



## Government Engineering College Palakkad, Sreekrishnapuram

Under Section 2(f) of UGC Act 1956  
(Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University)



# ChatDiet: Empowering personalized nutrition-oriented food recommender chatbots through an LLM-augmented framework

SEMINAR GUIDE : MRS SUJO VASU

DATE: OCTOBER 9 ,2024

NAME: ASHA K WILSON

REG NO: PKD21IT024

---

# AGENDA

- INTRODUCTION
  - CHATDIET FRAMEWORK - MAJOR COMPONENTS
  - CHATDIET - CASE STUDY
  - ARCHITECTURE
  - CHAT DIET EVALUATION
  - CRITICAL CHALLENGE
  - CONCLUSION
  - REFERENCE
-

---

# INTRODUCTION

- Nutrition impacts overall well-being, disease management, sleep, mood, and immunity.
  - Technology is increasingly used to improve health through food recommendations.
  - Traditional food services often prioritize taste over nutritional health.
  - Nutrition-oriented recommendations encourage healthy, sustainable eating habits.
  - Conventional nutrition services struggle with personalization and interactivity.
-

---

# Why Nutrition-Oriented Food Recommendation system ?

**Focus on  
Nutritional  
Content**

**Customization  
for Health  
Conditions**

**Challenges in  
Personalization**

**Need for  
Explainability  
and Interactivity**

---

## Why Exploiting LLMs for Recommendation Tasks ?

- LLMs Adaptability

### Role of LLMs

- Serve as central model or facilitator.
- Data transformation

### Implementation

- Prompt Engineering
- Abstract Embeddings

### Limitations

- Direct use of personal data.
  - Challenges in handling complex physiological and health data.
-

---

# CHATDIET FRAMEWORK - MAJOR COMPONENTS

**Personal Model:** Integrates individual-specific data, tailoring recommendations to the user's unique health and nutritional needs.

**Population Model:** Incorporates general nutrition knowledge relevant to the population, providing a broader context for recommendations.

**Orchestrator:** Mediates between user queries and models, gathers relevant information from both personal and population models.

**LLM:** Combines aggregated data from the orchestrator with its internal knowledge to generate personalized and contextually relevant food recommendations.

---

## CHATDIET - CASE STUDY

**Objective:** Focuses on the intricate connection between dietary habits, physical activity, sleep, and health outcomes for providing personalized food recommendations.

### Dataset Used

- N-of-1 Dataset (3 Years)

### Devices Used

- Oura Ring
- Arboleaf Smart Weighing Scale
- Cronometer Food-Logging Application
- Apple HealthKit

### Synthetic Dataset

- To quantitatively evaluate ChatDiet with a larger sample size.
-

---

# Personal Model

**Purpose:** The Personal Model integrates unique, individual-specific data into the recommendation process.

**Personal Data:** Food preferences, dietary history, electronic health records, and physiological signals from wearable devices.

**Implementation:** Utilizes causal discovery and inference methods to identify how nutrition affects health outcomes.

---



---

# Population Model

## **Purpose:**

Provides population-level information to ground personal recommendations in general dietary trends and health norms.

**Population Data:** Food knowledge graphs , General nutritional standards , Public dietary guidelines , Nutritional and supplement facts

**Data Forms:** Text and non-text data used to enhance recommendations.

---

---

## Orchestrator

The Orchestrator in the ChatDiet framework performs three key tasks to enhance food recommendations:

### Retrieving:

- Selects the most relevant data from Personal and Population Models based on user queries.

### Transcribing:

- Converts non-textual data into text formats, enabling effective input for LLMs.

### Prompt Engineering:

- It ensures that the LLM understands its role and context in the conversation.
-

