PantryPalette: Your Ingredient-Inspired Recipe Guide

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Problem statement:

Every day, households struggle with unused ingredients in their kitchens, often leading to food waste due to a lack of inspiration or knowledge on how to use them effectively. Many individuals resort to takeout or repetitive meals, simply because they don't know what to cook with the ingredients they already have.

Meanwhile, traditional recipe search methods require manual browsing through extensive databases, leading to time-consuming and frustrating experiences. Users with dietary restrictions, allergies, or cultural food preferences face an additional challenge in finding recipes that align with their needs.

PantryPalette is designed to solve this problem by offering a seamless, ingredient-based recipe discovery experience that helps users maximize their groceries, reduce food waste, and discover new meal ideas with ease.

Identification of What is to be Modeled:

To develop a robust and efficient **recipe recommendation system**, we will design an **NLP-based model** that can match a user's provided ingredients to relevant recipes. The following components will be included:

1. Data Sources.

- **Static Data**:
  - We will use the **RecipeNLG dataset**, which contains **~2 million structured recipes**. This will serve as a comprehensive database of diverse recipes for training and inference.

- **Dynamic Data**:
  - The **Spoonacular API** will be integrated to fetch **real-time recipe data**, ensuring that users receive up-to-date and diverse recipe recommendations.

2. Model Approach.

To ensure **efficient and interpretable** recipe recommendations, we will use a **lightweight NLP-based model** with the following steps:

a) Preprocessing:
- Tokenization of ingredient lists for structured analysis.
- Standardizing ingredient names and quantities (e.g., converting "½ cup" to "0.5 cup").

b) Feature Engineering:

- **TF-IDF Vectorization**: Transform ingredient lists into numerical representations for comparison.
- **Cosine Similarity**: Calculate ingredient-based similarity between user inputs and available recipes to **rank the most relevant results**.

c) Recommendation Strategy:

- Retrieve the **top-ranked recipes** based on ingredient overlap and similarity scores.
- Provide **alternative recommendations** by suggesting recipes that require minimal additional ingredients.

3. System Functionality.

- The system will be designed with **usability and efficiency** in mind, ensuring seamless interaction for end users.

Workflow:

- **Input**: Users provide a list of available ingredients.
- **Processing**:
  - Preprocess user input and extract key features.
  - Compare input ingredients with recipes using **TF-IDF & Cosine Similarity**.
  - Retrieve the most **relevant** recipes from the database.
- **Output**: Display a **ranked list of recipes** with:
  - Recipe name, ingredients, and cooking instructions.
  - Alternative ingredient suggestions (if any).
  - Links to external sources (if applicable).

4. Expected Outcome.

By the end of this project, we aim to have:

- A **fully functional, containerized** application that provides **real-time, ingredient-based recipe recommendations**.
- A **user-friendly interface** (via Streamlit) that allows non-technical users to interact with the system.
- A **scalable and efficient** NLP-based model that can handle large datasets while maintaining quick response times.
- **Comprehensive documentation** covering data sources, model decisions, deployment pipeline, and potential risks.