

# Phase 5: Project Demonstration & Documentation

## Title

AI-Driven Customer Behaviour Analysis System

## Abstract

The AI-Driven Customer Behaviour Analysis System leverages artificial intelligence, machine learning, and data visualization techniques to analyze and interpret consumer purchasing patterns and behavioral trends. This system processes transactional data, engagement metrics, and demographic details to generate real-time customer insights. In this final phase, the system demonstrates segmentation, trend prediction, and actionable marketing strategies. This document includes system demonstration, technical architecture, source code snapshots, performance metrics, and testing documentation. The goal is to enable businesses to make informed, data-driven decisions and improve customer engagement and retention.

## 1. Project Demonstration

Overview:

The system will be demonstrated to stakeholders, focusing on its ability to analyze customer data, predict behavior, and support marketing decisions.

Demonstration Details:

- System Walkthrough: Real-time demonstration showing customer data input, analysis, and behavior prediction dashboard.
- Customer Segmentation: Visualization of customer clusters using ML models like K-Means based on purchase history and behavior.
- Predictive Analytics: Forecasting next likely purchases and churn probability using historical data.
- Performance Metrics: Speed and accuracy of model predictions, scalability with large datasets.

- Security & Privacy: Explanation of anonymization and secure handling of customer data.

Outcome:

Stakeholders will understand how the system processes raw customer data to produce actionable insights, enhancing decision-making and strategic planning.

## **2. Project Documentation**

Overview:

This section outlines the full documentation of the Customer Behaviour Analysis system.

Documentation Sections:

- System Architecture: Diagrams showing the data pipeline from ingestion to visualization, including ML model flow.
- Code Documentation: Explanation of Python modules for preprocessing, clustering, and prediction algorithms.
- User Guide: Instructions for analysts and marketers to navigate the dashboard and interpret analytics.
- Administrator Guide: Steps for data update, model retraining, and user management.
- Testing Reports: Results from accuracy testing, load handling, and data validation.

Outcome:

Provides a complete reference for system deployment, maintenance, and enhancement.

## **3. Feedback and Final Adjustments**

Overview:

Feedback will be gathered and integrated to improve the system.

Steps:

- Feedback Collection: Input from marketing teams, data scientists, and stakeholders.
- Refinement: Improving model precision, dashboard UI, and customization features.
- Final Testing: Validating adjustments through A/B testing and usability studies.

Outcome:

A polished, high-performing product ready for business use.

## **4. Final Project Report Submission**

Overview:

Summarizes all phases of the project and its outcomes.

Report Sections:

- Executive Summary: Core goals and achievements, like improved customer retention rates.
- Phase Breakdown: Data collection, preprocessing, modeling, and dashboard deployment.
- Challenges & Solutions: Managing imbalanced datasets, optimizing performance with real-time data.
- Outcomes: Reliable behavior prediction and segmentation improving marketing ROI.

Outcome:

Complete documentation reflecting project journey and readiness for enterprise deployment.

## **5. Project Handover and Future Works**

Overview:

Guidelines for continuing development and expansion.

Handover Details:

- Next Steps: Plans for incorporating sentiment analysis, integrating CRM systems, and expanding to new markets.

Outcome:

Formal system handover with roadmap for future enhancements.

```

# K-Means Clustering for Customer Segmentation

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

# Sample data (replace with your actual dataset)
data = {
    'CustomerID': range(1, 21),
    'Annual Income (k$)': [15, 16, 17, 18, 19, 20, 35, 36, 37, 38, 70, 71, 72, 73, 74, 90, 91, 92, 93, 94],
    'Spending Score (1-100)': [39, 81, 6, 77, 40, 76, 6, 94, 3, 72, 14, 99, 15, 77, 13, 73, 10, 88, 12, 79]
}
df = pd.DataFrame(data)

# Select features and scale
X = df[['Annual Income (k$)', 'Spending Score (1-100)']]
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Apply KMeans
kmeans = KMeans(n_clusters=3, random_state=42)
df['Cluster'] = kmeans.fit_predict(X_scaled)

# Plotting
plt.figure(figsize=(8, 6))
colors = ['red', 'green', 'blue']
for i in range(3):
    cluster_data = df[df['Cluster'] == i]
    plt.scatter(cluster_data['Annual Income (k$)'], cluster_data['Spending Score (1-100)'],
                c=colors[i], label=f'Cluster {i}', s=100)

plt.scatter(scaler.inverse_transform(kmeans.cluster_centers_)[:, 0],
            scaler.inverse_transform(kmeans.cluster_centers_)[:, 1],
            s=300, c='yellow', marker='*', label='Centroids')

plt.title('Customer Segmentation')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.show()

