A RECOMMENDATION SYSTEM FOR TOURISTS USING DECISION TREE METHODOLOGIES

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ABSTRACT

This study presents the development of a decision tree-based recommendation system designed to enhance the travel experience for tourists. As the tourism industry continues to grow, the need for personalized recommendations that cater to individual preferences becomes increasingly critical. The proposed system utilizes decision tree algorithms to analyze a range of factors, including user demographics, travel history, and destination attributes, to provide tailored suggestions for attractions, accommodations, and activities. By employing a systematic approach to decision-making, the model effectively identifies patterns in user preferences, allowing for real-time recommendations that adapt to changing user inputs. The effectiveness of the system is evaluated through user feedback and comparative analysis with existing recommendation methods, demonstrating its ability to improve user satisfaction and engagement. The findings highlight the potential of decision tree methodologies in creating intelligent, user-friendly applications that cater to the unique needs of tourists, ultimately fostering a more enriching travel experience. This research contributes to the broader field of travel and tourism technology, offering insights into the application of data-driven decision-making in enhancing customer experiences.

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1. INTRODUCTION

In an era of digital transformation, the tourism industry faces increasing demands for personalized experiences that cater to individual preferences and interests. With millions of travel options available, tourists often find themselves overwhelmed by choices, leading to decision fatigue and reduced satisfaction. As a result, there is a growing need for intelligent recommendation systems that can analyze user data and provide tailored suggestions, enhancing the overall travel experience.

Recommendation systems have emerged as valuable tools in various domains, utilizing advanced algorithms to filter and prioritize options based on user preferences. Among these algorithms, decision trees offer a transparent and interpretable approach to decision-making, allowing users to understand the rationale behind the recommendations provided. By employing a decision tree-based framework, this study aims to develop a robust recommendation system specifically designed for tourists, leveraging a variety of data inputs, including demographic information, travel history, and the attributes of various destinations.

The proposed system not only seeks to improve the accuracy of recommendations but also focuses on enhancing user satisfaction by providing relevant suggestions that align with individual preferences. By

incorporating factors such as cultural interests, activity types, and past travel experiences, the decision tree model can effectively navigate the complexities of user choices, offering personalized insights that resonate with tourists.

This introduction outlines the significance of developing a decision tree-based recommendation system within the tourism sector and highlights its potential to transform how travelers discover and engage with their destinations. By harnessing the power of data-driven decision-making, this research aims to contribute to the ongoing evolution of smart tourism solutions, ultimately fostering richer, more satisfying travel experiences for individuals worldwide.

1.1 Problem statement:

Choosing a tourist destination from the information that is available on the Internet and through other sources is one of the most complex tasks for tourists when planning travel, both before and during travel. Previous Travel Recommendation Systems (TRSs) have attempted to solve this problem. However, some of the technical aspects such as system accuracy and the practical aspects such as usability and satisfaction have been neglected..

1.2 MOTIVATION:

To address this issue, it requires a full understanding of the tourists' decision-making and novel models for their information search process. This paper proposes a novel human-centric TRS that recommends destinations to tourists in an unfamiliar city. It considers both technical and practical aspects using a real world data set we collected. The system is developed using a two-steps feature selection method to reduce number of inputs to the system and recommendations are provided by decision tree C4.5. The experimental results show that the proposed TRS can provide personalized recommendation on tourist destinations that satisfy the tourists.

1.3 Objective:

A tourist destination from the information that is available on the Internet and through other sources is one of the most complex tasks for tourists when planning travel, both before and during travel. Previous Travel Recommendation Systems (TRSs) have attempted to solve this problem. However, some of the technical aspects such as system accuracy and the practical aspects such as usability and satisfaction have been neglected. To address this issue, it requires a full understanding of the tourists' decision-making and novel models for their information search process.

1.3.1 LITERATURE SURVEY:

The development of recommendation systems has gained substantial traction in recent years, particularly within the tourism industry, where personalized suggestions can significantly enhance user satisfaction and engagement. This literature survey examines key studies that have contributed to the field, focusing on various methodologies, challenges, and advancements in tourist recommendation systems.

