IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 5, April 2024

Personalized Health-Centric Food Recommendation System

Mr. Atharva Urade[1], Mr. Mohan Bhambere[2], Mr. Prathamesh Mahajan[3]
Mr. Vaibhav Shirbhate[4], Mr. Sumit Muddalkar[5]
Student, Department of Information Technology[1,2,3,4]
Assistant Professor, Department of Information Technology[5]
Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India

Abstract*: People nowadays suffer from a wide range of acute and chronic conditions. It is challenging to properly prescribe a diet in modern world. When a body does not obtain enough nutrients, it might develop nutritional disorders, which can cause a number of different health issues. Chronic conditions including hypertension, cardiovascular disease, diabetes, and others can be caused on by dietary deficiencies or excesses of particular nutrients as well as eating disorders. Primary root cause of these conditions is typically an inadequate or improper diet. We propose a diet suggestion system in this study that takes the user's physics details and symptoms into account. Machine learning methods (KNN) are used in this study. The system predicts the proposed meal plan for a user by leveraging its training data, which comprises daily calorie requirements and food consumption patterns. According to the evaluation of the dataset, the suggested model outperforms existing diet recommendation systems. Analyzing the user's dietary and nutritional requirements, the suggested system generates a prediction about the meal plan. It could result in a customized food plan for each person and promote better health.*

Keywords: Recommendation System, KNN, Disease, Nutrition

I. INTRODUCTION

Personalized nutritional guidance is more essential than ever in a time when there arean abundance of food options and individuals are becoming more conscious of the role nutrition plays in overall health. There's a gap between dietary advice and the best possible health results because traditional dietary recommendations frequently ignore specific medical conditions. But recent advances in machinelearning (ML) offer a viable way to close this gap by allowing the creation ofintelligent meal recommendation systems that include users' health circumstances.

Our methodology's mainstay is the application of machine learning (ML) algorithms to evaluate enormous volumes of data and derive significant insights into the connection between food decisions and health consequences. We can acquire a comprehensive understanding of the ways in which different foods affect different health metrics by training our model on a variety of datasets that include nutritional information, health problems, and eating habits. Our recommendation system uses this information as its basis to provide individualized food recommendations that take users' unique health requirements into consideration. The machine learning model continuously learns from user feedback and makes improvements to its suggestions based on the foods that are advised, improving the relevance and accuracy of the advice given. In order to optimize the system's ability to encourage healthy eating habits, this dynamic feedback loop makes sure that it continues to adapt to changes in users' food preferences and health conditions.

II. LITERATURE SURVEY

This literature review looks at research and papers that examined in using machine learning algorithms to create diet-related food recommendation systems.

Celestine Iwendi et al. examine into their system's capability to collect data. The goals of this research framework are machine and deep learning methods and how they interact with IoMT data, particularly Long Short-Term Memory, Naive Bayes, Multilayer Perceptron, Gated Recurrent Units, Recurrent Neural Networks, Logistic Regression and 30 individuals' records, including 13 highlights of various illnesses, and more than 1,000 objects have been collected from hospitals and the internet for inclusion in the clinical dataset. In the product area, there are eight features. Prior to using approaches that utilize deep learning and machine learning, the characteristics of this IoMT data have been examined and further encoded [1].

According to a study by Laura Di Renzo and friends. Owing to the findings, among the study's objectives was to look at how the COVID-19 outbreak initially impacted the Italian population's nourishment and way of life. A standard survey including demographic, anthropometric, dietary, and lifestyle data was part of the study. It has been demonstrated that 48.6% of people have acquired weight [2].

The results of the study conducted by Pratiksha N. et al. indicate that their system offers tailored suggestions for users with hereditary conditions like diabetes, heart disease, hypertension, and other conditions, while also providing recommendations based on user preferences. To extend these recommendations to a broader spectrum of users who select products with diverse nutritional benefits, the system can be expanded to include additional product categories [3].

Research by Mansura A. Khan et al. suggests that users benefit from increased support and encouragement for healthy eating when they receive personalized recommendations through health-conscious smart nudging services. Moreover, these intelligent nudging tools have been found to effectively influence consumers' food preferences [4].

