A RECOMMENDATION MOBILE APPLICATION FOR TOURIST'S PERSONAL PREFERENCE BY MACHINE LEARNING

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ABSTRACT

Nowadays, with the rapid growth of mobile technology, a mobile tourist recommendation system is widely applied tools for offering travel information. Tourists can access self-guided travel information through the internet. However, there is a lot of travel and tourism information. Therefore, this research aims to develop a recommendation mobile application for tourist's personal preference by using Collaborative Filtering technique, which uses the principle of Cosine Similarity. Collaborative filtering is a significant technique widely used by recommender systems and it uses similarities between users and items to filter out items that a user might like. The evaluation of model accuracy was performed by comparing RMSE and MAE values. Also, the results indicate that the recommendation mobile application was achieved the objective to recommend tourist attractions based on users need.

Keywords: Recommendation system, Mobile application, Tourist's Personal Preference, Machine Learning

INTRODUCTION

Thailand is a popular travel destination known for its beautiful beaches, ancient temples, delicious food, and friendly people and Chonburi is a crucial province located in the Eastern region of Thailand, known for its beautiful beaches and seaside resorts. There are many popular tourist destinations in Chonburi like Pattaya, a popular beach town known for its nightlife and entertainment, and the nearby island of Koh Lan, known for its clear waters and coral reefs. The province also has some historical and cultural places to visit like Wat Yansangwararam, a temple complex featuring a large golden Buddha statue and other traditional Thai buildings, and the Sri Racha Tiger Zoo, which is home to a wide variety of animals including tigers, elephants, and crocodiles.

Nowadays, machine learning is an important method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. Machine learning is used in a wide range of applications, such as image recognition, natural language processing, predictive modeling, and more. Also, machine learning is being used in the travel industry to improve various aspects of the customer experience, such as personalized recommendations for flights, hotels, and activities, as well as improving the efficiency of operations, such as flight scheduling and pricing optimization.

A recommendation system in travel is a significant tool that uses machine learning algorithms to suggest destinations, activities, and travel packages to customers based on their preferences and past behavior. These systems can be used by travel companies and websites to improve the customer experience and increase bookings. The recommendation systems use various types of data such as customer demographics, past booking history, browsing behavior, search queries, and customer reviews and ratings. The system will analyze this data and use it to identify patterns and relationships. Based on this information, the system will be able to generate personalized recommendations for each customer. It's important to note that AI and ML are powerful tools, but they are not a magic solution, but rather a support to human expertise and creativity. They need to be used in conjunction with other strategies and tools to achieve the best results.

In recent years, mobile technology has had a significant impact on the travel industry. It makes easy for people to plan, book, and navigate their trips. To promote travel in Chonburi, the province can highlight these tourist destinations and activities through various marketing campaigns and promotions through mobile application. Nowadays, mobile recommendation systems using collaborative filtering have been widely studied because it is able to take advantage of the large amounts of data that are generated by users' interactions with mobile apps and services. Therefore, the purpose of this research is to develop a mobile application for traveler preference recommendations using machine learning.

The remainder of this paper is structured as follows: the second part provides related works on background. The third part demonstrated methodology used in the study including dataset and related approaches and the fourth part present design and implementation of the recommendation mobile application. The fifth part reports on the results of outcomes obtained using the predictive model implemented along with the discussion. Finally, the fifth part draws on the conclusion and future works.

LITERATURE REVIEW

With the development of the advance technology, a recommendation system is used to analyze user preferences and adapts its functions to each individual users [1]. There are much research drawn considerable attention to Recommender systems for tourist attractions [2]. Content-based recommendation system offers the similarity by using evaluated from a user [3]. Collaborative Filtering (CF) is a successful recommendation technique which generates rating predictions for a target user by exploiting the ratings of similar users [4] and it includes user-based collaborative filtering and item-based collaborative filtering [5]. In user-based collaborative filtering, it evaluates the similar interests of users in certain items, so they may have the same interests in other items. In collaborative filtering, cosine similarity is a commonly used similarity metric for measuring the similarity between users or items. The goal of collaborative filtering is to make recommendations to users based on their past behavior and the behavior of other users. Cosine similarity and Pearson similarity were used to calculate the general similarity [6]. According to Claypool et al., a voting mechanism was proposed to integrate the prediction results [7]. A mobile personalized recommendation for the sustainable development of m-commerce was developed based on a user-based collaborative filtering recommendation and it can promote the sustainable development of mobile commerce [8]. A

