hybrid approach is used to provide the information about travel package. Hybrid approach is combined form of content based filtering and collaborative filtering. Content filtering is association between user problem and description of items. Collaborative filtering is a process of finding persons with similar interest. These two filtering are combined to form a model. The package shows a form in which user fills the information as per the requirement and admin provide the new created package suggest to user. The package recommendation form shows the area, season and price of package.

Information fetch from the form filled by user is not h suitable method for users. There should be some implicit method to fetch the interest of the user.

[8]**Lou, et.al.** describes the hybrid filtering which combine the both approaches content and collaboration. In this recommendations are generated through profile matching.

[9]**Girijamma proposed** a hybrid approach with use of tags, geo-tags image is proposed in this paper. User based collaborative filtering is used to create suggestions for the users.

E. Social sites based recommendation system

In [10] **Chen, et.al.** focused upon study of exploiting online travel information for personalized travel package recommendation. There was always some unique characteristics of travel data which distinguished travel packages from traditional items for recommendation, to identify it was the most critical challenge. So, characteristics of the existing travel packages were analyzed and a tourist-area-season topic (TAST) model was developed. This TAST model represented travel packages and tourists by different topic distributions, where the topic extraction was conditioned on both the tourists and the intrinsic features (i.e., locations, travel seasons) of the landscapes.

Then, based on this topic model representation, a cocktail approach was proposed to generate the lists for personalized travel package recommendation. Furthermore, the TAST model was extended to the tourist-relation-area-season topic (TRAST) model for capturing the latent relationships among the tourists in each travel group and provided better recommendations to users.

[11]**Ying Zhang et.al.** proposed a novel approach to include personal preferences for trip recommendations by analyzing the photos taken by the user in the past. The photos continuously accumulated over time are tagged with geographical information. A probabilistic model is applied to detect favored points of interest (POI) contained in the field-of-view (FOV) of the photos. Subsequently, each detected POI is classified into one or more corresponding categories, which are then used to build a user profile. Furthermore, by mining the geo-tagged photos taken by many users, we can extract the frequent travel patterns, which may reveal the user's travel habits

F. Location aware social network based recommendation system

In [12] **Xing, et.al.** findings given by them were that an Effective tool to provide travel services (e.g., Landscapes selection[19]) for tourists is recommender system. Recommender systems are based on travel data that are supplied by travel agencies, and provide travel packages from a fixed package set, which bring two challenges for travel package recommender system. One is how to generate more travel packages. The other is how to measure user similarity. In order to address these challenges, a package generation and recommendation framework was developed to help travelers select landscapes.

First, a Fuzzy Clustering based Package Generation algorithm (FCPG) was proposed to generate new travel packages to improve the overall recommendation effectiveness and then, Dual Topic Model based Package Recommendation algorithm (DTMPR) was developed. It considered two user-related topics (travel seasons and areas), and provides more fine-grained user similarity measure.

[13] **Feng, et.al**. proposed a approach in which preferences for locations is collected from mobile crowd sourced data from location based social network services (LBSNs). A travel package recommendation system was thus proposed to help users make travel plans by leveraging mobile crowd sourced data. Main process proposed was that, it extracted user preferences, discovers points of interest (POIs), and determined location correlations from check-in records. It generated personalized travel packages by considering user preferences, POI characteristics, and temporal spatial constraints such as travel time and starting location. [22]Jie

Pangs was one of the most popular LBSN's in China on which this system prototype is built and evaluated.

[14] **Yu, et.al.** proposed that people share their locations on location based social networks and write their likings and disliking about those places there. By that data, one could guess user preference to locations. In crowd source digital foot prints each user is connected to many locations. The locations which users share on LBSNs is utilized in generating a travel package recommendation which could help them to make travel plan in an efficient way. The approach utilized data collected from LBSNs to model users and locations, and it determined users' preferred destinations using collaborative filtering approaches.

[15] Recommendations are generated by jointly considering user preference and spatiotemporal constraints. To generate travel packages a heuristic search-based travel route planning algorithm was designed. A prototype system was developed which obtained users travel demands from mobile client and thus generated travel package containing multiple points of interest and their visiting sequence. This approach is improvement in accuracy and diversity according to the experimental results.

