

Diet Recommendation System Using Machine Learning

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Abstract—In today's society, people are increasingly conscious about their health and lifestyle. However, simply avoiding unhealthy foods and exercising may not be sufficient for maintaining a balanced diet. To lead a healthy life, a balanced diet tailored to an individual's height, weight, and age is necessary. When coupled with physical activity, a proper diet can assist in achieving and sustaining a healthy weight, decreasing the risk of chronic diseases such as heart disease and cancer, and improving overall health. A balanced diet should provide the necessary nutrients for the body to function correctly. Food calories are a measure of the energy stored in food, which the body utilizes for various activities such as breathing, walking, and running. While the average person requires approximately 2000 calories daily, calorie intake is dependent on physical characteristics like weight, height, age, and gender. As a result, one's food choices impact not just their current wellbeing but also their future health. Therefore, a suggested diet plan based on one's physical characteristics and goals may be recommended by a diet recommendation system.

Keywords- Recommendation System, Diet Plan, Body Mass Index, Basic Metabolic Rate, Machine Learning, Harris-Benedict equation, Calories

I. INTRODUCTION

Nowadays, poor diet and nutrition are major contributors to various health problems and diseases, including heart attacks, gastrointestinal cancers, and deficiencies in vitamins and minerals. Incorporating a well-balanced diet into fitness routine is essential for achieving desired results. To address this, a diet recommendation system has been developed. This system uses information provided by users, such as their age, gender, height, weight and working hours to recommend a balanced diet that meets their specific needs. While exercise is undoubtedly important, a nutritious diet based on physical aspects can help to reach and maintain a healthy weight, reduce risk of chronic diseases, and promote overall health. However, knowing what to eat and how much can be overwhelming, especially for those new to the fitness world. Fortunately, advancements in technology have led to the development of diet recommendation systems, designed to provide personalized diet plans based on an individual's physical aspects, preferences, and fitness goals.

Challenges :

i) Data quality: The accuracy of the diet recommendation system heavily relies on the quality of the data. The system

needs to have access to accurate and reliable data regarding the user's health status, dietary restrictions, preferences, and lifestyle choices. Missing or incomplete data can also affect the performance of the recommendation system.

ii) Feature selection: The selection of relevant features that can influence diet recommendations is another challenge. Relevant features may include the user's age, gender, weight, height, physical activity level, and medical history. Additionally, dietary restrictions, food preferences, and cultural background should also be considered.

iii) Personalization: Another challenge is to provide personalized recommendations that are tailored to the user's individual needs and preferences. The system needs to be able to adapt and learn from user feedback to improve the accuracy of recommendations over time.

II. LITERATURE REVIEW

[1] Personalized nutrition: Moving from static to dynamic dietary recommendations" (M. Celis-Morales et al., 2019): This review article discusses the importance of personalized nutrition and the challenges associated with developing effective diet recommendation systems. The authors highlight the need for more accurate and reliable dietary assessment methods, as well as the use of machine learning and other advanced technologies to improve the precision of personalized recommendations.

[2] Personalized Diet and Exercise Recommender System for Patients Suffering from Metabolic Syndrome and Obesity" by A. J. Silva et al. (2020): This study proposed a personalized diet and exercise recommender system for patients suffering from metabolic syndrome and obesity. The system used machine learning algorithms to analyze the patient's health data, such as medical history, age, and gender, to provide personalized recommendations for a healthy diet and exercise plan.

[3] A personalized diet recommendation system for athletes based on the glycemic index" by S. Pourramezan et al. (2020): This study proposed a personalized diet recommendation system for athletes based on the glycemic index (GI) of foods. The system used machine learning algorithms to analyse the athlete's training data, such as their exercise intensity and duration, to provide personalized recommendations for a diet that would optimize their athletic performance.

[4] A personalized diet recommendation system based on the genetic algorithm" by T. H. Nguyen et al. (2021): This study proposed a personalized diet recommendation system based on the genetic algorithm. The system used machine learning algorithms to analyse the user's health data, such as body

mass index (BMI), blood pressure, and cholesterol levels, to provide recommendations for a healthy diet.

