International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

A Review on Travel Recommendation Techniques

P Sushmita Singh

Abstract— The systems that help its users to select the best possible option among the available choices are called as Recommender Systems. Nowadays, these systems have been put into use in various fields of technology and are the most preferred systems for enabling the user or the customers to make satisfactory online purchases. Among other upcoming industries, Tourism is considered to be the most flourished and profitable industry. Hence, making use of recommendation providing systems in the aspect of tourism can enhance the quality of travelling for the traveller and also can turn out to be a profitable use of technology to the tourism department. There are several types of Recommender Systems that are being used in recommending the various tourist attractions for example- Automatic Travel Recommendation Systems (ATRS), Personalized Travel Recommendation Systems (PTRS) etc. This paper briefs about the most happening Travel Recommendation Systems that are currently being used by the common people and also compares the methods and techniques used in them.

Index Terms— Cloud Computing, Hybridization, Machine Learning, Multimedia, Recommendation Techniques, Social Media, Travel Recommendation Systems.

1 Introduction

JOHN Mashey coined the term "Big Data". The huge data sets that cannot be handled or managed by using the ordinary software tools, comes under Big Data [1]. There are various implementations of Big Data found in the sector of healthcare, financial services, education and commercial recommendation. Under commercial recommendation falls the travel recommendation concept. Due to heavy usage of social media, there are ample opportunities to address various issues in the travel recommendation. We can find enormous amount of data from the web portals like Gowalla [2], FourSquare [3], Facebook [4] etc. In such portals, users share their travel experiences through their mobile devices. Also, the travel guide or the trip planning websites like Lonely Planet, Yahoo Travel and Home&Abroad are rich in travel related information. Few years ago, ATRS was used extensively. But it faced two main challenges:

1) The types of users would be different, so their choices about a Place of Interest (POI) also may vary. There was a need for a PTRS that could be used by any user.
2) Rather than getting a single POI, the ATRS was expected to recommend a sequence of similar POIs. To overcome these challenges, the PTRS came into existence. These systems predicted POIs on the basis of the user's preference and also recommended a sequence of related POIs.

• *Author P Sushmita Singh is currently pursuing Master's degree program in Computer Science and Engineering in SJBIT – Visveswaraya Technological University, Karnataka, India, PH-91-8147210848.*
E-mail: pss22894@gmail.com.

Different scholars used different methodologies to increase the efficiency of the PTRS. Majorly, the sources of user's data are Geo-tags, Check-In data, GPS records, Blogs etc. [1]. Every technique that was implemented to raise the performance of the Travel Recommendation Systems had few advantages and disadvantages.
Their merits and demerits are described in the next section of this paper sub titled as Related Work. Section 3 covers the most fruitful implementation methods till date in the field of travel recommendation. Section 4 compares the attributes used in different travel recommendation methods and analyzes their performance. Finally, in section 5, a conclusion is drawn about the best method among all the studied methods. Also mentioned is the future aspect of a travel recommendation system in the coming days.

2 Related Work

Travel Recommendation types and methods to provide travel sequence and recommend travel packages are discussed in the related work with their advantages and disadvantages as shown in the Table 1.1.

Zheng *et al.,* [5] has used data from past GPS trajectories for collaborative location and activity recommendations in a hierarchical graph based – similarity measurement framework that works on location based collaborative filtering (LBCF) method. But the LBCF had two major issues: 1) As the number of users and locations increased, the computational complexity also increased. 2) The mining of accurate similar users became difficult, in case the user had

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

least or non-famous location records. It resulted in "New user cold problem" and "sparsity problem".

Jiang *et al.,* [6] proposed "Author Topic Model (ATM) based collaborative filtering" for recommending user preferred POIs. In this method, the user preferred topics are gathered from the representative tags associated with the images via the ATM. Identical users can be fetched explicitly based on the resemblance of the user's place preference. GPS records are not necessary here. Although, the ATM overcame the drawbacks of LBCF; the data would be even sparser and noisier in ATM.

