Tag Based Recommendation Systems for Tourism in Saudi Arabia

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Abstract

A recommendation system, when applied to tourism, can select and recommend appropriate top-listed tourist places, from abundant data sources. In the field of the tourism industry, recommendation systems and related information technologies are increasingly becoming the most widespread and promising applications of IT. Literature provides many reasons for having a recommendation system. However, the most important reasons for using a modern recommendation system are to make the traveler's life and choice options easier by providing more information about their selected tourist place in a reliable manner. This paper proposes a tag-based recommendation system for tourists visiting Saudi Arabia. This approach is aimed at helping visitors to find a list of interesting and best places and gain their positive attention.

Keywords: Recommendation Systems, Recommendation system in tourism industry, Tag based recommendation system for tourism industry, Tourism and recommendation systems.

Introduction

Recommendation systems have attracted active research since the publication of the primary papers on cooperative filtering in the 1990s. Lately, numerous internet sites are applying Recommender Systems. The common phrases used are: "You would like to know this", "different items you might like", "clients who purchased <this thing> got an extra < > free!". Most people would have seen these recommendations when perusing the web, on free e-mail sites, Amazon, Twitter, Facebook or other locations. As their contents and display techniques have been developing over time, a need has arisen for giving suggestions to customers by aggregating and intelligent filtering of accessible alternatives (Frikha, Mhiri, and Gargouri, 2017; Ribeiro, Silva, Barbosa, Silva, and Metrôlho, 2018). The rapid development in the huge variety of information and data accessible on the Web and in the new e-commerce services (item purchasing, item correlation, selling, and so forth) can strongly influence clients, driving them to settle on sub-optimal choices (Sutjiadi, Trianto, and Budihardjo, 2018). The literature has shown that recommendation systems helped customers overcome information overload problem when searching for their preferences.

Recommendation Systems in the Context of Tourism

A large amount of tourism-related leisure and informative events are being offered via mobile apps and on websites. This large amount has prepared for a journey into an exciting but time-consuming task. Recommendation system applications can solve the problems. Literature shows that tourists are very keen to use technology and web-based tools that can support them in their decision making process when planning their trips. They can determine their preferred destinations, places for a holiday, historical places, best restaurants and appropriate/affordable accommodation. However, helping tourists, when they are visiting any place for the first time is not a trivial task. Complex problems of automated planning, group recommendation, management of semantic knowledge and context awareness arise. These issues have now been studied well, but still pose major challenges in the field (Frikha, Mhiri, and Gargouri, 2017).

Most recommendation systems for tourism aim to match the user's favourites based on comparisons of his/her record and possible activities using the resources of the city and leisure opportunities (Nilashi, Bagherifard, Rahmani, and Rafe, 2017). Tourist recommendation systems require some initial information or data. These are typically provided by the system users when using open sources. The system automatically gathers the initial information on the user's favourites through implicit and explicit feedback. Literature indicates that many tourist-based recommendation systems are using hybrid approaches that include basic recommendation methods. They use collaborative filtering methods based on the context of tourists and the preferred destination types.

Moreover, tourist recommendation systems have the capacity of generating a private agenda to the individual tourist recommending a list of recommended activities for the tourist based on past activities. Some tourist-based recommendation systems offer a personalised schedule using information such as closing time and opening time of the tourist attractions and the time taken to travel from one place to another. In an e-tourism example provided by (Ribeiro, Silva, Barbosa, Silva, and Metrôlho, 2018), an application of a tourist preparation system is discussed and includes recommendations to the tourists for leisure activities.

Tag-based recommendation systems offer users options for selecting any suitable item based on their prior preferences. The tag-based recommendation systems are being implemented and used by many researchers. Practitioners through the World-Wide Web in order to predict customer preferences and the future expectations of the customer towards new places or items, increasing both customer engagement and business sales (Ribeiro, Metrôlho, Leal, Martins, and Bastos, 2018; Bansal, Das, and Bhattacharyya, 2015; Melville, Mooney, and Nagarajan, 2002). It is possible to expand its use in e-commerce and e-business aspects of tourism. There had been a very limited application of (tag-based) recommendation systems in the case of Saudi Arabian tourism (Brdesee, 2013). This research proposes a tag-based recommendation system for the tourist industry in Saudi Arabia.

Tourism in Saudi Arabia and Scope of Using Tag-Based Recommendation Systems

Saudi Arabia is a desert country covering most of the Arabian Peninsula, between the Arabian Gulf coastlines and the Red Sea. The most visited places in the country are Masjid al-Haram in the city of Mecca, the destination of the annual Hajj pilgrimage and Nabawi Mosque in Medina's Masjid. Millions of people from all over the world visit Saudi Arabia. These visitors face many challenges when it comes to travelling and visiting around the country. This paper aims to propose a tag-based recommendation system approach for those visiting Saudi Arabia. This technique offers visitors a list of interesting and best places that are likely to attract their attention.

