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TOURISM RECOMMENDATION SYSTEM USING MACHINE LEARNING

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ABSTRACT —

Travel and vacations can help employees reduce stress. Stress affects thinking, so taking a break from stress can help improve focus by reducing stress. People have many options of places to go for holiday s, but sometimes our holiday choices may not always be worth visiting because some places are only k nown and worth visiting during certain seasons. Therefore, choosing a destination based on informatio n on the internet and other sources is the most difficult task to complete before or after planning a trip. There are many systems that can give people travel advice, but the accuracy of some technologies, sys tems and applications is overlooked. Deep decisionmaking skills to find information are needed to sol ve this problem. That's why we propose a decision treebased recommendation for travel. This machine will help collect more information based on the opinions of people who visit these sites. It will provid e instructions for each purpose. Administrators and users of the modules create these recommendation s. Administrators have permission to review and add sites. Users can view comments about the site the y choose as reviews.

Keywords: machine learning, travel planning, recommendations, analysis.

I. Introduction

A great journey is not planned; They just happened. There are many activities that can be done on the road to help people connect with loved ones and friends. Freedom from constant internet connection al lows time for deep conversations, listening to nostalgic music, reliving old days and funny stories (ad mit it, you love it), and more importantly, creating new memories.After all, the main purpose of travel is always the journey itself. What is the problem if a short change in a city you will never know makes you forget? By taking your time, you allow yourself and some surprises to happen. One of the most e xciting and wonderful things in life is travel. It shows the excitement and fun of the places visited and the journey as a whole.

2. Literature review

The current study incorporates ideas and findings from a variety of academic literature focusing on tra velrelated topics and predictions of current and future conditions in specific sectors. The following sec tion summarizes the main themes and findings extracted from this literature to address a variety of issu es.

1. Short-term forecasting based on machine learning

A study by researchers [1] used machine learning to predict shortterm travel times based on data colle cted from RITIS (Regional Integrated Transportation Information System) data). RITIS is a traffic ana lysis system that uses data analysis, segmentation analysis and signal analysis. This study used raw tra ffic data from selected segments along I485 in Charlotte, North Carolina. The final section of I485, a major commercial interstate highway surrounding the city, was completed in June 2015. Over the past 25 years, the Charlotte area's population has grown from 688,000 to 1.4 million, and that number is ex pected to grow by 200,000 people. 500,000 people in the next 20 years. Charlotte is the state's largest city and one of the largest cities in the United States. As a result, the rapid increase in population has c aused traffic congestion to increase.

The southbound portion of Interstate 485, especially in Charlotte, frequently encounters problems on weekdays due to heavy traffic and interstate traffic. This crisis not only affects travel time, but also hin ders economic development in the region. To solve this problem, the I485 Express Line project was la unched in the summer of 2019 and is expected to be completed in 2022 at an estimated cost of $346 m illion. This project includes the addition of an expansion lane in each direction along I485 between Exi t 67 (I77) and Exit 51 (US 74). Therefore, the expected travel time and traffic on this highway need to be improved. Selected items are shown in the attached image, which shows a satellite map of the area.

TTP Method Ensemble Learning

The method proposed in this study focuses on ensemble learning, a supervised learning algorithm that provides multiple models to increase efficiency. Our particular focus is on treebased learning, which i nvolves the use of many simple models (e.g., decision tree models) to provide alternatives to the probl em at hand. The integration process aims to increase the accuracy of prediction results by combining d ifferent models. This is because model diversity helps reduce the high variance that is often associated with a single decision tree model and can lead to poor resultsTo better understand the principles behin d collaborative learning, it is important to consider its psychological roots. We often adopt a similar ap proach in our daily lives and consult many experts before making important decisions. For example, w e will consult the opinions of many doctors before a major surgery. Likewise, when deciding to buy a car, we can read many user reviews to fully understand its pros and cons. Additionally, in the world of academic publishing, research articles are often reviewed by many experts in the field before publicati on. These reallife situations exemplify the idea that bringing multiple perspectives together can lead to smarter, better decisionmaking.Using the integrated learning process, we aim to integrate knowledge and multiple models from different perspectives to improve the accuracy and stability of predictions in our research.