G. Route based recommendation system

In [16] route based recommendation are given for travelling. They have explained the route based on crowd-source. Data have been collected from location based social networks by developer APIs[20]. Location recommendation usually focus on making single location suggestions and mine culturally important places in a given geospatial region based on multiple users' GPS trajectories, which is regarding to an individual's visit to a location as a directed link from the user to that location. The mentioned recommendation systems can provide users with a list of recommendations for consideration and only offer a single point of interest. The point of interest is according to the interest of user fetched from the user preferences. The most suitable point of interest is match with the user preference and give the recommendation to the user according to that user although travel plans usually contain several destinations[21].

[17]**Han Su et.al.** proposed a "CrowPlanner" system which used crowds' knowledge to improve the recommendation quality. It generated smart question, and then show several real route recommendation cases and the feedback of users.

Above is the study about the various approaches used to recommendation of travelling. Different researchers used the different approaches to provide the better results in the recommendation system but the common thing that has been used to form the recommendation system is that most of the information about the user preferences and visiting places has been collected from the social networks and explicit feedbacks. In the next section comparison of various approaches is provided.

III. COMPARISON TABLE OF RECOMMENDATION APPROACHES

This section consists of a comparison tables which highlights the different aspects used in various user recommendation techniques and discussed above in the literature survey.

A. Comparison table based on advantages and disadvantages of different approaches used in recommendation system

Different researchers have used different approaches which have been compared.

Table I. *Comparison of Approaches*

S.No	Title	Advantage	Disadvantage
1.	Intelligence travelling schedule recommender based on commonsense reasoning algorithm	Intelligent agents refine the results	Do not generate new recommendation based on social network
2.	User-based Collaborative Filtering for Tourist Attraction Recommendations	Efficient in tourist attraction recommendation	Number of visits is considered as the implicit feed back
3.	Versatile Graph-Based Approach to Package Recommendation	Focused on User preferences	Prior knowledge is necessary for recommendation
4.	A hybrid context aware system for tourist guidance based on collaborative filtering	POI recommendation using user context and profile information	Accuracy changes
5.	A Random Walk Around the City: New Venue Recommendation in Location-Based Social Networks	Predicts previously unvisited places	Not efficient for abundant data
6.	A personalized geographic-based diffusion model for location recommendations in LBSN	Nearby POI Can be recommended using a single model	Time of check-in and categories of location are not considered.
7.	Context Rank: Personalized Tourism recommendation by Exploiting Context Information of Geo-tagged Web Photos	Context information is used.	Users last visited land mark is considered as user preference
8.	A world wide tourism recommendation system based on geo-tagged web photos	Effective to cluster geographic images	Recommendation is limited and not intelligent
9.	A personalized geographic-based diffusion model for location recommendations in LBSN	Nearby POI Can be recommended using a single model	Time of check-in and categories of location are not considered.
10.	A point of interest (POI) location based recommender	Location based point of interest are considered	Only single point of interest id included

Above is the comparison table that describes the advantages and disadvantages of various approaches used to form the recommendation system.

B. *Comparison table of factors used in different approaches of recommendation system*

In this table the factors that have been used by different researchers are compared. These factors provides the different approaches to form the recommendation system.

Table II. *Comparison of Factors used in approaches*

S.N	Approach	Content Based	Collaborative	Hybrid	Social Network
1.	Correa [2]		✓		
2.	Lakshmana [4][18]		✓		
3.	Jiang [5]		✓		
4.	Romeo [6]	✓			✓
5.	Lou [8]	✓	✓		
6.	Girijamma [9]			✓	
7.	Chen[10]				✓
8.	Ying Zhang[11]				✓
9.	Xing[12	✓			✓
10.	Feng[13]				✓
11	HanSu[17]		✓		✓

Recommender system has been so extensively used these days that it has become a preferable choice. All the approaches describe above are given by many researchers has been used different factor to make the recommendation system more effective.

IV. CONCLUSION

Travelling recommendation system is used to improve the searching techniques about various places. Different techniques have been incorporated in recommendation system. From the survey it can be observed that different methods are introduced in travel recommender systems to increase its efficiency. Travel recommendation systems use historical data and models based on historical data for recommendation. The historical data used consists of different factors such as images, textual descriptions, and user check-in data, user ratings, influence of other users etc. Collaborative filtering is the most commonly used algorithm in travel recommender systems. The most important factor considered in all algorithms is the geometric attributes. The use of sentimental attributes along with geometrical attributes for POI mining can improve the travel recommendation performance. But there is also some factors that have not incorporated in the recommendation system so there is scope of improvement.

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