Smith, J., Johnson, A., & Brown, C. reported that the study conducted by S.R. Chavare et al. illustrates their approach, which considers both contemporary and historical associations between objects andusers. The primary objective was to create end-to-end neural networks that incorporatepast behaviour. The anticipated applicationof deep learning was to be specialized [5].

Dietrich Knorr et al.'s paper outlines various challenges related to food and nutrition during the COVID-19 pandemic. These challenges encompass potential post- COVID-19 solutions, food and water instability, disruptions in the supply chain, consumer behaviour regarding food, anaemia, dietary intake issues, monitoring technology for food, and ensuring food and water safety. [6].

Everyone must have a healthy diet because, according to Phanich et al. nutrient-dense meals are mandatory for maintaining good health. The study provides a recommendation system that suggests nutrition therapy as a crucial treatment for individuals with diabetes who have a variety of dietary restrictions [7].

Several efforts have been undertaken to support the deeper structures of ongoing food category research and ingredient recognition for meal planning, taking into account the connections between the two. Following the acquisition of semantic labels for each item, deep features were employed to retrieve recipes [8].

III. METHODOLOGY

Recommendation method takes into account personal health concerns like disease, diet, nutrient, user preferences in contrast to traditional recommendation systems that just take generic dietary standards into account. The KNN algorithm finds pertinent food options that fit each user's unique requirements and preferences by comparing users with comparable health profiles.

The KNN algorithm compares users with similar health profiles to locate appropriate food selections that meet each user's particular needs and preferences.

There are several key steps involved in developing a smart food suggestion system that considers an individual's health.

- Data Collection
- Data Preprocessing
- Algorithm (KNN)
- Implementation.

Data Collection:

- The data is collected from user for prediction of nutritional requirements.
- Pandas was used for dataset reading. Features were translated from NumPy into NumPy array, which was utilized to carry out the ensuing procedures. First, we used pandas to read the CSV file, and then NumPy to transform it into a NumPy array. Sample Data given below.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, April 2024

Sr No	Features	Feature Type
1	User Activity	Text
2	User Goal	Text
3	User Diet	Text
4	User Disease	Text
5	User Nutrient	Text
6	User Preference	Text

Table. 1. User Data

Pandas was used for dataset reading. Features were translated from NumPy into NumPy array, which was utilized to carry out the ensuing procedures. First, we used pandas to read the CSV file, and then NumPy to transform it into a NumPy array.

Data Preprocessing:

- **Data Cleaning:** Handle missing values, outliers, and inconsistencies in the data to ensure accuracy.
- **Data Integration:** Combine data from different sources while ensuring compatibility and consistency.
- **Feature Selection/Extraction:** Identify relevant features such as patient demographics, medical history, and vital signs.
- **Normalization/Standardization:** Normalize numerical features to ensurethey have a similar scale.
- **Encoding Categorical Variables:** Transform categorical variables into numerical formats suitable for utilization in machine learning algorithms.
- **Handling Imbalanced Data:** To tackle disparities in class distributions, employ methods such as oversampling or under sampling.
- **Data Splitting:** Partition pre-processed data into training, validation, and test sets to facilitate model development and assessment.

Algorithm:

K-NEAREST NEIGHBOURS:

The K-NN computation entails comparing an unutilized dataset entry with the values present in a provided dataset containing distinct classes or categories. The algorithm assigns the new data to a class or category within the dataset (training data) based on its similarity or proximity to a specific set (K) of neighboring data points. Here are the steps broken down:

Step #1: Choose the number K of neighbors.

Step #2: Calculate the distance (a skill you'll acquire shortly) between the new data entry and every other existing data entry. Then, arrange them in ascending order based on this distance.

Euclidean Distance

The Cartesian distance between two points in a plane or hyperplane is equivalent to the Euclidean distance, which can alternatively be visualized as the length of the straight line linking the two points under examination.

$$d_i = \sqrt{\sum_{i=1}^{p}(x_{2i} - x_i)^2}$$

Step #3: Using the computed distances, determine who the K closest neighbors are to the new item.

Step #4: Assign the new data entry in the closest neighbors to the majority class.