Aim and Objectives

This research paper proposes a framework of a recommendation system for the tourism industry in Saudi Arabia. The aims and objectives are as follows:

(a) Develop a tag-based recommendation systems framework for use in the tourism industry in Saudi Arabia
(b) Plan to provide effective and suitable travel guide to tourists visiting Saudi Arabia
(c) Answer what recommendation system and the role of recommendation system in the tourism industry is.

Proposed Approach

Recommendation systems and other related tools aim to propose lists of items or places that match precisely traveller preferences and choices. In the past decades, different type and variety of recommendations for travellers seemed to have played a significant role in the overall visitor satisfaction. Therefore, increasing the variety of suggestions for travellers might be useful both for the tourism industry and travellers who are interested in travel to and within Saudi Arabia.

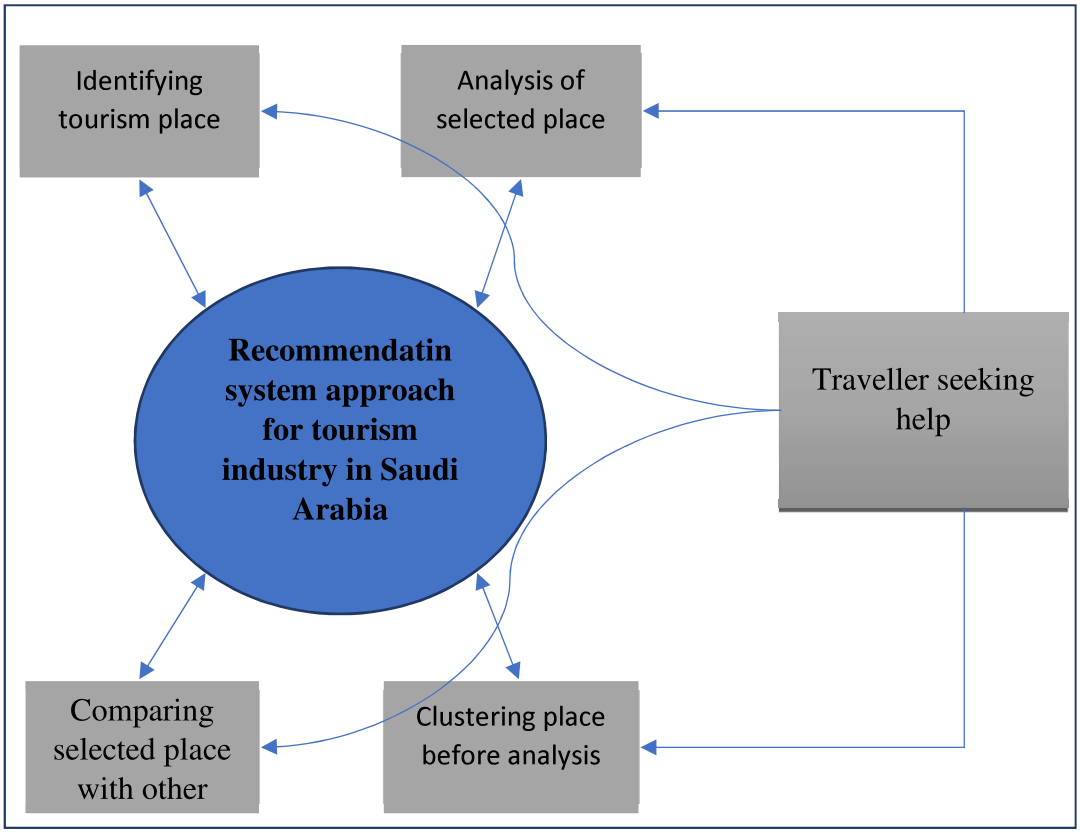

Figure 1: Recommendation system approach for the tourism industry in Saudi Arabia

The emergence of Web 2.0 in the field of the tourism industry has changed unreceptive travellers to active creators of the online content related to tourism. This has improved the amount of tourism-related information available to travellers. These include pictures and videos on the website. However, this trend is no longer favourite, according to ontologies. Therefore, a new idea, a tag-based recommendation system, has been applied. This is also known as social tagging. The social tagging trend has quickly become the most widespread and popular method to define content related to tourism within any particular website.

Fig 1 explains a tag-based recommendation system approach for the tourism industry in Saudi Arabia.

