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Service Rating Prediction and Recommender System-A Survey

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Abstract: Recommendation systems help users with convenient access to the products and services they might be interested in the real world. Due to the needs of effective prediction and efficient recommendation, it is beneficial for the location-based services (LBS), to find out the user's next movable location that the user might visit. So in this paper, different types of approaches used to find, predict, and analyze location based services are discussed. The service prediction based on the implicit and explicit feedback is a trending one. It is necessary to deploy those prediction and recommendation services for real-time mobile application with trajectory mapping. While considering location information's, then the data size became huge and dynamic. Finding optimal solution to predict the rating based on the location and explicit behavior is surveyed. At last the suggestions for further process also given in this paper.

Keywords: Big data, Geographical location, Recommender systems, Web mining, social network services, Rating prediction, Predictive models, Point of Interest.

I. INTRODUCTION

The rapid development of mobile devices gives immense access of internet and many social network services. Day by day the mobile users count increases rapidly. And the statistics says that, the smart phone user's count in India in the 2017 is 299.24 million [1]. Using the smart phones many services are accessed, particularly the location based services are widely deployed in all types of applications in the mobile device. These applications allow the users to share their opinions, reviews, suggestions and images via several social networks and services. Due to the huge sized and dynamic data, the recommendation and suggestion is become difficult. With the help of geographical information's and social network data's the recommendation can be effectively performed to satisfy the users need [2].

The location based services are offering reliable and nearest services to the users, it will be more effective when the service is rated by the users who are familiar in social networks. When a user searches a feasible restaurant considering the location, the results should have with the nearest geographic locations. The result will be more effective when the geographical location details and social networks joined together. The social relationships and their ratings can be used for service recommendation. In this paper we reviewed some related works, and define the demerits and usage of those techniques. Additionally the common challenges and issues in the location based service recommendation; recommender system and service exploring process are studied.

A. LOCATION BASED SERVICE (LBS):

The LBS is a type of service derivative from the ability in internet to identify and transmit location information's to various applications. Authors in [3] defined the LBS, LBS are the application which incorporates with the user's location details, and this utilizes the user geographical locations from their mobile devices and refines the results according to that. So from this, the user can get nearest services at a specified time. This also reduces the time for information retrieval and overload problems. The LBS techniques are designed to satisfy the users need and improve the consumer satisfaction.

The fig 1.0 shows the different types of services available in the LBS, which includes different trajectory based services like map, routing, navigation guidance's etc., the LBS also provides the tracking services like vehicle tracking via GPS, traffic details gathering etc. LBS also incorporated with many information services like yellow pages, city guidance and many.

Numerous social network applications like Face book, Twitter, Instagram, Google+ and context advertising applications are falls under LBS. under the above category, many authors proposed different types of applications. However, the location based services has tremendous challenges under every applications. This survey initiated to find the challenges and issues of LBS with the recommendation systems.

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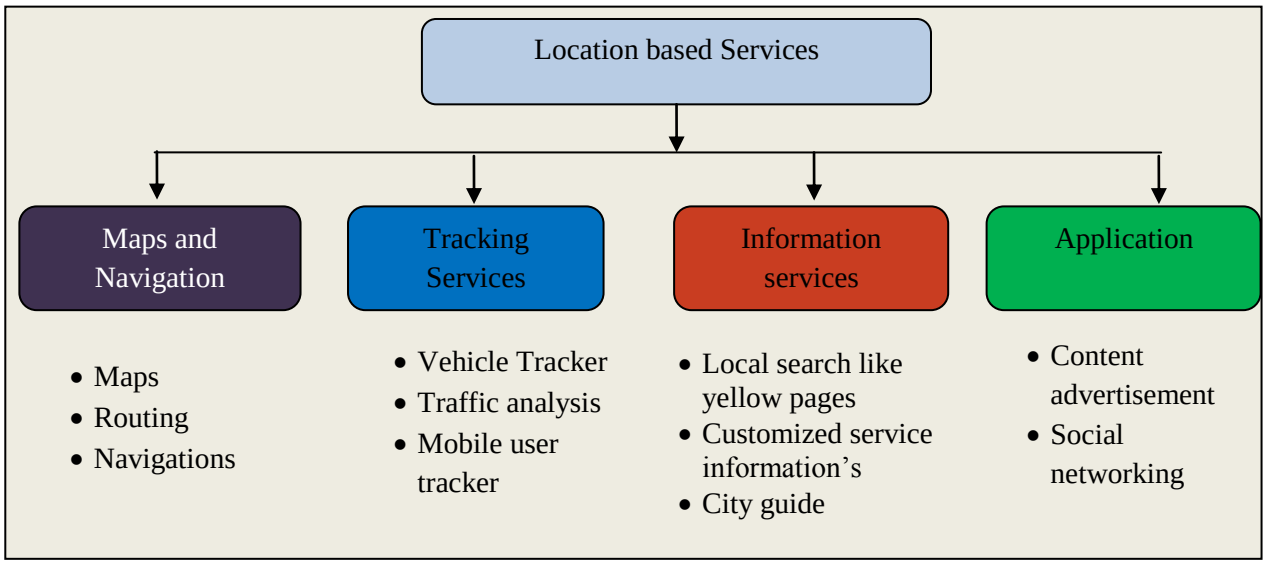

