An Approach Travel Recommendation System and Route Optimizer using AI

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***Abstract*—The allure of traveling as a hobby has grown significantly throughout time. To enjoy the trip as much as possible and to make the most of the limited time while traveling, one must prepare and conduct adequate research before traveling to a place. Travelers currently use the technique of leaving the planning of the trip to travel companies. Travel agencies frequently follow a fixed set of travel itineraries in order to maximize profits, but these plans are not tailored to the demands of the customers. The existing travel recommendation systems on the market today have some restrictions, such as the fact that they don't account for traffic conditions or the distance between the hotel and the most popular attractions. The suggested system takes into account a number of variables, including the age of the tourist, their interests, the weather at the time of the journey, and the traffic in the cities at the time. It will make suggestions for hotels, restaurants, and other activities a visitor can partake in during his stay by applying sentiment analysis and geo-tagging.**

Keywords—Hotels, Efficient Routes, Tourism, Location, Recommendation

I. INTRODUCTION

According to a recent survey named Global Travel Trends Report, 87% of Indians intended to plan a once-in-a-lifetime trip this year, while 91% wanted to take a dream holiday in 2022 that they may not have thought of before.

Travelling has gained momentum once again as the COVID pandemic has ended. People are looking forward to resuming their travel plans. Often people have saved money for a lot of years and look forward to their trips. Usually, people give a travel agency to plan their travels to avoid the hassle of planning and getting details about the trip. The itineraries developed by the companies often cater to particular interests such as adventure or luxury lifestyle which are suitable to everyone's needs.[1]

Big Data has been developing in the past years. There is a mass of information which is constantly updated in multiple forms like audios, videos, social media, sensors, CCTV cameras and geotagging. Information about various tourist places and transportation means is updated regularly such as timings of the monument, cancelled trains or traffic conditions continuously. [2]

The travel recommendation system must not depend on the static dataset available and an ontological system can be used which will continuously update the dataset and help make better predictions. [3]

In areas like education, healthcare, and agriculture, a variety of technologies and algorithms are currently being employed for recommendation systems. The proposed travel recommendation system will make use of the greedy algorithm which will help us find the shortest distance using least resources between two points eliminating other routes which may take up more of the traveler's time or money. [4]

Typically, a travel recommendation system will only make use of the history and inputs of the user who wants to plan their itinerary which is also known as content filtering. Another type of filtering is collaborative based filtering which also makes predictions on the basis of the data of the user and also of other users who have the same interests or desires. The proposed system will make use of a hybrid approach which will make use of relationships present between two users and also relationships between a user and a place of interest (POI) to make predictions. [5]

By openly asking the user to categorize themselves in one profile, which creates implicit demands that the user doesn't meet, VacationCoach takes advantage of user profiling. Even more specific profile information can be entered by the user by filling out the appropriate form. To require less user input, TripleHop's matching engine takes a more advanced method. It infers the significance of factors the user does not specifically mention. This is followed by a combination of statistics on previous user searches and a prediction calculated as a weighted average of importance provided by identical users.

II. LITERATURE SURVEY

Cluster analysis is done using hotel related online reviews. The user behaviour is observed and predictions are made on the basis of this history. These predictions can be used for promoting a product or a service by the hotel. The collaborative filtering uses explicit feedback which states whether a user likes or dislikes a particular service. This system finds interest similarity to find users which are similar to each other and to what extent each user is interested in an item. Hotel similarity is another parameter which is calculated on the basis of the number of users who clicked a hotel 'A' and 'B'. The main steps in this system include (i) identify the user's text features to find similarity features between the users (ii) find the hotel ranking. The paper analyses the trajectory of user preferences over the past time which helps make better predictions and in turn produces more effective marketing strategies.[6]

Tourists nowadays use the internet to find information of the various spots that they can visit. It can be a favourite place they want to visit for some famous tourist destination. The trip planning sometimes can fail as the trips provided online can sometimes be not the one which covers each and every planned destination they want to visit. Users would receive recommendations based on their interests under the system that is being suggested. This system requires images from the users to work. If not provided then this system will work. The system will take the user data as input and then the data should be divided into training and test data.. The data is then tested using a hybrid methodology, and each result is integrated to provide a final ranked list of recommendations. Users who have never rated an item before are recommended using collaborative filtering. The recommendation will be based on the user's interests and the interests of nearby users who share those interests. Systems for content filtering suggest suitable items to users based on previous interactions or preferences. In this approach, a list of goods can be found in the user profile. This data is used to extract significant things based on user profiles and item profiles.[7]