[5] Smart Diet Recommender System Based on Personal Health Data Analysis" by M. K. Rahman et al. (2018): This study proposed a smart diet recommender system based on personal health data analysis. The system used machine learning algorithms to analyse the user's health data, such as their age, gender, weight, and physical activity, to provide personalized recommendations for a healthy diet.

III. METHODOLOGY

Our approach to calculate the user's daily caloric needs based on their weight, height, age, gender, and activity level, and recommends meals based on their calorie range.

The system randomly selects items from different food groups (protein, fruit, vegetable, grains, etc.) to provide a balanced meal plan for the user. The meal plan includes breakfast, lunch, dinner, and snacks.

The system has three stages: the Information Collection Phase, the Learning Phase, and the Recommendation Phase. During the Information Collection Phase, data is collected on a particular problem and various solutions are categorized. In the Learning Phase, conclusions are drawn from the collected information. Finally, the Recommendation Phase provides a list of recommendations based on the user's physical aspects, preference, and Body Mass Index (BMI). This system aims to provide personalized and effective diet recommendations to improve the health and wellbeing of individuals. The use of Harris-Benedict equation to calculate the user's daily calorie requirements and then generates meal plans with foods from various food groups such as protein, fruits, vegetables, grains, and snacks. There are mainly 3 phases which includes,

1. The study is to consider various important aspects of the user's lifestyle and make sure that these factors are incorporated while the system works on a solution to build and recommend a healthy and nutritious diet for the user.

2. A good nutritious healthy diet and a moderate amount of physical activity can help in maintaining a healthy weight. But the benefits of good nutrition have a lot more to do than just managing the weight.

3. Being fit is all about the 70/30 rule. Here's how it goes, for a person to stay healthy he/she must focus 70% on his dietary intake and 30% on his physical activity/exercise.

Harris-Benedict equation

The Harris-Benedict equation is a mathematical formula used to estimate an individual's basal metabolic rate (BMR), which is the amount of energy or calories required to maintain bodily functions at rest.

The equation was developed by two scientists, James Harris and Francis Benedict, in 1919 and was originally used to estimate the calorie requirements of soldiers. Over time, it has been modified and updated to improve its accuracy and applicability to various populations.

The Harris-Benedict equation takes into account an individual's age, sex, weight, and height, and it provides an estimate of their BMR based on these factors. BMR is the minimum amount of energy required to sustain vital functions such as breathing, circulation, and maintaining body temperature. Knowing one's BMR can be useful in creating a nutrition or weight loss plan, as it gives an estimate of how many calories an individual needs to consume in order to maintain, gain, or lose weight.

The Proposed System

A diet recommendation system is a system that recommends a specific diet plan to individuals based on their dietary preferences, health goals, and lifestyle. The system calculates a daily caloric requirement based on user input (weight, height, age, gender, and activity level) using the Harris-Benedict equation, which is a formula that estimates resting energy expenditure (REE) or basal metabolic rate (BMR).

IMPLEMENTATION

The system calculates the basal metabolic rate (BMR) of a person based on their weight, height, age, gender, and level of physical activity. It then suggests a sample meal plan based on the calculated BMR.

It consists of several input fields and a drop-down menu for the user to select their gender and physical activity level. Once the user enters their information and clicks on the "Calculate" button, the program calculates their BMR using the Harris-Benedict equation and suggests a sample meal plan based on the calculated BMR.

The calculated caloric requirement is then used to generate a diet plan based on two calorie ranges: below 1500 calories and between 1500 and 1800 calories.

For the first calorie range (below 1500 calories), the code generates a diet plan consisting of five meals/snacks using predefined lists of foods for each meal category (protein, fruit, vegetable, grains, and ps (protein sources)). The food items for each meal category are chosen randomly using the `randint()` function, and the chosen food items are displayed on the browser. For the second calorie range (between 1500 and 1800 calories), the code generates a similar diet plan as the first calorie range, but with an additional fruit item for lunch.

