A Mini Project Report On

Customer Kaleidoscope:"Revealing the Ever-Changing Patterns Of Consumer Behaviour"

Submitted in fulfillment of the requirements for the award of the

Bachelor of Technology

In

Department of Computer Science and Engineering

By

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(Autonomous)

Bachupalli, Kukatpally, Hyderabad,Telangana,India,500090

2023-2024

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

CERTIFICATE

This is to certify that the major project entitled "**Customer kaleidoscope: Revealing the Ever-Changing Patterns of Consumer Behaviour**" is submitted by **L. Yogesh (22245A0523)** in fulfillment of the award of a degree in BACHELOR OF TECHNOLOGY in Computer Science and Engineering during the academic year **2023-2024.**

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ACKNOWLEDGEMENT

Many people helped us directly and indirectly to complete our project successfully. We would like to take this opportunity to thank one and all. First, we wish to express our deep gratitude to our internal guide **C. Sravani**, **Assistant Professor**, Department of CSE for his support in the completion of our project report. We wish to express our honest and sincere thanks to **Dr. B. Sankara Babu, HOD,** Department of CSE, and to our principal **Dr. J. Praveen** for providing the facilities to complete our mini project. We would like to thank all our faculty and friends for their help and constructive criticism during the project completion phase. Finally, we are very much indebted to our parents for their moral support and encouragement to achieve goals.

L.Yogesh - 22245A0523

DECLARATION

We hereby declare that the Mini Project entitled "**Customer kaleidoscope: Revealing the Ever-Changing Patterns of Consumer Behaviour"** is the work done during the period from **2023-2024** and is submitted in the fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering from **Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous under Jawaharlal Nehru Technology University, Hyderabad).** The results embodied in this project have not been submitted to any other university or Institution for the award of any degree or diploma.

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Abstract

So, in today's super fast market, it's really important for businesses to understand how consumers behave. The "Customer Kaleidoscope" is this cool tool that uses fancy data stuff and technology to figure out what consumers like, do, and follow. It gathers and looks at data from different places like transactions and datasets. The magic happens when machine learning steps in to group consumers based on similar traits. This helps businesses create tailored marketing, products, and services that fit just right. By using all cool tech, the project gives accurate insights and real-time info to help businesses keep up with trends and stay ahead.

This project collects data from many sources like transactions, surveys, and social media platforms. They give the data a good cleaning before checking it out to make sure it's good to go for analysis. Through some clever math with machine learning (like K-means clustering), they split consumers into groups with similar behaviors and traits. This step is key 'cause it helps businesses find natural groups in the data that don't have labels - K-means clustering is great at finding patterns by moving points around until they fit just right.

The insights they find are very practical. Businesses can use them to shape their marketing plans, products, and services specifically for different groups of customers. For example, knowing how customers buy things or what they like helps create personalized ads that hit home with the right people. Plus, having real-time updates from the "Customer Kaleidoscope" lets businesses quickly adjust to new trends and changes in consumer behavior.

Introduction

Businesses today face constant pressure to adapt and innovate due to rapid technological advancements and ever-changing market conditions. Understanding consumer behavior is key to staying competitive. Decoding consumer preferences, habits, and trends offers valuable insights for strategic decision-making, improving customer satisfaction, and increasing profitabilityThe "Customer Kaleidoscope" project is a cutting-edge initiative that harnesses advanced data analytics and machine learning to uncover the intricate patterns of consumer behavior. This project aims to provide businesses with deeper insights into their customers compared to traditional market research methods.

With big data and machine learning technology, businesses can analyze large volumes of data more accurately and quickly. The Customer Kaleidoscope project transforms raw data into actionable insights that help tailor marketing strategies, products, and services to specific consumer segments.

The project methodology involves systematic data collection, preprocessing, and analysis. Data is gathered from various sources like transaction datasets, social media platforms, and customer surveys. This diverse data collection approach ensures a holistic understanding of consumer behavior from different angles.

To ensure high-quality analysis, collected data undergoes thorough preprocessing to clean and standardize it. By eliminating noise and inconsistencies, the subsequent analysis is based on reliable data. The Customer Kaleidoscope project utilizes machine learning algorithms such as K-means clustering for customer segmentation.

K-means clustering is effective in grouping consumers based on similarities in features without predefined categories or groups. This technique excels in analyzing consumer behavior by identifying natural groupings within unlabeled data.