Li *et al.,* [7] proposed a layered structure for estimating the GPS location of a photo (uploaded by the user) using hierarchical global feature clustering and local feature refinement. This technique not only saved the overall execution cost but also enhanced the quality of GPS estimation. But, still it was difficult to find image GPS for photos. Sang *et al.,* [8] in his work described the capability of a location oriented facility that would recommend a package in pursuit of the user's interest in a sequence. It was significant in recommending sequential activities but it did not consider the longer check-in sessions.

Kori *et al.,* [9] described a system that fetches a particular user's travel routes on the basis of the blog entries made in the past and it also provides relevant content to the fetched routes. Sequential pattern mining technique was used for fetching the routes. Prefix span algorithm was implemented. The system gave the most popular POI but the data had to be in a structured format for it to be considered.

Table 1.1: Comparison of different traditional techniques used in POI Recommendation.

SL.NO	AUTHOR	ALGORITHM	TECHNIQUE	ADVANTAGES	DISADVATAGE
01.	Y.Zheng et al.,[1]	CF Algorithm	HGB- SMF	No pre-requisite knowledge needed	•New user cold start problem •Sparsity problem
02.	H.Kori et al.,[2]	Prefix span algorithm	Sequential pattern mining	Most popular POI is found	Data should be in structured format
03.	Y.Shi et al.,[3]	PLR Algorithm	Data field clustering	Any form of data can be clustered	Yields less significant clusters
04.	M.Clements et al.,[4]	RankDiff Algorithm	Cosine similarity	Best for large data	Worst for small data
05.	C.Cheng Et al.,[5]	Markov Chains	Matrix factorisation	Best choice at present	Computation-expensive
06.	S.Jiang Et al.,[6]	Various algorithms	Data mining & routing methods	Personalised & sequenced results	Not all computational capabilities were addressed

Shi et al., [10] in his work makes use of "Personal landmark recommendation algorithm". The data field clustering method defined in this can be used for clustering any form of data but it yields less significant clusters.

Clements et al., [11] describes a technique known as "Cosine similarity" and uses the "Rankdiff algorithm". This approach is best for large data-sets and worst for small data- sets.

Cheng et al., [12] makes use of "Markov chains algorithm" for recommending the successive POI. The technique used is called Matrix factorization. This is the best choice available at present for selecting the next POI to be visited. But it is computationally very expensive.

Jiang *et al.,* [1] described a Personalized Travel Sequence Recommendation System that uses various data mining and routing methods. It provides POI recommendations and routes as per the user's interest and gives a sequence of similar POIs.. But not all computational capabilities like transportation and hotel information were well addressed.

3 Travel Recommendation Techniques

A. Based on Cloud Computing and HADOOP

An architecture based on cloud computing called TouchMap [13] is proposed that would effectively recommend a personalized trip for the users. TouchMap has two major functional components: 1) POI search component and 2) Trip planning component. HADOOP framework is used in the first component. MapReduce technique is utilized for processing large amount of POI data related to different attractions via Parallel Computing. First, say, a tourist plans a trip to south India. Different states and cities in the southern part of India can be considered as tourist attractions. POIs in such attractions have to be fetched efficiently. So, these attractions are given to every Mapper and these Mappers fetch the POIs that are close to these attractions. This resultant list of POIs is given to the Reducer. All the Reducers put their data together to give out a final list of important POIs that must and should be visited in the trip. Since cloud platform is used, different cloud connected computers can search for the nearby POIs at the same time. This reduces the computational efforts and produces quick and valid results.

In the second component of the system, the POI mining is done at two levels. In the first phase, the information about the POIs of every attraction in a trip is straight away taken from the user preferences. The top most attraction that has maximum score is considered as the input for the next level. The second phase is an online mechanism where the user has to give the input in the form of attribute values like place, trip starting and ending date and time, budget etc. This input is given through handheld mobile devices while planning a trip. Then the TripMine [14] algorithm is used to plan the trip. MapReduce method is again used to recommend appropriate routes. A re-ranking process is carried out to get the trip with the highest score for the recommendation. This work deals

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

with the subject matters of cloud computing and user constraints together.

