Food Dicted: A Restaurant & Food Recommendation System

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Abstract

To provide an answer for the mundane questions like where to eat? And what to eat? We are developing an Android Application that uses simple Machine Learning Algorithms like Content based filtering and Clustering. The first phase of the output consists of prediction of restaurants based on user input and the second phase includes prediction of dishes based on the tags selected by the user.Now days we are provided with a large number of choices which is overwhelming,here there is a need to filter and efficiently deliver information in order to minimize the problems of information overload. Recommender systems are used to solve this problem by searching through this information and predict an output according to the users personal preferences. This system explores various characteristics and the potential of different techniques of prediction to analyze the result.The system uses content based recommendation techniques for producing food recommendations.It is based on similarity score of foods. Basically, our system constructs user profiles from the inputs (preferences) given by the user and food profiles(tags selected) from the ingredients of the food, then it recommends the most appropriate dish according to the preferences of the users.

Keywords:*Predicting restaurant; Predicting dish; Android development; Cosine Similarity Matrix; Machine Learning; php database;*

1. INTRODUCTION

The main idea is to create an application that takes into consideration the likes and dislikes of the user, implements machine learning algorithms and provides not only a restaurant but also with the dishes to be eaten in the particular restaurant.We can take for examples various social networking sites such as Instagram that use various recommendation system techniques and suggest users, what to follow etc based on the users previous choices and taste[1].

Recommendation systems analyze patterns and give the desired outcomes. Given this general idea, our project's main aim is creating a recommendation system for users which predicts the restaurant and dishes based on the user's input of his preferences.

The Development of the application has been done using Android Studio. Databases are stored in the XAMPP server and linked to the system using PHP code. The login and register functionality and its security has been implemented using Javascript. The database consists of a number of tables that take care of storing the user inputs or preferences and also the restaurant suggestions for users.We have used similarity measures or similarity metrics to provide restaurant recommendations based on user selections.
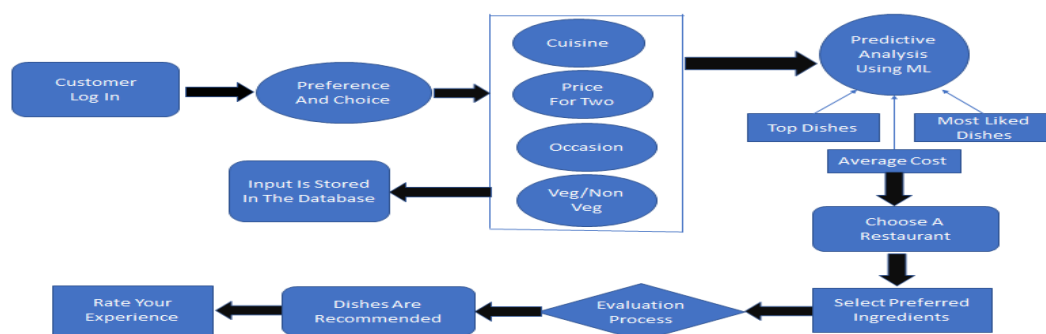
Figure 1. Block Diagram of the entire system

1.1. UNIQUENESS:

There are a lot of models in the market that give the user restaurants based on their preference but we are moving one step ahead. Our system model will provide along with the restaurant, the dish to be eaten there.

1.2. BACKGROUND:

There are a ton of applications that provide the facility of food delivery at home. They also contain details of the restaurants along with the menu, approximate price and restaurant type. Some of the examples are Zomato and Swiggy.Also Freyne and Berkovsky made recommendations by splitting recipes down into different individual ingredients[2] and measuring similarity scoring based on the ingredients contained within recipes, which users had given a thumbs up.

1.3. CONNECTION:

Our system contains the list of restaurants in the database and asks a set of questions to the users, based on the
answer it predicts a restaurant first and then asks the user to select tags which are ingredients in the dishes, based on which we predict and recommend the user a dish[3][4].

1.4. GOAL OF THE WORK:

The ultimate goal of the project is to clear the ambiguity from the user's mind. To avoid wasting time on selection of restaurants and dishes among so many variations. We provide a clear recommendation based on the user preference.