Random Forest

The RF (Random Forest) algorithm is rooted in the concept of ensemble learning, which combines a la rge collection of unrelated decision trees. Every decision tree can produce results given a set of variabl e parameters. The RF algorithm introduces randomness by generating more data from the original sam ple using a method called bootstrap aggregation (also known as bagging). Bagging is a group of algori thms specifically designed to improve the accuracy of machine learning algorithms by adding random nessDuring the packaging process, the RF algorithm uses the same original sample data to create multi ple samples, thus reducing variance (Figure 3). RF extends the bagging concept by building a decision tree based on different packaging models provided by the original training data. To support diversity of decision trees, the RF algorithm limits the number of features that can be used to build each tree. Th

is limitation makes the trees different from each other in terms of the selected features.Recently, RF m odels have gained wide application in various research fields due to their effectiveness and versatility.

2. Research on tourist prediction using machine learning algorithms [2] points out that according to res earch [2] the tourism industry plays an important role in helping visitors tour to learn about the culture , traditions, language and lifestyle of the people living in that place. The benefits of tourism also inclu de job creation, foreign exchange, infrastructure development, poverty alleviation, inequality reductio n and regional development.In addition, the contribution of tourism to world peace is also accepted. M achine learning has become a key technology driver in many industries, including the tourism industry . It brought significant changes in the tourism sector and service sector.One of the most difficult things people face when planning a trip is deciding the best way to get to their destination. Also, people ofte n want to identify tourists who may walk along the route and decide the best time to visit these places. While most existing studies focus on finding ways to minimize travel costs (e.g., travel time or distanc e), little attention has been paid to incorporating user preferences into recommendations. Some system s only provide information about the best time to visit your location. To solve these limitations, we cre ated an app that addresses the above issues and aims to improve people's travel experience. Our app ef fectively plans routes that include the user's favorite stops using the user's location. We prioritize creat ing great tours featuring famous travelers. We also recommend the best time to visit these places, elim inating the need for users to search for various places to gather necessary travel information. Our app i s a comprehensive platform that provides information about the best deals and travel times and easily puts this content in one place.Tourism forecasting attracts great attention from researchers, especially due to its economic importance to the country's economy. Traditional methods such as time analysis a nd regression models are widely used to make predictions in business research. Although these metho ds have achieved some success, the introduction of machine learning methods has the potential to cont ribute to this field.Machine learning algorithms, especially those aimed at prediction, have found appli cation in tourism analysis. This section explains the different types of machine learning and how they are used to analyze travelrelated data. Relational learning is a type of unsupervised learning that aims t o demonstrate the relationship or relationship between various aspects of a culture. Classification learn ing, on the other hand, is a supervised learning method that involves training a model consisting of exa mple classification models to classify unseen examples.In the tourism industry, machine learning is m ainly used for three purposes: estimating the cost of travel, analyzing the number of tourists, and predi cting the number of arriving tourists. This section provides a brief overview of ten machine learning to ols that support these tasks. Machine learning techniques have three applications in the tourism industr y: (1) predicting tourism costs, (2) analyzing ICSG 2020 K O C H I 2 0 2 0 tourist numbers, and (3) an alyzing estimated tourist numbers. This section briefly describes ten machine learning methods used to support these tasks.

1. Logistic Regression: Logistic regression is a method that involves creating equations to distribute la rge data sets. It is specifically designed to predict random values such as binary values (e.g. 0/1, yes/n o, true/false) using independence criteria. The output of logistic regression is the probability that the pr edicted value falls within the range 0 to 1 as expected. To achieve this goal, logistic regression calculat es coefficients that form the logit transformation of the predicted probability.

2. Linear Regression: Linear regression involves creating a model or equation based on existing data. This model is used to make predictions about a particular variable (called the dependent variable, or "y ") based on the specific value of another variable, called the independent variable, or "x" (also called t he predictor variable). Using the linear regression model, you can estimate and estimate the variance o

f the variable based on the values of the independent variables.

3. Decision tree: Decision tree is a supervised learning algorithm often used for classification and regr ession. First, select the best character from the dataset as the root node. The training data is divided int o subsets based on the characteristics of the selected attributes. This separation process is repeated unti l all parts are separated and a leaf consisting of many branches is formed. Determining which features to segment by counting data increments helps identify the features that provide the most information. Decision trees are designed to create training models that can be used to predict the order or value of t arget variables.

4. Support Vector Machine: Support Vector Machine (SVM) algorithm is a widely used binary classifi er. Introduced by Vapnik in 1995, SVM has gained popularity as a powerful machine learning techniq ue and can be considered in a separate class. It uses separating hyperplanes to create arbitrary boundari es between data points with different labels. SVM is a tightly controlled algorithm; This means that it uses input or training data to develop the best hyperplane to identify and classify new samples. Depen ding on the kernel used, SVM can perform both linear and nonlinear classification tasks.