The proposed system makes use of the concept of big data and the admin updates the dataset by uploading information and related datasets. The system will make predictions using Euclidean Distance (to find distance between two locations), KNN Algorithm (to find nearest attraction) and Apriori Algorithm (suggest famous places). Currently, the system makes predictions only on the basis of the current location, range and interest of the user and does not take into account the history of the user. [8]

Use of big data is the core foundation of this paper. The first step is the use of preprocessing as actual data is completely different from the imaginary data and data quality is diverse. Next step is data mining, which refers to the use of various machine learning methods to analyze the internal laws of data and mine the value of data. Typically, the K-means method is used to classify the consumer base. To determine the route of the trip Markov model is used. It is used for probabilistic problems of continuity. It states that the probability of the next visited location will be dependent on the previous location. [9]

The software displayed the shortest route and an estimated travel time after selecting a desired location. Then the ratings of the place are checked and filtered. Facilities in the vicinity such as gas stations, restaurants, hospitals, and others were also noted. Then the famous restaurants with famous cuisine were suggested. After the user's suggestion of the cuisine for other users, it was verified by the application and a reward was provided. Credits may be cashed for reduced food coupons or a discount on adventure gear rentals made available via the app. [10]

The proposed system uses the Fuzzy C algorithms for creation of the users dataset and find similarity between users and between an user and a product. It takes inference from how a person acts individually as well as how he acts in a group. The hybridization recommender system is used to integrate the recommendation model built and the geographical information system. The recommendation system must go through all the possible points of interest and collect information from all such locations to analyse the user's behaviour and make detailed recommendations to the user. [11]

This paper talks about the travelling salesman problem by using the binary system as identifiers. We first list all the local optimum routes that a person can take the most optimal route. Assuming that the traveller had passed through n cities they are labelled as 0, 1, 2, 3, 4, …… n-1 . For example if the traveller goes through 3rd and 5th cities out of 7 then it will be represented by 0010100. It's also uses a improved version of genetic algorithm in which we use the status of chromosome X which is represented by the figure that is composed of dots and is represented as a N - Dimensional Vector [12]

When there are several destinations provided by the user for the trip on Google Maps, what it does is that it forms a layout of the whole path according to the order of the input. Now, this may not be the best order for the trip as the user may have to take a return trip to one of the starting points mid journey. What TPAS does is that after the user input it considers the distance between all the destinations and forms a path according to that. This saves the user time as well as money.[13]

The existing methods for travel planning almost all do the same thing, that is, taking all the destinations under consideration and sorting them according to the distance from the starting point. To integrate secondary information and concentrate on significant visited places for the prediction of the next POI, we first create a heterogeneous network in this research (point of interest). Then a beam search method is used to dynamically produce numerous possibilities for viable routes. A Multi-Layer Perceptron (MLP) and Long Short-Term Memory (LSTM) are the two primary components of the suggested architecture (MLP).[14]

Two significant issues arise when designing an itinerary that spans multiple days. There is a window issue, as well as scheduling considerations like the daily trips' fixed travel times and the suggested play times for attractions. b. In two instances, the beginning point and the conclusion point are both consistent and inconsistent. The travelling salesman problem and the path planning problem are identical. This study uses a two-way space-time network algorithm while taking into account a traveler's customized attractions, start and end points, and travel preferences. This algorithm considers the customized travel arrangements that individuals can make in terms of time and place. With a consistent starting point and ending point, it not only addresses the issue of time windows but also that of route planning. [15]

This system mainly focuses on tweet analysis. It classifies the tweets on the basis of various keywords related to the travel domain such as museum, trip, etc which appear in a tweet. This takes into consideration the relevance or the importance of the word in a certain document and its repetition among all the documents available in the system. Several classifiers, including the Naive Bayes classifier, the Support vector classifier, and the Stochastic Gradient classifier, are used to implement this classification. The score of the tweet is also calculated using various parameters such as length of tweet, hash-tags count and retweet count. The suggested approach divides the trip tweets into four categories, including ancient buildings, galleries, playgrounds, and eateries. Keywords related to these categories are grouped together. Sentiment analysis is also used to categorize the tweets into positive, negative and neutral. It also identifies the friends list which has similar interests from the following lists. It also takes into consideration the weight of various attributes in the dataset and the recency of the tweets. This all is taken into consideration while building the model.[16]

