Location Based Recommendation of Indian Cuisine Recipes based on Ingredients using Machine Learning Techniques

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Abstract : There are plenty of sorts of Indian delicacies available with the same ingredients. In India, traditional recipes are varied due to the locally available spices, vegetables, fruits & herbs. In this paper, we purposed a way that recommends Indian recipes based on readily available ingredients and popular dishes. In this task, we perform a web search to create a collection of recipe types and apply a content-based approach to machine learning to recommend recipes. This system provides Indian food recommendations based on ingredients.

Keywords: Machine Learning, content-based filtering, NLP, Indian cuisine, Web scraping, Recommendation System.

1. INTRODUCTION

The goal of a Recommender system is to generate meaningful recommendations to a collection of users for items or products that might interest them. Recommender system was defined from the perspective of E-commerce as a tool that helps users search through records of knowledge which is related to user's interest and preference. Nowadays Recommender systems are widely used in various domains like OTT platforms, gaming platforms. We are motivated from the existing system where user can think of only the recipes which are introduced to him through cookery shows, recipe books mothers/grandmas or according to his cooking experience or dining experience.

This project proposes a recommendation system which assists a user to get the list of recipes from the available ingredients using machine learning techniques. Users have to add food ingredients one by one, a Content-based filtering algorithm will provide a list of dishes which can be made & also the step-wise cooking procedure to the user.

PROBLEM STATEMENT

To provide personalized territorial Indian cuisine experience to user. Thus, we introduce the Location Based Recommendation of Indian Cuisine Recipes based on Ingredients using Machine Learning Techniques. In cooking, a set of ingredients composes a particular dish. Ingredients are the main substances that determine the taste or flavor of the dish. Here for the given ingredients recipes one can make is limited to his cooking knowledge. In order to overcome this hurdle, it is necessary to expand the data on the feature value of automation and analyze it.

OBJECTIVES

- Create platform to exhibit variety of Indian Cuisine & richness of Indian food culture.
- To building a proficient system to determine & recommend a recipe based on the preferred ingredients & location.
- To develop a system that recommends recipe similar to favorite recipes of user.
- To develop a web-based system.

PROJECT SCOPE & LIMITATION

This web application can help anyone who would like explore different Indian Cuisines. The application is targeted towards an Indian audience, people in food industry, food bloggers & YouTube content creators. Complex websites such as the recipe recommendation system usually take some time to test and validate. The system may have some potential bugs or flaws because of the development time constraint. However, because of the flexibility and powerful functionality of Flask, these bugs or flaws can be fixed.

2. LITERATURE SURVEY

1. Optimization Framework for Flavour and Nutrition Balanced Recipe: A Data Driven Approach.

Author: Isura Nirmal, Amith Caldera, Roshan Dela Bandara

Description: Food has been playing a major part of human civilization as not only being a physiological need, but being a major factor for defining the culture and society. The choice of the food is mainly depended on both flavor and nutrient but the biasness towards to the flavor factor has lead the human to effect badly on their healthier lifestyle. Recipe recommendation literature typically considers either flavor or nutrient factor. Various flavor traits are also preventing the promotion of healthy foods while maintaining the pliability. Our data driven flavor and nutrient optimization framework consists of classification model which achieved 79.546 % prediction accuracy when detecting the cuisine, generalized flavor recommendation approach and personalized nutrient recommendation approach when deciding the optimization task.

2. Cuisine classification using recipe's ingredients.

Author: S. Kalajdziski, G. Radevski, I. Ivanoska, K. Trivodaliev

Description: The purpose of this paper is to explore the linkage between recipe's ingredients and identification of a cuisine. This has been tackled as a problem of cuisine classification. We will examine various approaches (different machine learning algorithms) for recipes classification based on the recipe's ingredients. The output will be the recommendation of the classification methodology, i.e. what kind of preprocessing can be done to improve the classification and the performance of several classifiers on the dataset we will be using.

