SmartBite:

AI-Driven Food Demand Forecasting and Waste Reduction System

Prashant Kumar (230101), Akula Jithendranath (230120), Manasa Chinnam (230078)

PROBLEM STATEMENT

Predicting daily food demand in college cafeterias to reduce shortages and food waste.

INTRODUCTION / MOTIVATION

College cafeterias often rely on manual estimation for meal planning, leading to food wastage, higher costs, and inefficiency. Predicting daily food demand for each meal, accounting for variations in time slots and special events, is challenging.

SmartBite leverages AI and Machine Learning to forecast food demand, analyze student preferences, and suggest menu adjustments to improve satisfaction. By presenting predictions, demand trends, and recommendations via an interactive dashboard, the system provides actionable insights to optimize meal preparation, resource utilization, and operational efficiency.

DATASET

The dataset will consist of historical cafeteria records containing daily meal details, including:

- **Date, Day of Week, Meal Type, Dish Name, Orders, Event Flag, Student Count etc**.

Data sources & approaches:

- **Primary:** Ask college admin for POS logs / billing history. Ideal: 6–12 months of data.
- **If not available:** Create a synthetic dataset (scripted simulator) that models realistic daily variation + event spikes. Start with synthetic data for early experiments, then swap in real data when available.
- **Public augmentation:** Search Kaggle/Hugging Face for food demand datasets to borrow patterns or initial baseline data.

LITERATURE REVIEW

Recent works in food demand forecasting demonstrate the effectiveness of combining traditional ML and deep learning models.

In [1], Random Forest and XGBoost improved prediction accuracy for daily meal demand.

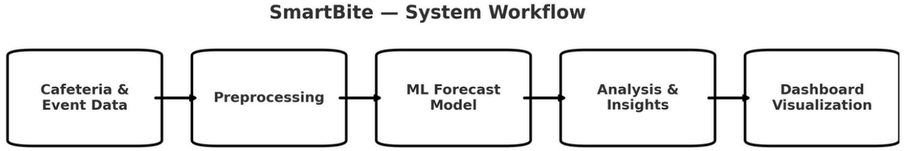
In [2], Prophet models effectively captured seasonality and event-based variations.

In [3], LSTM architectures modeled complex temporal dependencies with higher accuracy.

In [4], clustering and association rule mining revealed customer preferences for menu optimization.

TASKS

- Data collection and preprocessing.
- Exploratory data analysis **(EDA)**: visualize demand patterns across meals, weekdays, and events.
- Model development: baseline **(Linear Regression, XGBoost)** and advanced models **(LSTM, Prophet)**.
- Analyze student preferences to recommend popular dishes or alternatives.
- Dashboard development for real-time insights.
- Model evaluation using **MAE, RMSE**, and **MAPE**.



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