Throughout this research, they discuss how the system distinguishes between new and existing users. It claims that

the majority of users are involved on social media and regularly post information about their travels. A newly established user with no previous activity is known as a "cold start." The system goes through numerous processes in a cold start case, including elliptic curve cryptography for travel data, profile matching, possibility checking, and journey priority ranking. Three notifications are displayed under the heading "Travel Priority": red denotes "skip," yellow denotes "warning," and green denotes "appropriate travel advise." Additionally, customer interest and grouping are done to recommend travel based on their preferences.[17]

The limitation of the traditional recommendation system is that it takes into consideration only one of the categories of locations. This paper uses K-means clustering by grouping users according to the categories of tourist attractions such as scenic, historical, religious etc. Firstly the preference of the user for each category is calculated which is equal to 1. Then clustering is done according to the number of categories (5 in this case). It creates user sets containing the users that have the same interests and then after calculating the target requirements' interests it assigns the user to a cluster. The attractions work in a similar way.[18]

Techniques like Apple Maps and Google Maps have the limitation of not showing the shortest path between two points. The travelling salesman dilemma refers to finding the shortest route to visit each tourist attraction just once. In this study, the TSP problem is solved using a dynamic programming approach. The issues that arise in real-world circumstances may be understood by DP algorithms with ease, and they can offer the best answers. This study examines the DP algorithm's suitability for mobile devices with constrained processing power. By segmenting large issues into smaller ones and iteratively locating the best solutions for each, the DP algorithm makes difficult problems simpler. [19]

In this paper, use of conditional probability is calculated to find the certainty of an action. Users' individual data must be used as well as their history must be analysed to make decisions. The weight of the travel location is determined by various factors such as costs, resources, facilities, etc. This paper uses K means to classify information from target users to the created user groups. It also takes into consideration the entire time a person spends at a location including the visiting time and route time. It determines the nearest neighbour and determines the degree of preference for an unknown user in a particular location. The value of degree is calculated from the users' feedback and continuously used to update and make better predictions. [20]

The traditional method of travelling consists of the user visiting places based on recommended scenic spots. It lacks multifaceted understanding of user interests and hence may or may not be liked by a few people. A personalized vacation prediction model is created using the enhanced collaborative filtering method. It does so by taking user's previous travel destinations into consideration. It also takes the nearest neighbour recommendation and then it matches the spots and tries to suggest similar spots. The two level model is used by the algorithm to forecast a customer's opinion of the project. Collaborative filtering's core principle is the employment of prior user group behaviour or opinions to forecast what a certain user is most likely to be interested in. [21]

The recommendation system unexpectedly improved when a Hidden Markov model was added to an item-based collaborative filtering approach in this work. A markov chain is a process that moves through state space from one state to another with "no memory," meaning that the likelihood of the subsequent state depends on the present state. A method of multi-directional data decomposition is CD decomposition. A tensor is depicted as the accumulation of a limited number of ranks. [22]

When making an itinerary for a trip, a lot of things are taken into consideration such as the popularity of POI (point of interest), the user's historical travel data. In this paper, a personalised travel route recommendation framework, named PTDR is used. It has 2 parts which are POI recommendation and itinerary generation. An analysis of the user's active interest is done from check-in behaviour in detail. Then CNN is used to learn the user's active interest from the potential features of the target area and the user's historical interest. Then the PTRD framework is used for performing travel route recommendations based on metadata from geotagged photos. Then the same framework is used for generation of the itinerary.[23]

An item's semantics can be described using tags, which are non-hierarchical structures used to express information. The tourist can express their opinions on the tourist attraction by adding a tag to the attraction. It is a crucial source of information for anticipating the needs of tourists. Multiple tourist destinations can be marked with attractions tags, which can subsequently highlight the similarities between these locations. The tourist will learn from this that this location shares their preferences. User, Resource, and tag are typically the only 3 components of a full tag system. A three-dimensional link exists between visitors, tags, and resources in a personalised recommendation system algorithm based on tags. [24]

This paper analyses how to build a recommendation information retrieval model with personalised tourism based on the Apriori algorithm. This model also uses a TextRank algorithm to read the text and to choose the keywords which are then ranked and used to generate the trip details. Apriori algorithm refers to mining frequent set items and finding patterns so that it is easier to understand. After reading about the trip details, the keywords in the content are set and then the personalised dictionary of the user is used. After this, the user orientation dictionary is updated and then the travel information is recommended. The same number of marked data can be stated to increase efficiency and effectiveness of the Apriori algorithm's use in the retrieval of tourism-related information, where P denotes the matrix's number of rows. [25]

III. METHODOLOGY

After examining the current systems, we discovered a number of functions that are currently available. However, it was noted that a number of features may be included to increase the system's effectiveness and user-friendliness. As a result of examining these factors, we have developed the proposed system's flow. The block diagram of the suggested approach is displayed in the accompanying figure. Then, we went into great detail about each stage.