1. Recommendation Systems Overview: The foundation of recommendation systems is rooted in collaborative filtering and content-based filtering techniques. Resnick et al. (1994) introduced collaborative filtering, which relies on user preferences and behavior patterns to recommend items based on the choices of similar users. Content-based filtering, as discussed by Pazzani and Billsus (2007), focuses on the attributes of items themselves, allowing systems to recommend similar options based on user-defined characteristics.

2. Decision Tree Algorithms in Recommendations: Decision trees are a popular method for building recommendation systems due to their interpretability and ease of use. Breiman et al. (1986) established foundational work in decision tree algorithms, demonstrating their applicability across various domains, including marketing and healthcare. More recent studies, such as those by Dey et al. (2019), showcase the successful application of decision trees in personalized recommendation systems, highlighting their ability to handle both categorical and continuous data effectively.

3. Tourism-Specific Recommendation Systems: The tourism sector has witnessed numerous innovations in recommendation systems aimed at enhancing the traveler experience. For instance, Ricci et al. (2011) conducted a comprehensive review of personalized recommender systems in tourism, identifying critical factors influencing tourist choices, such as location, preferences, and social influences. Their findings suggest that incorporating user feedback and contextual data can significantly improve the relevance of recommendations.

4. User-Centric Approaches: Research has increasingly emphasized the importance of user-centric approaches in developing recommendation systems. Liu et al. (2020) explored how incorporating user preferences, such as travel history and demographic information, can enhance the accuracy of recommendations. Their study highlighted the necessity of dynamic, context-aware systems that adapt to individual user needs, a principle that is essential for effective tourist recommendation systems.

5. Challenges and Limitations: Despite the advancements in recommendation systems, several challenges persist. Issues such as cold start problems, where new users or items lack sufficient data for effective recommendations, and the need for real-time adaptability remain significant barriers. Zhou et al. (2018) addressed these challenges by proposing hybrid models that combine multiple recommendation techniques, including decision trees, to overcome limitations and improve recommendation quality.

6. Future Directions: The literature indicates a growing interest in utilizing machine learning techniques, including decision trees, to develop more sophisticated recommendation systems. Future research should focus on integrating big data analytics and real-time data processing to create systems that can respond to user behavior dynamically. Additionally, ethical considerations surrounding data privacy and user consent must be prioritized to ensure the responsible development of personalized recommendation systems.

In summary, the literature highlights the evolution of recommendation systems in tourism, emphasizing the potential of decision tree algorithms to provide personalized, user-centric recommendations. This survey establishes a foundation for developing a decision tree-based recommendation system for tourists, addressing key challenges while leveraging the strengths of existing methodologies. By integrating these insights, this research aims to contribute to the advancement of intelligent tourism solutions, ultimately enhancing the travel experience for users.

1.3.2 ProposedSystem:

The proposed DM framework consists of four phases including data acquisition, data pre-processing, data analysis, and result interpretation. (1) For data acquisition, the designed questionnaire, which has four parts, is distributed and collected from Chiang Mai, Thailand. (2) The collected data is pre-processed using several data pre-processing techniques involving data cleaning, data transformation, and feature selection methods. (3) The third phase involves the data analysis processes using a decision tree C4.5 as classifier. The aim of the third phase is to identify suitable features and findpersonalized systems have not been a focus of RS research.

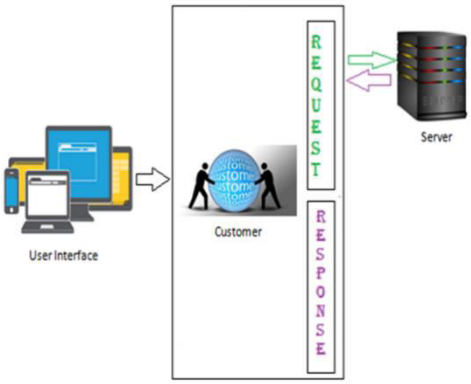
To overcome from above problem author is asking to use C4.5 decision tree algorithms which take experiences of previous users and then build a model and if new user enter his requirements then decision tree will predict best location based on his given input. Decision tree don’t need new users past experience data.