Results and Discussion

This proposed tag-based approach is based on four methods, as given in Fig 1.

1) Identifying relevant tourism places with the best balance between a variety of the places and how accurate the places are regarding places which are already selected by the visitors

2) Analysis of selected or chosen place, in which each tourism chosen place can be analysed in the context of how much the chosen place is different from the previously selected one

3) Compare each tourism place chosen with the list of already selected places. In this method, the analysis of the list of places that done by comparing it with the first item each time place is selected

4) In the clustering tourism places, travellers can cluster the list of suitable places before they start selecting the best recommended place. When any traveller wants to visit Saudi Arabia and tag any particular place, they can use the four methods given above to analyse information.

This subsection discusses the proposed solution and how the proposed approach works as per the four steps listed above.

Identification of Suitable Place (a tag)

According to this method, the system will try to find or identify the best or most visited places in Saudi Arabia, in this way, the system offers the best stability for accuracy and diversity (Bridge, Göker, McGinty, and Smyth, 2005; Ziegler, McNee, Konstan, and Lausen, 2005). As shown in algorithm 1, an iterative process is used on the entire initial list of places to discover the tourist place. That had the highest combination of accuracy in the context of tourist profile and diversity for a list of top or most visited places (P) in Saudi Arabia. A parameter λ that ranges between zero and one is used for authorisations to regulate the anticipated level of diversity in the system for the tourist industry. If the parameter is equal to zero, the only accuracy will be measured. For example, the first P list of places may be selected. However, if the parameter is equal to one, it means the system will allow the tourist to select from each iteration the place that is different from already selected ones, irrespective of the tourist place position in the hierarchical list. Once the traveller identifies a place suitable for him, the system allows the place to be tagged and stores it. The same traveller can use the tag to revisit the place. This traveller or other travellers can use this information in future also.

Table 1: Algorithm 1

Algorithm 1: identifying relevant tourism places
Input from traveller: *P*: list of suitable places ranked through accuracy, *R*: represents number of recommended places, λ represents variety of tourism places 1. Top tourism places *P[0]*= pop very first place from *R;* 2. *P*=1; 3. Maximum=0; 4. **While** *P*<*R***do;** 5. **For** every place *i* in *R***do;** 6. *q*=place_list(*i, topP*); 7. *w*=(λ * *q*) + (1- λ) * weight of *i*); 8. **if** (w>maximum) **then;** 9. maximum=*w;* 10. suitable_place=*I;* 11. *tag that place and store in the system;* **12. end if ;**

13. end for; 14. *p[n]*=suitable_place 15. *n*=*n*+1 16. **end while;**
Brief description: In this algorithm, if the selected place in the system, then it allows the tourist to choose from every iteration the tourist place that is different than the place already selected. Once tourists recognise their suitable place, this tag-based recommendation system then allows them to tag that place and place it in the system, so that other tourists can get help from this information. Please see the detailed description in this section.

According to algorithm 1, the first line in the algorithm represents the first tourist place of the ordered list and is moved to the top tourist place P list. This tourist place has the highest rank in the system. After that, the algorithm shows that the system makes P-1 iterations of a loop. The loop in the algorithm indicates that in every iteration, the tourist place of P that offers a suitable trade-off among accuracy and diversity is nominated and included to the top list P. In algorithm 1, line number 6 calculates the distance, which means the opposite of the resemblance measure shown in line number 4 for every tourist place R and the entire set of tourist places previously included in the top list P. After that line number 7 in the algorithm compute distance that along with the weight of the tourist place. For example, the weight can be the score given by tourists. This measures how the system will meet the tourist preferences to calculate its overall score based on the anticipated level of diversity. Finally, having examined all the tourist places R, the best one is included as the top tourist place P inline 13 in algorithm 1, and the system proceeds to the next iteration in the loop.

Analysis of Selected tourist Places to Identify the Further Detail of the Selected Place

The following will happens if travellers already have a large amount of information in their tagging. The system then used the second method. The method presented in algorithm 2 shows how the system can analyse the selected tourist places. The system in this algorithm scans the entire list of tourist places *P* in every iteration of the process of selection. This is the concept that helps to make an individual scan of the list of the place. When a tourist place which is adequately different from those tourist places that have already been chosen is found, it is included to top list of places *R* and the system remain the analysis of *P* from this current point (line number 8 in algorithm 2).