5. Naive Bayes: The Naive Bayes algorithm is a distribution tracing method that produces a distributio n based on Bayes' theorem. It is especially useful in processing large files and is easy to use. This algo rithm assumes that the probability of each feature is independent of the probability of other features, a nd therefore the assumption is "naive". This sense of independence makes it easier to calculate and be efficient, especially when dealing with multiple devices. Naive Bayes requires little training informati on for classification, and the calculation of each element is precomputed, allowing for fast and effectiv e classification. It uses Bayes' theorem to calculate the posterior probability P(cx) using the prior prob ability P(c), evidence probability P(x), and event probability P(xc). Overall, Naive Bayes is an advanc ed classifier that provides efficient and accurate classification based on the results of calculations.

3. Machine Learning Based Travel Recommendation System

In this section, we will discuss previous publications that demonstrate the use of recommendations in t he tourism industry. These studies use a variety of techniques, including machine learning and deep ne ural networks, to improve travelers' recommendations. Lucas et al. A promising hybrid technology call ed selfcare scheduling has been developed. Their system uses clusterinbased classification to provide personalized travel recommendations. Another study by A. Umanets and colleagues describes an appli cation that involves social interaction called Guide Me. The mobile app, available on iOS and iOS, rec ommends finding places to travel based on user ratings and preferences. Kulkarni et al. Using review d ata, Amazon aims to rank tourists based on positive and negative comments. They use deep learning to evaluate points of interest (POIs) in recommendations. Zheng et al. A proposal was prepared using so cial analysis for Seoul, South Korea. They believe that tourists' preferences play an important role in c hoosing a travel destination. In addition to data analysis, Wang created a personalized product recomm endation that also took into account user variables such as age, gender, profession and city. A large dat abase consisting of 1,283,715 comments was used in the study. G and H. Verma focused on rural touri sm in India and used strategy mining with supervised machine learning to classify reviews of various c ompanies related to travel, drug check hotels and tour agencies. They proposed a quality model based on the time frequency inverse document frequency (TFIDF) metric. Muthukrishnan et al. Dictionary a nd rulebased sentiment analysis was used to extract visitors' characteristics from mobile app reviews o n Twitter. They classify words into different emotions based on polarity. Zelenka et al. The aim of the

strategy is to provide accurate field assessments and performance evaluations.They conducted researc h using Tripadvisor and Booking.com and created a trust model by analyzing the review and verificati on process of these sites. Paolanti et al. The deep learning geodata framework is designed to analyze s patial, temporal and demographic tourism flows in tourism areas. Their study evaluated the framework using comprehensive data. Overall, these publications show how business insights can be improved u sing a variety of techniques such as machine learning, deep learning, analytical thinking, and social an alysis.

4. Machine learning algorithms to generate recommendations.

A. Collaborative filtering (CF): Collaborative filtering is a user-to-user association method [8-9]. It is based on the idea that if many users have similar interests in one area, they will like similar pro ducts or activities in other categories [34]. The similarity between users is calculated based on transpar ent and invisible users. Negative ratings are provided by user search patterns and clickthrough rates, w hile definitive ratings are provided by the users themselves. Platforms like Facebook use collaborative filtering to recommend friends, posts, pages, and other content based on mutual friends, shared interest s, and shared locations.

B. Contentbased filtering (CBF): Contentbased filtering focuses on the concept of "show me more con tent I'm interested in." These systems recommend users products similar to those they have liked in the past [34]. Similarity between products is determined by common features or characteristics. For exam ple, on YouTube, understand users' preferences by looking at their search patterns and recommend sim ilar content to them in the Recommended Videos section. Contenbased filtering assumes that if a user l ikes one item in one category, they will also like other items in the same category.

C. Knowledgebased systems (KBS): Knowledgebased systems produce recommendations based on sp ecific knowledge or skills [34]. Users provide their needs or requirements to the system, and the syste m then compares these requirements with its knowledge base to provide recommendations. For examp le, on an ecommerce site, users specify the products they want with features such as price range, color and size. The system will then recommend the most suitable product based on the match between the u ser's specifications and the manufacturer's product.

D. Hybrid validation system: The hybrid validation system combines features of various validation tec hnologies to overcome the limitations of a single method [34]. Netflix is an example of a popular hybr id offering that combines collaborative and contentbased approaches. It recommends videos or movies to users based on their interests, viewing history, and similarities with other users. For example, if a u ser prefers romantic movies like "PS I Love You," "The Notebook," and "The Fault in Our Stars," Net flix will recommend other movies that fall into the romance genre. Additionally, if two users have sim ilar viewing habits, the system will recommend content to them based on each other's interests.

