IoMT Assisted ML Based Diet Recommendation System

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Abstract: All over the world people are more worried about their well-being and lifestyle in today's generation. But by just avoiding contaminated food and exercising isn't enough. A balanced diet is also necessary. Eating a healthy food and having a proper diet which is appropriate for your height, weight and age can help you lead a good life. Diet and exercise can help you to have good health and maintain a healthy weight, reduce the risk of chronic diseases (like heart disease and cancer) to improve overall health. A proper diet provides the nutrients that your body needs to function properly. Food calories means the amount of energy that food contains. Our body need calories for almost everything such as breathing, walking, running. On an average, a person needs 2000 calories per day. However, the number of calories burned depends on physical characteristics such as weight, height, age and gender. As a result, your daily diet affects your health and the proposed method provides a nutritional plan based on your physical characteristics and ultimate goals

Index Terms - Machine Learning, KNN, Random Forest Algorithm, Recommendation System, Diet Plan, BMI, Calories.

I. INTRODUCTION

Recent studies have shown that a solid diet prescribed by a nutritionist or an automated artificial intelligence medical nutrition cloud system can extend life, prevent future illness, and improve overall quality of life. increase. On the other hand, medical staff still do not fully understand the motivations of dietitian patients for the recommendation system. This research provides a deep health learning solution based on medical datasets. The solution automatically determines the nutrition that a given patient should receive based on medical condition and other factors like lifetime, sex, mass, calories, fat, sodium, fiber and lipid.

A patient/nutritionist recommender system monitors the user (patient/nutritionist) with an individualized approach, monitors notable or acceptable diets and food consumption among a wide range of possible options, and recommends such choices. A system that produces as output [1]. A patient/nutritionist referral system is used judiciously to get sufferers to take dietary supplements. Diets and foods that are believed to reach the patient's health care requirements, preferences, and nutritional selections.

Food and nutrition, on the other hand, is a complex field, with multiple hurdles for recommendation technology. Thousands of food/ingredients must be collected before making suggestions. Since foods/ingredients are usually mixed in a dish and not consumed separately, the complexity of recommendation systems is enormous (Freyne and Berkovsky 2010). In addition, food recommendation systems not only recommend foods that meet the user's interests, but also advise on healthy food options, track eating habits, identify health concerns, and encourage users to take action. urge you to change.

From the early stages of fatal development to old age, nutrition is an important foundation of human health and growth. Nutrition and a healthy diet are absolutely necessary for existence, personal growth, intellectual development, achievement, creativity, fitness and welfare [2]. The purpose of this work is to investigate dietary recommendation systems. The second section summarizes related work. Part 3 describes the algorithm used. Part 4 explores methods of nutritional counselling in detail. Section 5 of the study concludes with a summary on this topic.

II. LITERATURE SURVEY

Shubhanshi Saini and Sanjay Kumar Dubey proposed using an analytical hierarchical process to prescribe diets for jaundice (AHP) patients. This diet recommendation strategy is unprecedented and offers a new perspective that differs from traditional methods. Key nutrients are used as criteria for his AHP, and several diet plans are analyzed against these factors to find the optimal choice. The end result is a meal plan that includes morning meal, lunch and dinner for the jaundice patient. AHP conclusions are more calculated

using the Fuzzy Analytic Hierarchy Process (FAHP). FAHP showed the similar outcomes as AHP.
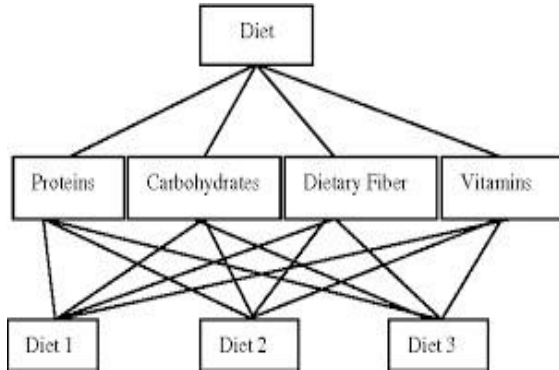
Step 1: These components are weighted on a scale of 0 to 9 based on the questionnaire and survey results.

Table 1 is an example table. The weight of each criterion if filled in relation to its relevance in relation to other criteria. For example, weight 7 indicates that criteria 1 is more essential than criteria 2, and vice versa.

Step 2: The created table is used to compute the mth root of the product and its sum. Multiply the entire row by the mth root. m is the number of elements in the matrix.

Step 3: Next, the Eigen vector is computed by dividing the nth root product by their total.

Step 4: The next step is to calculate λ max to calculate the Consistency Index (C.I) and Consistency Ratio (C.R). Aw is determined by adding the product of each row element to the eigenvectors λ/ω. (1) where λ max is the eigenvalue and ω is the eigenvector.

Step 5: The consistency index is determined as (λ). (2) Doi:10.22266/ijies2017.0831.10 Intelligent Engineering and Systems from International Journal, Volume 10, Issue 4, 2017.