3. You Are What You Eat: Exploring Rich RecipeInformation for Cross-Region Food Analysis.

Author: Weiqing Min, Bing-Kun Bao, Shuhuan Mei, Yaohui Zhu, Yong Rui,

Fellow, IEEE,and Shuqiang Jiang

Description: Cuisine is a style of cooking and usually associated with a specific geographic region. Recipes from different cuisines shared on the web are an indicator of culinary cultures in different countries. Therefore, analysis of these recipes can lead to deep understanding of food from the cultural perspective. In this paper, we perform the first cross-region recipe analysis by jointly using the recipe ingredients, food images, and attributes such as the cuisine and course (e.g., main dish and dessert). For that solution, we propose a culinary culture analysis framework to discover the topics of ingredient bases and visualize them to enable various applications. We first propose a probabilistic topic model to discover cuisine-course specific topics. The manifold ranking method is then utilized to incorporate deep visual features to retrieve food images for topic visualization. At last, we applied the topic modelling and visualization method for three applications: 1) multimodal cuisine summarization with both recipe ingredients and images, 2) cuisine-course pattern analysis including topic-specific cuisine distribution and cuisine-specific course distribution of topics, and 3) cuisine recommendation for both cuisine-oriented and ingredient-oriented queries.

4. Recommendation of Indian Cuisine Recipes Based on Ingredients.

Author: ProfB.B.Gite, Aarti Nagarkar , Chaitali Rangam

Description: The Recipe Recommendation Program for Indian Cuisines is a program that learns from the past tastes of a user's favourite recipes to recommend a fresh, untested cuisine. The basis of the recommendation is the ingredients that the user has already liked in the recipes India's traditional cuisine has been largely refreshing owing to its impressive use of herbs and tastes. Indian cuisine is renowned for its broad variety of dishes. The cooking style moves from the city to the district and is usually divided into South Indian and North Indian cuisine. India is very much praised for its variety of multi-foods Accessible in various and inn resorts, suggestive of unity in a number of ways. The staple food in India involves maize, rice, and chana (Bengal Gram) heartbeats That are the most important. At present, there has been a great deal of improvement in the Indian sense of taste. Bengali cuisine is exciting because of its excellent usage of panch phoron, a word used to apply to the five essential flavors, to be a common mustard. Fenugreek seed, cumin seed, aniseed seed, and black cumin crop. Likewise, other dishes from all over the world are a mix of flavors that nourish taste buds.

5. Personalized Search over Encrypted Data with Efficient and Secure Updates in Mobile Clouds.

Author: Xuehui Mao, Shizhong Yuan, Weimin Xu

Description: There are a variety of recipe recommendation methods based

on user's preferences, nutrition balance, or user's health condition. However, there is little study on recipe recommendation considering flavor preferences of regional cuisines, which is helpful for a restaurant to plan on launching dishes from other regions, and to be well received by the local people. Therefore, we propose a method to recommend a restaurant the dishes of other

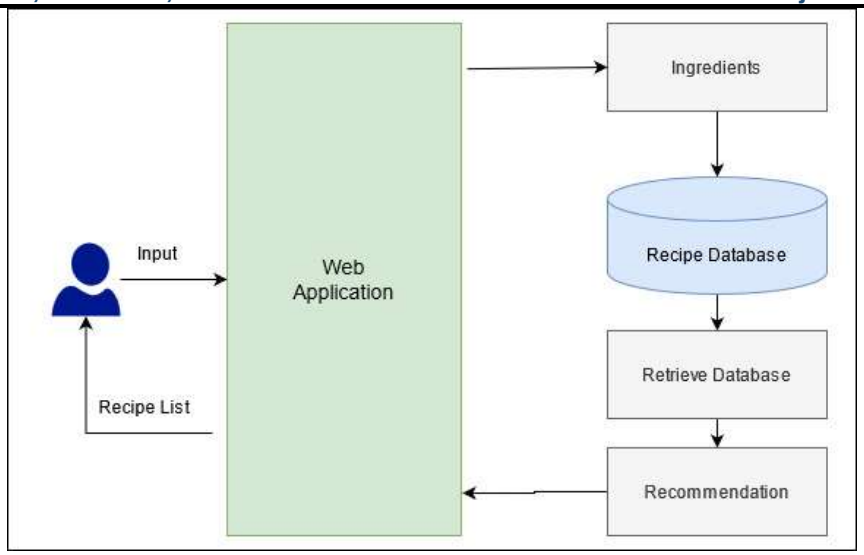
regions in terms of flavor similarity among the regional cuisines in China. Firstly, we quantify ingredient preferences of a regional cuisine by TF-IDF