5. Travel recommendations using machine learning A. Recommendations

Recommendations have two main purposes [3]. First, their purpose is to predict the user's interests and preferences by analyzing the user's behavior or the behavior of similar users, thus generating recomm endations for the individual. Second, experts agree on solving the ranking problem, which is called the highlevel consensus problem. Instead of guessing specific answers for the user, this method suggests t he top k items to the user. Aggarwal identified five simple recommendation models as shown in Figur

e 1. Collaborative filter models make recommendations based on customer ratings from multiple users . In contrast, recommendations based on the process of analyzing the content of users and products foc us on individual users rather than considering all users. Knowledgebased recommendations create reco mmendations based explicitly on user needs, without relying on outside information or historical data. Public consent systems use publicly available information about users to create classifications that dis play certain public information for rating or purchasing purposes. Finally, hybrid recommendation syst ems combine different methods to create a more powerful system that leverages the power of different recommendation types in different domains.

B. Machine Learning Framework

Machine Learning (ML) can be broadly defined as a computational method that uses previous data to i mprove performance and accuracy [9], [10]. “Information” in this case refers to historical data written in electronic form, the quality and quantity of which are important to student success. Data in ML is d ivided into three categories:

1) Training data: ML algorithms use this data to learn a specific task.

2) Validation data: Use this data to tune the hyperparameters of the learning algorithm.

3) Test data: These data are used to evaluate the results of the trained ML model. Many companies cur rently offer advanced machine learning programs that can be used to predict specific jobs. This frame work includes the libraries, platforms, models, and other things needed to run machine learning. Devel opers can access these machine learning processes through APIs (application programming interfaces) or microservices.

III. Methods

Main Methods:

Previous efforts have focused on finding methods that reduce the cost of travel for a species (e.g. trave l time or distance). Some systems only provide information about the best time to travel to a particular location. Therefore, most users need to visit many websites to gather all the necessary information for travel planning.

For example, "TripAdvisor" is a travel recommendation service that uses machine learning algorithms to provide recommendations to travelers. "TripAdvisor" provides recommendations for hotels, restaura nts and attractions by analyzing past user behavior, preferences and reviews.Additionally, Booking.co m uses machine learning algorithms to provide personalized recommendations based on users' past bo okings, searches and reviews. The system also incorporates user feedback to improve the accuracy of i ts recommendations.

Report Process:

We are creating a solution-
providing application to solve these limitations and improve the user journey. Our goal is to plan the b

est trips that take into account the user's interests, including their location. Our specific goal is to creat e a beautiful travel experience that encompasses the beautiful travelerIn addition, our system will prov ide recommendations on the best travel time for various destinations, eliminating the need for users to go to different platforms to type this information. Users will have access to a variety of features to pro vide personalized travel through our app.We use advanced techniques to achieve high accuracy in trav el recommendations. Our system also includes a weather forecast that clearly shows the best months fr om date to destination. Overall, our app is designed to simplify travel planning and provide users with convenient and unforgettable travel experiences.

Figure: 3.1 Design requirements

System requirements specifications

4.1 Software requirements:

Software requirements Minimum software required for proper operation of the application. The softwa re requirements for our project are: Windows 7 or later

Python

Django framework MySQL database

4.2 Hardware requirements:

Hardware Physical requirements for the application to run properly Specifies the minimum hardware r equired. The hardware requirements for our project are: Processor - Core i3

Hard Disk - 160 GB Memory - 1 GB RAM Overview

Advantages

1. Personalization: Machine learning algorithms can analyze travelers' preferences, past behavior, and demographic data to deliver personalized recommendations that improve overall experiences based on personal interests.

3. Save time: Using machine learning, travel agencies and travelers can save time and energy analyzin g lots of data, thus providing travel recommendations faster and delivering better results.

4. Financial benefits: Recommendations generated by machine learning algorithms increase revenue f or travel agencies and businesses by increasing the likelihood of booking and purchasing.

5. Customer satisfaction: Customized recommendations based on machine learning can improve custo mer satisfaction, thereby increasing loyalty and repeat business among satisfied travelers.

6. Adaptive dynamic recommendations: Machine learning algorithms instantly adjust recommendation s based on changes in people's preferences or market conditions, ensuring recommendations are effecti ve and relevant.