B. Based on Skyline Query

Skyline operator is used for optimizing the results of a query by filtering the data from a database such that only those objects remain that are not worse than any other [15].
Three commonly used algorithms for processing a Skyline query are: **1) Block Nested Loop (BNL):** Every data bit is matched with all other data bits in the collected dataset to know if it is governed by other data bits. If it is not presided over by the other data bits, then it is enlisted separately and it can also become the result of the given Skyline query. It would be removed if it is mastered by some other data point. This algorithm considers all the data points in the dataset.
2) Divide and Conquer (DAC): The data in the dataset is divided into small chunks. Every chunk of data is processed and the data points from all the chunks are put together and a Skyline query is executed to obtain the final results. This algorithm considers only few data points. **3) Branch and Bound Skyline (BBS):** This is the most used algorithm. It decreases the set of data bits that have to be examined since it indexes the data.
The system works in two stages. A platform based on PHP that requests the services from a server forms the client/user end. The server end on the other hand, serves the client request and also helps in communicating between the local servers and the Google Map Server. Apache 2.4.6 Server and MySQL database is used along with Geography Markup Language (GML). The user preference of POIs is on the basis of the records in the system log. A special type of BNL algorithm called Soft Filter Skyline (SFS) [16] is used in this system. This algorithm computes the sum of all dimensions for every data bit. It then arranges them in an increasing order as per the magnitude. This reduces the overall system processing time. On the front end of the system, three choices are available to the user: at the first web page, user gets to see newly added POIs. The second web page provides the listings of the most popular POI in a day, month, season and year so that users can plan their trip accordingly. The third web page is a search page where the user gives the input in the form of a keyword to search about a particular POI.
Skyline querying has the advantage of recommending the attractions that are best suited to a particular user at a particular time. It also provides the scores of each POI and their distance from the user's current location.

C. Based on Hybridization Filtering

A Package Attraction based Trip Recommender (PATR) framework as depicted in Fig.3.1, would accurately recommend a trip by considering tour packages and user preferred POIs together. PATR works in two levels. In the first level, a Score Inference Model is used to obtain the score of each attraction and tour packages on the basis of the choices given by the user. In the second level, a Hybrid Trip Mine algorithm [17] is used to generate the best possible trip by considering the POIs and tour packages efficiently.
To increase the quality of the recommended trip further, two more methods Score Estimation (SE) and Score Bound Tightening (SBT) are introduced into the system [17]. These methods help in removing the duplicate recommendations of a trip.

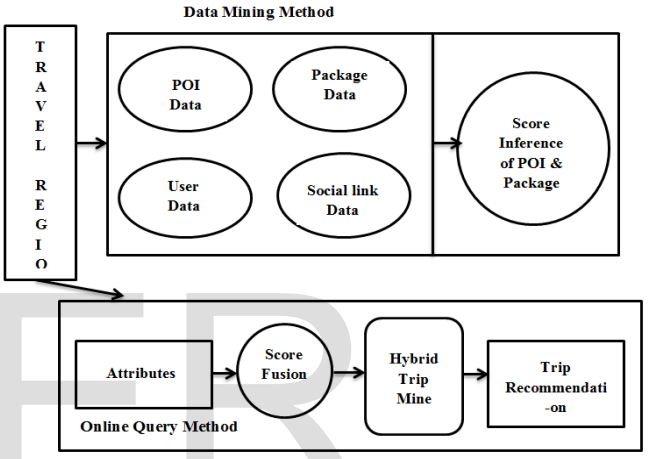

Fig.3.1. System Framework of PATR

At first, an offline data mining method is executed. In this data related to POI, tour package, personal data of the user, the data from user's social links is collected from various sources and a score is obtained from each POI and package using the Score Inference Model. In the next phase which is an online query method, the various attributes of a trip like cost, timings of POIs etc. are gathered; again a valid score is given to POI and packages based on these attributes. A Hybrid Trip Mine algorithm is used with mechanism like SE and SBT to cut down the count of unwanted candidate sets and improve the efficiency and accuracy of the recommended trip.

