Food Recommendation System for Diabetic Patient

Mr. Sameer Maitre, Mr. Ajay Waghmare, Ms. Bhagyashree Metre, Ms. Sakshi Deshmukh, Ms. Shruti Gokhale,

Prof. L.K.Gautam

Sipna College of Engineering & Technology, Amravati.

Abstract— Blood glucose levels that are too high can cause diabetes. Our primary energy source is blood glucose, which is obtained from the food you eat. The pancreas produces the hormone insulin, which facilitates the uptake of glucose from food into our cells for use as fuel. Type-1 and Type-2 diabetes are conditions in which the body produces little to no insulin or uses it poorly. After that, glucose remains in our blood and does not enter our cells. Over time, having too much glucose in our blood can result in health issues. Patients frequently experience heart attacks or strokes, eye issues that can cause vision loss or blindness, discomfort, tingling, or numbness in their hands and feet (also known as nerve damage), renal issues that could result in our kidneys ceasing to function, teeth and gum issues, and kidney problems. A person with diabetes needs to maintain a healthy balance in their everyday activities to keep their diabetes under control and retain good health[1].

Our proposed system, uses their health records in the form of general parameters and recommends them a perfect combination of diet to maintain good health.

Introduction

A study by WHO reports that inadequate and imbalanced intake of food causes around 9% of heart attack deaths, about 11% of ischemic heart disease deaths, and 14% of gastrointestinal cancer deaths worldwide. Moreover, around 0.25 billion children are suffering from Vitamin-A deficiency, 0.2 billion people are suffering from iron deficiency (anemia), and 0.7 billion people are suffering from iodine deficiency. The main objective of this work to recommend a diet to different individual[5].

Our proposed system, uses their health records and recommends them a perfect combination of diet to maintain good health.

This work is made easily accessible and available to the users in the form of a website, so that they can get their plans wherever and whenever they want to. Nowadays, a human being is suffering from various health problems such as fitness problem, inappropriate diet, mental problems etc. Various studies depict that inappropriate and inadequate intake of diet is the major reasons of various health issues and diseases.

Literature review

The fact that Software Based Smartphone Applications for Promoting Healthy Diet and Nutrition by Steven S. Coughlin, Mary S. Whitehead, et al. [1] were put into place highlights how quickly technology has advanced, encouraging the use of smartphones in health promotion research and practice. The most popular approaches include giving criticism, setting healthy eating goals, cooking healthy meals, making grocery list decisions while keeping track of one's weight, and many others. The project also emphasizes how cellphones have the ability to enhance the precision and thoroughness of self- monitored nutritional intake in weight-control interventions and how they typically lighten the workload associated with such monitoring using conventional paper-based records. Accuracy of diet and nutrition measurements obtained using mobile devices has generally been found to be good. Participants prefer quick and easy to administer applications and those that increase awareness of food intake and weight management.

Barry M. Popkin, distinguished professor at W. R. Kenan, Jr. University, wrote a study titled "Food Consumption and its Impact on Cardiovascular Disease: Importance of Solutions" that focused on the globalized food system. In [2], we learn about:

1.   The evolution of the contemporary, globalized food system and its effects on the food supply.

2.   A general agreement on the evidence linking different diets and macronutrients to CVD and its associated comorbidities.

3.   A description of how modifications to the world's food system can both solve the nation's present dietary-related public health issues and counteract climate change. This paper provided a state-of-the-art review of the link between specific macronutrients and foods and cardiovascular diseases (CVD) and summarized how the global food system contributes to dietary patterns that greatly increase the risks for

the population to experience ill health. In the article by Yue You, Svetlana Vladislavovna Doubova, Diana Margarita Pinto Masis, Ricardo Pérez Cuevas, Victor Hugo Borja-Aburto, and Alan Hubbard, machine learning methodology is applied to evaluate the effectiveness of the diabetic's programme for patients with type 2 diabetes in family medicine clinics in Mexico. [3] Clinic and laboratory databases are where the data is gathered.

The machine learning algorithms utilized were precisely a regression tree, and the main examination of diabetes' impact on glucose management was the outcome, which was the predicted treatment impact. The glycemic control of people with type 2 diabetes is generally discussed in this paper. Counting the number of T2D individuals utilizing databases and algorithms.

Developing a decision support system to assess diabetic patients' carbohydrate consumption by Levente Kovacs, Lorand Vajda, and Patricia Pinter [4] makes use of telemedicine. The technology was created to provide home monitoring, which is an illustration of telemedicine. A form with text fields and drop-down menus can be used to enter personal and medical information to build new patient profiles.