personalized tourist attractions recommendation was applied recommendation quality in the tourism domain [9]. Mobile recommender systems have been proposed to users with similar interests [10]-[14]. Also, Lu et al. [15] reviewed the different studies in the field of recommendation system. Therefore, mobile recommendation systems using collaborative filtering are an active field of research, and new methods and techniques are being developed to improve the accuracy and personalization of recommendations in mobile environments.

METHODOLOGY

A. Collaborative filtering

Collaborative filtering is a method of making recommendations [16] based on the preferences of similar users. It works by identifying customers with similar tastes and preferences and using their behavior to predict what other items they may like. There are two main types of collaborative filtering: User-based and Item-based. User-based compares the behavior of one user with other similar users to make recommendations. It looks at the items that similar users have liked or purchased in the past and suggests those items to the current user. On the other hand, item-based compares the relationships between different items to make recommendations. It looks at how similar items are related to each other and suggests items that are related to the ones a user has liked or purchased in the past. The system uses the data of past behavior, such as which destinations, activities, or packages a customer has booked in the past, to create a profile of their preferences.

User-based collaborative filtering

```
for each user u:
   for each item i that user u has not rated:
      calculate the similarity between user u and all other users
      find the k most similar users to user u
      calculate the predicted rating for item i for user u using the ratings of the k most similar users
      add the predicted rating to a list of predicted ratings
   calculate the MAE between the predicted ratings and the actual ratings for the items that user u has not rated
```

Item-based collaborative filtering

```
for each item i:
   for each user u that has not rated item i:
      calculate the similarity between item i and all other items (using cosine similarity)
      find the k most similar items to item i
      calculate the predicted rating for item i by user u using the ratings of the k most similar items
      add the predicted rating to a list of predicted ratings
   calculate the MAE between the predicted ratings and the actual ratings for the items that user u has not rated
```

B. COSINE SIMILARITY

Cosine similarity metric is a metric used to measure how similar between two or more items are [17]. The approach measures the cosine of the angle between two vectors projected in a multi-dimensional space. The output value ranges from 0–1. 0 means that there is no correlation and 1 means that the two variables have a strong correlation. Given two N dimension vector A and B, the cosine similarity between them is calculated as follows:

$$similarity(A,B) = \frac{A \cdot B}{\|A\| \times \|B\|} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \times \sqrt{\sum_{i=1}^{n} B_i^2}} \quad (1)$$

C. Mean Absolute Error (MAE)

Mean Absolute Error (MAE) evaluates the accuracy of the difference predict ratings given by the users

$$MAE = \frac{1}{T}\sum_{(u,i)\in T}|\hat{r}_{ui} - r_{ui}| \quad (2)$$

Where T is defined by the test user real ratings.

u is a user.

i is an item.

$\hat{r}_{ui}$ is the predicted rating.

r_{ui} is the test ratings.

D. Root Mean Square Error (RMSE)

Root Mean Square Error (RMSE) is one of the most widely metrics used to measure the quality of the predicted ratings. It evaluates the difference between values for large errors in the rating prediction.

$$RMSE = \sqrt{\frac{1}{T}\sum_{(u,i)\in T}(\hat{r}_{ui} - r_{ui})^2} \quad (3)$$

Where T is defined by the test user real ratings.

u is a user.

i is an item.

$\hat{r}_{ui}$ is the predicted rating.

r_{ui} is the test ratings.