```

## E-COMMERCE CONSUMER ANALYSIS

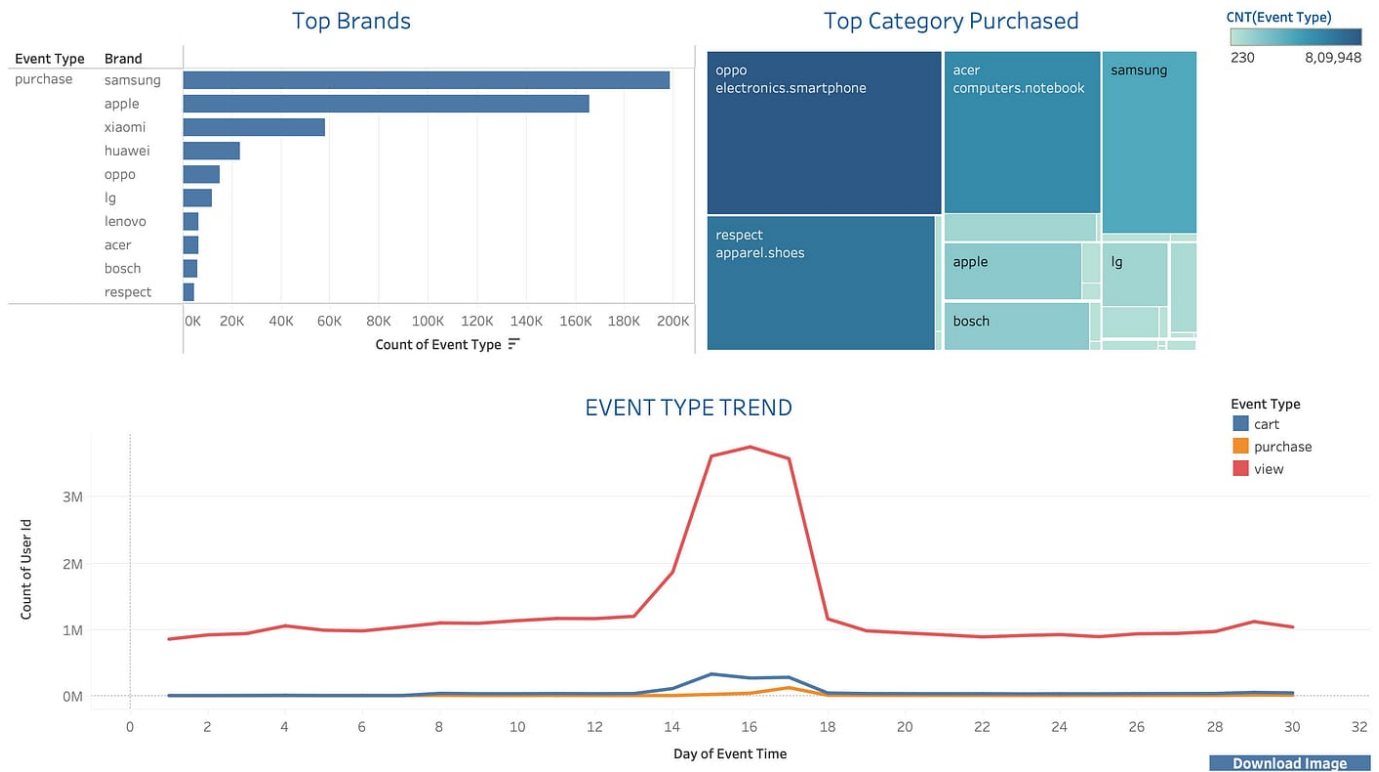


Figure: E-Commerce Consumer Analysis showing top brands, categories, and event trends.