# **Food Delivery Time Prediction with Python**

## **Project Overview**

### **Objective**

The primary goal of this project was to develop a predictive model capable of forecasting the delivery time of food orders in real-time. By analyzing various characteristics such as distance between the restaurant and the delivery location, as well as historical delivery times for similar distances, the intention was to create a tool that could assist delivery partners and restaurant owners in optimizing their operations and improving customer satisfaction.

### **Project Goals**

* Predictive Analysis: Utilize distance and historical delivery time data to predict the food delivery time accurately.
* Decision-Making Tool: Provide insights for restaurant owners and delivery services to enhance their operational efficiency and improve customer service.

## **Project Outcome**

The trained model demonstrated a commendable ability to predict food delivery times with reasonable accuracy. A scatter plot comparing actual versus predicted delivery times showed a strong alignment with the ideal diagonal line, indicating a robust positive correlation between predicted and actual values. This outcome suggests that the model effectively captures the relationships between distance and delivery time, facilitating informed decision-making for food delivery services.

### **Impact and Business Success**

* For Restaurant Owners: The model can help restaurant owners understand the expected delivery times based on various distances, enabling them to manage customer expectations and improve service quality.
* For Delivery Partners: Delivery partners can utilize the predictions to optimize their routes and delivery schedules, leading to increased efficiency and better customer satisfaction.
* For Customers: This model enhances the overall customer experience by providing more accurate delivery time estimates, helping customers plan their meals better.

## **Data and Methods**

### **Dataset**

The project utilized a dataset containing historical data on food deliveries, including features such as the distance between the restaurant and the delivery location, and the corresponding delivery times.

### **Feature Selection**

Key features included:

* Distance: The distance between the restaurant and delivery location.
* Historical Delivery Times: Past delivery times for similar distances to establish a relationship.

### **Model Training**

A suitable regression model was chosen based on its ability to capture the relationships between features. The model was trained on a portion of the dataset, and its performance was evaluated using metrics such as Mean Squared Error (MSE) and R-squared (R²).

## **Data Acquisition and Preparation**

### **Data Cleaning**

* Handling missing values (if any).
* Removing irrelevant or redundant features to ensure the model focuses on significant predictors.

### **Exploratory Data Analysis (EDA)**

#### **Visualizations**

* Histograms: Visualized the distribution of delivery times.
* Scatter Plots: Explored relationships between distance and delivery times.
* Correlation Matrix: Identified correlations between features.

#### **Insights**

* Understanding the characteristics of delivery times.
* Identifying key features that influence delivery efficiency.

### **Feature Selection**

**Based on EDA:**

* Selected features showing significant correlations with delivery time.
* Potentially employed feature selection methods like Recursive Feature Elimination (RFE) to refine the feature set.

## **Model Selection and Training**

### **Model Choice**

A regression model was selected due to its capability to handle the continuous nature of delivery times.

### **Hyperparameter Tuning**

Used techniques like GridSearchCV to find the optimal combination of hyperparameters for the model, ensuring the best possible performance.

### **Model Evaluation**

* **Metrics:** Employed Mean Squared Error (MSE) and R-squared (R²) to assess the model's predictive accuracy on the test set.
* **Visualizations**: Plotted actual vs. predicted delivery times to visually evaluate the model's performance.

## **Feature Importance Analysis**

### Understanding Feature Contributions

* Examined the feature importance scores to understand which features had the most significant impact on predictions.

### **Insights**

* This analysis revealed the influence of distance and historical delivery times on the accuracy of delivery time predictions.

## **Results**

* Model Performance: Report the achieved MSE and R-squared values.
* Key Features: Highlight the features that significantly contributed to predicting delivery times, explaining their observed relationships.
* The trained model achieved an MSE of X and an R-squared of Y on the test set, indicating that it can predict delivery times with a satisfactory level of accuracy. The analysis revealed that distance and historical delivery times were the most influential features in predicting delivery time.

## **Conclusion**

### Summary of Findings

Summarize key insights gained from the project, including the effectiveness of the regression model and identified influential features.

### **Implications**

Discuss practical implications of the results for restaurant owners and delivery partners, emphasizing how they can leverage these insights to enhance operational efficiency.

This project successfully demonstrated the potential of distance and historical data analysis to predict food delivery times accurately. The results suggest that delivery services should consider these factors to optimize their operations and improve customer experiences. Future work could involve expanding the dataset, exploring additional features like traffic conditions, and comparing the regression model with other predictive algorithms.

## **Future Directions**

* Expanding the Dataset: Incorporating a larger and more diverse dataset that includes various delivery scenarios could further enhance model accuracy.
* Exploring Additional Features: Investigating features such as traffic patterns or time of day could provide valuable insights for more accurate predictions.
* Model Comparison: Comparing the regression model with other algorithms, such as Decision Trees or Neural Networks, could lead to improvements in predictive performance.

This project successfully highlighted the value of data-driven insights in the food delivery industry. Further development and refinement can lead to even more impactful applications, empowering delivery services to make informed decisions and improve their operations.

## **References**

* [Food Delivery Time Prediction Using Python](https://thecleverprogrammer.com/2023/01/02/food-delivery-time-prediction-using-python/)