Optimized Model Framework for Restaurant Sales Prediction

1. Introduction

This document outlines a comprehensive framework for predicting the sales of specific products for restaurants over the next 1-7 days. The solution integrates a central model for general market-wide patterns and user-specific models for personalized predictions, ensuring a robust balance between generalization and customization.

2. Central Model

The central model captures market-wide sales trends using large-scale restaurant data. Key features include:

- Model Type: LSTM or Transformer (ideal for time-series data).

- Input Features: Product ID, date, sales, discount, price, restaurant type, event type, weather.

- Update Frequency: Monthly, using aggregated data from all users.

3. User-Specific Model

User-specific models leverage restaurant-specific historical and real-time data to provide personalized predictions. Key features include:

- Model Type: Gradient Boosting Decision Tree (GBDT) or lightweight neural networks.

- Input Features: Same as the central model, focusing on user-specific characteristics.

- Update Frequency: Daily, based on new data uploaded by the user.

4. Dynamic Fusion Mechanism

To balance predictions from the central and user-specific models, a dynamic fusion mechanism is employed. Short-term forecasts rely more on user-specific models, while long-term predictions weigh more towards the central model. The fusion formula is:

Final Prediction = alpha * (User Model Output) + (1 - alpha) * (Central Model Output), where alpha depends on forecast

duration and past model performance.