D. Based on Heuristic Search

When a recommended trip involves several different modes of transports like bus, taxi, train and flight; it becomes difficult for the user to opt for the best transportation service. This work proposed not only recommending of a user customized trip, but also mentions about the optimal route and mode of transport to reach the desired POI. First, the user inputs the departure time, source and destination place into

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

the system. In phase one, a Heuristic algorithm KSPG (K-Shortest Path Generation) [18] is used to obtain the top-most shortest paths that are considered as the travel plans. A* [18] is another Heuristic search strategy used along with KSPG to obtain the travel plans. In the second phase, an algorithm called Information Entropy Recommendation [18] is used to rank the user's travel plans using the preferences given by the user. User's travel history is used to get his/her preferences.

E. Based on Fuzzy Logic and Genetic Algorithms

This Recommender System recommends a trip itinerary for a particular POI along with some multimedia data associated with the POI. The system is designed using a combination of Fuzzy Logic (FL) and Genetic Algorithms (GA). FL is logic or a way of thinking which is close to reality but may not be the exact reality [19]. This system is an add-on to the MacauMap [20] which is a famous portable and web oriented travel map guide system used in Macau. GA is used for discovering the travel itinerary. A FL component is used for computing the preferable stay time at each visiting POI as per the choice of the user. The generated itinerary can be modified as per the user's convenience. This is Client- Server Architecture as shown in Fig.3.2. The Server has a Recommender Engine that does two major tasks:
1) To select few POIs as per the user's preference.
2) To generate a best schedule of these POIs including various factors – like duration of stay at a POI, distance between the POIs etc.

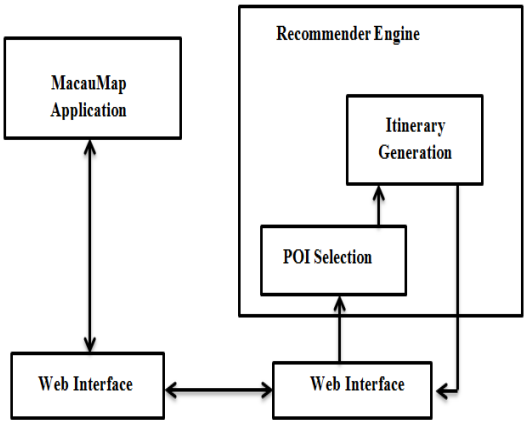

Fig.3.2. Operation mode of MacauMap Recommender System

The Client phase has the MacauMap application through which a user can interact and get an idea of the tour through the itinerary. Simple Object Access Protocol (SOAP) [21] is used for exchanging the messages between the client and the server. This system enables easy communication via proxies and firewalls than the previously existing systems.
The itinerary is given based on certain factors like – the POI choices given by the user, the travel history of the user, feedback and rating of the POI by the other active users in the system. Data is mined on the basis of the above mentioned factors using Collaborative Filtering (CF). A GA is a kind of search method used to obtain the best results in a huge data set. It uses the concepts of selection, inheritance, mutation [22] etc. These concepts are applied on the travel data set to fetch the best POIs that would suit the user. FL concept is used to determine the duration of stay at each recommended POI. Once the schedule of the trip is loaded to a mobile device, the user can play or watch any type of multimedia associated with the tourist attraction. Any type of modification can be done easily on the recommended POI list or on the given itinerary.

F. Based on Hybridization and Machine Learning

An amalgamation of the three important Recommendation methods – Collaborative Filtering (CF), Content Based Filtering (CB) and Demographic Filtering (DF) [23] is used in this Travel Recommender System.