2. LITERATURE SURVEY OF EXISTING SYSTEM

There are abundant applications based on different recommendation systems that use simple Machine Learning Algorithms[5] to provide a prediction that will satisfy the user. There are two different applications i.e either you are suggested a restaurant or you are suggested a dish. There is rarely any system that does both. The existing system predicts the result based on the user ratings[6] or the frequently visited restaurants or the frequently eaten dishes. Our system takes into consideration the preferences given by the user and predicts the output based on those preferences which inturn makes sure that the given result is accurate.

3. IMPLEMENTATION STRATEGY

A large amount of data was collected from the internet. Details such as name, cuisines, restaurant type, price, ratings,veg/non veg, occasions of 6405 restaurants was collected from a single site. This was used as a dataset for recommending restaurants to the user depending on the preferences selected by him.The user interface of this application was developed as an android app using AndroidStudio. Restaurants for suggestion based on the inputs of the user are obtained by implementing similarity metrics, mainly cosine similarity and the exponential decay function and also by using knowledge based[7][8] recommendation algorithms Suggested restaurants are ordered in terms of similarity scores assigned to them.
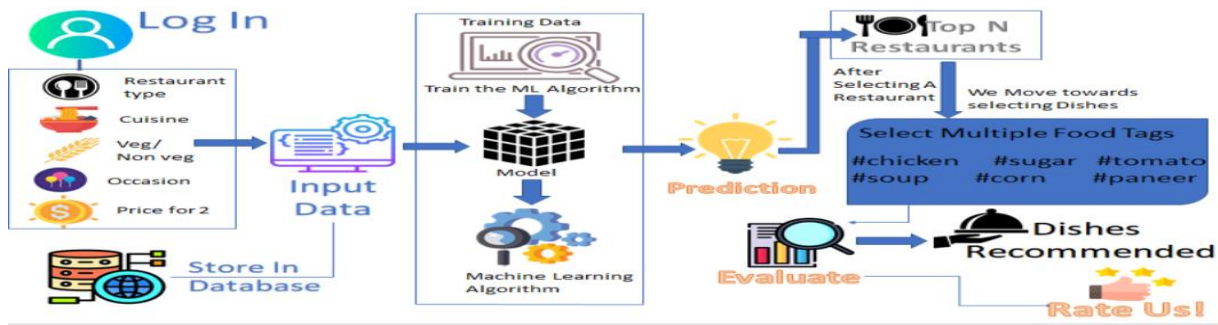
Figure 2. Flowchart of the entire system

The Overall working of system consists of:

3.1.User Login: If the user is new he has to sign up and create his account , whereas if an account is already created he has to login and continue.

3.2.Input Data: The user has to then give his preferences of cuisine, restaurant type, price,veg/non veg and occasion which will then be stored into the database.

3.3.Restaurant Selection: Top N restaurants will be then suggested to the user according to his location and his preferences[9][10]. These restaurants are suggested by implementing similarity metrics, mainly cosine similarity and the exponential decay function. Suggested restaurants are ordered in terms of similarity scores assigned to them. The user has to pick the restaurant he prefers.

3.4.Selection of Ingredients: The user will then be given a list of Ingredients from which he has to choose. Those ingredients which he chooses are considered and accordingly a dish is suggested.

4. MACHINE LEARNING

The CSV file is extracted and loaded in the Machine Learning model using pandas library. We then make different dictionaries in which the key part contains the restaurant name and in the value part contains cuisine,restaurant type,price,occasion and veg/non veg.We have used clustering algorithms and Similarity matrix[11][12] . Hence total there are 5 dictionaries each of which calculate it own similarity score using using cosine similarity formula:

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

After each cosine similarity is calculated, the values are multiplied to get the final similarity score which is then sorted and displayed in reverse order, i.e the restaurant with highest similarity score is displayed first.

5. ANDROID DEVELOPMENT

We have used Android Studio for developing the user interface.In Android CardView and Recycler view is used for displaying the cuisines,restaurant types and occasion.The inputs are then stored in the phpmyadmin database. Based on these results Machine Learning Algorithms work and the results are dynamically displayed in the RecyclerView Format. Coming to the second part, The tags are taken from the text box and from Machine Learning algorithms the final dishes recommendation is also displayed using recycler views.[13][14]

6. INTEGRATION

The Android and Machine Learning part is integrated using Flask. We are first converting the user input into a Json file and parsing it using volley from Android to ML. Again the restaurant result is parsed using a Json file from ML to Android. We are using Android Bundles[15] as well to store the data in android collectively.