The suggested meal plan includes five meals: breakfast, lunch, snack, dinner, and a second snack. The specific food items for each meal are randomly selected from predefined lists of proteins, fruits, vegetables, grains, and "tasty extras." The food items are chosen based on the calculated BMR and are intended to provide a balanced and healthy meal plan for the user.

Overall, this program can be a useful tool for anyone looking to improve their diet and maintain a healthy lifestyle.

FLOW CHART

1. User's will enter the necessary information like their age, gender, weight, working hours et.
2. The information will then go through the ML model.
3. Then, it generates meal plans based on the person's caloric requirements.
4. After analysing all the data the system will calculate user's BMI and their current state (total daily energy expenditure).
5. The system will then recommend diet to the users into three categories (breakfast, lunch, dinner, snacks) based on input
6. The users can choose from multiple recommended items and make their diet plan.

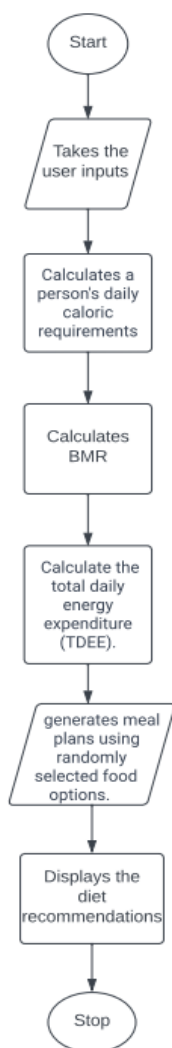


Fig 1 :- Flow Chart of Diet Recommendation System

IV. RESULT AND ANALYSIS

List of food items categorized by their respective food groups, and some additional items categorized as "taste enhancers" that can be added to a meal for flavour.

```

def predict_diet():
    protein = ['Yogurt(1 cup)', 'Cooked meat(3 Oz)', 'Cooked fish(4 Oz)', '1 whole egg + 4 egg whites', 'Tofu(5 Oz)']
    fruit = ['Berries(80 Oz)', 'Apple', 'Orange', 'Banana', 'Dried Fruits(Handfull)', 'Fruit Juice(125ml)']
    vegetable = ['Any vegetable(80g)']
    grains = ['Cooked Grain(150g)', 'Whole Grain Bread(1 slice)', 'Half Large Potato(75g)', 'Oats(250g)', '2 corn tortillas']
    ps = ['Soy nuts(1 Oz)', 'Low fat milk(250ml)', 'Hummus(4 Tbsp)', 'Cottage cheese (125g)', 'Flavored yogurt(125g)']
    taste_en = ['2 TSP (10 ml) olive oil', '2 TBSP (30g) reduced-calorie salad dressin', '1/4 medium avocado', 'Small handful of nuts', '1/2 ounce grated Parmesan cheese', '1 TBSP (20g) jam, jelly, honey, syrup, sugar']
    
```

Fig 2:-Dataset(List of food items categorized by their respective food groups)

```

<body>
<h1><center>AI DIETITIAN</center></h1>
<form action="#" method="POST">
<label for="height">Height (in cm):</label>
<input type="number" id="height" name="height">
<label for="weight">Weight (in kg):</label>
<input type="number" id="weight" name="weight">
<label for="age">Age:</label>
<input type="number" id="age" name="age">
<label for="gender">Gender:</label>
<select id="gender" name="gender">
<option value="male">Male</option>
<option value="female">Female</option>
</select>
<label for="hrs">Your working hours:</label>
<select id="hrs" name="hrs">
<option value="1">Sedentary(little or no exercise)</option>
<option value="2">Lightly active(1-3 days/week)</option>
<option value="3">Moderately active(3-5 days/week)</option>
<option value="4">Very active(6-7 days/week)</option>
<option value="5">super active(twice/week)</option>
</select>
<button type="submit" name="submit">Submit</button>
</form>
</body>
    
```