Fig 1.0 Location Based Services List

B. RECOMMENDATION SYSTEM (RS):

To solve the problems of information overload in the service requisition, the recommender systems are used. So it considered as an important mechanism in the service oriented applications [4]. This section describes the basic information's of recommender system and the list of earlier works on the recommender systems in the service related applications. Fig 2.0 shows the flow of recommendation system and its necessary data and process in every step. This consist of three steps, data source collection, methodology selection, and recommendation services. The data source for recommender system will be collected from the user profiles, their location based searches, social behavior and their trajectory details.

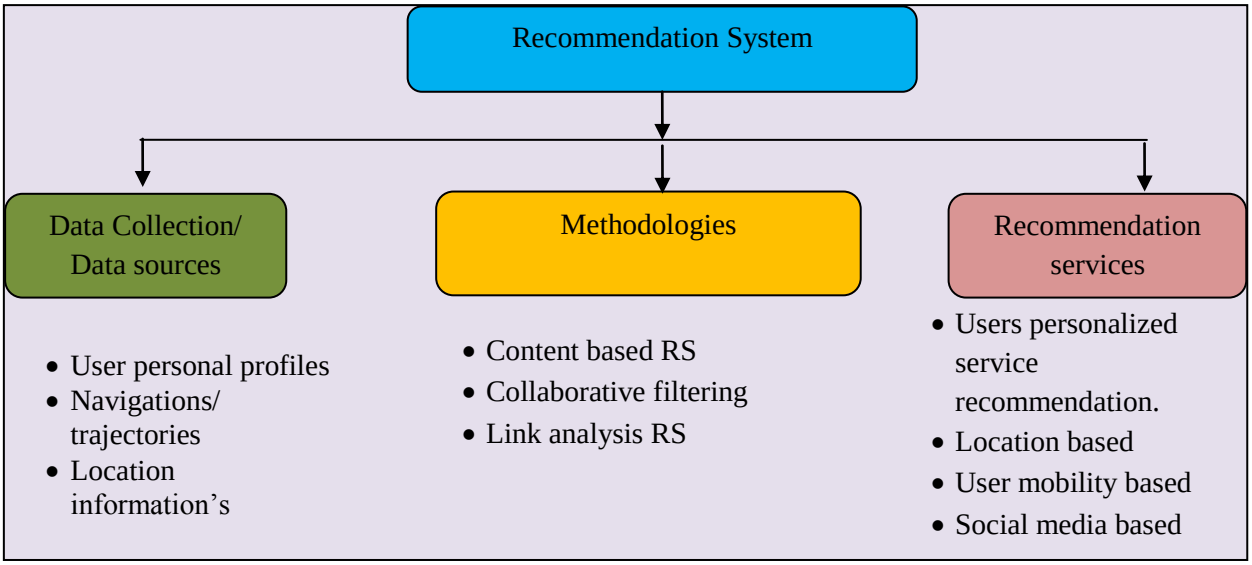

Fig 2.0 Recommendation System Flow

The methodology in RS has categorized into three groups with the consideration of LBS.