---

## Generative Response

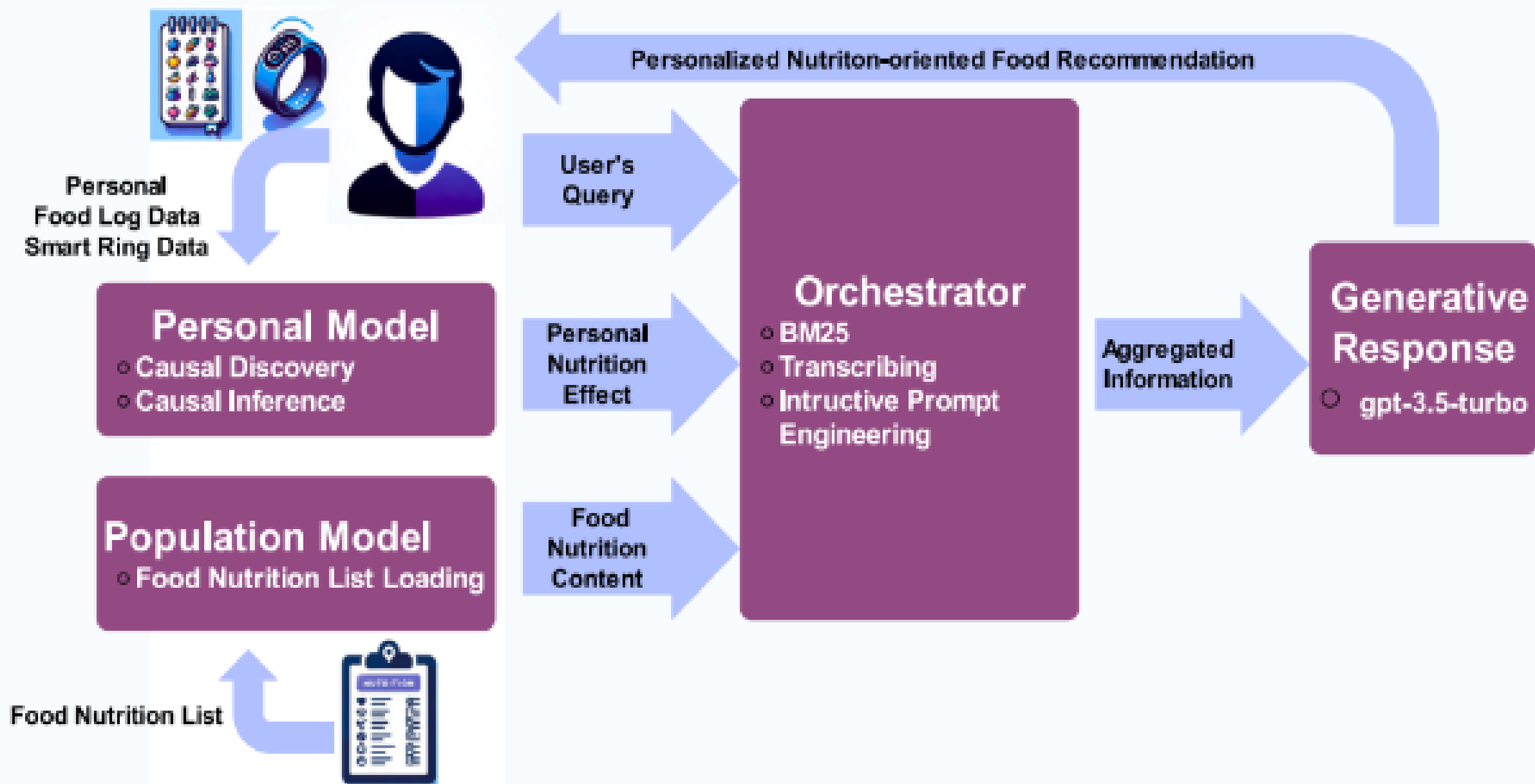
- Purpose:** Generate personalized, nutrition-oriented food recommendations.

**Role:** Processes data from the Orchestrator to generate responses.

**Integration:** Combines personal context, population knowledge, and the user's query processed by the Orchestrator.

**Model Used:** GPT-3.5-turbo

---



---

## CHATDIET EVALUATION

- Purpose: Assess effectiveness of food recommendations, explainability, personalization, and interactivity.
- Evaluation Details:
  - Effectiveness Test Results:
    - HRV: 0.95
    - Overall Sleep Quality: 0.93
    - REM Sleep Duration: 0.85
    - Deep Sleep Duration: 0.95

---

## Quantitative Validation of Effectiveness

### Example:

- If a recommendation explains that a food (e.g., Acai berries) affects a health outcome (e.g., deep sleep) due to a specific nutrient (e.g., Vitamin E), and this aligns with the estimated nutritional impact, the recommendation is classified as 'correct'.