The proposed system will acquire databases available on the net for various tourist cities or general information about various tourist locations, hotels, and restaurants and their costs in various cities using web scraping.

The flow of the proposed system is shown in figure 1 and starts by acquiring a dataset of various locations that are frequented by tourist. By doing this, it also gains personal information about different tourist also which make the

recommendation better. After acquiring the information, it filters out similarities between the new users which have made an account and the users that have already been a part of the system.

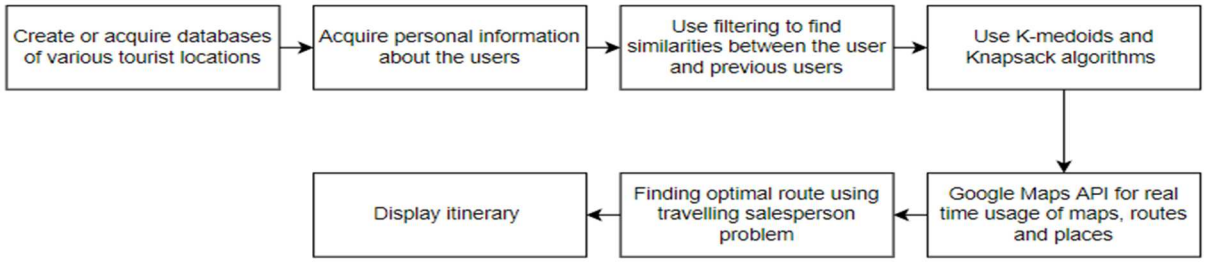

Fig.1. Flow Chart of System

It then uses K-medoids and Knapsack algorithms which are used to cluster similar data with each other. The use of Google Maps APL makes sure that the system also incorporates usage of maps, routes and places that are already provided by google. The travelling salesperson problem is used to find the most efficient path possible for the person to reason from point A to point B earliest. After the model is trained, it will display a custom itinerary to each individual user according to their preferences.

1. *Databases*

The proposed system will acquire databases available on the net for various tourist cities or generate information about various tourist locations, hotels, and restaurants and their costs in various cities using web scraping. The created database will also have information about public transportation and its costs. The database will contain information about the previous users as well such as their ages, likes, health, or financial constraints. It will also store the data which will be obtained from the users of the system and it can be used for future prediction.

2. *Input constraints*

The proposed system will first take input from the user who wants to travel. The input will be taken via a website created which hides the back-end work from the user. The input parameters will include age, sex, likes, dislikes, time health, etc.

Implicit parameters like age and sex are the ones which is the basis of what location the person wants to go to. Old people are less likely to go to extreme sports like mountain climbing, swimming, trekking, etc. While children will prefer amusement parks. As for sex, there are places where particular sex cannot go to or are not willing to go. There are some temples where women have forbidden entry, we have to add that to our database also.

Explicit constraints usually contain likes, dislikes, time, health, etc. These parameters keep on changing over time. Users can define whether they like a particular activity, or place or not and the system will take care to recommend what the user's interests actually are. Sometimes the user can have time constraints because of which they will not be able to go on a trip for more than a specific number of days. Users might also not be able to go on a one-day trip for more than a few hours because of health-related issues or other reasons. Health is also a major factor affecting where a user can go. A person with vertigo will try to avoid high places having hilly areas.

3. *Filtering: Content based and Collaborative based, hotel selection*

We need to filter the database on the basis of various different constraints provided. It will use content-based filtering and collaborative-based filtering. Usage of other items similar to what the user likes and recommends based on that is called content-based filtering. It will use the data from existing users and on the basis of that will be able to recommend the user the best itinerary. In Collaborative based filtering the user will be recommended stuff that he has never seen or liked before. It will use data from a user whose profile is similar to that of the current user and based on that recommend the stuff that the other user has liked. Using the information available, we also recommend hotels to the users.

