A Machine Learning Approach to Food Recommendation Using Content-Based Filtering

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Abstract.

A machine learning algorithm that recommend useful items or products to customers is called a recommender system. They may be determined using a variety of parameters, such as previous purchases, search history, demographic data, and other elements. Approaches like collaborative filtering, content based filtering, and hybrid filtering are the main categories used to develop recommender systems. Amazon, Netflix, and Spotify all use recommender systems, which are some of the most well-known examples of this technology. Most of the research in this field of food domain making suggestions for food items based on a user's tastes or health issues. Group recommendation are also helpful in the food domain, particularly when a group of users wants to host a party in a restaurant or have dinner together at home. Such situations pose numerous difficulties for food recommendation systems because it is necessary to adequately account for the tastes of each group member. Recommender systems have become an integral part of online services, providing personalized suggestions to users. Content based filtering is one such technique that recommends items based on their content features. In this study, we analyse a CBF model for recommending items based on their names, types, and outlet types. This paper presents an analysis of a content-based filtering (CBF) model for item recommendation using a dataset of products, their types, and outlet types. The model leverages TF-IDF vectorization and cosine similarity to recommend similar items. The result and accuracy of this model is evaluated using some metrics like F1-score, recall and precision.

Keywords. Recommender System, Content Based Filtering, Collaborative Filtering, TF-IDF, Cosine Similarity

1. INTRODUCTION

Smartphone technology is revolutionizing our level of existence. With just a few swipes and touches, we can access anything. In the age of online food delivery applications, users in metropolitan areas have a lot of options To find food goods that people are interested in, food recommendation systems are required. Using any app that is available in their location, users may place meal orders depending on the restaurants in their neighborhood or their favorite foods[1]. Recommender systems are information filtering solutions that solve this issue by offering users tailored suggestions for potentially intriguing content. In a typical recommender system, the item is a good or service which recommended by the system to its users, which includes things like shopping, listening to music, and reading books[2]. To offer items, products, and services based on user preferences and past purchase history, recommender systems employ two distinct methods like collaborative filtering technique and content based filtering technique[3]. Collaborative filtering technique is a well-liked recommendation algorithm strategy that bases its suggestions on the evaluations of other system users. The premise behind the strategy is that if consumers agree on one item rating, they are likely to agree on other item ratings as well. The benefit of collaborative filtering is that it relies on human evaluations, which assign scores to things based on both content and quality or taste—factors that are challenging for a computer algorithm to assess[4]. A meal recommendation system provides information about the healthfulness of the suggested dishes together with recommendations that

are based on the needs and preferences of the user. The likelihood that consumers will select healthier dishes over those they usually cook is also investigated[5].

2. LITERATURE REVIEW

The Author created the recommender system Fiducia to suggest restaurants based on Zomato reviews and patrons' gastronomic tastes using Naive Bayes Classifier, Bow, Decision Tree, and Long Short Term Memory techniques, it performed a sentiment analysis on these text passages and, based on item-item and user-item similarity, chose an appropriate restaurant for the particular item. Fiducia has an accuracy rate of about 85%[6]. According to the author, Zomato is a restaurant review app that contains review data and may be used to forecast menu items by applying the phrase frequency inverse document frequency and creating a word vector using the Radom Forest Classifier technique, they developed a machine model for item prediction, then analysed the data using sentiment analysis. 92%, 93%, and 87% are its accuracy, recall, and precision rates, respectively[7]. The concept of online food delivery applications is explored, along with the advantages and disadvantages and the study concluded that internet meal delivery services are booming due to India's urbanisation, and that their future appears bright. The success of internet websites is largely dependent on their comfort, convenience, and user-friendliness[8]. Using the Zomato Pune dataset, customers' food ratings are divided into three fundamental categories: good, negative, or neutral. The authors plan to develop the idea into an adaptable system structure that merely removes and ranks the best reviews[9]. To assess customer input and automatically assign a general restaurant grade, study uses text mining. Natural language processing is used to fetch pertinent descriptors and evaluation ratings of user identified features from unstructured text[10]. It was discovered that the most of user were knowing about food apps, and that the majority of people use them to place food orders. A factor analysis revealed that the respondents ranked convenience, ease of payment, longer delivery times, and receiving the expected order as the most important factors in relation to their monthly expenditure, while good customer service, receiving the expected order, and fewer restaurants were ranked as the most important factors in relation to age[11]. It provides a summary of the relationship between database knowledge discovery and data mining. This also covers data-mining methods, real-world applications, and the difficulties associated with applying knowledge discovery in the actual world[12]. After extracting food preferences of user from their reviews, a context-aware recommender system created by author makes restaurant recommendations depends on those preferences. A semantic method was used to group food items gathered from user reviews along with the sentiments connected with them. The findings demonstrate that this algorithm provides recommendations with 92.8% accuracy. The Wu-palmer and cosine approaches are combined in one approach to system development[13].

3. METHODOLOGY

A food recommender system makes recommendations to consumers about foods based on their interests, previous interactions, and contextual information. The following steps are commonly included to design the recommender models:

Figure 3.10. Step to design recommender model.

3.1. Data Collection

First stage of a recommender system is data collection. The information gathered from an online meal ordering platform.

3.2. Data Pre-processing

This stage involves eliminating noisy and unnecessary data from the data, removing duplicate data, fill missing values, identify and correcting errors and standardizing data.

3.3. Recommender System Approaches with Model

In this mode the content-based filtering method suggests foods that are comparable to what the consumer has already ordered. It makes use of user and item data, represents each item attributes as a feature vector using TF-IDF (Term Frequency-Inverse Document Frequency). Next step is to apply Cosine Similarity to calculate the similarities between the objects. It recommends the most similar products based on past user choices.

3.4. Evaluation Matrices

One method of unsupervised learning is content-based filtering. We can use F1-score, recall and precision. Verify that the test set contains the suggested items. Determine the F1-score, precision, and recall.

4. RESULT

In our evaluation of the Content-Based Filtering (CBF) model, we measured the precision, recall, and F1-score to assess its performance. These metrics are crucial for understanding the effectiveness of the recommendation system. The results are Precision: 0.66, Recall: 1.00 and F1-Score: 0.90.

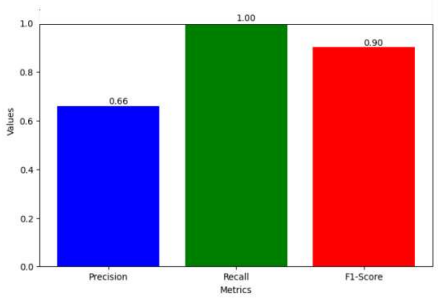

Figure 4.1.Result of Performance Matrices.

5. CONCLUSION AND FUTURE SCOPE

The Content-Based Filtering (CBF) model demonstrates high recall with a value of 1.00, indicating its strength in ensuring that all relevant items are recommended. However, the precision 0.66 suggests that there is space for improvement in reducing the number of irrelevant items recommended. The overall F1-score of 0.90 reflects a reasonably balanced performance. These results suggest that while the Content based filtering model is good in terms of recall, further refinement is needed to improve precision. Future work could explore methods to enhance the precision without compromising recall, such as incorporating additional features or refining the filtering criteria.

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Biographies

Zinkal Patel received the bachelor's degree in computer science from Veer Narmad South Gujarat University, Surat in 2008, the master's degree in computer science from Sardar Patel University, Vallabh Vidhyanagar in 2011 and pursuing the philosophy of doctorate degree in IT & CS Department from Parul University respectively. My research areas include data mining and machine learning.