1) Content-based recommendation: The content-based recommendation, which extracts the user profile information's like location details, age, gender, and friend list etc., the location features which includes the tags that associated with the location details.

2) Link analysis-based recommendation: The link analysis-based recommendation utilizes link analysis models. This type of RS uses the user click navigation to find the hypertext induced topic search (HITS) and PageRank, to identify experienced users and interesting locations.

3) Collaborative filtering (CF) recommendation: The Collaborative filtering (CF) recommendation, which gathers a user's preferences from historical behavior and navigation history with the location information. Data sources used

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Recommender systems in LBSNs can take advantages of various data sources such as 1) user profiles, which explicitly specify a user's age, gender, interests, preferences, etc.; 2) user geo-located content, which includes a user's ratings of visited locations, geo-tagged content, check-ins, etc.; and 3) user trajectories, consisting of sequential locations contained in a user's GPS trajectories.

Nowadays recommendation systems show much users interest in day to day life activities. Recommendation systems help people with convenient access to the products and services they might be looking for. The old traditional recommendation systems focused only on the virtual world. The popularity of location-based services, including navigational services, traffic management, and location-based advertisement has grown rapidly in recent years. These services bring users from virtual world to physical world. Due to the needs of effective marketing and efficient system forecasting, it is beneficial for these location based services to be able to forecast the activities a user may perform at the next location to visit. Intuitively, we can recommend some items related to the user's next movable location [5]. Here, the ''item'' is anything that is sold by stores located in the location where users might visit, such as frequently sold items and high utility items., etc. Thus, effective items recommendation and effective location prediction techniques for location based services targeting mobile users are desirable.

C. LOCATION BASED SERVICE RECOMMENDATION SYSTEM:

The location-based recommendation methods usually use the frequent moving behaviors of users to predict the next move of a user by considering users current and next location and recommend the items which are related to that location. To make accurate location prediction, the location based systems always not only record users GPS trajectories like latitude, longitude and time, but also mine the frequent moving behaviors from the users GPS trajectories and some authors [6] used Wi-Fi history to find the locations of users. Some of the existing location-based recommendation methods always recommend services which are more frequently visited by the Users using the visiting and social behavior analysis. It leads to recommenders always recommending low rated services for users based only on the frequent services. As the result, recommendation might not benefit stores even when the recommenders can precisely predict user's next geographical locations. Fortunately, along with frequent pattern mining, high utility service mining has been proposed for discovering the services with high rating from the service log database. To improve the applicability of the location based service recommendation system, we can adopt this in the future work for discovering high rated service based on the frequency and the overall implicit rating in each location. Many data mining studies have discussed the problems of predicting the user's next location where a mobile user moves to. Personal based prediction and general-based prediction are the two approaches adopted for location prediction. The personal-based prediction [7] approach considers movement behavior of each individual as independent and thus uses only the movements of an individual user to predict his/her next location. On the other hand, the generalbased prediction [8] makes a prediction based on the common movement behavior of general mobile users. On the contrary, our proposal predicts the next location of a user based on both geographic and semantic information in trajectories. In recent years, a number of studies on semantic trajectory data mining have appeared in the literature [9] [10]. In addition to the GPS trajectory, [11] also exploit the cell trajectory to derive the semantic similarity between two mobile users. The cell trajectory consists of a sequence of spatio-temporal points in form of cell station ID, arrival time, and leave time. However, the traditional item/service recommendation methods do not fully consider both the users next locations and high utility services. To support location prediction and services recommendation based on the semantic trajectories of mobile users, authors proposed a novel location prediction and services recommendation framework in [12] to evaluate the next location of a user's movement. The framework consists of two major phases: (i) offline mining phase, and (ii) on-line location prediction and services recommendation phase. In the offline mining phase, authors adopted the notion of stay locations to represent the users' movement behavior.

To extract the semantic feature from individual user's movement behavior, authors mine the semantic trajectory patterns for each individual user. Moreover, authors formed user clusters based on the notion of semantic trajectory similar to the earlier works. Furthermore, the frequent trajectory patterns of users in the same cluster based on their geographic features are extracted. Besides, the high utility mining algorithm is used by the authors to discover high utility services of each location. In the on-line location prediction and services recommendation phase, based on these semantic and geographic patterns, a novel cluster-based location prediction and services recommendation technique to predict a mobile user's next location is proposed. From the paper, the location prediction and services recommendation approach delivers least performance when there is dynamic and uncertain services available. And moreover the authors failed to consider social impact to filter the results set.