4. *K- medoids, Knapsack algorithms*

After filtering the user information accordingly, two main algorithms will be used to yield the final itinerary. The places in close proximity to each other will be grouped together in a medoid, which is the centrally located element in the cluster. This algorithm is known as the K-medoids algorithm. The second algorithm will be the knapsack algorithm. The total number of hours that a user can spend in a day will be taken as the maximum capacity of the stack. The number of places in the city corresponds to the number of items. Items have profit and weight where profit corresponds to popularity and weight corresponds to time. For finding the optimal solution to a knapsack problem we need more profit and less weight and the weight should not exceed the capacity

5. *Google Maps API integration*

It is possible to embed Google Maps onto an external website so that site-specific data can be layered by using the Google Maps API. The proposed system uses this API to add routes, maps, and places. As it contains real-time information about places such as weather, climate, etc. it can be used to get all the data that cannot be manually collected. The API will also provide information about the traffic conditions in the city. This data when given to the user, will help the user anticipate the conditions in the city and make any changes required to the itinerary during his/her time of visit.

6. *Travelling salesperson problem*

This issue is used to identify the fastest route between source and destination and the locations included in between. The traveling salesperson problem is used to minimize the travel time spent and maximize the places one can visit from the hotel. The found POI's places of interest in each cluster would act as the nodes and the source and the destination would be the hotel selected by the system. We will use the dynamic programming approach or the genetic algorithm approach to solve the problem.

7. *Display itinerary*

The final itinerary contains each day's activities and the scheduled order of visiting the sites. The projected budget includes the expense of the hotel stay, the cost of the rental

car, and any additional expenses that might be incurred when traveling to a specific location. The user would benefit from getting an early estimate of the tour's cost. The proposed system will also make use of the Google API to give the user optimal routes in the tourist location and an approximate idea of the weather during their time of travel.

IV. Conclusion

The existing systems in travel recommendation have various limitations such as the systems make use of either content based or collaborative based recommendation system. The existing systems do not help the user with the current conditions such as traffic or climate in a particular city. By adopting both content based and collaborative based recommendation system based on user input as well as taking into account a number of other criteria, such as the city's weather and the anticipated traffic conditions at the time of travel, the system overcomes the limitations of the previous models.

V. Future Work

In the proposed system, we can include details on the different modes of transportation, such as flight comparison or rail reservations, allowing the user to plan their complete trip using a single application. In addition, the app will provide real-time navigation as we go through cities, helping us to avoid traffic and see as many locations as possible. In order to help new users in making appropriate decisions, the system can also retain and display prior travel itineraries made by previous users. In order to improve future expedition planning, the user can also provide reviews of the plan he used. Additionally, it may generate a variety of trip itineraries based on the user's preferences, including luxury travel, trekking, and adventure travel. The main goal of the system is to provide an end to end guidance to the users when they are travelling including hotels, restaurants,routes and climates and traffic.

References

[1] Deolekar, R., Nerurkar, A., & Deshpande, S. (2019, March). An intelligent system for tourism management using k-medoids algorithm. *In 2019 6th International Conference on Computing for Sustainable Global Development (INDIACom)* (pp. 956-960). IEEE

[2] Das, D., Sahoo, L., & Datta, S. (2017). A survey on recommendation system. *International Journal of Computer Applications, 160*(7).

[3] Gunasekara, H., & Silva, T. (2021, December). Personalized Travel Recommendation System Using an Ontology. *In 2021 5th SLAAI International Conference on Artificial Intelligence (SLAAI-ICAI)* (pp. 1-6). IEEE.

[4] Ajantha, D., Vijay, J., & Sridhar, R. (2017, March). A user-location vector based approach for personalised tourism and travel recommendation. *In 2017 International conference on big data analytics and computational intelligence (ICBDAC)* (pp. 440-446). IEEE

[5] Arote, S. S., & Paikrao, R. L. (2018, February). A modified approach towards personalized travel recommendation system using sentiment analysis. *In 2018 International Conference On Advances in Communication and Computing Technology (ICACCT)* (pp. 203-207). IEEE

[6] Lv, X. (2021, March). Analysis and Optimization Strategy of Travel Hotel Website Reservation Behavior Based on Collaborative Filtering. *In 2021 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS)* (pp. 362-365). IEEE

[7] Garipelly, V., Adusumalli, P. T., & Singh, P. (2021, July). Travel Recommendation System Using Content and Collaborative Filtering-A Hybrid Approach. *In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT)* (pp. 1-4). IEEE

[8] Kokate, S., Gaikwad, A., Patil, P., Gutte, M., & Shinde, K. (2018, August). Traveler's Recommendation System Using Data Mining Techniques. *In 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)* (pp. 1-5). IEEE.

