Forecasting Food Delivery Demand Using Weather & Time

Capstone Project

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Predictive Analysis of Food Delivery Orders Based on Weather Conditions

1. Introduction
The goal of this project was to predict the number of food delivery orders based on weather conditions, time of day and any other factors that play a role. This analysis allows the delivery companies to optimize their operations to reduce costs and maximize profit.

2. Problem Statement
The demand data for food delivery services is unequally distributed according to weather conditions, as well as other factors, such as time of day. These fluctuations must be accurately predicted in order to optimize workforce allocation, minimize operational costs, and maximize customer satisfaction.

3. Objectives
1. Build a predictive model to estimate the number of food delivery orders.
2. Analyze the impact of weather conditions on delivery demand.
3. Provide a cost-revenue-profit analysis for optimized decision-making.
4. Simulate scenarios for planning workforce and operational adjustments.

4. Methodology
The project methodology involves the following steps:
1. Data Preprocessing:
  - Handling missing and inconsistent data.
  - Encoding categorical features such as weather conditions and days of the week.
  - Scaling numerical features for consistent model input.

2. Model Training:
  - Using a Random Forest Regressor to predict delivery orders.
  - Training and testing the model with an 80-20 data split.

3. Cost and Revenue Analysis:
  - Calculating total delivery costs based on operational factors.
  - Estimating revenue and profit for each scenario.

5. Key Features
• Weather Conditions:
 - Clear, Rainy, Snowy.

• Time of Day:
 - Morning, Afternoon, Evening, Night.

• Numerical Features:
 - Temperature, Precipitation, Wind Speed.

6. Results

• Predictive Model:
 - The Random Forest Regressor provided accurate predictions of delivery demand.

• Cost-Revenue-Analysis:
 - Predicted Total Cost, Revenue, and Profit/Loss (CAD) for each time of day and scenario.

• Insights:
 - Higher demand observed during evenings and clear weather.
 - Profit margins vary significantly with weather and time.

7. Challenges

1. Handling missing and inconsistent data entries.
2. Incorporating multiple external factors like traffic or holidays.
3. Balancing model complexity with interpretability.

8. Conclusion and Recommendations

We show through this project that it is possible to predict food delivery orders given weather conditions and the time of day. It is formulated based on cost revenue analysis for delivery companies to gain actionable insights to optimize operations.