II. LITERATURE REVIEW

This section describes the recent techniques and methods deployed to perform the location based services. The literature specifies the different types of services and applications with its merits and demerits are discussed in table

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1.0. in the earlier works in the recommendation services, collaborative filtering algorithms are used. This faces the different types of recommendation problems like cold start, sparsity and NP hard problems. When the historical records are too low, then the cold start problem arises. With the rapid growth of social and mobile usage, many users expecting the reviews, ratings and opinions of a recommendation service from their friends and neighbors. There are several approaches were developed with the above considerations, and many used the frequent item mining with these social considerations. Additionally the personalization and personal interest factors are identified with the user latent features. This combines the individual preference and social interaction to rank the services. There are different types of services are considered in the literature such as travel package recommendation, product and item recommendation, web service recommendation and service recommendation (restaurant, game store, hotels etc.,).

Table 1.0 Location Based Service Recommendation Literature Work

Paper Id	Year	Abstract	Techniques	Merits	Demerits
13	2011	Utilizes the concept of Aspect Oriented Programming for building mobility aspect to generate the recommendations based on the user preferences and users demographic information such as location, time, need etc.	Aspect-Oriented Mobility-Aware Recommender System (AOMARS)	Handles user mobility issue of the recommender systems.	visualization and interaction are not performed
14	2013	Delivering high quality service recommendation while preserving location privacy of mobile users is a challenging issue in mobile commerce.	New location privacy preserving Algorithm based on weighted road network.	privacy protection is established	Data availability is not sure
15	2015	A novel ubiquitous Web service recommendation approach to context-aware recommendation based on user location update is proposed	context-aware Recommendation based on user location update (CASR-ULU).	User location update is used on user preference and performing updated location similarity mining.	Personalized recommendation is not specified.
16	2016	A web based system that enables fast analytics over LBS by issuing a small number of queries through its restricted kNN interface.	ANALOC	assume complete access to location data	Less POI attributes are considered.
17	2016	develop a location-aware place recommender system on Android smart phones	User-based collaborative filtering algorithm	Provides personalized services	Low in accuracy
18	2016	Proposed the expenditure aware rating prediction problem.	Expenditure Aware Rating Prediction method (EARP), EM (expectation Maximization) clustering	Overcomes the problems of baseline algorithms in the LBS	Not suitable for all types of LBS
19	2016	Authors proposed a location-aware personalized CF method for Web service recommendation. The proposed method leverages both locations of users and Web services when selecting similar neighbors for the target user or service	personalized location-aware collaborative filtering method	Provides effective web service recommendation based on the available information	Location in-formations are not detailed considered. QOS prediction time is too high
20	2017	It enables density based clustering over the backend database of an LBS using nothing but limited access to the kNN interface provided	HDBSCAN-1D algorithm	Provides visual impact of LBS	Worked on static dataset

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The survey gives the merits and demerits of the recent approaches falls under location based service recommendation systems.Authors in the literature also focused on observations on ratings combining with geographical location information. In this paper, the authors get the geographical information's of the neighbors. This data later used with the rating process for appropriate recommendation system. To deploy that the author used matrix factorization model and item latent factor vectors. However, this utilizes different user ratings, this failed to consider user mobility for accurate service prediction.In the literature several approaches used context aware and location aware filtering methods for LBS. but there are some limitations like POI considerations; accuracy improvement for both personalized and generalized service recommendations. Considering human mobility patterns and providing visual output regarding the service need a complete analysis.

III. CONCLUSION

Due to the marvelous growth and usage of mobiles and internets, recommender system affected by many problems like data overloading, appropriate service recommendation and mapping etc., In this paper, we have provided a review on the related solution to handle such problems in the LBS. the work is segregated into three sections like, location based services, recommender system and location based service recommender system. This survey also provides different techniques and approaches developed for location based services in the recent years. Further, this survey serves as a suggestion, introducing the concepts, LBS properties, applications and challenges, and merits of earlier work for recommender systems in LBNs.

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