In-Vehicle Coupon Recommendation System Project

This project explores how personalized coupon recommendations can enhance acceptance and marketing efficiency.

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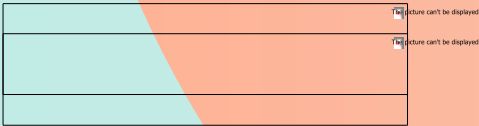
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Introduction

Problem Statement

In the competitive food and beverage industry, businesses frequently use coupons to attract customers. However, sending irrelevant or poorly timed coupons often results in low redemption rates, wasted marketing resources, and customer disengagement. At the same time, customers value offers that are timely, relevant, and tailored to their preferences and current situation. Currently, businesses lack a data-driven system to determine which specific coupon type and expiration period should be offered to maximize the likelihood of acceptance.

Objective: To develop a predictive model that leverages passenger demographics, trip context (time, weather, destination, etc.) and behavioral patterns to recommend the most appropriate coupon type and expiration period for a given passenger during their journey.

Project Goal

01   **Build a predictive Model**

Recommending the best coupon type and expiration duration using a predictive model.

02   **Personalization Factors**

Tailoring offers using passenger demographics, trip context, and behavioral tendencies.

03   **Maximizing Acceptance Rates**

The goal is to maximize coupon acceptance rates through personalized recommendations.

01 Project Focus

Developing a Coupon Recommendation System to boost customer satisfaction and increase coupon acceptance rates.

02 Why? The Importance of Personalization

Delivering personalized, timely, and relevant offers is crucial for customer satisfaction and engagement in today's digital economy.
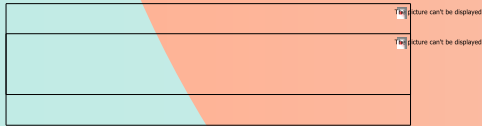
03 Optimizing Efforts

This project also focuses on optimizing promotional efforts through data-driven strategies.

02

Machine Learning

Model Development

Classification Model

Develop a classification model that predicts and recommends the most appropriate coupon-expiration combination.

Goal

The goal is to recommend the best coupon type and expiration duration using a predictive model which maximizes coupon acceptance rates, so the coupon sent must be relevant.

03

Data Understanding

Data Source

UC Irvine Machine Learning Repository

The data is sourced from the UC Irvine Machine Learning Repository.

Dataset Link

https://archive.ics.uci.edu/datasets/

Data Size and Features

01 **Dataset Size**

The dataset comprises 12,684 records, so careful handling is required for computational efficiency.

02 **Input Variables**

Input variables include demographics, contextual factors, and behavioral patterns to accurately represent preferences.

03 **Target Variables**

Target variables consist of coupon type (Restaurant, Coffee House, Bar, etc.) and expiration (2 hours vs 1 day).

Initial Steps

01   **Importing Libraries**

Importing necessary libraries such as Pandas, NumPy, and Seaborn is essential; these tools enhance data handling capabilities.

02

Data Loading and Inspection

Loading and inspecting the data ensures its integrity and suitability for analysis.

Data Cleaning

Handling Null Values

Addressing missing data points maintains accuracy throughout the analysis process.
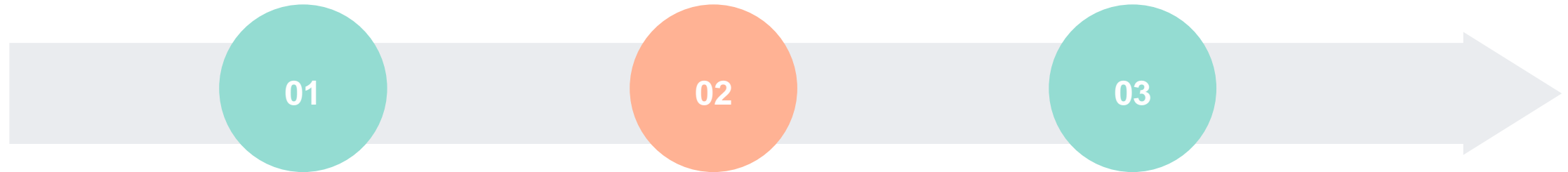
Encoding Categorical Variables

Encoding categorical data enables compatibility with machine learning algorithms since the data must be numeric.

Dropping Irrelevant Columns

Removing unnecessary columns streamlines analysis by focusing on relevant attributes.

Exploratory Data Analysis

01

Distribution Plots

Using distribution plots for demographics and behavior offers insights into data patterns.