Fig 3:-Required user inputs

Calculates a person's daily calorie needs based on their gender, weight, height, age, and activity level, and then generates a meal plan based on their calorie needs.

```

if gender == 'Male':
    cal = 88.362 + (13.397 * float(w)) + (4.799 * float(h)) - (5.677 * float(age))

elif gender == 'Female':
    cal = 447.593 + (9.247 * float(w)) + (3.898 * float(h)) - (4.330 * float(age))

if act == 'Sedentary (little or no exercise)':
    cal = cal * 1.2

elif act == 'Lightly active (1-3 days/week)':
    cal = cal * 1.375

elif act == 'Moderately active (3-5 days/week)':
    cal = cal * 1.55

elif act == 'Very active (6-7 days/week)':
    cal = cal * 1.725

elif act == 'Super active (twice/day)':
    cal = cal * 1.9

if cal < 1500:
    fin = ("Breakfast: " + protein[randint(0, 5)] + " " + fruit[randint(0, 5)] )

    fin2 = ("Lunch: " + protein[randint(0, 5)] + " " + vegetable[0] + " " + Leafy Greens + grains[
        randint(0, 4)] + " " + taste_en[randint(0, 5)])

    fin3 = ("Snack: " + ps[randint(0, 4)] + " " + vegetable[0])

    fin4 = ("Dinner: " + protein[randint(0, 5)] + " " + 2 + " " + vegetable[0] + " " + Leafy Greens + grains[
        randint(0, 4)] + " " + taste_en[randint(0, 5)])

    fin5 = ("Snack: " + fruit[randint(0, 5)])
    
```

Fig 4:-Given conditions and calculates a person's daily calorie needs

This code is a simple HTML form that takes input from the user about their height, weight, age, gender, and working hours. Upon submitting the form, the data is sent to a Python script running on localhost:5000/predict_diet using a POST request. The Python script processes the data and returns a JSON response that is displayed on the same webpage.

Form of required user inputs:

The PHP code handles the POST request from the form submission and sends the data to the Python script using the

file_get_contents() function. The response from the Python script is decoded from JSON format and displayed on the webpage using echo statements in HTML paragraph tags.

AI DIETITIAN

Height (in cm):
167

Weight (in kg):
55

Age:
23

Gender:
Female

Your working hours:
Moderately active(3-5 days/week)

Submit

Fig 5:-User Interface

Breakfast:1 whole egg + 4 egg whites + Berries(80 Oz)

Lunch: Cooked fish(4 Oz) + Any vegetable(80g) + Leafy GreensHalf Large Potato(75g) + Small handful of nuts

Snack: Cottage cheese (125g) + Any vegetable(80g)

Dinner: Yogurt(1 cup) + 2 Any vegetable(80g) + Leafy GreensOats(250g) + 2 TSP (10 ml) olive oil

Snack: Fruit Juice(125ml)

Fig 6:-Personalized Diet Recommendations

V. CONCLUSION

This paper discusses diet recommendation system in fitness is a useful tool for individuals looking to achieve their fitness goals. By taking into account factors such as gender, age, weight, height, and activity level, the system can provide personalized meal plans that are tailored to the individual's needs. The meal plans include a variety of food groups such as protein, vegetables, fruits, grains, and healthy fats, providing a balanced diet for optimal health and fitness. However, it is important to note that this system is not a substitute for professional medical advice and consultation with a registered dietitian or healthcare provider is recommended before starting any diet or exercise program.

The diet recommendation system can also benefit fitness professionals, such as personal trainers and nutritionists, as

it provides them with a tool to generate nutrition plans for their clients, saving them time and effort in creating personalized plans from scratch.

Overall, the diet recommendation system is an innovative solution that can significantly improve the effectiveness of nutrition planning in the fitness industry, helping individuals achieve their fitness goals and promoting optimal health and wellness. However, it is important to note that the system should not be used as a substitute for professional medical advice and consultation with a licensed healthcare professional is always recommended before starting any new diet or fitness program.

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