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Photo 2 Food: Recipe Recommendation System: A survey

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Abstract:- We have a plethora of food recipes on the internet when we look for what we want to cook, which makes our jobs difficult when we only have selected ingredients at our disposal. It is easy to find a recipe and then get the ingredients to make it, but the problems occur when we only have select few ingredients, and a person wants to find what they can make out of it. In order to tackle this challenge, we create a dataset that contains a humongous set of recipes and has step-by-step guide on how to make them. A user will need to input the picture, either directly uploading them via a web interface or choosing them from the gallery after photos are uploaded. These input photos are analysed, and a recipe set gets returned where users can choose which one they want to make. It can be achieved using CNN. CNN classifies the ingredients and puts them in separate classes based on the training. The set is then matched with available database of recipe and presented in form of links and images from where user can chose what to make. Several components will interact to give recommendations and present the aesthetic UI/UX design result. Users can interact with the app without knowing all the processing involved in the background that contains data pre-processing, data cleaning, model training, and other technical things.

Keywords:- *CNN, Ingredients, Recipe, UI/UX, Web interface.*

I. INTRODUCTION

It will help get curated recipes in one place and solve the problem of looking for them manually. Going through multiple websites and finding food recipes in magazines and cookbooks is a hectic task for home cooks.

It will not only help the home cooks but also is going to help chefs that are working in restaurants and hotels. It will help maximum utility of the items that are not used for a long time. Removing clutter from the kitchen and improving productivity. Photo2Food is an AI-driven food recommendation system that will suggest food recipes based on ingredients currently present with the user. Users will need to take Photo/photos of all the ingredients; The algorithm will detect each ingredient present in the picture and return a result of recipes that can be made using those available ingredients. Many students and bachelors living away from families develop a bad habit of eating food that is either preserved or ordered online, which does not guarantee safety. A few of the reasons are that people do not want to cook food because of various problems. One of them is going to the market to get appropriate ingredients to make food, even if they get it. It will be used to make particular food and will not be used later that, will cost those ingredients to expire after a specific time, not to mention the money wasted on it.

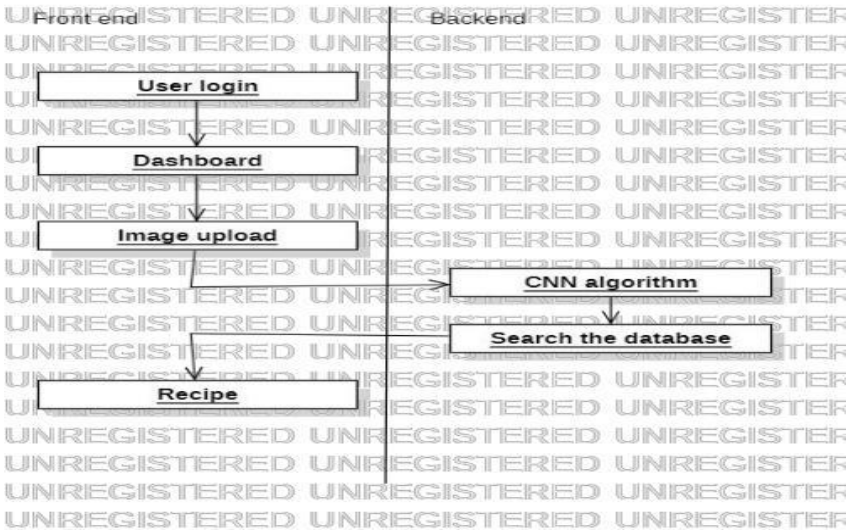

Fig. 1: Flow of the app

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A. Data scraping

In order to obtain a data set to train the model, the Prevalent technique of web scraping of data is done.[6] Web scraping is a method of automatically obtaining a large amount of data-set in an unstructured and semi-structured form, although most are unstructured. The data collected is saved in HTML form, later converted into either a spreadsheet or a database for later use. Data scraper is used to scrape off data from websites like AllRecipes and the food network that contain a plethora of recipes; it also contains the method of cooking and respective ingredients with quantities. The data which is scraped off is stored in a CSV file first and later used for various operations. Once data is collected, it is later then transformed and cleaned for storing purposes. Using the KNN Classification set of rules, the entered textual content is transformed into a vector layout and Categorized with skilled statistics. Suitable magnificence is wherein the matched recipes are endorsed to the consumer. The final output is visualized via a website that is UI/UX where users can interact.

B. Use of KNN to train model

KNN or K nearest neighbor is the simplest form of ML algorithm used for classification purposes. KNN takes the image input and classify those images based on the test data which was given while training. It calculates the K-nearest neighbor using distance matrix to classify same items together. Euclidean distance method is used to calculate the distance between the the new data point and already present classes the K defines the number of total cluster to be made in the given data set.

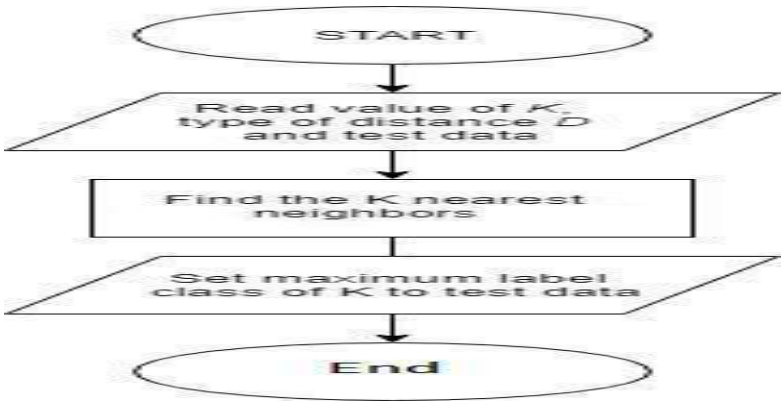

Fig. 2: Flowchart for KNN[4]

II. LITERATURE REVIEW

The completion of recipe by recognizing ingredients is not a very difficult task[1] In this Paper its demonstrated how machine learning approaches might be used to create models that can be utilized to finish a recipe. It is not essential to predict the complexity of desirable component combinations to be able to complete a recipe by applying machine learning algorithms to current recipes. We investigated and analyzed two potential strategies for this goal. The first approach, non-negative matrix factorization, is preferred due to the methods and data features. Because the data is binary, it is non-negative, and it is part-based because a recipe is a linear combination of particular constituent groups. The combination of this approach with this sort of data is excellent since non-negative matrix factorization produces a linear non-negative part-based representation of the data. Because the characteristics created by NMF are sparse, interpreting the findings is not tricky. A feature includes elements that can be combined to make a recipe. According to the features, the items that are advised to complete a dish are chosen based on the type of recipe. NMF can retrieve an item that has been removed from a recipe, which is referred to as recipe completeness. NMF, on the other hand, has two drawbacks. The approach cannot consider information from a second data set, which is a primary drawback. In light of the food matching theory, it could be worthwhile to incorporate information on taste components found in foods into the model. When utilizing NMF, however, this is not an option. A linear regression approach must be used to produce predictions for recipes that are not present in the train data (cross-validation). However, because of this, the forecasts are only approximations of genuine predictions. A way may be to add the new recipe to the recipe data, factorize the entire matrix, and then combine the two low-rank matrices to get the predictions for the new recipe. This would, however, be a time-consuming and computationally costly procedure.

One of the elements that affect meals desire is different taste.**[2]** Although the flavours of cuisines range from one place to another, there are taste similarities between the various cuisines from geographically adjoining regions. This paper provides a recommendation system for recipe to advocate a solution of dishes from the numerous Chinese nearby cuisines for a particular taste desire in phrases of taste similarity. The formerly evolved algorithms decide the taste similarities of the various cuisines. First, the TF-IDF (Term Frequency-Inverse Document Frequency)[3] set of rules is used to calculate the aspect alternatives of the nearby cuisines, on the idea of which every dish of the nearby cuisines is given a score. Then, we use the cosine similarity to degree the taste similarities of the various nearby cuisines. Finally, the Tidal-Trust set of rules is hired to pick out the dishes with the maximum comparable flavours and advocate them to the user. The outcomes of the questionnaire assessment for the device display the suggestions from the device are Converting a RBG image into grayscale format

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predefined function called RGB2gray is used to convert a given image into a greyscale format for removing the hue from an image and and decreasing the saturation level to zero, while maintaining the Illumination of the image as it is. The RGB channel has a lot of detailed features in an image. The computational challenge to find all the features and divide them into class is very high and time consuming, so the conversion of image to greyscale helps in making it easier for algorithm to reduce the dimensionality and makes the computation easier. Study of images and their features falls under the subject called computer vision. With the help of computer vision an image can be examined and the data from it can be extracted for the study and research purposes. It helps to solve various problem that require image classification. One of the most popular technique for analysis used is HSV(hue, saturation, value).These property are the basic of any image. One of the component "hue" does not vary with change in surrounding light so it becomes major component to analyse an image.

Generally, specific recommendation systems have different target users in different areas The knowledge - based recommendation system described in this research is intended for individualized recipe recommendations and offers consumers with a recipe browsing service. Most conventional applications are built on a client-server design, with the client providing the user interface and the server handling business operations and data upkeep. The multiplicity of recipes, on the other hand, inevitably leads to information overload. As a result, the system in this study incorporates a personalised recommendation engine, allowing us to recommend what each user is most interested in. The system proposed in this study is aimed for personalised recipe recommendations and provides a recipe browsing service to customers. Most traditional programmes are constructed on a client-server architecture, with the client managing user interface and the server handling business operations and data maintenance. The abundance of recipes, on the other hand, eventually results in knowledge overload. As a consequence, the system in this study includes a personalised recommender engine, which allows us to recommend what each user is most interested in. Employment of content-based algorithm and a model-based CF algorithm in the hybrid recommender system was done. CF will employ a set of user information (for example, ratings) to develop the recommendation result, but it frequently ignores the influence of product features on consumers, and CF cannot operate well for a new user or a new product due to the cold start problem. The CB technique is based on product features and text descriptions, and it never has the cold start problem that CF has, but listing a series of questions to gather user interest might always damage the user experience Pictures are frequently used as input to our system, a sophisticated visual model for extracting an abstract representation of the image[5]. Visual models for generic object recognition have a lengthy history, ranging from handmade descriptors and models to current data-driven convolutional neural networks (CNNs). Food identification, data was limited to very few categories in certain contexts (for example, fast food). Manually collected Handcrafted features, pooling, and shallow classifier like SVMs were used to address recognition. Since these models cant handle the huge data set its more advisable to use CNN for this purpose. CNNs are one of the most evocative architecture for recognition of food images in particular.

In recent time the use of CNN has become very prevalent for food image recognition in supervised manner in the paper[6] The use of CNN-based features for food retrieval was examined in this work. To accomplish this aim, we constructed the Food524DB dataset by combining food classes from existing state-of-the-art datasets. Until now, With 524 food classes, Food524DB is the largest freely available food dataset. There are 247,636 photos in all. The CNN-based features that have been proposed have been received from On Food524DB, a Residual Network (ResNet-50) was fine-tuned. The assessment has been completed. The research was done on the UNICT-FD1200 dataset, which is a particular food retrieval dataset. There are 1,200 classes in this collection. The proposed method's effectiveness was demonstrated by the results. CNN-based features retrieved from the dataset the same network architecture, trained on the images and in comparison to state-of-the-art features assessed on the same dataset.: general food recognition, recipe analysis/retrieval, and restaurant based recognition.

A food data set for recipe generally contains main attributes such as images which are labeled according to their classes which are mainly used for the purpose of classier training models. In the research the main purpose of data set is divided into three groups: general food recognition, recipe analysis/retrieval, and restaurant based recognition[5]. General food recognition datasets are primarily used to train food classifiers and generally consist of images and the accompanying (food) class labels. From early datasets with a small number of cuisine-specific photos to more enormous datasets with a considerably more significant number of images per class and a more comprehensive range of foods and cuisines, these datasets have grown to contain more food classes. These more extensive datasets are ideal for fine-tuning deep CNNs, resulting in cutting-edge food identification.

It is essential to learn about model where a given food image can return corresponding ingredients which is essential of the model that is mentioned in the paper. Recognition of ingredients on content-basis is hard due to visual variation its really difficult to recognize the images properly which is caused by zero-shot retrieval[7] Using the mutual yet ambiguous relationship between ingredient identification and food categorization, the research presents deep architectures for simultaneous learning of ingredient recognition and food categorization. The learned deep features and semantic labels of ingredients are then utilized in a novel way for zero-shot recipe retrieval. This research demonstrates the viability of ingredient recognition and sheds light on the zero-shot problem that is unique to cooking recipe retrieval by testing on a large Chinese cuisine dataset with images of extremely complicated dishes.

Object recognition is a process that finds things in the real world from analyzing an image[8]. There are various

tools an libraries that can help achieve tasks like image recognition. These tools and technologies being Tensorflow(tf), OpenCV and keras are of the major libraries used for purpose of image recognition and ML algorithm.. OpenCV can be used for visualization of the data and image processing.

People can maintain a healthy diet by automatically creating a food diary that tracks the ingredients they consume. We approach the challenge of recognising food ingredients as a multi-label learning problem. A method was presented by Marc Bola˜nos et el.[9] for customising a high-performance top class CNN to behave as a multi-label predictor for learning recipes by looking at their ingredient list. We show that our model can predict a recipe's list of components from a picture, even if the model has never seen the recipe that corresponds to the picture. We release two new datasets that are ideal for this purpose. We also show how a model trained with a large variety of recipes and ingredients may generalise better to new data and visualise how each of its neurons specializes to distinct ingredients. The use of CNN architecture such RestNet50 and InceptionV3 was done to achieve the best result.

Trained models can be used to perform the task or solve problems which we have identified to perform this task it is very difficult to do so on out given system the data is very huge and computational problem can arise due to low resources. In one of the studies researcher used 'Google Colab'[10] which is a open source public tool that can used to overcome those limitations. It various the resources such as Graphical processing Unit(GPU) to give a higher performance as compared to local resources. It also proved a online storage so we can store the data on cloud.

III. LIMITATION

In all the findings it is seen that most common algorithm that has been used for classification of images is KNN. Though it is a fact that K nearest neighbor is simplest of all the algorithm that present but while using a large data set that has a lot of variance it is better to opt a solution within a deep learning domain KNN would be slower and cant give accurate result on large data set with high intra-class variance features.

IV. CONCLUSION

In order to develop a working system to produce the optimal result, It is best to use the data set that has already been procured and crowd sourced. Collecting data for a recipe for a database and gathering data to train and test a Machine learning model is a daunting and challenging task. The best approach to creating a model that can accurately take input from an image and produce the result in a recipe based on the ingredients is best to use the model that has already been trained in this particular domain. Training the model for implementation purposes and collecting data for the same is not an optimal solution. The computational cost for training the model and performing the test is very high, and with limited resources such as low power GPU and CPU, it will take much time. All these components are open source and present in the market. These components can be stringed together to form a working system to produce the best results.

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