Vital sign changes can be tracked using automatically generated graphs. The ability to prescribe medications is supported by notifications. There are instruments to help remind the patient to take their medication or to perform other tasks, such checking their blood pressure or exercising (each patient has daily programmes set up by their expert that trigger notifications every day).The clustering technique called Improved K-means which falls under the category of point assignment algorithms which is of unsupervised the initial partitions (centroids) have been calculated in a more significant way rather than random selection. This results in reducing the number of iterations.

Proposed Methodology

The goal of this project is to develop a Diabetic Food Recommendation System that can provide personalized and relevant food recommendations for individuals with diabetes. The system will leverage machine learning techniques to analyze various factors such as the nutritional content, glycemic index, portion size, and personal preferences of users to generate tailored food recommendations.

The Diabetic Food Recommendation System will be designed to address the following challenges:

Nutritional Content: Identifying foods that are rich in essential nutrients, low in carbohydrates, and have a balanced macronutrient profile is crucial for individuals with diabetes[3]. The recommendation system should be able to evaluate the nutritional content of different foods and provide recommendations based on the specific dietary requirements of the user.

Portion Size: Controlling portion sizes is important for managing blood sugar levels and overall calorie intake. The recommendation system should provide guidance on appropriate portion sizes for different foods, taking into consideration the user's individual needs and goals.

Personal Preferences: Taste preferences, cultural dietary habits, and individual food restrictions are important factors that influence food choices. The recommendation system should be able to account for these personal preferences and provide food recommendations that are aligned with the user's taste preferences and dietary restrictions.

The Diabetic Food Recommendation System aims to provide practical and actionable recommendations to help individuals with diabetes make informed food choices and manage their condition effectively[8]. By leveraging machine learning and techniques, the system can provide personalized, relevant, and adaptable food recommendations that align with the user's dietary requirements, taste preferences, and lifestyle, ultimately contributing to improved diabetes management outcomes.

Design

PROCESS

Food recommender systems are gaining popularity due to their importance in maintaining a healthy lifestyle. Most existing studies in the food domain focus on recommendations that suggest appropriate food items for individual users based on their preferences or health problems. In addition, recommendation features are extremely useful in the food industry. Such scenarios present numerous challenges for food recommender systems because the system must recommend food based on the height and weight of the users, which must be considered appropriately. These systems also include features for tracking nutritional consumption and persuading users to change their eating habits for the better. We present an overview of recommendation techniques for individuals and groups in the healthy food domain in this paper. Furthermore, we examine the current state-of-the-art in food recommender systems and discuss research challenges associated with the development of future food recommendation technologies.

COLLECTION OF DATA

The data has specific food related information which is related to the changes in the nutrients for the human being. The data used is observed from the lifestyle and daily records. The data collection process is responsible for the framework to do an inspection of the data collected and the data that can be compared to previously obtained data. This task further leads to the next task which is preprocessing which is applied to normalize the dataset using normalizing techniques. This task helps in dealing with data collecting and balancing to make a dataset that will be based on Machine learning.

We collect our data from Kaggle website in the form of rows and column. In our dataset there are multiple columns which contain the more information about the ingredient , prep time min, total time min , servings , course , is veg , is sugar free, is High protein , is gluten free , is sattvic, is vegan , diet, Allergic, Total Calories , website etc.

We have use Indian Food Dataset from Kaggle.com

Figure 4.1 – Dataset Screenshot 1

Figure 4.2 – Dataset Screenshot 2

Figure 4.3 - Dataset Screenshot 3

DATA PREPARATION

In this study, the data preparation stage is data pre-processing that prepares raw data before the following process (clustering and memory-based processes) to obtain clean data. One way to data pre-processing is to reduce irrelevant attributes.

Figure 4.4 – Modified Dataset 1chances of receiving identical recommendations exist because a user's preferences might not alter frequently. The aforementioned approaches for recommendingailments or have dietsto do dealwith balancing dietspecifically with programs. certain

The proposed system recommends substituted foods according to nutrition and food parameters.

Based on the user's choices and the system's recommendations for personalized recipes. The algorithm of the suggested system made use of matrix factorization and latent feature vectors. By using tags that closely match the recommendations with users' tastes, prediction accuracy is attained. To balance the user's diet in accordance with his needs, the writers do not take nutrition into account. It is suggested to employ a content-based food recommender system that makes recipe recommendations based on the user's pre-established preferences[6]. Additionally,

Decision Tree Classifier

A supervised learning approach called a decision tree can be applied to classification and regression problems.

The method generates rules that can be represented by a tree structure using training data. It includes a root node, internal nodes, and leaf nodes like any other tree representation would. The internal node represents an attribute condition, the branches the condition's outcomes, and the leaf node the class

Figure 4.5 - Modified Dataset 2   label.

Following the if-else style rules, you start at the root node at the top and work your way down to the leaf node to arrive at the classification. Your classification problem's class label is the leaf node where you end up [9] .