02

Correlation Heatmaps

Correlation heatmaps reveal relationships between variables, aiding feature selection.

03

Target Variable Analysis

Analyzing target variables helps understand coupon-expiration drivers; this enhances decision-making throughout the experimentation.
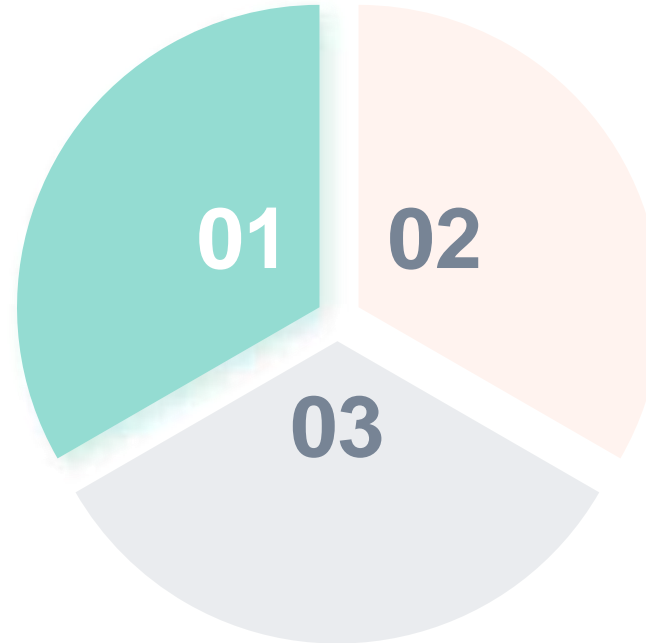
Modeling Approach

