**Code and Workflow Documentation – GutMeal**

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**Introduction**We like to stay updated with market trends, which inspired us to develop GutMeal, a project focused on personalized nutrition solutions. We created a pharmacological model to predict meal recommendations tailored to an individual’s gut health, using gut microbe data. Throughout the project, we gathered and prioritized requirements, built detailed product backlogs, created Epic and feature level user stories and collaborated with data science and design teams to align the product with user needs and business objectives. Leveraging market research and data analysis, we validated product features and achieved a predictive accuracy of 85% with machine learning models**.**

**Overview of Our Work**

**Questionnaire Dataset Integration with ML:**

The Questionnaire Dataset is a pivotal part of the project, designed to gather comprehensive user data and feed it into the Machine Learning pipeline for accurate meal predictions. Here's how it works:

**Data Collection:**

The questionnaire collects key information such as dietary preferences, age, digestive issue, health conditions (e.g., allergies, chronic illnesses), and lifestyle habits (e.g., Stress Level, Sleep Quality). Responses are standardized and preprocessed to ensure compatibility with the Machine Learning model.

**Feature Engineering:**

Features are extracted from questionnaire responses to represent user-specific dietary needs and health constraints**.**

**Data Pre-Processing Steps:**

Numerical scores for health parameters (e.g., severity of food allergies).

One-hot encoding for categorical data like dietary restrictions (e.g., vegetarian, vegan).

Normalized values for continuous variables like daily caloric intake or activity levels.

**Model 1 Predictions:**

The processed dataset was used an input for different models such as logistic Regression, K nearest Neighbors and XGBoost. We got a 4% more accuracy deploying the XGboost model.

This model builds upon whether the user will be requesting a meal plan recommendation which is our next model.

Predictions are refined through iterative feedback from users, allowing the model to learn and improve over time.

**Meal Prediction Model with ML:**

The Meal Prediction Model is the core of the project, utilizing Machine Learning to generate personalized meal recommendations based on user data and gut microbe analysis. Here's an outline of how it works:

**Input Data:**

Gut Microbe Dataset: Simulates realistic gut microbiota compositions to understand dietary impacts on individual health.

**Model Selection:**

We employed XGBoost (Extreme Gradient Boosting), a powerful ensemble learning algorithm known for its efficiency and accuracy in tabular data predictions.

XGBoost was selected for its ability to handle heterogeneous features and its robustness against overfitting.

**Training and Validation:**

The model was trained on a synthetic dataset generated from gut microbe simulation.

Cross-validation techniques were applied to ensure the model generalizes well across diverse user profiles.

**Prediction Workflow:**

The model predicts meal plans by analyzing:

Nutritional needs derived from gut microbiota composition.

Dietary preferences and health conditions.

Lifestyle factors (e.g., BMI, Various types of allergies, Protein/Fat/Carb/Fiber Intake)

**Evaluation Metrics:**

The model's effectiveness is measured through:

Accuracy of meal recommendations aligned with health requirements.

Reduction in dietary conflicts (e.g., allergenic ingredients).

**Impact and Scalability:**

The ML-driven model enables scalable, real-time meal planning tailored to diverse user profiles.

It provides a foundation for integrating additional features, such as wearable device data, for even more precise recommendations.

**Business Model: Personalized Meal Plan Module for a Healthcare App**

We designed a new module focused on personalized recipe creation for individuals with dietary restrictions. This module uses AI and a structured workflow to:

Provide AI-generated meal plans tailored to user needs.

Enable collaboration between patients, doctors, and chefs for enhanced dietary management.

Offer educational resources to engage users and promote healthy choices.

Streamline follow-ups and feedback to ensure meal plans are effective.  
The Details of business process plan is available in another file- ‘Business model GutMeal’.