Table 2: Algorithm 2

Algorithm 2: Analysis Of The Selected Or Chosen Place
Input From Traveller: *P*: List Of Suitable Places Ranked Through Accuracy, *R*: Represents Number Of Recommended Places, *Λ* Represents Variety Of Tourism Places 1. Top Tourism Places *P[0]*= Pop Very First Place From *R;* 2. *P*=1; 3. **While** *P*<*R***do;** 4. Maximum=0; 5. **For** Every Place *I* In *R***do;** 6. *Q*=Place_List(*I, Topp*); 7. **If** (Q> *Λ*) **Then;** 8. *P[N]*=Pop Place *I* From *R* 9. *N*=*N*+1; 10. **If** (*N*=*R*) **Then**; **11. End For;**

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12. End If;
13.         Else If (Q>Maximum_Distance) Then;
14.     Maximum_Distance=Q;
15.     Maximum=I;
16. End If;
17. If I is The Last Place In The P;
18.     P[N]=Pop Place I From R;
19.     N=N+1;
20.     Update My Tag;
21.     End If;
22.     End For;
23.     End While;
```

Brief Description:
This Algorithm Is About The "Analysis Of Selected Or Chosen Place", Where Each Chosen Tourist Place Can Be Analysed In The Context Of How Much The Chosen Place Is Different Compared To Place Selected Earlier. Please See The Detailed Description In This Section.

The examination of *P* continues from that spot. The algorithm 2 used the λ parameter for the diversity so that system can minimise the threshold for the distance that a tourist place *P* required to have with respect to the places in top *R* with regard to the selection of places. The element of selection is the anticipated diversity. A more straightforward system would be to choose from a list of places *P*. The rank of the chosen tourist places is not straightaway taken into consideration at any instant. If the system reaches the last place in the list of places *P* and the algorithm 2 includes top tourist places *R*, then the highest diversity with respect to the list in line number 18 in the algorithm is applied. If top list *R* still does not comprise any place *R*, it starts the system again to analyse the places listed in *P* from the start.

Comparison of Single Selected Tourism Place

The following will happen if travellers are required to compare their tag with tags of other users in the system. For this requirement, algorithm 3 shows how to compare a single selected tourist place. Once we added the first tourist place of P to the top list of places R, as shown in Algorithm 2, it might be a situation in which the first tourist place in the list is adequately different from the select place is in the 20th position of list P.

After adding this selected tourist place to list of top places *R*, the algorithm identifies the next position of the places which is 21st and that is adequately different from the two tourist places which are already in the top list *R*. This tourist place, that is the next place to be added in the top list *R*, might be for case in position number 17th though this could also be the case where the tourist place is in the best position. For example, in position number 9, the distance could be similar to the other two places in top list *R*. This is because, when tourist place 9 was examined, the place was only compared with the 1sttourist place in top list *R* as the 2nd place had not yet been included in the list. This example indicates that we might choose tourist places which have a more similar level of diversity than other terrorist places with maximum accuracy. In order to fix or correct this system behaviour, the method in algorithm 3 goes back to the start of places *P* each time that system locates tourist place adequately different from the places in top *R*.

Table 3: Algorithm 3

Algorithm 3: Compare single selected tourism place
Input from traveller: *P*: list of suitable places ranked through accuracy, *R*: represents number of recommended places, λ represents variety of tourism places 1. Top tourism places *P[0]*= pop very first place from *R;* 2. *P*=1; 3. **While** *P*<*R***do;** 4. Maximum_distance=0; 5. **For** every place/tag*i* in *R***do;** 6. *q*=place_list(*i, topP*); 7. **if** (q> λ) **then;** 8. *p[n]*=pop place *I* from *R* 9. *n*=*n*+1; **10.** ***end for;*** 11. **If** (*n*=*R*) **then**; **12. end for;** **13. end if;** 14. **else if** (q>maximum_distance) **then;** 15. *Maximum_distance=q*; 16. *Maximum=i;* **17. End if;** **18. If** *i*is the last place in the *P;* 19. *p[n]*=pop place *I* from *R;* 20. *n*=*n*+1; 21. *Update my tag;* **22. end if;** **23. end for;** **24. end while;**
Brief description: This algorithm allows travellers to compare the single chosen place with the list of previously selected places. In this method, the examination of the list of tourist places compares it with the first item every time a place is selected. Please see the detailed description in this section.

Clustering of Tourism Place

The idea of clustering tourist places can be applied in comparing single tourist place. Through this process, the computational cost can be minimised. Consequently, the iterations are completed on the clusters list instead of on the original tourist places list, while the diversity and the accuracy of the outcomes will continue to be maintained.

Table 4: Algorithm 4

Algorithm 4: clustering tourism place