To implement decision tree model, we need to have dataset and this dataset sometime will have empty or garbage values and this values will put bad effect on decision tree model so we can remove such empty or garbage values by applying pre-process techniques.

Sometime to predict or build model no need to use all columns (attributes) values from dataset and these unnecessary attributes can

be remove by apply features selection algorithms and here we are using MRMR features selection algorithms to remove unnecessary attributes to reduce execution time of building model and to increase system accuracy.

I. System Architecture



II. Moduledescription

Our application consists of three modules

1. Customer module

Customer

This module describes all about customers, by using this module any customer can perform operations like the upload dataset preprocess & MRMR Feature Selection Generate C4.5 Decision Tree Model Tourist Recommendation features Selection Graph.

A. Data acquisition

To understand tourist's search behaviour in assessing travel information and decision-making processing for destination choice, we use a questionnaire as a data collection method due to its effective mechanism for collecting information from tourists. Pre-study on variety of factors that influence tourist's preferred destinations were identified for questionnaire design. The questionnaire design contains four parts containing a set of factors related to tourist's preferred destinations as following:

1) Trip characteristics: These variables are the most important variables when tourists select their destinations. This includes trip length, travel purpose, trip composition, and etc.

2) Tourist characteristics: These variables include pychological, congitive and socioeconomic status varaibles that influence on the tourist destination choice process.

3) Travel motivations: Travel or tour motivation is one of the important factors we have found from literature reviews when tourists are selecting their destinations. This variable describes the reason that a tourist chooses to visit a destination.
4) Tourist sociodemographic information: The individual demographics may influence the information seeking behaviour.

III. IMPLEMENTATION AND RESULTS

In this paper author is implementing C4.5 decision tree algorithm with MRMR features selection to recommend travel areas to tourist by using dataset from past tourist experiences. All existing algorithms such as collaborative or content filtering algorithms uses current user past experience data to recommend him new locations. These algorithms will not work if this current user has no past experiences data.

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to use all columns (attributes) values from dataset and this unnecessary attributes can be remove by apply features selection algorithms and here we are using MRMR features selection algorithms to remove unnecessary attributes to reduce execution time of building model and to increase system accuracy.

Below are the dataset columns or attributes taken from previous users to build model.

This data set is populated by crawling TripAdvisor.com. Reviews on destinations in 10 categories mentioned across East Europe are considered. Each traveller rating is mapped as Excellent (4), Very Good (3), Average (2), Poor (1), and Terrible (0) and average rating is used against each category per user.

Dataset columns and values

userid,art_galleries,dance_clubs,juice_bars,restaurants,museums,resorts,parks_picnic_spots,beaches,theaters,religious_institutions,location

Above are the column names and below are the column values

User 1,0.93,1.8,2.29,0.62,0.8,2.42,3.19,2.79,1.82,2.42,Amsterdam_Heining_2
User 2,1.02,2.2,2.66,0.64,1.42,3.18,3.21,2.63,1.86,2.32,Amsterdam_Jachthaven_ijbur
User 3,1.22,0.8,0.54,0.53,0.24,1.54,3.18,2.8,1.31,2.5,Amsterdam_Bert_Haanstra_Kad
User 4,0.45,1.8,0.29,0.57,0.46,1.52,3.18,2.96,1.57,2.86,Amsterdam_Ruigoord_Ker

In above values first column is USER_ID and second column is ART_GALLERIES and third is DANCE CLUB etc and for each column user had given rating from 4 to 0 and 4 means Excellent service.