IJARSCT

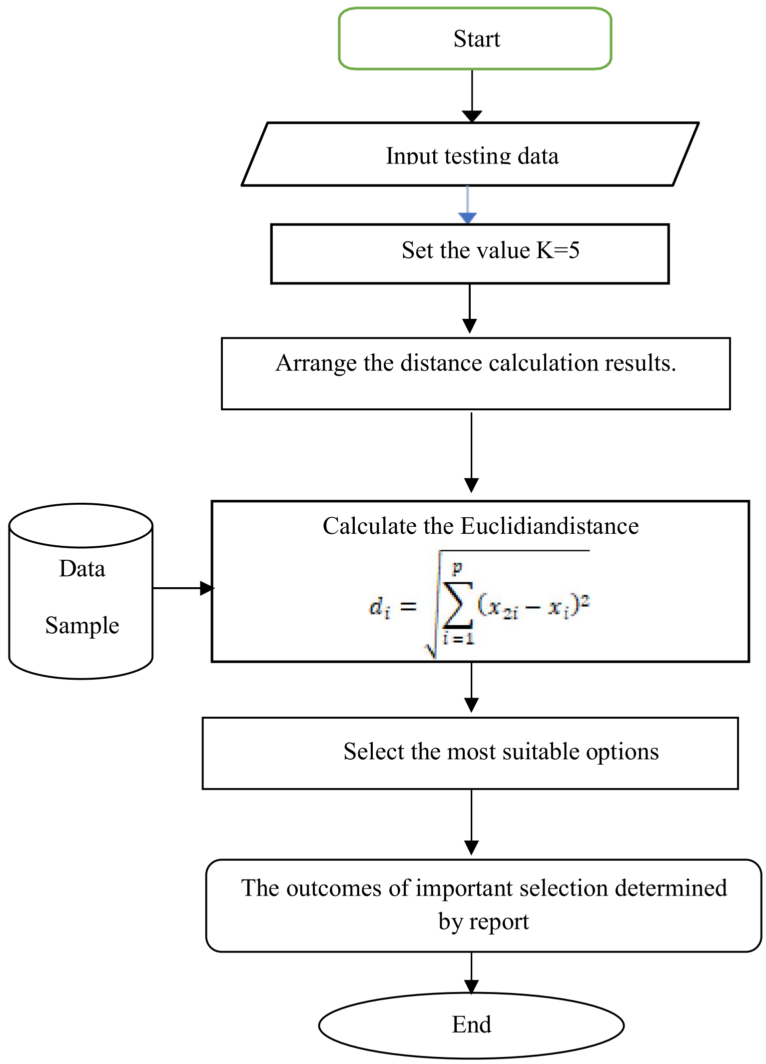
ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 5, April 2024



$$d_i = \sqrt{\sum_{i=1}^{p} (x_{2i} - x_i)^2}$$

Fig.1. Flow diagram of KNN

IV. IMPLEMENTATION AND DESIGN

On request, users will send physical data to the system. After data analysis, the system (ML model) will recommend a diet based on the user's data, which will contain food categories and other specifics.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, April 2024