Input from traveller: *P*: list of suitable places ranked through accuracy, *R*: represents number of recommended places, λ represents variety of tourism places 1. Top tourism places *P[0]*= pop very first place from *R;* 2. Select any particular tag; 3. *P*=1; 4. Maximum=0; 5. **While** *P*<*R***do;** 6. **For** every *P* in 1…*k* **do;** 7. *i*= first place from cluster *C;* 8. *q*=place_list(*i, topP*); 9. *w*=(λ * *q*) + (1- λ) * weight of *i*); 10. **if** (w>maximum) **then;** 11. maximum=*w;* 12. suitable_place=*I; suitable_cluster=U;* **13. end if ;** **14. end for;** 15. *p[n]*=suitable_place from *C* 16. *n*=*n*+1; 17. **end while;**
Brief description: This algorithm, clustering the tourism place, in this system functionality travellers can cluster the list of appropriate places before, they start choosing the best suggested place. Please see the detailed description in this section.

The algorithm 4 begins by moving the 1st tourist place of the ordered list *P* to the tourist place list *R*. Afterward, and the system behaves as the algorithm 1. However, the reiterations are made over the 1st tourist places of every cluster. According to algorithm 4, line number 6 represents measurement of the1st tourist place of every cluster iteration and provides a balanced rank of tourist places diversity and accuracy as the list of tourist places R is calculated in line number 8 and the tourist place with the best rank is chosen in every iteration.

Conclusion

The role of the tag-based recommendation system in the tourist industry is to match the tourist preferences with the tourist activities in any city of Saudi Arabia and also the preferences of leisure resources. In this case, recommendation systems required some new data sources, typically provided by the tourist. These are particularly valuable for the people who travel to Saudi Arabia for tourist purposes if they can mechanically infer the preferences over implicit or explicit tourist feedback.

Many of the recommendation systems are based on hybrid methods that combine basic recommendation methods. For example, collaborative filtering, content-based and demographic-based recommendation system approaches are used.

In this research, a tag-based recommendation system was developed, comprising of four different approaches as recommendation systems for the tourism industry in Saudi Arabia. The proposed approach can be used by travellers visiting Saudi Arabia to find suitable places based on their preferences, as the approach is based on the selection of some tourist places from the initial list of recommended tourist places in the country, computed by the recommendation system.

However, the proposed research has one limitation. Due to limited time, we were not able to evaluate each selected method. The next stage will be the testing and validation of each proposed method using real-world case studies. This will strengthen the quality and reliability of the proposed tag-based recommendation system approach.

References

Bansal, T., Das, M. and Bhattacharyya, C., (2015), September. Content driven user profiling for comment-worthy recommendations of news and blog articles. In Proceedings of the 9th ACM Conference on Recommender Systems (pp. 195-202). ACM.

Brdesee, H. (2013). Exploring factors impacting e-commerce adoption in tourism industry in Saudi Arabia. Business IT and Logistics. RMIT University. Retrieved October 12, 2019, from https://researchbank.rmit.edu.au/view/rmit:160565/Brdesee.pdf

Bridge, D., Göker, M.H., McGinty, L. and Smyth, B. (2005). Case-based recommender systems. The Knowledge Engineering Review, 20(3), pp.315-320.

Frikha, M., Mhiri, M. and Gargouri, F., (2017), October. Using Social Interaction Between Friends in Knowledge-Based Personalized Recommendation. In *2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA)* (pp. 1454-1461).

Melville, P., Mooney, R.J. and Nagarajan, R., (2002). Content-boosted collaborative filtering for improved recommendations. *Aaai/iaai*, *23*, pp.187-192.

Nilashi, M., Bagherifard, K., Rahmani, M. and Rafe, V., 2017. A recommender system for tourism industry using cluster ensemble and prediction machine learning techniques. *Computers & Industrial Engineering*, *109*, pp.357-368.

Ribeiro, F., Metrôlho, J., Leal, J., Martins, H. and Bastos, P., (2018), March. A mobile application to provide personalized information for mobility impaired tourists. In *World Conference on Information Systems and Technologies* (pp. 164-173). Springer, Cham.

Ribeiro, F.R., Silva, A., Barbosa, F., Silva, A.P. and Metrôlho, J.C., (2018). Mobile applications for accessible tourism: overview, challenges and a proposed platform. *Information Technology & Tourism*, *19*(1-4), pp.29-59.

Sutjiadi, R., Trianto, E.M. and Budihardjo, A.G., (2018). Surabaya Tourism Destination Recommendation Using Fuzzy C-Means Algorithm. *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)*, *10*(2-3), pp.177-181.

Ziegler, C.N., McNee, S.M., Konstan, J.A. and Lausen, G., (2005), May. Improving recommendation lists through topic diversification. In Proceedings of the 14th international conference on World Wide Web (pp. 22-32). ACM.