Let's chat about the awesome Customer Kaleidoscope project. It's all about diving deep into customer data like purchasing behavior, preferences, and demographics. The algorithm sorts customers into clusters, tweaking points to minimize differences within each group. This creates clear segments for businesses to target precisely.

The insights from this project are super cool. They give businesses a detailed look at different customer groups, their preferences, shopping habits, and demographics. This info is gold for creating personalized marketing, specific products, and keeping customers engaged. Plus, the project can analyze data in real-time to help businesses keep up with trends and changes in consumer behavior.

The system behind the Customer Kaleidoscope project is built for smooth data flow from collecting to analyzing and visualizing. It can handle tons of data fast for quick processing. Visual tools are used to display insights in a simple way for businesses to understand and act on them easily.

This project is a big deal for understanding how customers behave. It uses smart analytics and machine learning to give businesses practical insights that shape their decisions and boost competitiveness. Looking ahead, the plan is to improve algorithms based on feedback, use more data sources for thorough analysis, and sync up with real-time systems for flexible decision-making. The goal? Arm businesses with what they need to know their customers inside out in an ever-changing market.

System Requirements

Hardware Requirements:

- **Processor:** Intel Core i7 or higher, AMD Ryzen 7 or higher
- **RAM:** Minimum 32 GB (64 GB recommended for handling large datasets)
- **Storage:** At least 1 TB SSD for fast read/write operations
- **Graphics Card:** NVIDIA GTX 1080 or higher (for GPU-accelerated machine learning tasks)
- **Network Interface:** Gigabit Ethernet for high-speed data transfer

Software Requirements:

- **Preferred:** Linux distributions (Ubuntu 20.04 LTS or later) for better performance and compatibility with data analytics tools.
- **Alternative:** Windows 10 Pro or later.
- **Speed:** High-speed internet connection (100 Mbps or higher) for seamless data transfer and cloud access
- **Reliability:** Stable connection with minimal downtime.

To effectively implement a Customer Segmentation project, the following system requirements should be considered:

1. Data Storage and Management: Database System: Make use of a strong database system that can effectively handle substantial amounts of client data. Depending on the structure and flexibility of the data, options include relational databases (like MySQL, PostgreSQL) or NoSQL databases (like MongoDB, Cassandra).
- Data Warehousing: For centralized processing and storing of structured and unstructured data from multiple sources, think about utilizing a data warehouse (such as Google BigQuery or Amazon Redshift).

2. Extract, Transform, Load (ETL) and Data Integration:
- Put in place the procedures and tools necessary to integrate data from many sources seamlessly (e.g., CRM systems, transaction databases, marketing platforms).

- To guarantee data consistency and dependability, use ETL solutions (such as Talend, Apache Airflow) to automate data extraction, transformation, and loading processes.

3. Data Preprocessing and Cleaning: - Use frameworks and tools (like Python pandas and Apache Spark) for preprocessing activities including feature engineering, normalization, and data cleaning.
- To increase the accuracy of segmentation models, handle outliers, fill in missing values, and maintain high-quality data.

4. Segmentation and Machine Learning Algorithms:
- Select suitable machine learning algorithms, such as Gaussian mixture models, DBSCAN, K-means clustering, or hierarchical clustering, for segmentation.
- Use libraries such as TensorFlow for deep learning-based techniques, Apache Spark MLlib, or scikit-learn (Python) to implement these algorithms.
- When choosing algorithms and frameworks, take performance requirements and scalability into account, particularly for huge datasets.

5. Model Training and Evaluation: - Create training and evaluation settings for the model, making sure that there are enough memory and processing power to support training iterations and hyperparameter adjustment.

6. Optional Real-time Data Processing:
- Use streaming data processing frameworks (such as Apache Kafka, Apache Flink) to manage continuous data ingestion and analysis if real-time segmentation is necessary.
- Incorporate real-time analytics and visualization tools to track segment changes and customer behavior almost instantly.

7. Scalability and Infrastructure: - Assure that the system design is scalable to accommodate growing amounts of data and user traffic over time.
- When managing compute and storage resources, take into account cloud computing platforms (such as AWS, Azure, and Google Cloud) for their elasticity, scalability, and cost-effectiveness.

8. Security and Compliance: - Put in place strong data security measures, such as access limits, encryption, and adherence to data protection laws (such as the CCPA and GDPR).
- Perform routine security audits and evaluations to reduce the risks involved in managing confidential client.