Baseline Models

Dummy Classifiers

Decision Tree

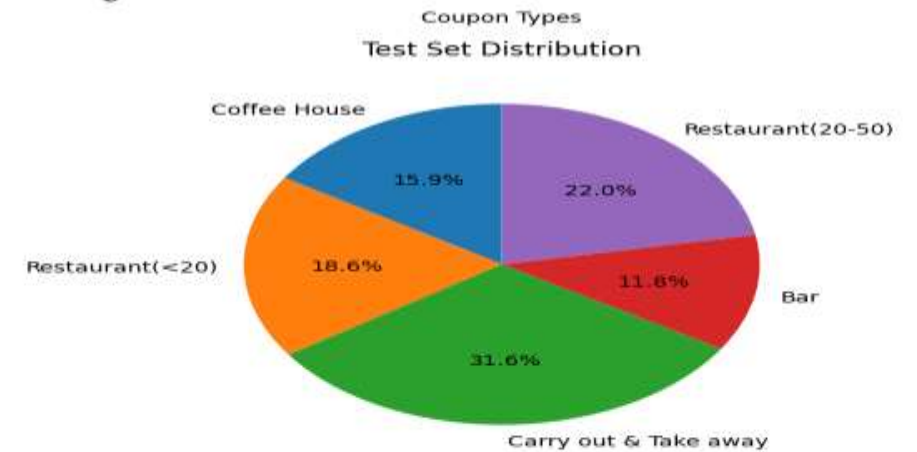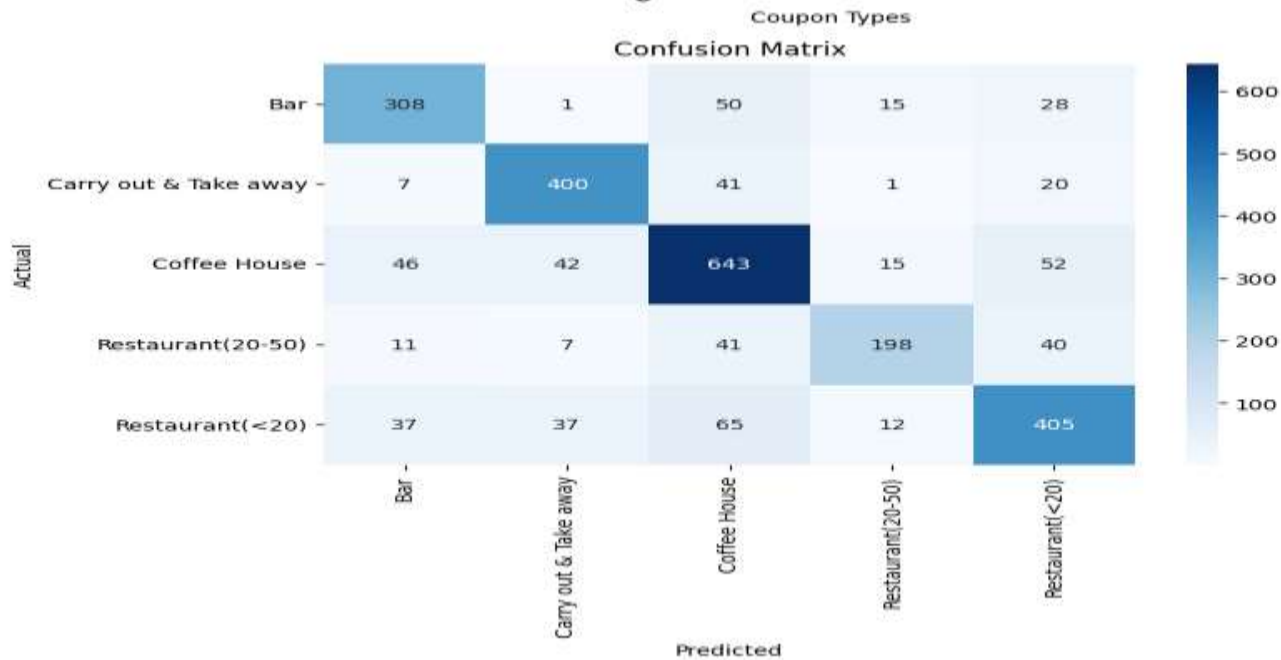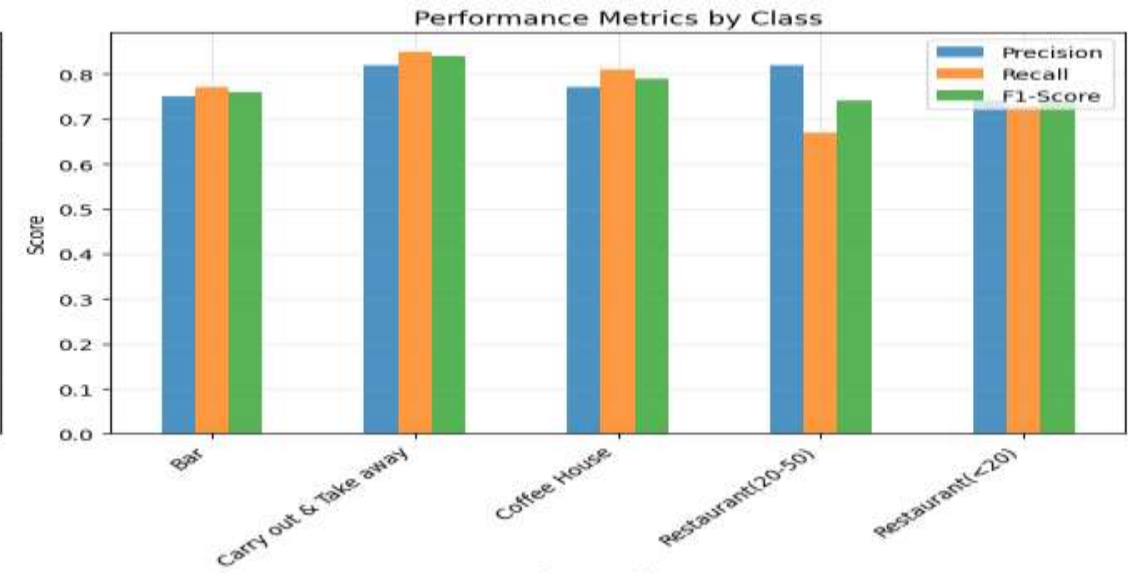**01**
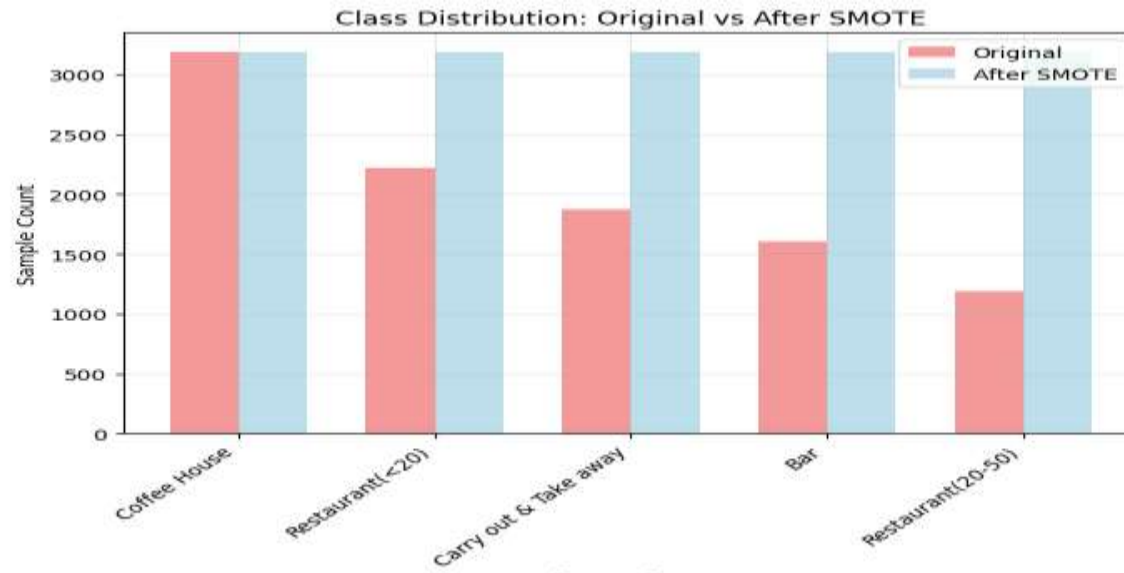
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03