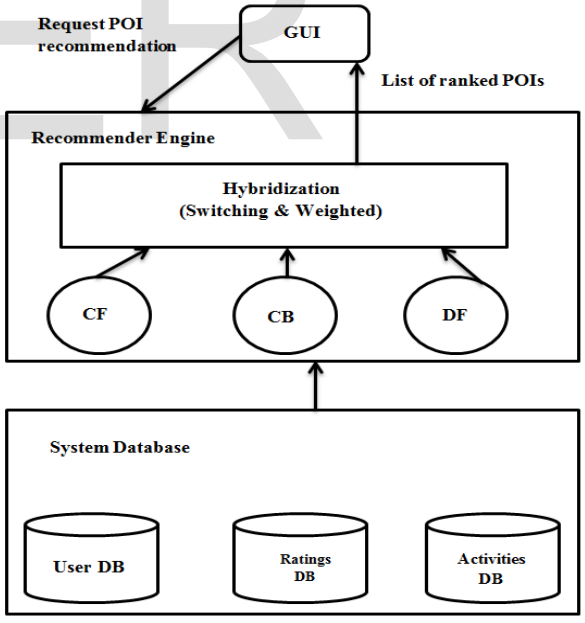

Fig.3.3. Architecture of the Recommender System

Different types of algorithms belonging to the domain of Machine Learning have been employed in this system. K-Nearest Neighbour algorithm is used while filtering the data using CF and CB and Decision Tree method is used while mining the data on the basis of DF.

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

Using the three recommendation techniques individually resulted in certain drawbacks which is why all the three techniques are clubbed using Hybridization methods such as Mixed [24], Weighted [25] or Switching [26]. This system depicted in Fig.3.3, personally recommends the most suitable POIs in a specific region based on the user's profile and his previous trip appreciations. The user credentials are stored in the user database, the various activities of the user at a POI are recorded in the activity database and the ratings given by other users of the system are saved in the rating database. A user oriented CF method is chosen to rate the various POIs in a region for the purpose of recommendation but, it may lead to cold start problem.

So, the commonality among the various users is measured by using Tanimoto Coefficient technique and K- Nearest Neighbour algorithm [27]. For performing CB, Euclidean Distance Similarity is calculated for a given set of POIs. Decision Tree is built using the Accord.Net Framework to implement the DF method [28]. ID-3 algorithm is chosen for constructing a Decision Tree [29]. DF overcomes the cold start problem faced by methods like CF and CB, but fails to recommend an item if it has no previous rates.

So, a modified DF method is used where for every activity that was unrated, a separate Decision Tree is constructed and a rating is obtained for every non – rated item. To increase the efficiency of this hybridization further, two methods are utilized**:**

1) Switching Hybrid Method: it switches between different recommended POIs to output the best POI that can be visited at a given point of time and situation.

2) Weighted Hybrid Method: it is executed by considering the task of recommending the personalized POIs as a Linear Programming Problem. Different weights are assigned to the various POIs in the recommended list and the POI with the highest weight is recommended to be visited first [30].

4. PERFORMANCE ANALYSIS

Various methods that are used in the recommendation technique were analyzed. Each method has its own advantages and disadvantages as depicted in Table 4.1. Different data sets were applied for each of the recommendation methods.

Cloud Computing and HADOOP framework was used together on the Gowalla data set. This gave quick and valid recommendations. The computational cost was also less. But, the system's reliable operation was dependent on the cloud connectivity. The Skyline Querying was used on the data sets of the Demodulation and Encoding Heritage System (DEH) of Taiwan. This method gave best POI recommendations along with the distance of the recommended POI from the user's present location.

The proper functioning of the system was dependent on the connectivity between various interlinked servers. The Hybridization technique was used to recommend POIs using the Gowalla data set. This approach was efficient since all the unwanted POIs were removed from the dataset and only the required and preferable POIs were recommended. The output was always unstable. Heuristic search technique was employed on the datasets from a travel related website called Ctrip. This Recommender System was reliable as it provided the mode of transport to reach the recommended POI. But, it failed to recommend POIs in areas where there was data sparsity problem like in a new city. The combination of Fuzzy Logic and Genetic Algorithms was made and tested on the dataset of the web application called "MacauMap".