### Results:

- Recommendation Effectiveness Ratio (RER):
    - HRV: 0.95
    - Overall Sleep Quality: 0.93
    - REM Sleep Duration: 0.85
    - Deep Sleep Duration: 0.95
-

---

## ChatDiet's Explainability

Objective: Showcase ChatDiet's ability to explain its recommendations.

### Features:

- **Explainability:** Emphasizes the logic and decision-making process behind recommendations.
  - **Example:**
    - If a user wants to improve REM sleep duration, ChatDiet suggests foods rich in Vitamin E, Valine, and Protein (e.g., Almonds).
-

---

## **ChatDiet's Personalization**

**Objective:** Show ChatDiet's ability to tailor food recommendations based on **individual nutrition effects**.

**Personalization Approach:** Illustrates how ChatDiet integrates personal data into recommendations, contrasting with general population knowledge.

---



---

## ChatDiet's Interactivity Demonstration

**Objective: Demonstrate ChatDiet's interactive capabilities.**

### **Examples:**

- **Clarification:** Users can request more details if initial responses are unclear.
  - **Adaptability:** Offers alternative recommendations if the user shows disinterest in suggested foods.
-



## EXAMPLE

What food would you recommend to enhance my REM sleep?

Based on your personal nutrition effects, I recommend consuming foods high in Valine (g) to improve your REM sleep duration. Valine has a positive effect of 66.9828 per unit on REM sleep duration.

One food that is rich in Valine is tofu. Tofu is a plant-based protein source made from soybeans. It contains all essential amino acids, including Valine. Consuming tofu as part of your diet can provide a good amount of Valine, which can potentially improve your REM sleep duration.

ChatDiet



**\*Estimated by personal model, the average treatment effect of Valine on REM Sleep is 66.9828**

# CRITICAL CHALLENGE - HALLUCINATION IN RECOMMENDATIONS



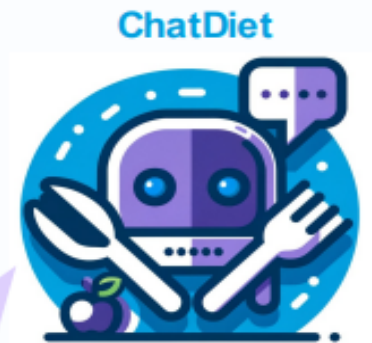
Suggest me a food to enhance my deep sleep duration.

Almonds contain several nutrients that have positive effects on deep sleep duration, such as vitamin E, magnesium, tryptophan, and tyrosine.

Vitamin E: Almonds are a good source of vitamin E, which has a positive effect on deep sleep duration (3.3408 per unit).

Tryptophan: Almonds also contain tryptophan, an amino acid that is a precursor of serotonin and melatonin, both of which aid in **promoting deep sleep (-22.8412 per unit)**.

Tyrosine: Additionally, almonds contain tyrosine, an amino acid that helps in the production of neurotransmitters like dopamine and norepinephrine, which are important for **regulating sleep (-6.5572 per unit)**.



---

## CONCLUSION

---

**Implementation Success:** The ChatDiet chatbot, developed using three years of individual health data, achieved a 92% effectiveness rate in food recommendations.

---

**Limitations:** ChatDiet's recommendations are limited to the factors available in the dataset, and occasional inaccuracies may occur, leading to nonsensical suggestions.

---

**Challenges:** Faced issues with hallucinations in recommendations, leading to inconsistencies and credibility concerns.

---

**Future Focus:** Future enhancements will include counterfactual analysis to predict user engagement and improve recommendation accuracy.

---

---

## REFERENCE

- Zhongqi Yang et al. ChatDiet: Empowering personalized nutrition-oriented food recommender chatbots through an LLM-augmented framework, smart health 32(1):100465 (March 2024).

---

THANK YOU

---





---

QUESTIONS

A 3D rendering of a large, bright orange question mark standing prominently in the center. It is surrounded by a dense field of dark grey, three-dimensional dollar signs (\$). The scene is lit from the upper left, creating strong highlights and shadows that emphasize the three-dimensional nature of the symbols. The background is a continuous field of these dollar signs, receding into the distance.

---