

CS F407

REPORT TITLE

Restaurant Recommendation System

Under the supervision of

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Introduction

A Restaurant Recommendation System is an advanced information filtering application designed to predict the ratings a user or group assigns various restaurants. The recommender system can efficiently process and analyse the data by breaking down the large rating matrix from users and restaurants into two smaller matrices, one for user features and another for restaurant features.

The main objective of our project is to develop a personalised restaurant recommendation system based on user preferences. Every individual has unique food preferences and dietary restrictions, so we focus on meticulous feature selection to leverage the insights from user reviews.

Our recommendation system aims to filter through a vast pool of restaurant information and provide each user or group with the most relevant and accurate suggestions.

Our recommendation engine utilises machine learning algorithms to discover meaningful patterns in the dataset by learning from users' past choices. By doing so, it generates restaurant recommendations that align with the specific needs and interests of the users.

Moreover, we understand that dining is often a social activity involving multiple users. Therefore, our system goes beyond individual recommendations and considers the information of all members within a group. By analysing the preferences and restrictions of each group member, our system intelligently suggests restaurants that satisfy the entire group based on specific criteria.

In summary, our Restaurant Recommendation System aims to provide personalised and group-based restaurant suggestions, leveraging machine learning techniques and careful feature selection to ensure users receive relevant and satisfactory recommendations that cater to their diverse culinary preferences.

Business Understanding

- Identify the target users of the system. Are they tourists, locals, food enthusiasts, or people with specific dietary preferences? Understanding user demographics and priorities is vital in tailoring recommendations.
- Bangalore is a large city with diverse neighbourhoods, each having its unique culinary scene. Consider integrating location-based recommendations to suggest restaurants near the user's current location or in a specific area of interest.
- Identify relevant parameters for recommendation and analyse the eateries based on these recommendation parameters.
- Determine key parameters that differentiate a set of eateries from the others and identify its target audience.

Data Understanding

Gather Information on Eateries: Collect data on the various eateries available in Bangalore cities, including their names, locations, cuisines, price ranges, seating capacity, operating hours, and other relevant details.

Analyse relevant restaurant information (cuisine type, price range, location, etc.), user choices and behaviour.

Data Preparation:

Data preparation is a crucial step in building a Restaurant Recommendation System. It involves selecting, cleaning, and transforming the data to create a well-structured dataset that can be used to train and test the recommendation model. Here's a detailed view of the Data Preparation phase:

Data Collection:

- Gather data from various sources, including user reviews, restaurant information, user preferences, dietary restrictions, location data, and any other relevant data influencing restaurant recommendations.

Data Cleaning:

- Handle missing data: Check for missing values in the dataset and decide how to handle them. Depending on the situation, you can either remove data points with missing values, impute missing values using statistical methods, or use advanced imputation techniques.
- Outlier detection: Identify outliers in the data and decide whether to remove or keep them, depending on their impact on the recommendation model.

Data Integration:

- Merge data from different sources into a unified dataset, ensuring that the relevant data is appropriately linked for building the recommendation system.

Data Transformation:

- User-Restaurant Interaction Matrix: Create a user-restaurant interaction matrix that captures user ratings or preferences for various restaurants. This matrix will serve as the foundation for the recommendation system.
- User Profiling: Analyze user reviews and preferences to extract relevant features, such as favourite cuisine types, dietary restrictions, preferred price range, etc.

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- Restaurant Profiling: Extract restaurant features, such as cuisine type, location, price range, average ratings, and other attributes that can influence user preferences.
 - Encoding Categorical Variables: Convert categorical variables (e.g., cuisine type) into numerical representations using one-hot encoding or label encoding.
 - Feature Scaling: Scale numerical features to ensure they have similar ranges, which can prevent certain features from dominating the recommendation process.

Data Splitting:

Divide the dataset into training and validation sets. The training set will be used to build the recommendation model, while the validation set will be used to evaluate its performance.

Modeling:

Modeling is a critical phase in building a Restaurant Recommendation System, as it involves selecting appropriate algorithms and techniques to generate personalized and relevant restaurant suggestions based on user preferences. Here's a detailed view of the Modeling phase:

Algorithm Selection:

Choose suitable recommendation algorithms based on the nature of available data and project requirements. Standard recommendation techniques include:

- Collaborative Filtering: This approach recommends restaurants based on the preferences of similar users or groups of users.
- Content-Based Filtering: This method recommends restaurants based on the attributes and features of the restaurants and user preferences.
- Hybrid Methods: Combine collaborative filtering and content-based filtering to leverage the strengths of both approaches.

Data Preparation:

- Use the preprocessed and transformed data obtained from the Data Preparation phase as the input for the modeling stage.

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- Ensure the data is correctly formatted for the selected algorithm, considering factors like user-restaurant interaction matrix or user profiles.

Train the Model:

- If using machine learning algorithms, split the data into training and validation sets.
- Feed the training data into the chosen algorithm to train the recommendation model.
- Fine-tune hyperparameters to optimise the model's performance using cross-validation or grid search techniques.

Evaluation:

Evaluation is a crucial phase in developing a Restaurant Recommendation System as it helps measure the performance and effectiveness of the system in providing relevant and accurate restaurant suggestions. Here's a detailed view of the Evaluation phase:

Evaluation Metrics Selection:

Choose appropriate evaluation metrics based on the nature of the recommendation problem. Standard evaluation metrics for restaurant recommendation systems include:

- Accuracy: The proportion of correct restaurant suggestions provided by the system.
- Precision: The proportion of relevant restaurants among the suggested restaurants.
- Recall: The proportion of relevant restaurants that were successfully recommended.
- F1 Score: The harmonic mean of precision and recall, balancing both metrics.
- Mean Average Precision (MAP): The average precision over different users or groups of users.
- Area Under the Receiver Operating Characteristic (ROC-AUC) curve: Measures the quality of ranking-based recommendations.

Data Preparation:

Use the validation or a held-out test set (if available) to evaluate the recommendation system's performance.

Ensure that the data used for evaluation represents a diverse set of user preferences and restaurant choices.

Deployment:

The Deployment process in a Restaurant Recommendation System involves taking the developed model and making it available for real-world use by end-users. Here's a detailed view of the Deployment phase:

Infrastructure Setup:

- Prepare the necessary infrastructure and resources to host the recommendation system. This may include setting up servers, databases, and other required software components.

Model Serialization:

- Serialise the trained recommendation model into a format quickly loaded and used by the deployed application. Standard designs include Pickle files or serialised models using libraries like TensorFlow or PyTorch.

Web/Application Development:

- Develop a user-friendly web or mobile application interface for the recommendation system. Ensure that it is intuitive, responsive, and easy to navigate.

Backend Integration:

Integrate the serialised recommendation model with the backend of the application. The backend will handle user requests, process data, and interact with the model for generating restaurant recommendations.