XGBOOST/LightGBM

Class Balancing Strategies

SMOTE

SMOTE (Synthetic Minority Over-sampling Technique) balances class distribution by creating synthetic samples.

Visualization

Hyperparameter Tuning

GridSearchCV

GridSearchCV automates hyperparameter tuning to find the optimal configuration.

Model Evaluation

Accuracy

Accuracy is the proportion of correct predictions out of all predictions.

Confusion Matrix

Confusion Matrix provides a breakdown of prediction outcomes, including true positives, true negatives, false positives, and false negatives.

Precision, Recall, F1-score

Precision measures the accuracy of positive predictions; Recall measures the ability to capture all positive instances; F1 balances Precision and Recall. F1 is the most relevant for our business case.
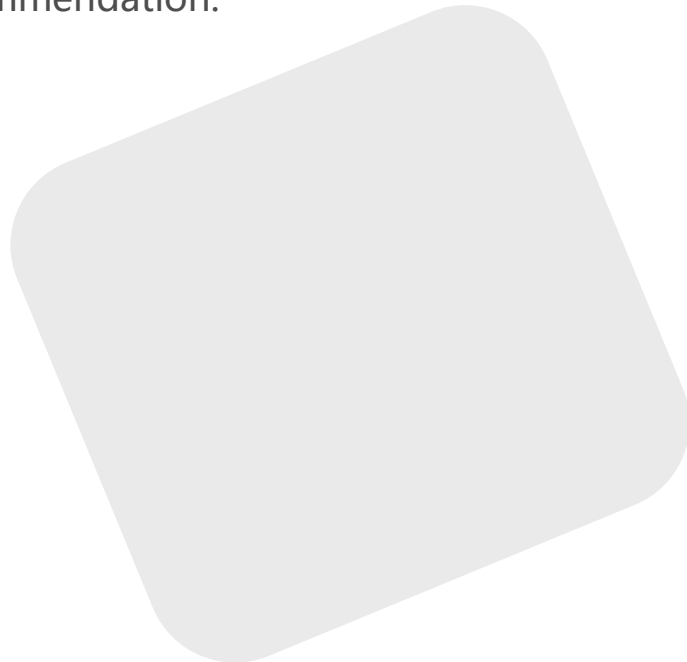
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Outcomes