The entire process is repeated for displaying the dishes as well.

7. DATABASE

We have used the phpmyadmin database to store the preferences that the user gives as input. The data gets stored with an unique UserID. When the user logins the previous preference is already stored, the user need not enter his preferences again. When the user wishes to update his/her preferences he can do so and the updated preferences will be visible in the database.[16]

8. LACUNA

Our system stores the previous inputs of the user and takes into consideration the previous selection as well. We are considering the health issue parameter as well. Eg: If a person is diabetic he won't select sugar in the ingredients tag which in turn won't recommend a dish containing sugar. Our model unlike other models does not stop at the restaurant recommendation, it suggests the food item as well which has never been implemented before.

9. EXAMPLE SET

Consider the following example where the following parameters are inputted by the user[17]:

Now, after selecting a particular restaurant, the following ingredients were selected:

No	Input Parameter	Value
1	Cuisine	Seafood,Continental
2	Restaurant Type	Lounge
3	Occasion	Birthday Party
4	Veg/Non Veg	Non Veg
5	Price for two	2000

Based on these values, restaurants will be suggested.

Now, after selecting a particular restaurant, the following ingredients were selected:

No	Ingredient Name
1	Prawns
2	Rice
3	Paneer
4	Caramel
5	Chicken

The algorithm generates the following dishes as suggestions:

No	Dish ID	Dish Name
1	113	Prawn Pie
2	14	Paneer Steak
3	78	Quick Salted Caramel Pie
4	10	Continental Rice
5	8	Biryani

10.1 CALCULATING ACCURACY

$$\text{Precision} = \frac{number\ of\ our\ recommendations\ that\ are\ relevant}{number\ of\ items\ that\ we\ recommended} = \tfrac{4}{5} = 80\%$$

$$\text{Recall} = \frac{number\ of\ our\ recommendations\ that\ are\ relevant}{number\ of\ all\ possible\ relevant\ item} = \tfrac{4}{5} = 80\%$$

10.2 LEARNING GRAPH:

Figure 3. Learning Curve
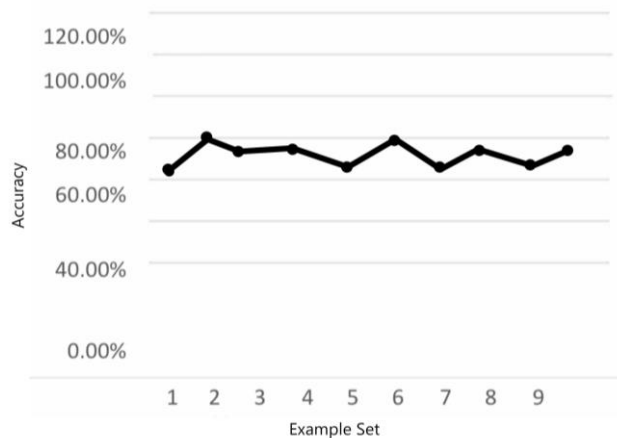
10.3 ACCURACY GRAPH:

Figure 4. Accuracy Curve

11. FUTURE SCOPE

- To allow the user to login through various other platforms like twitter, facebook, instagram , in a way trying to publicise our app as well.
- Email verification feature to ensure that no one else can use any persons email-id to login.
- To consider various health issues, more tags can be included for the user to choose from.
- To later create a system which takes orders from the users and delivers it to their homes.
- Reserve a table beforehand from the application.Basically providing the booking system.

12. CONCLUSION

As the research has demonstrated that similarity metrics and clustering provides relevant and accurate predictions and the user need not waste their time in the selection of restaurants and dishes, As we ask the user a set of questions and based on the answers we predict and recommend a list of restaurants to the user.Graphs can be formed from the predicted results, which will help in the management and updation of the application.

We successfully provide suggestions of the restaurant and dishes according to the user's location and preferences .The inputs of the user are stored in the database ,thus the user need not always update his preferences and can do so whenever necessary.Therefore the user need not waste their time in the selection of restaurants and dishes.

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