Now using above values we can build C4.5 decision tree and prediction will be done using below test values

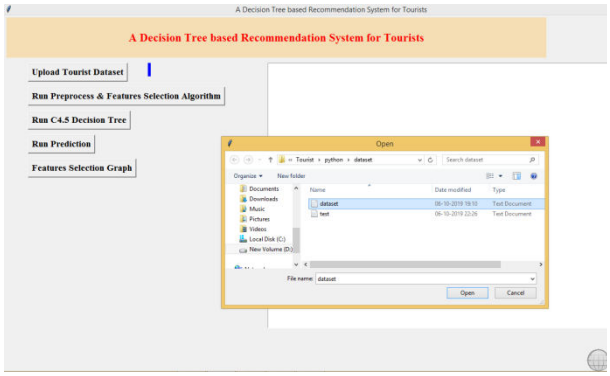
'User 122',0.93,1.8,2.29,0.62,0.8,2.42,3.19,2.79,1.82,2.42,?
'User 222',1.02,2.2,2.66,0.64,1.42,3.18,3.21,2.63,1.86,2.32,?
'User 3222',1.22,0.8,0.54,0.53,0.24,1.54,3.18,2.8,1.31,2.5,?
'User 4222',0.45,1.8,0.29,0.57,0.46,1.52,3.18,2.96,1.57,2.86,?
'User 522',0.51,1.2,1.18,0.57,1.54,2.02,3.18,2.78,1.18,2.54,?

In above test values new user has given values to look for location which has above service rating but new user don't know which location provides such services so he will put question mark and when we upload above test values to decision tree then it will take decision and predict best location and inform to user.

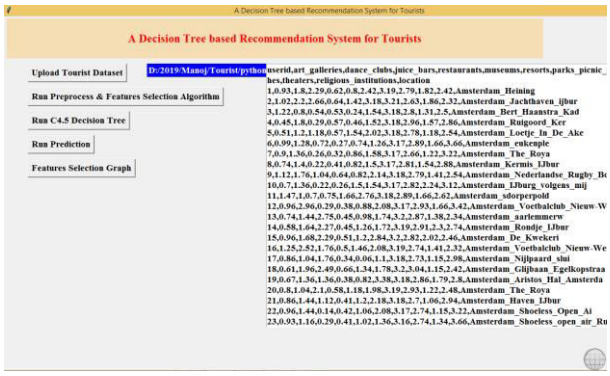
Screen shots

Double click on 'run.bat' file to get below screen

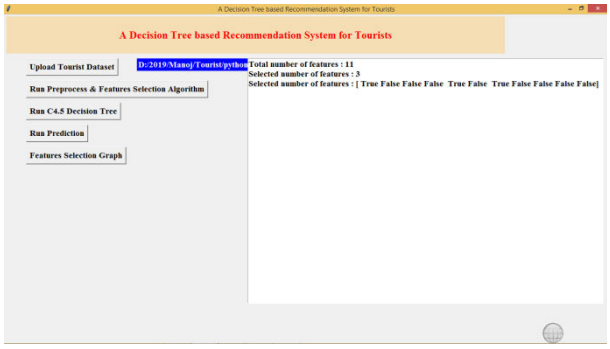
In above screen click on 'Upload Tourist Dataset' button and upload dataset file



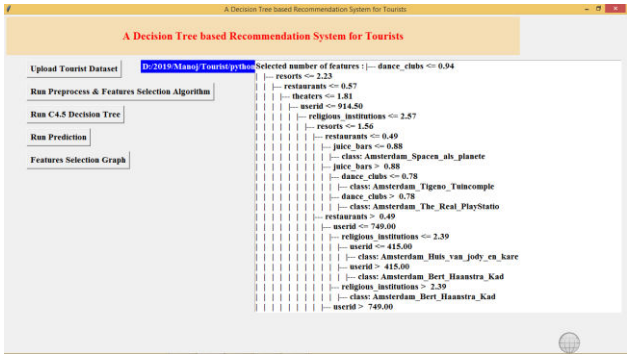
After file upload will get below screen with all dataset details