Experiments and Results

1.   User's will enter the necessary information like their age, gender, weight etc. on the website.

2.   The information will then go through the ML model in following manner:

2.1 Decision Tree Classifier is used to classify the food items and predict the food items based on the input.

Figure 4.6 - Modified Dataset 3 **3.** After analyzing all the data the system will respond by showing user's BMI and their **A Food Recommendation System (FRS)** current state (Overweight, Underweight, Healthy)
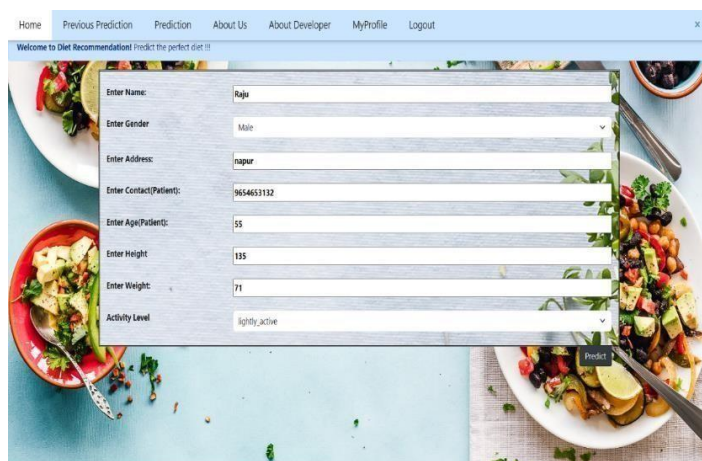
4. The System will then recommend diet to the users into three categories (breakfast, lunch, dinner) based on input

5. The Users can choose from multiple recommended items and make their diet plan.

6. After selecting food items the system will calculate selected food calories and show user's comparison between how much calories they chosen against how much they need to consume daily. 7. Accordingly then the User's will make its diet plan.
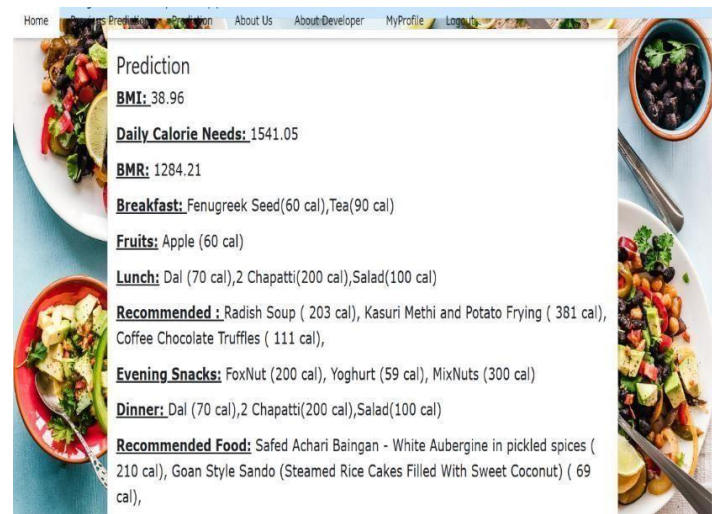
Screenshot 2: Prediction of User

Based on the parameters the food is recommended. The value is matched in the dataset and prediction is shown on web page. The various factors like BMI, BMR, calories needed are calculated.

Table No.1 - Calorie Evaluation with personal parameters

Screenshot 1 : Data of User

Sr. No.	Name of Person	Age	Height	Weight	Activity Level	BMI	Calorie Needed	Calorie Generated
1	Raju	55	135	71	LA	38.96	1541.05	1511
2	Riya	35	135	58	VA	31.82	1500.72	1469
3	Tejas	21	145	60	VA	28.54	1632.83	1612
4	Ajay	22	175	56	VA	18.25	1694.78	1726
5	Bhagyashree	29	130	58	LA	34.32	1513.31	1500
6	Suresh	65	142	71	S	37.2	1559.5	1563
7	Nikhil	42	163	61	LA	22.96	1601.73	1617
8	Sakshi	44	143	63	MA	30.81	1539.18	1534
9	Sameer	27	159	62	VA	24.52	1675.89	1641
10	Shruti	52	132	47	MA	26.97	1279.17	1250

Chart No. 1

Conclusion & Future Scope

By the end of our project, we concluded that if Diet Recommendation system based on diabetics was properly designed, implemented, and evaluated, it could be used as an effective tool to improve nutrition and promote a healthy lifestyle.

An accuracy of 78.488 % for food recommendation was achieved for this system.

Thesaid accuracies will provide recommendations to the users. Accuracy can be improved by adding more data into the system. The increase in the number of data values will help in the formation for classifier more precisely, thereby improving the accuracy of the system.

In the future, we plan to expand our project to include an Android application that will recommend foods for specific diseases as well as a basic exercise plan and its maintenance.

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