[9] Chen, P., Liu, J., Zhong, R., Li, G., & Li, Z. (2020, February). Intelligent Travel Route Recommendation Algorithm Based on Big Data. *In 2020 12th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA)* (pp. 531-534). IEEE.

[10] Raji, C. G., Gafoor, A., Ahammed, H., Edavalath, A., & Cijas, P. K. (2020, October). WeGo: An efficient travel assistant application using android. *In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC)* (pp. 594-598). IEEE.

[11] Anjali, A., Sandhu, J. K., & Goyal, D. (2021, February). User Profiling in Travel Recommender System using Hybridization and Collaborative Method. *In 2021 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS)* (pp. 143-148). IEEE.

[12] Ye, C., Yang, Z., & Yan, T. (2014, June). An efficient and scalable algorithm for the traveling salesman problem. *In 2014 IEEE 5th International Conference on Software Engineering and Service Science* (pp. 335-339). IEEE.

[13] Rathnayake, W. P. (2018, March). Google maps based travel planning & analyzing system (TPAS*). In 2018 International conference on current trends towards converging technologies (ICCTCT*) (pp. 1-5). IEEE.

[14] Huang, F., Xu, J., & Weng, J. (2020). Multi-task travel route planning with a flexible deep learning framework. IEEE Transactions on Intelligent Transportation Systems, 22(7), 3907-3918.

[15] Wang, Y., & Ma, J. (2020, July). Personalized Daily Travel Planning Based on Two-Stage Spatiotemporal Network. *In 2020 IEEE 6th International Conference on Control Science and Systems Engineering (ICCSSE)* (pp. 248-256). IEEE.

[16] Nitu, P., Coelho, J., & Madiraju, P. (2021). Improvising personalized travel recommendation system with recency effects. Big Data Mining and Analytics, 4(3), 139-154.

[17] Samraj, J., & Menaka, N. (2021, December). Sentimental Analysis Based on Cold-Start Recommendation with Deep Neural Learning (SACNN): A Novel Approach for Travel Recommendation in Pandemic. *In 2021 IEEE International Conference on Mobile Networks and Wireless Communications (ICMNWC)* (pp. 1-5). IEEE.

[18] Wang, D., Ma, B., & Cao, L. (2019, November). Trip Recommendation Algorithm Based on Attraction Tags. *In 2019 2nd International Conference on Safety Produce Informatization (IICSPI)* (pp. 620-623). IEEE.

[19] Nugroho, B. A., Izzah, A., & Widyastuti, R. (2019, September). Development of Android Application for City Tour Recommendation System Based on Dynamic Programming. *In 2019 International Conference on Sustainable Information Engineering and Technology (SIET) (pp. 240-245)*. IEEE.

[20] Liu, W. (2020, November). Optimal travel route selection method based on genetic tabu search algorithm. *In 2020 International Conference on Robots & Intelligent System (ICRIS)* (pp. 588-593). IEEE.

[21] L. Gang, "Personalized Recommendation of Tourist Attractions Based on Collaborative Filtering," 2020 13th International Conference on Intelligent Computation Technology and Automation (ICICTA), 2020, pp. 144-147, doi: 10.1109/ICICTA51737.2020.00038.

[22] Fang, Y. (2022, February). Research on Personalized Recommendation System Based on Machine Learning. *In 2022 IEEE International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA)* (pp. 1209-1213). IEEE.

[23] Duan, Z., Gao, Y., Feng, J., Zhang, X., & Wang, J. (2020, June). Personalized tourism route recommendation based on user's active interests. *In 2020 21st IEEE International Conference on Mobile Data Management (MDM)* (pp. 729-734). IEEE.

[24] Cui, Y., Huang, C., & Wang, Y. (2019, June). Research on personalized tourist attraction recommendation based on tag and collaborative filtering. *In 2019 Chinese Control And Decision Conference (CCDC)* (pp. 4362-4366). IEEE.

[25] Xu, Y. (2021, September). Research on Travel Personalized Recommendation Information Retrieval Based on Big Data Improvement Algorithm. *In 2021 5th Annual International Conference on Data Science and Business Analytics (ICDSBA)* (pp. 111-114). IEEE.