



## **NutriTrack - AI-Based Health Wellness System**

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Submitted in partial fulfillment of the requirements of the  
degree of

**Bachelor of Engineering  
(Information Technology)**

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## **AIDS Lab Exp 11**

**Aim:** Mini Project – NutriTrack - AI-Based Health Wellness System

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### **1.1 Introduction**

In today's fast-paced lifestyle, individuals often struggle to maintain a healthy diet and fitness regime tailored to their specific body requirements and goals. Generic dietary recommendations often fall short in catering to personalized needs, which may vary based on age, gender, activity levels, and health conditions.

### **2.2 Design and Implementation**

The design and implementation of the personalized diet and nutrition recommendation system are centered around creating an intuitive, responsive, and intelligent platform that seamlessly integrates a user-friendly frontend with a robust backend powered by machine learning models. The system is developed using React for the frontend and FastAPI for the backend to ensure efficient, scalable, and real-time communication between the user interface and the machine learning recommendation engine.

### **2.3 Feature Scaling**

RFM values were standardized using StandardScaler to ensure equal contribution to clustering models.

### **2.4 Evaluation Analysis**

#### **KNN (with Cosine Similarity):**

KNN recommends recipes by comparing the target nutritional vector (e.g., Calories, Protein) with each recipe's 9 scaled nutritional features using cosine similarity, after applying ingredient/allergy filters. Chosen for its simplicity, no training requirement, compatibility with filtering, and baseline performance (MSE: 51095.76), it's ideal for direct nutritional matching on small datasets.

#### **Weighted Euclidean Distance:**

A KNN variant using a weighted distance metric to emphasize key nutrients (e.g., Calories weight=2.0), improving control over deviations (Calories deviation reduced from 76.07% to 56.38%). Achieved better MSE (38406.71) than cosine, supports user-driven nutrient prioritization, and integrates with existing filters.

#### **K-Means Clustering:**

Clusters recipes into k groups (e.g., 50) based on nutritional features. For a target input, the closest cluster is selected, and top recipes are recommended. It improves diversity, efficiency, and handles cases with few exact matches, complementing KNN with pattern-based grouping.

## Support Vector Regressor (SVR):

Trains 9 regressors (one per nutrient) using TF-IDF ingredients and time features to predict nutritional values. Recommendations are based on distance between predicted profiles and the target. Chosen for modeling ingredient-nutrient relationships, handling high-dimensional data, and reducing nutrient deviations with supervised learning.

## Chapter 4: Results and Discussion

### 4.1 Dataset Description

The recipes dataset contains 522,517 recipes from 312 different categories. This dataset provides information about each recipe like cooking times, servings, ingredients, nutrition, instructions, and more.

RecipeId, Name, CookTime, PrepTime, TotalTime, RecipeIngredientParts, Calories, FatContent, SaturatedFatContent, CholesterolContent, SodiumContent, CarbohydrateContent, FiberContent, SugarContent, ProteinContent, RecipeInstructions

#### 4.1 KNN:

KNN, a simple supervised algorithm, predicts based on the average of K similar data points. With MSE of 30517.99 and MAE of 101.99, it offers balanced nutrient deviations (e.g., Calories 24.01%), making it the most consistent and reliable model in this setup.

```
Evaluation Metrics for Breakfast:
MSE: 30517.99
MAE: 101.99
Deviation Percentages (%):
  Calories: 24.01%
  FatContent: 30.20%
  SaturatedFatContent: 30.50%
  CholesterolContent: 49.94%
  SodiumContent: 21.27%
  CarbohydrateContent: 66.75%
  FiberContent: 53.67%
  SugarContent: 46.50%
  ProteinContent: 54.74%
```

### 4.2 KMeans Clustering

K-Means clusters recipes by nutritional similarity and showed lower MSE (19047.16) and MAE (79.63). However, higher deviations (e.g., Protein 58.04%) and its unsupervised nature limit its use for precise predictions, making KNN a better choice overall.

```
Evaluation Metrics for Breakfast:
MSE: 19047.16
MAE: 79.63
Deviation Percentages (%):
  Calories: 31.24%
  FatContent: 19.13%
  SaturatedFatContent: 20.33%
  CholesterolContent: 45.38%
  SodiumContent: 8.42%
  CarbohydrateContent: 52.84%
  FiberContent: 24.80%
  SugarContent: 46.70%
  ProteinContent: 58.04%
```

### 4.3 KNN (Weighted Euclidean Distance)

This KNN variant prioritizes nutrients via weights but had higher MSE (38406.71), MAE (108.02), and poor calorie accuracy (76.07% deviation). Despite benefits like customizable importance, it lacked the precision for effective recommendations.

```
Evaluation Metrics for Breakfast:
MSE: 22125.59
MAE: 85.94
Deviation Percentages (%):
  Calories: 38.06%
  FatContent: 16.47%
  SaturatedFatContent: 22.83%
  CholesterolContent: 41.70%
  SodiumContent: 10.53%
  CarbohydrateContent: 47.70%
  FiberContent: 34.13%
  SugarContent: 41.90%
  ProteinContent: 55.12%
```