7. Cost effectiveness: Machine learning offers travel agencies an efficient solution by eliminating the n eed for large amounts of staff and resources by implementing a consensus process.

disadvantages

1. Limited data: Machine learning algorithms rely on a lot of data. If the data is small or bad, it m akes incorrect or irrelevant recommendations.

2. Bias: If the training data used for machine learning algorithms is biased, it can lead to biased agreement, which can lead to bias or discrimination.

3. Lack of transparency: Some machine learning algorithms can be complex and difficult to un derstand, making it difficult for users to understand how recommendations are generated. Lack of transparency can increase concerns and reduce user trust.

4. Over-reliance on technology: Over-
reliance on machine learning algorithms for recommendations can ignore other important facto rs such as emotions and human intelligence, which can be beneficial for travel.

5. Lack of adaptability: Machine learning algorithms can struggle to respond quickly to sudden changes or unexpected events, which can cause recommendations to become outdated or irrele vant.

6. No human touch: Personalized recommendations created by machine learning algorithms lac k the human touch and emotional connection that makes travel unique and unforgettable. It is i mportant for travel agencies and businesses to balance the use of machine learning algorithms f or recommendations and the integration of human intelligence to provide information about tra vel and wealth.

IV. Results and Discussion

• Personalized recommendations: The system uses personal preferences, travel history, and beh avior to provide recommendations to travelers. By suggesting unique places, activities, and pla ces to stay, it increases discovery of new and exciting options that might otherwise be overlook ed.Increase engagement and satisfaction: Suggestions designed to create more engagement and user satisfaction. The system caters to their likes and dislikes, making the entire experience enj oyable and entertaining.

â¢ Increase profitability: Travel service providers, including airlines, hotels and resorts, can be nefit from the system's ability to tailor their products to travelers' needs and preferences. This e nsures that travelers are provided with options that meet their needs, thus increasing efficiency.

â Increase revenue: Personal recommendations provide travel service providers with the opport unity to increase revenue. Through sales or sales-
related products and services, the system allows service providers to offer additional products t

hat suit travelers' interests and needs.

âœ Advanced Data Analysis: The system collects and analyzes a lot of information about trave lers' behavior and preferences. This data analysis provides travel service providers with better i nformation, allowing them to make informed decisions to improve their services and products.

â´ Trust and Loyalty: The system builds trust in travelers by providing positive and relevant fee dback. When travelers receive recommendations that match their interests and make them happ y, they can develop loyalty to the system and travel service providers.

The system increases engagement, satisfaction and efficiency by focusing on personalized reco mmendations, while also increasing revenue growth for travel services providers. It uses data a nalysis to provide useful information, increase travelers' trust and confidence, and enable a mor e efficient and successful travel experience.

Screenshots

Figure:1 Home Page

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Figure:2 Sign in page

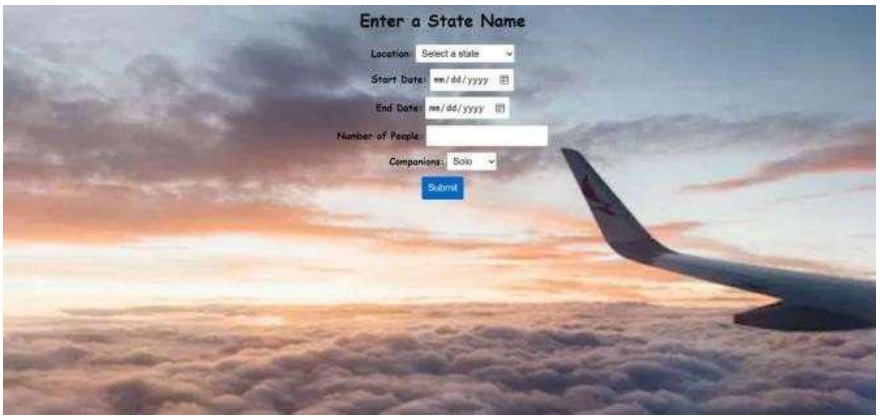

Figure:3 Plan page

Figure:4 Sign Up

Figure:5 Result Page

Figure:6 Result Page

Figure:7 Result Page

Figure:8 Final Map Page

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V. Conclusion

In summary, using machine learning in the travel recommendation process has many advantages but also some disadvantages. However, these problems can be solved by c arefully considering the quality of the data, design and security system during develop ment. Engaging with user feedback and exploring alternative perspectives can increas e transparency and diversity.