Table 4.1 – Performance Analysis of Travel Recommendation Methods

Sl. No.	Method	Dataset Used	Advantages	Disadvantages
1.	Cloud Computing + HADOOP	Gowalla	Low computation cost. Quick & valid recommendations	Dependent on cloud connectivity
2.	Skyline Query	DEH System	Best POI recommendation along with the distance from current location to POI.	Dependent on the connectivity of various interlinked servers.
3.	Hybridization	Gowalla	Efficient & accurate	Unstable Output
4.	Heuristic Search	Ctrip	Extra information about mode of transport	Cannot recommend POIs in a new city effectively
5.	Fuzzy Logic + Genetic Algorithm	Macau Map	Detailed itinerary with time duration for each POI visit	Not completely accurate recommendations
6.	Hybridization + Machine Learning	Trip Advisor	Overcomes drawbacks of other methods and gives highest accuracy	Gives only apt POIs, does not give a tour plan

It generated a detailed itinerary which could be modified by the user. It also mentioned the duration of time that could be spent in each of the visiting or the recommended POIs.

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

Since Fuzzy Logic was employed, the results would be only close to reality and may not be accurate completely. The predictions made about the POIs may not be completely personalized as per the user's interests. The final approach was by bringing together both the Hybridization techniques and the Machine Learning principles. This was an effort worth the praise since this system was able to overcome all the drawbacks that were faced by the other Travel Recommender Systems. It also produced accurate predictions about the POIs in a personalized way. But, it was only able to generate POIs of the user's interest and could not give a complete tour plan.

5. CONCLUSION

Traditional travel route planning fails to meet the user's personal interest and generates only highly ranked recommendations.
Several methods that are used in recommendation systems were examined and it was found that to overcome the drawbacks of automatic travel recommendation systems, the Personalized Travel Recommendation System that uses methods like Location based collaborative filtering and similar user mining method is the best available choice.
Again under the PTRS, a system that brings together the concepts of Hybridization, Machine Learning, Fuzzy Logic, Genetic Algorithms and Heuristic Search should be designed and implemented to get the best personalized, detailed and resourceful Travel Recommendation.
This system can be used with a larger dataset and make use of more forms of social media (like transportation, weather prediction etc.), to give more accurate distributions of the POI visiting time and recommendations that are personalized. This system can be a boon in disguise for the travel and tourism department of a state as it would increase the incoming revenue and also pave way for socio-cultural exchange among citizens of different countries.

ACKNOWLEDGMENT

The author wishes to thank Dr. Srikantaiah K C, Professor, Department of Computer Science and Engineering, SJB Institute of Technology, Bengaluru (Karnataka, India) for providing valuable guidance and support in carrying out this work successfully.

REFERENCES

[1] Shuhui Jiang, Xueming Qian, Tao Mei, Yun Fu, "Personalised Travel Sequence Recommendation on Multi-source Big Social Media", IEEE Transactions on Big data, vol.2, no. 1,Jan-Mar 2016.

[2] Gowalla, http://gowalla.com

[3] Foursquare, https://foursquare.com/

[4] Facebook, https://www.facebook.com

[5] Y. Zheng, L. Zhang, Z. Ma, X. Xie, and W. Ma, "Recommending friends and locations based on individual location history," ACM Transactions on Web, vol. 5, no. 1, p.p 5, 2011.

[6] S. Jiang, X. Qian, J. Shen, Y. Fu, and T. Mei, "Author Topic Model based Collaborative Filtering for Personalized POI Recommendation," IEEE Transactions on Multimedia, vol. 17, no. 6, pp. 907–918, June 2015.

[7] J. Li, X. Qian, Y. Y. Tang, L. Yang, and T. Mei, "GPS Estimation for places of interest from social users' uploaded photos," IEEE Transactions on Multimedia, vol. 15, no. 8, pp. 2058–2071, Dec. 2013.

[8] J. Sang, T. Mei, T. J. Sun, S. Li, and C. Xu, "Probabilistic Sequential POIs Recommendation via Check-in Data," in Proceedings of ACM SIGSPA - TIAL International Conference on Advanced Geographic Information systems., pp. 402–405, 2012

[9] H. Kori, S. Hattori, T. Tezuka, and K. Tanaka, "Automatic Generation of Multimedia Tour Guide from local blogs," in Proceedings of 13th International Conference on Multimedia Modeling, pp. 690–699, 2006

[10] Y. Shi, P. Serdyukov, A. Hanjalic, and M. Larson, "Personalized landmark Recommendation based on Geo-tags from photo sharing sites," in Proceedings of 5th AAAI Conference on Weblogs Social Media, vol. 11, pp. 622–625, 2011

[11] M. Clements, P. Serdyukov, A. de Vries, and M. Reinders, "Personalised Travel Recommendation based on location co-occurrence," arXiv preprint arXiv:1106.5213, 2011.