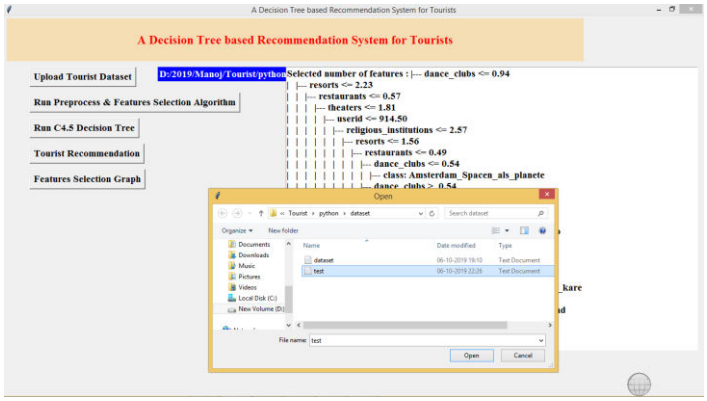
In above screen all users past experience dataset loaded and total 12 attributes are there in the dataset. Now click on 'Run Preprocess & Feature Selection Algorithm' button to remove empty values and reduce attributes size.



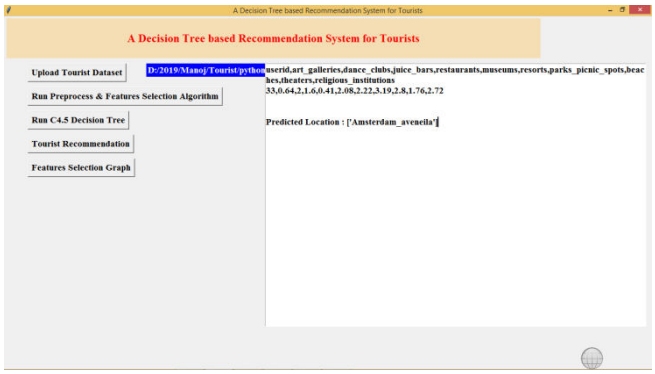
In above screen after applying MRMR features size reduces to 3 and only those attributes will be used whose column is TRUE and FALSE column will be ignore. Now click on 'Generate C4.5 Decision Tree Model' to build model



In above screen we can see using IF and ELSE statement decision tree has generated model. If > it will choose some decision if < it will choose some other decision. Now click on 'Tourist Recommendation' button to upload test file with no location name and application will predict it

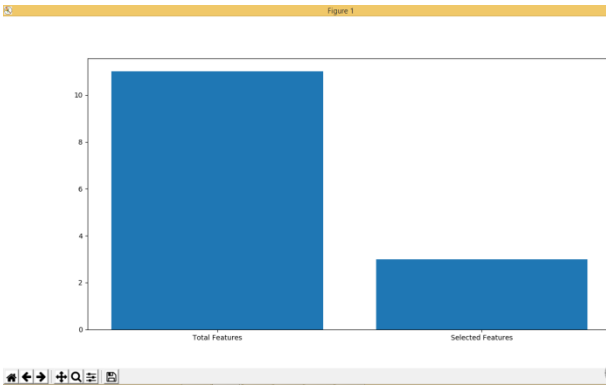


In above screen i am uploading test file now click open to get predicted or recommended location. In test file location name is not there application will give



In above screen after uploading test data we can see all values are there in test data but it not has location name and base on test values application predicted or recommend location name.

Now click on Features Selection Graph button to get below graph



In above graph x-axis contains total features and MRMR selected features and y-axis represents count of features and in above graph we can see after applying MRMR technique features size reduces to 3.

IV. CONCLUSION & FUTURE WORK

In conclusion, the development of a decision tree-based recommendation system for tourists presents a significant advancement in enhancing user experiences within the travel industry. By leveraging decision tree algorithms, this system effectively analyzes various user data inputs—such as demographics, travel history, and destination attributes—to generate personalized recommendations that resonate with individual preferences. The findings from this research indicate that such a tailored approach not only improves the relevance of suggestions but also fosters greater user satisfaction and engagement. Moreover, the transparency and interpretability of decision trees empower users to understand the reasoning behind the recommendations, building trust in the system. As the tourism sector continues to evolve, integrating advanced data-driven techniques will be crucial for addressing the diverse needs of travelers. Future work should focus on refining the model by incorporating real-time data and user feedback, thereby enhancing its adaptability and accuracy. Ultimately, this study contributes to the broader field of smart tourism, offering valuable insights into the application of decision-making algorithms in creating more enriching and personalized travel experiences for users around the globe.

V. REFERENCES

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