Step 6: Ultimately, the consistency ratio is calculated as: (3) where R.I is the mean consistency index. According to Saaty, a C.R of 0.1 indicates that the decisions made are reliable, and a C.R > 0.1 indicates that the decisions made are inconsistent.

In [1] the authors explain Enabling Efficient IoMT-Ready Nutrition Recommendation Systems for Patients with Machine Learning Models so that foods prescribed to patients by nutritionists can extend life expectancy, secure against illness, and improves standard of living. It deals with implementing algorithms such as Bayesian, multi-layered perceptrons, and long short-term memory. Using an LSTM deep learning model, this study achieved an accuracy of 97.74. It automatically recommends which foods to give based on the patient's condition.

In [2], the author recognized Machine learning-based diabetes prediction and meal suggestion system for diabetic individuals. Diabetes has now become a widespread illness among humans. The main strategy is to target Diabetes patients depending on their cholesterol, blood pressure, and haemoglobin levels. This study obtained 87% (Decision Tree), 90% (Nave Bayes), and 93% accuracy (Random Forest). The main finding of this study is that it will provide a diabetes prediction approach.

In [3], the author elaborates a hybrid approach-based diet recommendation system using ML. Accuracy for this is 0.639394 (Native approach), 0.665263 (K-NN), 0.952527 (LFM), 0.957547 (LFM) (Hybrid approach). In this work, we provide a hybrid method based on ML for big data analytics and NLP for data pre-processing to generate nutritional recommendations. Framework proposed in this 0.957547 (hybrid approach). In this study, they used a hybrid approach based on ML and NLP pre-processing of data for big data analytics to make nutritional recommendations. The approach proposed in this study provides highly accurate recommendations for healthy eating.

In [4] the author suggests a Meal suggestion system based on nutrition data and user feedback this document provides suggestions for a daily nutrition plan. This article proposed a meal recommendation system that generates daily individualised plans for consumers based on their nutritional needs. This work is primarily concerned with the development of complicated information models. MCDS is the approach employed.

In [5] the authors explain a Meal recommendation framework based on existing frameworks and issues. This study proposes a unified paradigm for food recommendations and identifies key issues affecting food recommendations, including: different contexts and domain knowledge paper provides a thorough review of food recommendation by proposing a unified food recommendation paradigm. The key issues impacting meal recommendations are acknowledged. It is expected that interdisciplinary techniques combining nutrition, food science, psychology, biology, and other disciplines would result in more potent ways.

In [6] author demonstrates many objective optimizations fit the recommendation system: meal recommendation scenario. This research article addresses the problem of meal suggestions based on several objective optimizations. This study presents a unique his

MaOO-based recommendation method adopted to provide a balanced and systematic approach for handling food recommendation task. Finally, three Paretobased algorithms were developed to address the problem of comprehensive research based on recommended recommendation tasks and datasets.

In [7] author created a Nurtriflow:A Diet Recommendation System. This research advises that users check their calorie target based on their BMI, as well as their eating habits and allergies. This research proposes a system that employs thermal photography with smartphones to construct visual and thermal representations of the user's food in order to identify the sort of food being consumed with roughly 90% accuracy. This research article describes the standard structure of food recommendations, which includes data collecting layers, a user profile database, and an easy-to-use interface.

[8] suggested a dietary recommendation for jaundice patients. The presence of bilirubin is the primary cause of the jaundice. Using the AHP approach, a healthy diet with all nutrients present in their right proportions may be advised to the patient. This study report argues that all of the nutrients essential for recovery are required. Carbohydrates, vitamins, and proteins are vital foods for jaundice sufferers.

In [9] authors have proposed a overview of recommendation system in the field of healthy food. This document outlines an approach to recommending healthy foods to individuals and groups. Several food recommendation systems use well-known recommendation methods such as collaborative filter recommendations, content-based recommendations, and constraint-based recommendations. In general, all food recommendation systems play an important role in providing foods that meet user preferences and nutritional needs. To make suggestions, the system must collect dietary needs, data about the user's past diets, and ratings of food recipes.

In [10] authors invented a prediction of chronic kidney disease and dietary advice using machine learning. The main goal is to use classification algorithms based on medical laboratory information to predict disease stage and prescribe an appropriate diet for CKD patients. The accuracies achieved are 93% (Native Bayes), 84% (K-NN), 96% (Decision Trees), 98% (Decision Trees) (Random Forest). The proposed system uses machine learning algorithms to predict the transition period from stage 1 to stage 5 of kidney disease and prescribe an appropriate diet based on the patient's situation.

In [11] authors have set up a Dash Food Advice System for ML Patients with High Blood Pressure. This study recommends a Mauritian diet program for hypertensive patients. The model is trained on 85% of the data set and tested on 15% of the data set. The classifier in this research has a 99% accuracy. The publication suggests healthful diets and dishes. The major purpose is to help not just hypertensive people regulate their diets, but also to help normal people protect themselves from other health problems.