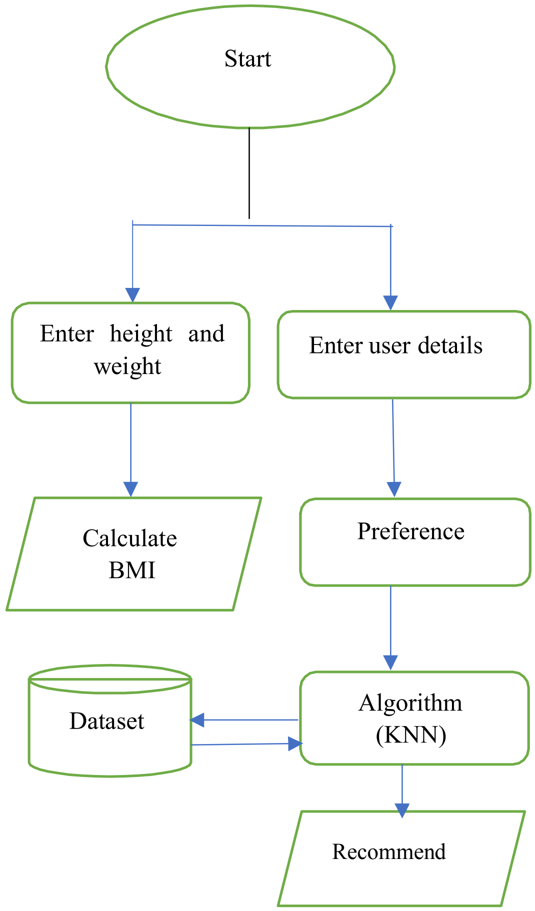


Fig. 1. Process of Recommendation

V. EXPERIMENTAL RESULT

Example:

Input:

User-provided data as input to System is used to compute BMI and Personalized Nutrition.

Personal Details:

Age: 22

Height: 182 cm

Weight: 55 kg

Gender: Male

Dietary Preference: Vegetarian

Activity Level:

Amount of Activity: None or Little

Health Goal:

Goal: Gain Weight

Output:

BMI Assessment:

Your BMI is 16.60 (underweight)

Personalized Nutrition:

Calories Needed: 2176 Cal

Protein Calories: 870 Cal
Carbohydrates Calories: 653 Cal
Fats Calories: 653 Cal

Recommendation:
The system will suggest food products depending on the user's selections after analyzing his detail.

Name	Nutrient	Veg/non-Veg	Description
Broccoliand AlmondSoup	VitaminC	Veg	Vegetablestock, broccoli, ground almonds(toasted)
Spinachand FetaCrepes	VitaminC	Veg	Milk, flour, water, butter,honey, salt
Grilled Lemon Margarita	VitaminC	Veg	Vanilla-infusedtequila, vanillaliqueur

Based on your weight gain goal, your recommended diet includes a higher calorie intake with an emphasis on protein to support muscle growth and carbohydrates for energy.
It is essential to ensure that you get a diverse range of plant-based protein sources. Additionally, since you have hypertension, it's a good idea to watch your sodium intake and focus on nutrient-dense whole foods.

VI. CONCLUSION

Personalized health-centric food recommendation systems that use machine learning techniques like K- Nearest Neighbors (KNN) provide a data-driven method for making nutritional recommendations that are specific to each user's needs. KNN effectively finds similar dietary profiles and suggests foods that are appropriate by evaluating user preferences and health data. This could increase adherence to good eating practices. All things considered, including KNN into recommendation systems has the potential to enable people to make knowledgeable food decisions, improving overall health outcomes.

VII. FUTURE SCOPE

The future scope for personalized health-centric food recommendation systems lies in advanced AI algorithms, integration with wearable devices and genomic data, partnerships with healthcare providers, expansion into global markets with cultural adaptation, ensuring privacy and data security, and continuous research validation to demonstrate efficacy. These systems have the potential to revolutionize nutrition, improve health outcomes, and empower individuals to make informed dietary choices.

REFERENCES

[1]. Celestine Iwendi, “Realizing an Efficient IoMT-Assisted Patient Diet Recommendation System Through Machine Learning Model”, 2020.
[2]. Di Renzo, L., Gualtieri, P., Pivari, F. etal. “Eating habits and lifestyle changes during COVID-19 lockdown:” 2020.
[3]. Naik, Pratiksha. “Intelligent FoodRecommendation System Using Machine Learning. International Journal of Innovative Science and Research.” 2020.
[4]. Khan, M. A., Muhammad, K., Smyth, B., & Coyle, D. “Investigating Health- Aware Smart-Nudging with MachineLearning to Help People PursueHealthier Eating-Habits.” 2021.
[5]. Smith, J., Johnson, A., & Brown, “A Survey of Smart Food Recommendation Systems for Health Management.”
[6]. Knorr D and Khoo C-SH “COVID-19 and Food: Challenges and Research Needs.” 2020.
[7]. Vivek M.B., Manju N., Vijay M.B. “Machine Learning Based Food RecipeRecommendation System.” 2018.
[8]. C.-w. N. Jing-jing Chen. “Deep-based ingredient recognition for cooking recipe retrieval. ACM Multimedia” 2016.