Technical Requirements Document 1. Introduction

1.1 Purpose

This document outlines the technical requirements for the Mall Customer Segmentation project. The aim is to ensure that the system is designed and implemented to effectively segment customers, enhance targeted marketing strategies, and improve customer satisfaction and sales.

1.2 Scope

The scope of this document includes data collection, data analysis, visualization, and reporting requirements, along with performance, scalability, and usability considerations.

2. System Overview

The system will collect customer data, analyze it to segment customers into distinct groups, visualize these segments, and generate reports with actionable insights. The system must be efficient, scalable, and user-friendly.

3. Functional Requirements

3.1 Data Collection

3.1.1 Data Sources

- Collect demographic data: age, gender, income.
- Collect purchasing behavior data: spending scores, purchase history.

3.1.2 Data Quality

- Implement data cleaning procedures to handle missing values and remove duplicates.
- Normalize data to ensure consistency.

3.1.3 Data Storage

- Use a relational database (e.g., MySQL, PostgreSQL) to store collected data.
- Ensure regular data updates through automated scripts.

3.2 Data Analysis

3.2.1 Exploratory Data Analysis (EDA)

- Use Python libraries such as Pandas, NumPy, Matplotlib, and Seaborn for EDA.
- Perform descriptive statistics to understand data distribution.

3.2.2 Clustering · Apply K-means

clustering algorithm.

- Determine the optimal number of clusters using the elbow method.
- Use Python libraries such as Scikit-learn for clustering.

3.3 Visualization

3.3.1 Tools and Libraries

- Use Matplotlib and Seaborn for creating static visualizations.
- Use Power BI for developing interactive dashboards.

3.3.2 Visual Representation

- Create scatter plots, bar charts, and histograms to represent customer segments.
- Develop dashboards to display key metrics and allow interactive exploration.

3.4 Reporting

3.4.1 Report Generation

- Generate detailed reports in PDF and HTML formats using Python libraries such as ReportLab and Jinja2.
- Include characteristics of each customer segment and actionable recommendations.

3.4.2 Distribution

- Implement automated email distribution of reports using SMTP.

4. Non-functional Requirements

4.1 Performance

4.1.1 Efficiency

- Optimize data processing and analysis algorithms for speed.
- Ensure visualization rendering is efficient and responsive.

4.1.2 Load Handling

- System should handle large datasets (e.g., millions of records) without performance degradation.

4.2 Scalability

4.2.1 Data Growth

- Design the database schema to accommodate increasing data volume.
- Implement scalable data processing pipelines using technologies like Apache Spark.

4.2.2 Integration

- Ensure the system can integrate with additional data sources (e.g., CRM systems) and marketing platforms (e.g., MailChimp).

4.3 Usability

4.3.1 User Interface

- Develop an intuitive user interface using web technologies (e.g., HTML, CSS, JavaScript).
- Ensure the UI is accessible and easy to navigate for nontechnical users.

4.3.2 Documentation and Training

- Provide detailed user manuals and technical documentation.
- Conduct training sessions and provide ongoing support to users.

5. Security Requirements

5.1 Data Protection

- Implement data encryption (e.g., AES-256) for data at rest and in transit.
- Ensure secure access control mechanisms are in place.

5.2 Compliance

- Ensure compliance with relevant data protection regulations (e.g., GDPR).

6. Maintenance and Support

6.1 Regular Updates

- Implement a schedule for regular system updates and maintenance.
- Ensure the system is adaptable to evolving business needs.

6.2 Support

- Provide technical support through a dedicated helpdesk.
- Implement a ticketing system for tracking and resolving issues.

7. Conclusion

Technical requirements document outlines the necessary specifications for the successful implementation of the Mall Customer Segmentation project. By adhering to these requirements, the project aims to deliver a robust, scalable, and user-friendly system that enhances targeted marketing strategies and improves customer satisfaction and sales.