[12] C. Cheng, H. Yang, M. R. Lyu, and I. King, "Where you like to go next: Successive Point-of-Interest Recommendation," in Proceedings of 23rd International Joint Conference on Artificial Intelligence., pp. 2605–2611, 2013

[13] Jia-Ching Ying, Eric Hsueh-Chan Lu, Chi-Min Huang, Kuan-Cheng Kuo, Yu-Hsien Hsiao and Vincent S. Tseng "A Framework for Cloud-based POI Search and Trip Planning Systems", in IEEE Transactions .

[14] E. H.-C. Lu, C.-Y. Lin, and V. S. Tseng, "Trip-Mine: An Efficient Trip Planning Approach with Travel Time Constraints," in MDM, pp. 152-161, 2011.

International Journal of Scientific & Engineering Research, Volume 9, Issue 10, October-2018
ISSN 2229-5518

[15] Yu-Ping Chen, Chee-Hoe Loh, Wei-You Chen, Wei-Jui Ho,and Yi-Chung Chen,"Skyline query-based attraction recommendation system: An example on Design and development of the Demodulation and Encoding Heritage System"

[16] S. M. Chiu, Y. C. Chen, H. Y., Su, and Y. L. Hsu, "Finding Similar Users in Social Networks by Using the Depth-k Skyline Query," Proceeding on IEEE conf. on Consumer Electronics, 2015.

[17] Shih-Hsin Fang, Eric Hsueh-Chan Lu and Vincent S. Tseng," Trip Recommendation with Multiple User Constraints by Integrating Point-of-Interests and Travel Packages", 2014 IEEE 15th International Conference on Mobile Data Management.

[18] Yiqun Hua, Jian Cao, Qi Gu," PD-TRP: A Service Composition Approach for the Personalized and Optimized Door-to-door Travel Plan Recommendation", 2017 IEEE 24th International Conference on Web Services.

[19] L. Zadeh, "Outline of a new approach to the analysis of complex system and decision process", IEEE Transactions on Systems, Man, and Cybernetics, SMC-3(1), pp. 28-44, 1973.

[20] R. P. Biuk-Aghai, "MacauMap: Next generation mobile travelling assistant", in Proceedings of Map Asia 2004, Beijing, China, 26-29 August 2004.

[21] Robert P. Biuk-Aghai Simon Fong Yain-Whar Si," Design of a Recommender System for Mobile Tourism Multimedia Selection".

[22] D. Goldberg, "Genetic and evolutionary algorithms come of age", Communications of the ACM, vol. 37, no. 3, pp. 113-119, March 1994.

[23] F. Ricci, L. Rokach, and B. Shapira, Introduction to recommender systems handbook. Springer, 2011.

[24] I. Garcia, L. Sebastia, and E. Onaindia, "On the design of individual and group recommender systems for tourism," Expert systems with applications, vol. 38, no. 6, pp. 7683–7692, 2011.

[25] S. Schiaffino and A. Amandi, "Building an expert travel agent as a software agent," Expert Systems with Applications, vol. 36, no. 2, pp. 1291–1299, 2009.

[26] S. Renjith and C. Anjali, "A personalized mobile travel recommender system using hybrid algorithm," in Computational Systems and Communications (ICCSC), 2014 First International Conference on. IEEE, 2014, pp. 12–17.

[27] S. Bagchi, "Performance and quality assessment of similarity measures in collaborative filtering using mahout," Procedia Computer Science, vol. 50, pp. 229–234, 2015.

[28] C. R. Souza, "The accord .net framework," 2013.

[29] J. R. Quinlan, "Induction of decision trees," Machine learning, vol. 1, no. 1, pp. 81–106, 1986.

[30] Mohamed Elyes Ben Haj Kbaier, Hela Masri," A personalized hybrid tourism recommender system", 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications.