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Personalized Diet Recommendation System

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ABSTRACT: Having a proper health is the main factor of every persons life .Eating a healthy diet is all about feeling great, having more energy ,improving your health and boosting your mood. A healthy diet rich in fruits ,vegetables , whole grains reduces the risk of many disease . So for being healthy it is very important to have a proper diet with proper nutrition values .Our project aims to helps each person to predict a proper diet based on various factors and using various algorithm.The project makes use of a dataset which contains various nutrients in the correct amount. In the wake of the situation, we have tried to develop a program that recommends diet to the people. The items recommended are limited to three categories: Weight Loss diet , Weight Gain diet and Healthy diet category. Our project uses Machine Learning Algorithms named K-Means Clustering for clustering the data and Random Forest Classification to classify according to the categories listed. To predict the food items the Diet Recommendation System uses user inputs from a Graphical User Interface including age, height, weight, vegetarian or non-vegetarian food and selecting the above three categories. The working prototype of the Diet Recommendation System lists a set of food items as per the user inputs. The module uses the weight and height to calculate the body Mass Index (BMI) of the user and based on the preference of the kind of diet he wants the Recommendation System predicts the list of food items.

KEYWORDS: BMI,k-means clustering,Random forest andmachine learning algorithm.

I. INTRODUCTION

The common saying Health is Wealth fits to everyone's life. Good health is the real wealth means money which has capability to help us always. Good healthis most important part of our life without whichwe are incompleteand living unhealthy life. Good health is really better than wealth and other things in this whole world. For getting fit we need to maintain standard and healthy eating. Healthy food at proper time is very necessary for the healthy body which is possible only through the well-balanced diet. It promotes the proper growth and development of our body which keeps us mentally, physically and socially healthy. With the help of our good health, we can fight any bad situations in the life. We should always remember that we need proper food, water, air, physical activity, sleep and rest on daily basis.

Now-a-days, a good health is just like a boon given by the God. It is very fact that good health is real money of life. Good health is considered as the precious earning of a human throughout his/her life. If one has losses his health, he has lost all the charms of life. A good wealth can be earned anytime using a good health however; a good health can never be earned again in the life if once destroyed. In order to maintain a good health, we need to do regular physical exercises, yoga, meditation, balanced food, good thoughts, cleanliness, personal hygiene, regular health check-ups, proper sleep, rest, etc. The importance of a balanced diet can't be emphasized enough for a healthy lifestyle. A healthy lifestyle can be attained by maintaining a balanced diet and keeping into consideration to meet all the essential nutrients required by the body. A proper meal plan helps to attain ideal body weight and reduce the risk of chronic diseases like diabetes, cardiovascular and other types of cancer.

But what exactly is a balanced diet? In simple words, it's a diet that offers the nutrients to help your body function properly. The importance of diet lies in the intake of the right number of calories. Your body gets the right nutrition when you consume a wide variety of food rich in calories such as fresh fruits and vegetables, whole grains, and proteins There's no questioning the importance of healthy food in your life. Unless you maintain a proper diet for a healthy body, you may be prone to diseases, infection, or even exhaustion. The importance of nutritious food for children especially needs to be highlighted since otherwise they may end up being prone to several growth and developmental problems.

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Considering the todays busy life of all the peoples in the present world, its outcomes in circumstance when people like tomiss out proper meals or have food at asymmetricalintervals. In such a condition, it becomes necessary for someone to give them a proper diet plan which needs to be strictly cling to. For the same thing, people have personal nutritionist who provides them a proper diet chart regularly to keep them fit. However, it is unfeasible for peoples to handle many instances and examine all the elements which are needed to be inspect for giving a healthy and balanced diet. Keeping an eye on that, an idea hit among the researchers to develops precise systems which implements machine learning algorithms to collect the user data such as height, age, weight etc. and study them to give a list of food items to the user for actual meal at the right time with right nutrition. Studying such systems and keeping in mind the importance of it, we worked on the Personalized diet recommendation.

II. THE RESEARCH METHOD

Recommendation engines are a subclass of machine learning which generally deal with ranking or rating products / users. A recommendation engine filters the data using different algorithms and recommends the most relevant items to users. Data collection is the first and most crucial step for building a recommendation engine. The data can be collected by two means: explicitly and implicitly. Explicit data is information that is provided intentionally, i.e. input from the users such as movie ratings. Implicit data is information that is not provided intentionally but gathered from available data streams like search history, clicks, order history, etc.After collecting and storing the data, we have to filter it so as to extract the relevant information required to make the final recommendations.
Recommender System is different types:

Collaborative Filtering: Collaborative Filtering recommends items based on similarity measures between users and/or items. The basic assumption behind the algorithm is that users with similar interests have common preferences.

Content-Based Recommendation: It is supervised machine learning used to induce a classifier to discriminate between interesting and uninteresting items for the user.

Hybrid recommender systems: Hybrid recommender systems are ones designed to use different available data sources to generate robust inferences.
Here in this project, we have used two machine learning algorithms i.e.K-Means clustering and random forest algorithm.

K-Means Clustering is an Unsupervised Learning algorithmwhich groups the unlabeled dataset into different clusters. Here K defines the number of pre-defined clusters that need to be created in the process, as if K=2, there will be two clusters.It allows us to cluster the data into different groups and a convenient way to discover the categories of groups in the unlabeled dataset on its own without the need for any training.It is a centroid-based algorithm, where each cluster is associated with a centroid. The main aim of this algorithm is tominimize the sum of distances between the data point and their corresponding clusters.

Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML. Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset.It takes less training time as compared to other algorithms. It predicts output with high accuracy.

III. THE REFLECTIVE PROCESS

A healthy diet is very important for good health .This project proposes an integration of machine learning algorithms to recommend the right food at the right time and with the right nutrition, calories, fat etc. here, we are using three attributes of food nutrition details, a person's physical details and time.

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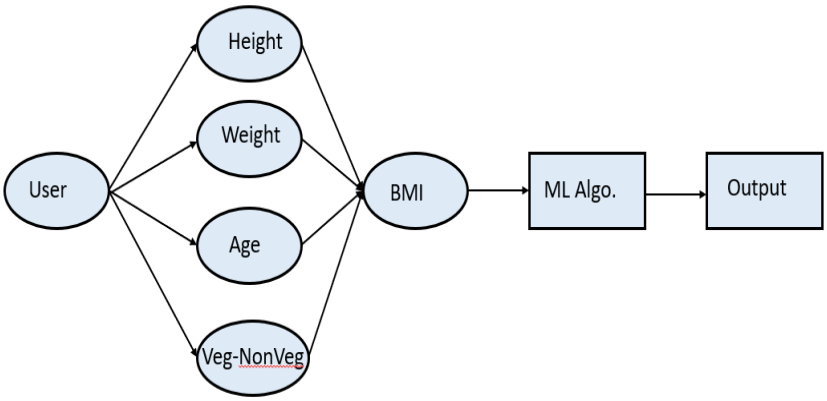
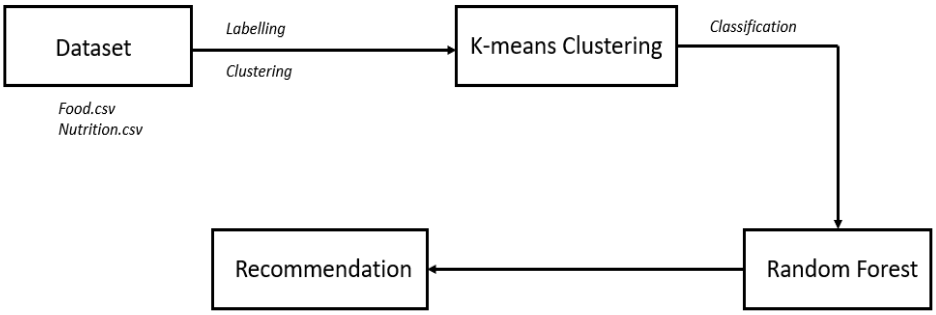
Figure1.Basiccomponentsofadiet recommendation system .



The design method of the project works as follows .The user has the enter his height ,weight ,age and type of food .After this the our system calculates the BMI of the user and based on various categories of bmi the machine learning algorithms k means clustering for clustering and random forest algorithm for classification of items is done and based on the calculations the food items are predicted to user according for weight loss, weight gain or proper health.

IV. PROPOSED METHODOLOGY



The Method

The method begins with taking input from the user about his information related to height, weight and age and then calculate the BMI i.e., Body Mass Index. And then according to criteria in which person falls like overweight, underweight or healthy the system predicts the diet chart based on the food and contents.

Steps in Building the System:

Step 1: Data Collection

The data for our project is collected from various sources and websites. Basically here we have used total two datasets food.csv and nutrition.csv The datasets that we are using to implement this project is collection of different food items as well asthe time during which the food needs to be consumed (Breakfast, Dinner, Lunch).The dataset also includes the information about whether the specific food item is veg or nonveg.The dataset also contains the information about the Calories, fats, proteins, calcium, sodium, sugars, carbohydrates, fiber ,iron, Vitamin D.

Step 2: Pre-processing

After the collection of data and reading the dataset, the whole dataset is classified into Breakfast, Lunch and Dinner.To convert the values to the NumPy array which can be considered for further use the NumPy library is used. Using the i_loc method all the details stored in each of the rows are retrieved in the specified category. The Personalized Diet Recommendation System calculates the BMI by taking inputs like Height and Weight of the user. Based on the calculated BMI the category is displayed that the person is underweight, healthy, overweight or severely

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over weight, severely underweight.

Step 3: K-Means Clustering

K- Means Clustering Algorithm allows to cluster the data and is a very convenient tool for discovering the groups in your dataset that might not have been predicted earlier.Here number of clusters required for the model is three namely healthy,weight gain ,weight loss. After importing the Libraries present in class can be accomplished using from sklearn.cluster import KMeans. The data is fitted to the model and then make predictions for the food items. K-Means Clustering receives a single hyperparameter: *k,* which specifies how many clusters we want to categorize our data into.Steps:

1. Select the number K to decide the number of clusters.
2. Select random K points or centroids. (It can be other from the input dataset).
3. Assign each data point to their closest centroid, which will form the predefined K clusters
4. Calculate the variance and place a new centroid of each cluster.
5. Repeat the third steps, which means reassign each datapoint to the new closest centroid of each cluster.
6. If any reassignment occurs, then go to step-4 else go to FINISH.
7. The model is ready.

Step 4:Random Forest Classification

Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset. Random forest takes less training time as compared to other algorithms.To predict the food items based on clustered data RandomForestClassifier is used. After the clustering is performed, using Random Forest classifier, the nearest food items are predicted which best suited for the appropriate diet.It predicts output with high accuracy, even for the large dataset it runs efficiently.Steps:

1. Select random K data points from the training set.
2. Build the decision trees associated with the selected data points (Subsets).
3. Choose the number N for decision trees that you want to build.
4. Repeat Step 1 & 2.

Step 5: GUI

The implementation of Personalized diet recommendation system starts with the taking user inputs from GUI(Graphical User Interface).In this project the Graphical User Interface is build using Python's Tkinter Library.To create Graphical User Interface using Tkinter we have to Import all its functionalities using statement from tkinter import *.From GUI it takes the inputs from user such as Height, weight, age ,Veg/NonVeg etc.For this GUI contains four text entry's and labels for each specific field at specific position.

Formula for body mass index (BMI):

$$BMI = \frac{weight}{height^2}$$

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BMI	Weight class
below 18.5	underweight
18.5 - 24.9	normal
25.0 - 29.9	overweight
30.0 and up	Very overweight

Step 6:Recommendation

Recommendation is a suggestion or proposal as to the best course of action, especially one put forward by an authoritative body.A recommendation system is a subclass of Information filtering Systems that seeks to predict the rating or the preference a user might give to an item. In simple words, it is an algorithm that suggests relevant items to

users. In Personalized Diet Recommendation System there are three main functions i.e. weight gain, weight loss and healthy that uses the machine learning algorithms like K-Means clustering and Random Forest classification algorithm to recommend right food item list at right time with right nutrition,Calories, fats, proteins, calcium, sodium, sugars, carbohydrates, fiber ,iron, Vitamin D etc. according to persons calculated Body Mass Index.

V. CONCLUSIONS

This Paper has effectively utilized Machine Learning Tools such as K-Means Clustering algorithm with Random Forest Classification Algorithm to predict the required diet for the user. The clusters generated are experimented extensively to recommend the diet at right time with right nutrition, calories. A Diet Recommendation System is implemented with the working functionalities like:

- Desired food menu prediction.
- Weight category prediction. Like overweight, underweight
- BMI Calculation.

Health is important for every person and can be accomplished with this working module. Thus,creating life healthy. Wide diversity of cultures, ingredients and individuals' preference makes decisions for what to eat at particular time is a great problem. Numerous diseases that were previously mentioned as genetic are now seen to be connected to biological afflictionrelated to nutrition.

Being healthy and eating better is something the vast most of the population wants and doing so usually requires great effort. The working modelachievea Personalized Diet Recommendation System with combination of Machine

Learning Algorithms to recommend the right food at the right time and with the right nutrition,calories,proteins etc.

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