Feature Identification

Important Features

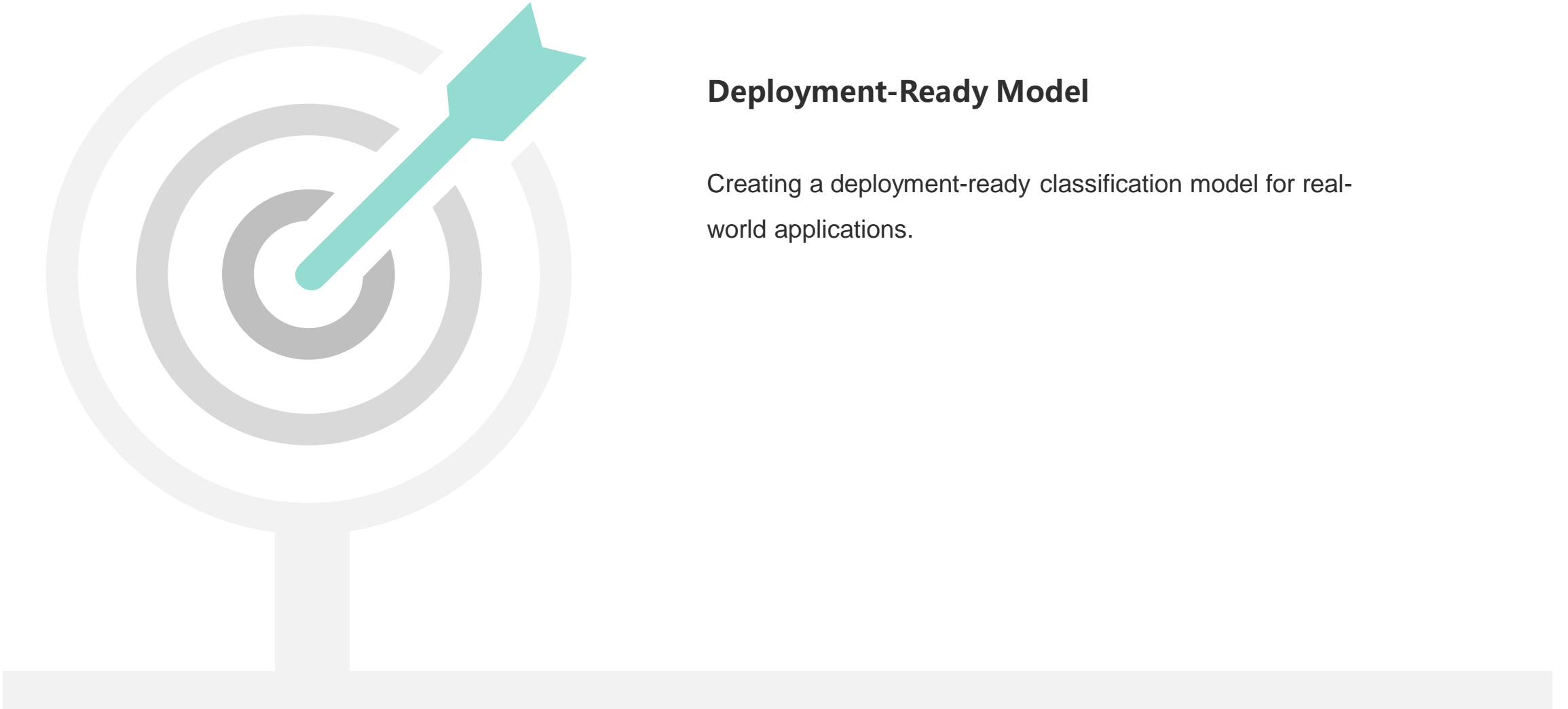Pinpointing which features are most predictive of coupon recommendation.

Coupon Effectiveness

Scenarios for Coupon Use

Knowing which coupons are most effective in which scenarios is also critical for success; for example, do certain coupons perform better on certain days?

Model Deployment

Deployment-Ready Model

Creating a deployment-ready classification model for real-world applications.

07

Key Insights

Recommendations

1.Promote Takeaway and Low-Cost Restaurant Coupons
Coupons for carry-out, takeaway, and restaurants priced under $20 perform best.

2.Use 1-Day Expiry for Better Results
Coupons valid for one day are more effective than those with shorter (2-hour) durations.

3.Target Young, Single, Middle-Income Users
Younger users (under 30), singles and those with middle incomes are most responsive to coupon offers.

4.Leverage Favorable Weather and Peak Times
Coupon acceptance increases in sunny weather and during peak times like 10 AM and 6 PM.

5.Focus on Convenient or Leisure-Driven Destinations
Users heading to shopping centers or without urgent destinations are more likely to use coupons.

Conclusion & Next Steps

- **Context matters** – Coupons perform best in sunny weather, at 10 AM or 6 PM and when users are not in a hurry.
- **Simple, affordable offers work** – 1-day takeaway and low-cost restaurant coupons have the highest acceptance.
- **Target the right users** – Young, single, middle-income individuals are most likely to redeem coupons.

Next Steps

- Integration with Uber & Bolt APIs
- Approach restaurant chains like Java House to run a pilot program aimed at boosting targeted marketing performance through personalized coupon delivery.

Thank you.