In [12] the authors have K-clique and Deep Learning Classifiers are used in a patient meal advising system. The system employs Gated recurrent network and K-clique to provide nutritional food suggestions based on the patient's health problems, illnesses, and other characteristics. Consumption of nutrient-rich meals offer various advantages, including adequate levels of fibre, minerals, proteins, and fat.

In [13] authors designed a Food Recommendation System Based on Machine Learning. This article employs a number of machine learners, including Decision Tree, Random Forest, and Naive Bayes. The accuracy is 96% (K-NN), 91% (Nave Bayes), 96% (Decision Tree), and 96% (Decision Tree) (Random Forest). The medical staff is currently investigating the reasons why patients employ a recommender system from dieticians.

In [14] created a personalize healthy diet recommendation system. This study proposes a mechanism to help hospital nutritionists make dietary recommendations to patients. When it comes to food, it's important to remember that everyone has different interests, lifestyles, and likes and dislikes. Optimal body weight is calculated from DRE calculated from Broca's index. A diet recommender system recommends alternative meal combinations by analyzing food composition to identify groups of nutritionally similar foods.

In [15] authors designed a health recommender system based on systematic review. Health recommendation systems play an important role in motivating people to change their habits by recommending appropriate

solutions based on observed user behaviour. Accuracy is 38% and performance is 35%. From the results of this survey, it is thought that it is necessary to clarify what the health recommendation system recommends to whom.

Sl no	Paper Title	Year	Methodology Used	Findings
1	Enabling Efficient IoMT-Ready Nutrition Recommendation Systems for Patients with Machine Learning Models [1]	2019	Deep Learning Classifier, Naïve Bayes, Logistic Regression, RNN, GRU, LSTM, Machine Learning Classifier	Based on sickness and other factors, automatically determine which foods should be supplied to certain patients.
2	Machine learning-based diabetes prediction and meal suggestion system for diabetic individuals [2]	2021	Decision tree, random forest & Naïve bayes	It will recommend a Diabetes prediction approach.
3	A Hybrid approach based Diet recommendation system using ML [3]	2022	Naïve Approach, k-NN, LFM,Hybrid Approach	It is capable of making accurate healthy diet suggestions.
4	Meal suggestion system based on nutrition data and user feedback [4]	2019	MCDA	The aim of the research clusters is to construct complex information model
5	Meal recommendation framework Existing frameworks and issues [5]	2020	Joint model	We must comprehend and model people's dietary recommendations based on different signals.
6	Many objective optimizations fit the recommendation system: meal recommendation scenario [6]	2022	MaOO algorithm (Many objective optimization)	This provides a more balanced approach to food recommendations than traditional recommendations.
7	Nurtriflow: A Diet Recommendation System[7]	2020	Collaborating Filtering, Fuzze Logic, Artificial Neural Network	The current study introduces a dietry recommendations technique that focuses on developing a daily diet plan for common users based on nutritional and dietry requirements.
8	Dietary Recommendations for Jaundice Patients [8]	2019	AHP and Fuzzy AHP(Analytical hierarchy process)	System numerous objective optimization system for food recommendation
9	Overview of recommendation system in the field of healthy food [9]	2019	Enhancing user interfaces to accommodate fundamental group negotiating mechanisms	Obtaining quick consensus in group decision making
10	Chronic kidney disease prediction and nutritional advice using machine learning [10]	2019	Logistic Regression, support vector Machines, Decision trees classifier & k-nearest neighbors.	The system recognises and recommends diets that will be valuable to both physicians and patients.
11	Dash Food Advice System for ML Patients with High Blood Pressure [11]	2019	ML, content-based filtering	As a result of these findings, scientists have developed the DASH Diet Guideline.
12	K-clique and Deep Learning Classifiers are used in a patient meal advising system. [12]	2020	K-Clique, Deep Learning Classifier, Gated Recurrent Unit	To deliver nutritional meal suggestions depending on the patient's health issues, diseases, and other features, the system utilises Gated recurrent network and K-clique.
13	Food Recommendation System Based on Machine Learning [13]	2022	ML, NB, Decision Tree, RF	The medical staff is currently investigating the reasons why patients employ a recommender system from dieticians
14	A Personalized Healthy Diet Recommendation System [14]	2019	Daily required energy is computed using Broca Index	The diet recommender system recommends alternative meal combinations by analysing dietary ingredients to determine a group of food items that are nutritionally similar

15	Health Recommender Systems: Systematic Review [15]	2021	PRISMA	Health recommender system recommends and to whom it recommends should be made apparent

IV. CONCLUSIONS

Technological developments such as machine learning and artificial intelligence are currently playing a major role in the growth of the IT (information technology) industry. Hence, using these modern technologies, we created a website for those who are concerned about their nutrition and wish to live a healthy lifestyle. The importance of nutritional assistance in leading a healthy and fit life is rising by the day, and a healthy diet plan is developed in the system by accepting User Choices and User Profiles.

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