### 4.4 Support Vector Regression

SVR, though powerful, had the worst performance (MSE: 174111.09, MAE: 218.83) with very high nutrient deviations (e.g., Protein 88.88%). Its sensitivity to noisy data led to poor generalization, making it unsuitable for this task.

```
Evaluation Metrics for Breakfast:
MSE: 174111.09
MAE: 218.83
Deviation Percentages (%):
  Calories: 49.27%
  FatContent: 34.47%
  SaturatedFatContent: 16.17%
  CholesterolContent: 43.15%
  SodiumContent: 73.07%
  CarbohydrateContent: 85.81%
  FiberContent: 92.27%
  SugarContent: 40.20%
  ProteinContent: 88.88%
```

## 4.6 Streamlit App Output

### Meal Recommendations

#### Breakfast

##### Grandma's Stuffed Peppers

545.7 kcal 28.3g protein 79g carbs 14.8g fat

Prep: 30 min Cook: 3 hr

**Ingredients:**  
parmesan cheese, white rice, sliced tomatoes, garlic powder, eggs, pepper, onion, fresh garlic cloves, green peppers, pre-shredded mozzarella cheese

White Rice

##### Albondigas Soup

549.8 kcal 34.8g protein 76.4g carbs 13.9g fat

Prep: 30 min Cook: 30 min

**Ingredients:**  
lean ground beef, beef bouillon cubes, potatoes, carrots, onion, zucchini, celery, cabbage, corn, cooked rice, fresh cilantro, egg

Meat

##### Tagliatelle With Fresh Tomatoes and Balsamic Vinegar

623.2 kcal 29.4g protein 100.3g carbs 12.7g fat

Prep: 30 min

**Ingredients:**  
garlic cloves, sweet onion, tomatoes, fresh basil, tagliatelle pasta noodles, fettuccine, parmigiano-reggiano cheese

European

##### Eggplant (Aubergine) Parmesan Stacks

747.7 kcal 36.2g protein 108.7g carbs 20.5g fat

Prep: 15 min Cook: 25 min

**Ingredients:**  
eggplant, potato, olive oil flavored cooking spray, onion, garlic cloves, fresh basil leaves, dried basil, tomato puree, part-skim mozzarella cheese, parmesan cheese, fresh rosemary

Grains

##### Unbelievable Boiled Meatloaf

537.3 kcal 26.8g protein 72.5g carbs 15.6g fat

Prep: 20 min Cook: 2 hr

**Ingredients:**  
ground beef, salt, pepper, bay leaf, parsley, eggs, onion, tomato sauce, potatoes

Meat

Meal recommendations based on user data

### Custom Diet Plan

Enter your desired nutritional values to get a custom diet plan.

#### Nutritional Targets

Calories	Fat Content
<input type="text" value="1200"/>	<input type="text" value="30"/>
Saturated Fat Content	Cholesterol Content
<input type="text" value="30"/>	<input type="text" value="100"/>
Sodium Content	Carbohydrate Content
<input type="text" value="20"/>	<input type="text" value="130"/>
Fiber Content	Sugar Content
<input type="text" value="26"/>	<input type="text" value="11"/>
Protein Content	
<input type="text" value="20"/>	

Include Ingredients

Allergies & Exclusions

### Custom Diet Recommendations

#### Breakfast

##### Potatoes Primavera

A nice simple side dish or vegetarian main all cooked in the one pan, add extra vegies if you like, capsicums and mushies go good in this too.

Calories: 386.0 kcal Protein: 13.1g

Carbs: 50.2g Fat: 16.4g

**Ingredients:**  
potatoes, butter, margarine, onion, garlic clove, zucchini, carrot, tomatoes, parmesan cheese, lemon juice, pine nuts

##### Carrot, Orange & Cumin Soup

Make and share this Carrot, Orange & Cumin Soup recipe from Food.com.

Calories: 368.3 kcal Protein: 10.3g

Carbs: 48.7g Fat: 15.8g

**Ingredients:**  
fresh carrots, butter, cumin seed, potatoes, onion, celery leaves, sea salt, black pepper, nutmeg, cornflour, milk

##### Simple Potato Curry

The following curry is very simple and has become a family favourite, it doesn't use any fancy spices and both my sons can make it from scratch!

Calories: 405.7 kcal Protein: 10.1g

Carbs: 56.3g Fat: 16.8g

**Ingredients:**  
onions, garlic, fresh ginger, butter, potatoes, curry powder, white wine vinegar, fresh lemon juice, salt, black pepper

##### Potato, Rutabaga & Parsnip Casserole

I finally convinced my brother that onions are edible. So now I serve this

Custom diet recommendations based on user requirements


Log Food


Today's Summary


Set Goals


Log Your Food


yoghurt

soy yoghurt

yoghurt soup

fruit yoghurt

yoghurt muesli

frozen yoghurt


Log Food

Today's Summary

Set Goals

Log Your Food

yoghurt

soy yoghurt

Serving Size: 1 container  
Weight: 170g

Meal Name

Breakfast

Serving Size

1 container (170g)

Quantity

1

Nutritional Summary

Calories:159.8

Protein:4.0g

Total Fat:2.0g

Saturated Fat:0.0g

Cholesterol:0.0mg

Sodium:25.5mg

Carbohydrates:31.0g

Fiber:1.0g

Sugar:22.0g

Log Food

Custom Diet goals based on user intake

## Conclusion

This project explored multiple models for recipe recommendation based on nutritional goals, comparing both supervised and unsupervised approaches. Among all, KNN emerged as the most reliable due to its consistent accuracy, balanced deviations, and simplicity. While K-Means showed promising MAE, its lack of predictive depth limits its utility. Overall, KNN offers the best balance of precision, interpretability, and adaptability for personalized nutritional recommendations.