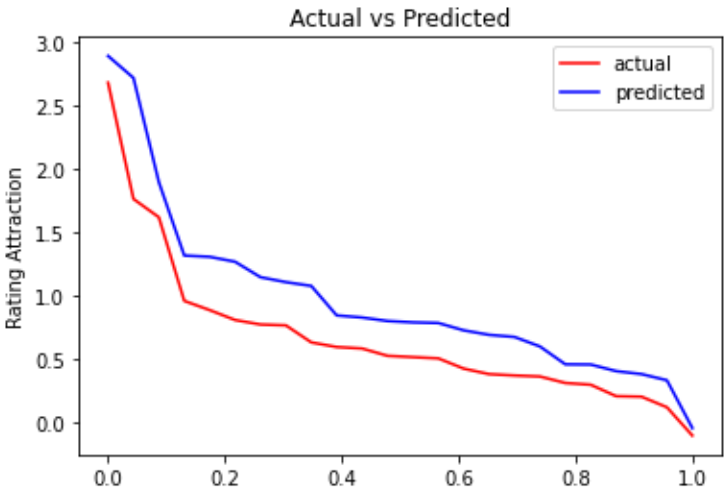
RESULTS

An evaluation of the recommender mobile application is made to measure the levels of their performances by model testing and user satisfaction.

A. Model Testing

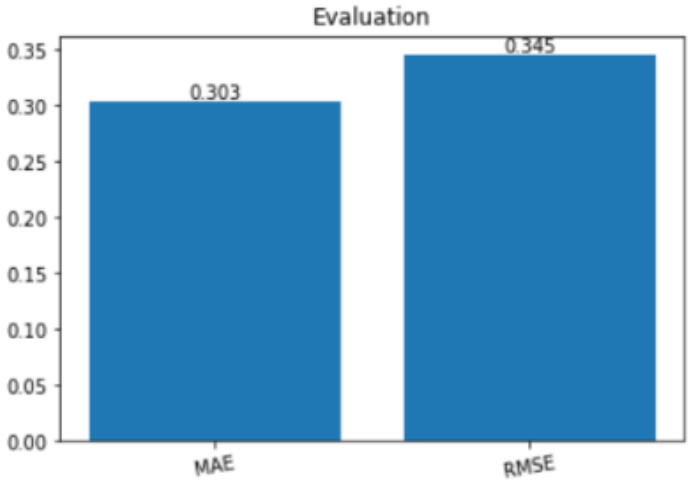
The objective of this research is to verify the rating values which are given by the user that can enhance the recommendation mobile app accuracy using the collaborative filtering. Fig 3 presented the results between actual and predicted values of the model.

Figure 3.
The results between actual and predicted values



Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) were used to evaluate the recommendation model and the result was shown in figer 4.

Figure 4.
the results between Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) values



B. Results from user satisfaction

The researcher conducted a mobile app trial with 20 users and the sample group has tried using the mobile application and answer the satisfaction questionnaire with the system then the results assessment was analyzed with basic statistics compared to criteria and summed up as presented in table I.

Table 1.
User Satisfaction Evaluation Results

No.				
		$\bar{x}$	**S.D**	**Level**
1	The app made it easy for me to use and not complicated.	4.6	0.48	Very good
2	How do you feel about the app design?	4.55	0.58	Very good
3	How is the navigation of the mobile application?	4.4	0.73	Good
4	How satisfied are you with the loading speed of the mobile app?	4.15	0.85	Good
5	Did the app help you accomplish your goal?	4.2	0.67	Good
6	Would you recommend this app to your family and friends?	4.4	0.58	Good
		4.38	0.65	Good

CONCLUSION

The main conclusion of this study was that all of the recommendation mobile application for tourist's personal preference obtained better results in all aspects and it proves that the recommendation mobile application could recommend interesting destinations to travelers and so answer the users' needs. For the future work, it might look to get additional data sets from other domains like behavior and attitude and it would be explore with more the deep learning techniques. Finally, the model deployment experiment should be extended to a real-world industry.

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