(Term Frequency-Inverse Document Frequency) and then score the dishes of

regional cuisines by ingredients preference. Secondly, the cosine theorem is used to compute the flavor similarities between regional cuisines. Thirdly, inspired by the Tidal-Trust algorithm, we compose the score of regional recipes and the flavor similarity between regional cuisines into a recommendation. Lastly, the top N dishes of other regions are recommended to a restaurant. The results of our questionnaire evaluation for the dishes recommended using the proposed method were that the mean satisfaction degree of two professional chefs is 77%, and the satisfaction degrees of 75 percent of the rest respondents are all above 70%.

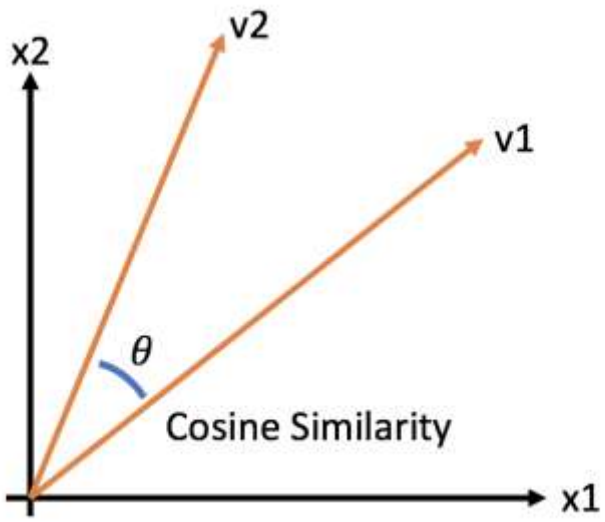
3. PROPOSED SYSTEM

The proposed system is web-based application. For this we will do web scraping to make the database of Indian cuisine and collect information all about the all-cuisine recipes and used ingredients. The dataset will be collected by web scraping which is pre-processed on the basis attributes. The project is recipe recommendation system by using Content Based Filtering Algorithm. In this system we will be using cosine similarity to find out the similarities between recipes and user input. After finding the similarity we will be proving the result to the user. This application is extremely handy and useful for cooking variety of recipe with minimum search effort from internet. It will help people to save their time and energy in finding recipes for daily routine as well as for special occasions.



4. MATHEMATICAL MODEL

In this Recommendation system we are going to implement Content-based filtering algorithm. To achieve Content-based filtering we will be using the cosine similarity to calculate a numeric quantity that denotes the similarity between two recipes. We used the cosine similarity score since it is independent of magnitude and is relatively easy and fast to calculate. Cosine similarity is a metric, helpful in determining, how similar the data objects are irrespective of their size. We can measure the similarity between two sentences in Python using Cosine Similarity. It is often used to measure document similarity in text analysis. In cosine similarity, data objects in a dataset are treated as a vector. The similarity measure refers to distance with dimensions representing features of the data object, in a dataset. If this distance is less, there will be a high degree of similarity, but when the distance is large, there will be a low degree of similarity where the outcome is neatly bounded in [0, 1].



The Cosine Similarity procedure computes similarity between all pairs of items. It is a symmetrical algorithm, which means that the result from computing the similarity of Item A to Item B is the same as computing the similarity of Item B to Item A. We can therefore compute the score for each pair of nodes once. We don't compute the similarity of items to themselves. The number of computations is $\{items^2 / 2 - (items)\}$ which can be very computationally expensive if we have a lot of items.

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Mathematically, Cosine Similarity is defined as follows:

$$K(X,Y) = COS(\theta) = \frac{X \cdot Y}{\|X\| \times \|Y\|}$$

X.Y = product (dot) of the 'X' and 'Y' vectors.
$\|X\| \cdot \|Y\|$= length of the two vectors 'X' and 'Y'.
$\|X\| \times \|Y\|$= cross product of the two vectors 'X' and 'Y'.

OVERVIEW OF PROJECT MODULES

The proposed system is web-based application. For this we did web scraping to create a dataset of Indian cuisines. We have collected information about many cuisines and ingredients required. The dataset collected by web scraping which is pre-processed on the basis of attributes. The project is recipe recommendation system by using Content Based Filtering Algorithm. In this system we have used cosine similarity to find out the similarities between recipes provided by user input ingredients. After finding the similarity we will be proving the result to the user. This application is extremely handy and useful for cooking variety of recipe with minimum search effort from internet. It will help people to save their time and energy in finding recipes for daily routine as well as for special occasions.

In this system there are three main modules,

1. User - In this user get registered with system.
2. Web Application - In this user can add ingredients and search recipe they want or put recipe name and get the list of similar recipes they were looking for.
3. Admin - Admin will manage the dataset.

TOOLS AND TECHNOLOGIES USED

Back-end Technology:

The project is implemented using Python (3.9.2) Flask framework (2.0.0). Flask is a lightweight web application framework designed to get results fast and leave room to make the app more detailed in the future. Flask uses Jinja2 (3.0.1) as templating engine. Jinja2 is small but fast, expressive, extensible templating engine, apart from being fast it also consist of lot of default features to manipulate the result. Special placeholders in the template allow writing code similar to Python syntax. Then the template is passed data to render the final document.

Front-end Technology:

The front-end of this web-application is designed using HTML, CSS, Bootstrap 5 and JavaScript. HTML provides the basic structure of sites, which is enhanced and modified by other technologies like CSS and JavaScript. CSS is used to control presentation, formatting, and layout. JavaScript is used to control the behavior of different elements. We have used latest CSS framework Bootstrap 5 to quickly design mobile responsive web application. Bootstrap is a free and open-source collection of CSS and JavaScript code used for creating dynamic websites layout and web applications. Bootstrap is the leading popular front-end framework which has really a nice set of predefined CSS codes. Bootstrap uses different types of classes to make the responsive websites.

Database Technology:

This project uses two type of data sources. One data source is for user info and other dataset consists of recipe details. To store user data we have used SQLite. SQLite is an in-process library that implements a self-contained, serverless, zero configuration, transactional SQL database engine. The code for SQLite is in the public domain and is thus free for use for any purpose, commercial or private. SQLite is the most widely deployed database in the world with more applications than we can count, including several high-profile projects. The dataset used is a CSV file which consist of 6000 plus records with 16 features.

IDE Description:

This project is developed using Visual Studio Code IDE. It enabled us to consolidate the different aspects of the project combining common developer tools into a single graphical user interface. We have also used Jupyter Notebook (3.0.0) to extract information from the dataset. The Jupyter Notebook is an interactive computing environment that enables single line execution, live code, equations, computational output, visualizations, and other multimedia resources, along with explanatory text in a single document. Notebook documents contain the inputs and outputs of an interactive session as well as narrative text that accompanies the code but is not meant for execution. Rich output generated by running code, including HTML, images, video, and plots, is embedded in the notebook, which makes it a complete and self-contained record of a computation. Jupyter Notebooks are saved in the structured text files — JSON (JavaScript Object Notation) — which makes it extremely easy to share.

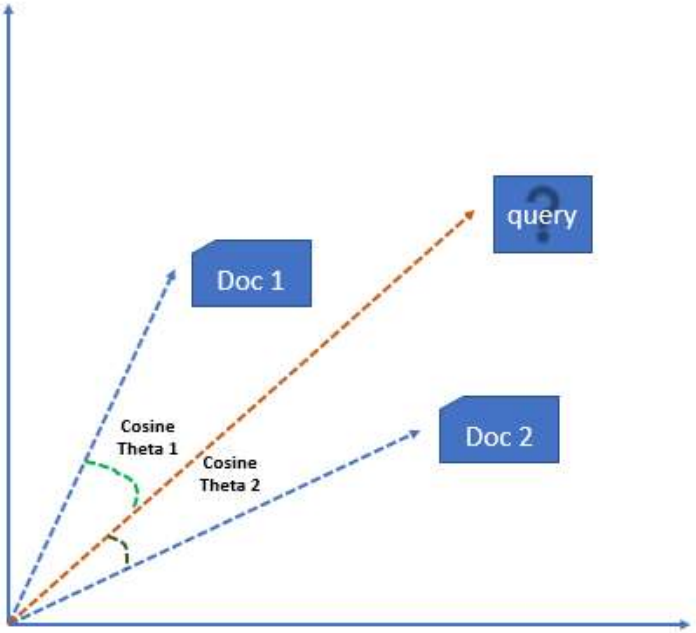
ALGORITHM DETAILS:

Content-Based filtering Algorithm:

Content-based Filtering is a Machine Learning technique that uses similarities in features to make decisions. This technique is often used in recommender systems, which are algorithms designed to advertise or recommend things to users based on knowledge accumulated about the user. In content-based filtering, items are recommended based on comparisons between item profile and user profile. A user profile is content that is found to be relevant to the user in form of keywords(or features). A user profile might be seen as a set of assigned keywords (terms, features) collected by algorithm from items found relevant (or interesting) by the user. A set of keywords (or features) of an item is the Item profile. For example, consider a scenario in which a person goes to buy his favorite cake 'X' to a pastry. Unfortunately, cake 'X' has been sold out and because of this the shopkeeper recommends the person to buy cake 'Y' which is made up of ingredients similar to cake 'X'. This is an instance of content-based filtering. Cosine similarity is a measure of similarity between two vectors of an inner product space that measures the cosine of the angle between them. The cosine of 0° is 1, and it is less than 1 for any other angle. It is thus a judgment of orientation and not magnitude: two vectors with the same orientation have a Cosine similarity of 1, two vectors at 90° have a similarity of 0, and two vectors diametrically opposed have a similarity of -1, independent of their magnitude. Cosine similarity is particularly used in positive space, where the outcome is neatly bounded in [0, 1].

Using Dot Product as a Similarity Measure:

Consider the case where the user input x and y are both binary vectors. Since $(x, y) = \Sigma^{d}_{i=1} x_i y_i$, a feature appearing in both and contributes a 1 to the sum. In other words, (x, y) is the number of features that are active in both vectors simultaneously. A high dot product then indicates more common features, thus a higher similarity. Vector Space Model In this model, each item is stored as a vector of its attributes (which are also vectors) in an n-dimensional space, and the angles between the vectors are calculated to determine the similarity between the vectors.



The method of calculating the user's likes / dislikes / measures is calculated by taking the cosine of the angle between the user profile vector (Ui) and the document vector; or in our case, the angle between two document vectors. The ultimate reason behind using cosine is that the value of cosine will increase as the angle between vectors with decreases, which signifies more similarity. The vectors are length-normalized, after which they become vectors of length 1.

SIMULATION RESULTS:

```
In [124]: recipelist = df["combined_features"].head(10)
          recipelist

Out[124]: 0    karela bitter gourd pavakkai onion flour besan...
          1    rice tomatoes belle bhat chickpea lentils cumi...
          2    rice vermicelli noodles onion carrots gajjar g...
          3    chicken onion tomato green chillies ginger clo...
          4    chana dal white urad dal red chillies coriande...
          5    rice soaked yellow moong dal soaked mint leave...
          6    vellai poosanikai ash gourd white pumpkin turm...
          7    tortillas black beans soaked overnight spinach...
          8    idli cut strips green bell pepper capsicum tom...
          9    cabbage leaves tomatoes tamarind white urad da...
          Name: combined_features, dtype: object
```

List of ten sample recipes

```
In [125]: vectorizer = CountVectorizer(lowercase=True)
          X = vectorizer.fit_transform(recipelist)
          print(vectorizer.get_feature_names())
          print(X.toarray())

['amchur', 'andhra', 'asafoetida', 'ash', 'beans', 'bell', 'belle', 'besan', 'bhat', 'big', 'bitter', 'black', 'brown', 'cabbag
e', 'capsicum', 'carrots', 'cashew', 'chana', 'cheddar', 'cheese', 'chicken', 'chickpea', 'chilli', 'chillies', 'chop', 'clove
s', 'coconut', 'coriander', 'cumin', 'curd', 'curry', 'cut', 'dal', 'dhania', 'diabetic', 'dry', 'fennel', 'fenugreek', 'flou
r', 'fresh', 'friendly', 'gajjar', 'garam', 'garlic', 'gingelly', 'ginger', 'gongura', 'gourd', 'greek', 'green', 'greens', 'ha
ldi', 'halved', 'high', 'hing', 'hung', 'idli', 'inches', 'indian', 'jaggery', 'jeera', 'juice', 'karela', 'ketchup', 'leaves',
'lemon', 'lentils', 'mango', 'masala', 'matar', 'methi', 'mexican', 'mint', 'moong', 'mustard', 'non', 'noodles', 'nuts', 'onio
n', 'onions', 'overnight', 'packed', 'palak', 'pavakkai', 'peanuts', 'peas', 'pepper', 'peppercorns', 'picked', 'pinch', 'poosa
nikai', 'protein', 'pudina', 'pumpkin', 'recipes', 'red', 'rice', 'roughly', 'rye', 'saunf', 'sesame', 'soaked', 'sorrel', 'sou
th', 'spinach', 'spoon', 'sprig', 'spring', 'strips', 'sunflower', 'tamarind', 'tightly', 'til', 'tomato', 'tomatoes', 'torn',
'tortillas', 'turmeric', 'udupi', 'urad', 'vegetarian', 'vegeterian', 'vellai', 'vermicelli', 'water', 'white', 'yellow', 'yogu
rt']
[[1 0 0 ... 0 0 0]
 [0 0 1 ... 1 0 0]
 [0 0 1 ... 1 0 0]
 ...
 [0 0 0 ... 0 0 1]
 [0 0 0 ... 0 0 0]
 [0 0 1 ... 1 0 0]]
```

Ingredients Matrix Created using Count Vectorizer

```
In [126]: cosine_sim = cosine_similarity(X)

          print(cosine_sim)
```

```
[[1.         0.25584086 0.07784989 0.22498852 0.11677484 0.25195163
  0.38810293 0.13834289 0.29250897 0.15569979]
 [0.25584086 1.         0.43817805 0.0904534  0.2921187  0.34139673
  0.22404481 0.09733285 0.30869745 0.40166321]
 [0.07784989 0.43817805 1.         0.16514456 0.36666667 0.40754381
  0.204524   0.29617444 0.34442336 0.43333333]
 [0.22498852 0.0904534  0.16514456 1.         0.22019275 0.13856633
  0.35887028 0.26901379 0.336107   0.27524094]
 [0.11677484 0.2921187  0.36666667 0.22019275 1.         0.21575849
  0.255655   0.17770466 0.18786729 0.4       ]
 [0.25195163 0.34139673 0.40754381 0.13856633 0.21575849 1.
  0.29418525 0.31951074 0.40533961 0.43151697]
 [0.38810293 0.22404481 0.204524   0.35887028 0.255655   0.29418525
  1.         0.13629326 0.31218987 0.35791699]
 [0.13834289 0.09733285 0.29617444 0.26901379 0.17770466 0.31951074
  0.13629326 1.         0.2503867  0.23693955]
 [0.29250897 0.30869745 0.34442336 0.336107   0.18786729 0.40533961
  0.31218987 0.2503867  1.         0.34442336]
 [0.15569979 0.40166321 0.43333333 0.27524094 0.4        0.43151697
  0.35791699 0.23693955 0.34442336 1.        ]]
```

Cosine Similarity Calculation

```
In [127]: display_cosine_sim = pd.DataFrame(cosine_sim, columns= recipelist)
          display_cosine_sim
```

Out[127]:

combined_features	karela bitter gourd pavakkai onion flour besan turmeric haldi red chilli cumin jeera coriander dhania amchur dry mango sunflower indian diabetic friendly	rice tomatoes belle bhat chickpea lentils cumin white urad dal mustard green chilli dry red chilli cashew peanuts asafoetida south indian recipes vegetarian	rice vermicelli noodles onion carrots gajjar green peas matar green chillies asafoetida hing mustard white urad dal sprig curry leaves lemon juice south indian recipes high protein vegetarian	chicken onion tomato green chillies ginger cloves garlic turmeric haldi garam masala sesame gingelly methi fenugreek coriander dhania dry red chillies fennel saunf sesame gingelly cloves garlic sorrel leaves gongura picked andhra non vegeterian	chana dal white urad dal red chillies coriander inches ginger chop onion chop tomato chop mustard asafoetida pinch sprig curry andhra vegetarian	rice soaked yellow moong dal soaked mint leaves pudina tightly packed coriander dhania leaves tightly packed green chilli ginger cumin jeera water sunflower cashew nuts halved cumin jeera black peppercorns sprig curry leaves pinch asafoetida hing south indian recipes high protein vegetarian	vellai poosanikai ash gourd white pumpkin turmeric haldi sunflower dry red chillies fresh coconut tamarind water methi fenugreek cumin jeera coriander dhania sesame til jaggery tamarind water sunflower mustard sprig curry leaves roughly torn dry red chillies udupi vegetarian	tortillas black beans soaked overnight spinach leaves palak onion tomato cloves garlic sprig coriander dhania leaves rice brown rice lemon juice spring onion greens cheddar cheese hung curd greek yogurt mexican vegetarian	idli cut strips green bell pepper capsicum tomato onions green chillies red chilli turmeric haldi tomato ketchup coriander dhania leaves mint leaves pudina sunflower south indian recipes vegetarian	cabbage leaves tomatoes tamarind white urad dal red chillies asafoetida pinch cloves garlic turmeric pinch big spoon rye cumin sprig curry leaves south indian recipes vegetarian
0	1.000000	0.255841	0.077850	0.224989	0.116775	0.251952	0.388103	0.138343	0.292509	0.155700
1	0.255841	1.000000	0.438178	0.090453	0.292119	0.341397	0.224045	0.097333	0.308697	0.401663
2	0.077850	0.438178	1.000000	0.165145	0.366667	0.407544	0.204524	0.296174	0.344423	0.433333
3	0.224989	0.090453	0.165145	1.000000	0.220193	0.138566	0.358870	0.269014	0.336107	0.275241
4	0.116775	0.292119	0.366667	0.220193	1.000000	0.215758	0.255655	0.177705	0.187867	0.400000
5	0.251952	0.341397	0.407544	0.138566	0.215758	1.000000	0.294185	0.319511	0.405340	0.431517
6	0.388103	0.224045	0.204524	0.358870	0.255655	0.294185	1.000000	0.136293	0.312190	0.357917
7	0.138343	0.097333	0.296174	0.269014	0.177705	0.319511	0.136293	1.000000	0.250387	0.236940
8	0.292509	0.308697	0.344423	0.336107	0.187867	0.405340	0.312190	0.250387	1.000000	0.344423
9	0.155700	0.401663	0.433333	0.275241	0.400000	0.431517	0.357917	0.236940	0.344423	1.000000

Data frame of Cosine Similarity Score

Recipes Arragned in Descending order according to its Cosine Similarity Score

```
In [134]: display_cosine_sim.sort_values(recipelist[0], ascending=False)
```

Out[134]:

combined_features	karela bitter gourd pavakkai onion flour besan turmeric haldi red chilli cumin jeera coriander dhania amchur dry mango sunflower indian diabetic friendly	rice tomatoes belle bhat chickpea lentils cumin white urad dal mustard green chilli dry red chilli cashew peanuts asafoetida south indian recipes vegetarian	rice vermicelli noodles onion carrots gajar green peas matar green chillies asafoetida hing mustard white urad dal sprig curry leaves lemon juice south indian recipes high protein vegetarian	chicken onion tomato green chillies ginger cloves garlic turmeric haldi garam masala sesame gingelly methi fenugreek coriander dhania dry red chillies fennel saunf sesame gingelly cloves garlic sorrel leaves gongura picked andhra non vegeterian	chana dal white urad dal red chillies coriander inches ginger chop onion chop tomato chop mustard asafoetida pinch sprig curry andhra vegetarian	rice soaked yellow moong dal soaked mint leaves pudina tightly packed coriander dhania leaves tightly packed green chilli ginger cumin jeera water sunflower cashew nuts halved cumin jeera black peppercorns sprig curry leaves pinch asafoetida hing south indian recipes high protein vegetarian	vellai poosanikai ash gourd white pumpkin turmeric haldi sunflower dry red chillies fresh coconut tamarind water methi fenugreek cumin jeera coriander dhania sesame til jaggery tamarind water sunflower mustard sprig curry leaves roughly torn dry red chillies udupi vegetarian	tortillas black beans soaked overnight spinach leaves palak onion tomato cloves garlic sprig coriander dhania leaves rice brown rice lemon juice spring onion greens cheddar cheese hung curd greek yogurt mexican vegetarian	idli cut strips green bell pepper capsicum tomato onions green chillies red chilli turmeric haldi tomato ketchup coriander dhania leaves mint leaves pudina sunflower south indian recipes vegetarian	cabbage leaves tomatoes tamarind white urad dal red chillies asafoetida pinch cloves garlic turmeric pinch big spoon rye cumin sprig curry leaves south indian recipes vegetarian
0	1.000000	0.255841	0.077850	0.224989	0.116775	0.251952	0.368103	0.136343	0.292509	0.155700
6	0.368103	0.224045	0.204524	0.358870	0.255655	0.294185	1.000000	0.136293	0.312190	0.357917
8	0.292509	0.306697	0.344423	0.336107	0.167867	0.405340	0.312190	0.250387	1.000000	0.344423
1	0.255841	1.000000	0.438178	0.090453	0.292119	0.341397	0.224045	0.097333	0.306697	0.401663
5	0.251952	0.341397	0.407544	0.138566	0.215758	1.000000	0.294185	0.319511	0.405340	0.431517
3	0.224989	0.090453	0.165145	1.000000	0.220193	0.138566	0.358870	0.269014	0.336107	0.275241
9	0.155700	0.401663	0.433333	0.275241	0.400000	0.431517	0.357917	0.236940	0.344423	1.000000
7	0.136343	0.097333	0.296174	0.269014	0.177705	0.319511	0.136293	1.000000	0.250387	0.236940
4	0.116775	0.292119	0.366667	0.220193	1.000000	0.215758	0.255655	0.177705	0.167867	0.400000
2	0.077850	0.438178	1.000000	0.165145	0.366667	0.407544	0.204524	0.296174	0.344423	0.433333

Ordered Data frame According to Cosine Similarity Score

CONCLUSION:

The recommendation system implemented in this paper aims at providing list of various recipe recommendations based on the ingredients of the cuisine. If a user enters particular ingredients containing similar recipes will be recommended to him. Recommendation systems are widely used everywhere in ranging from e-commerce, gaming to advertisements to provide user personalize experience and to search for relevant information. While simple recommendation systems recommend users based on a few parameters, complex ones take many parameters into consideration.

For this recommendation system we did web scraping to make the database of Indian cuisine and collect information all about the all-cuisine recipes and used ingredients. The above issues such as cold start need to be addressed. One of the ways in which we can do this is by linking each user to their social network profiles and suggest recipes liked by their friends. Heterogeneity can be addressed by building better, more dynamic crawlers. So, it will be possible in future that enhance the food recommendation by using hybrid approach and web crawling methods where the extracted meta-data is more.

FUTURE SCOPE:

It will be possible in future that enhance the food recommendation by using hybrid approach and web crawling methods where the extracted meta-data is more. Future improvements could include making suggestions based on the geographical location where the cuisine originated, or based on the particular chef whose dishes the user likes. The system could also leverage the user's location to suggest specialty dishes found in nearby restaurants. In addition to the above experiments, other classification algorithms such as Naive classifier, Bayes classifier, or support vector machine (SVM) can be implemented to study accuracy changes.

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