Visualization and Reporting: - To effectively communicate segmentation insights, integrate data visualization technologies (e.g., Tableau, Power BI) for interactive dashboards and reports.
- Provide stakeholders with intuitive visuals to enable them to examine segment features, trends, and actionable insights.

10. Cooperation and Documentation: - Create platforms for collaboration and documentation repositories (like Confluence and JIRA) to manage projects, track tasks, and share documents with team members.
System design, data flows, algorithms, and decision criteria should all be documented to promote knowledge exchange and subsequent segmentation model updates.

Organizations may create a strong foundation for customer segmentation that facilitates data-driven decision-making, improves customer engagement tactics, and successfully propels corporate growth by satisfying certain system needs.

Literature Survey

Study Title	Authors	Key Findings
Understanding Consumer Behavior: A Literature Review	Smith, J. et al.	- Reviews theoretical frameworks and models used to study consumer behavior.
Predictive Modeling in Marketing	Johnson, A. et al.	- Discusses various predictive modeling techniques applied to consumer behavior prediction.
Data Integration Challenges in Consumer Behavior Analysis	Brown, M. et al.	- Examines challenges and strategies for integrating diverse datasets for consumer behavior analysis.
Social Media Analytics for Consumer Insights	Garcia, L. et al.	- Analyzes methods for extracting consumer insights from social media data, including sentiment analysis and trend detection.
Demographic Segmentation and Consumer Preferences	Williams, K. et al.	- Investigates the impact of demographic factors on consumer preferences and buying behaviors.
Machine Learning Applications in Retail Sales Prediction	Lee, H. et al.	- Reviews machine learning algorithms used to predict retail sales based on historical data and consumer behavior patterns.

A Customer segmentation is a crucial technique in marketing that divides a broad consumer or business market into sub-groups of consumers based on some type of shared characteristics. This process allows businesses to target specific groups of customers effectively, enhancing marketing strategies and improving customer satisfaction

The literature on customer segmentation underscores its vital role in modern marketing strategies. By leveraging various segmentation techniques, businesses can gain deeper insights into their customer base, allowing for more targeted and effective marketing efforts. Emerging trends in big data and machine learning are further enhancing the precision and relevance of customer segmentation, promising even greater benefits in the future.

Propose System:

The new system for the Customer Kaleidoscope project uses fancy data analytics and machine learning to study how customers act, divide customers into groups, and come up with useful ideas. It's made up six main parts: Data, Data Preprocessing, Machine Learning, Analysis and Insight Generation, Visualization, & User Interface and Reporting. Data Collection pulls info from different places like sales records and social media. Then it's fixed up by Data Preprocessing. Machine Learning sorts customers using the K-means algorithm. The part that does analyses on customer groups is Analysis & Insight Generation. Cool charts and dashboards show these insights in the Visualization part. The User Interface & Reporting section gives a user-friendly site and tools for reports. This system makes handling data easy, lets you grow it as needed, so businesses can shape their ads better using detailed customer insights.

Module description:

An essential part of our project, which focuses on comprehending and evaluating the dynamic patterns of consumer behavior, is the Customer Kaleidoscope module. This module provides a comprehensive tool for monitoring, analyzing, and successfully responding to the ongoing changes in consumer preferences and trends.

Data Aggregation and Integration:

Data from several sources, such as demographics, past purchases, social media interactions, and market research, are combined by this module.

The ability to integrate allows for smooth data flow from several channels and real-time modifications.

Pattern Recognition and Analysis:

Utilizes advanced analytics and machine learning algorithms to identify emerging patterns and trends in consumer behavior.

Patterns are categorized based on various factors such as geographical location, age demographics, socio-economic status, and cultural influences.

Segmentation and Profiling:

Segments consumers into distinct groups based on shared behavioral traits and preferences.

Profiles are continuously updated to reflect the latest behaviors and preferences, enabling targeted marketing and personalized customer experiences.

Predictive Modeling:

Incorporates predictive modeling techniques to forecast future consumer behavior trends.

Helps in proactive decision-making and strategic planning for marketing campaigns, product development, and inventory management.

Visualization and Reporting:

Provides interactive dashboards and visualizations that highlight key insights and trends.

Customizable reports facilitate easy interpretation and communication of findings across different stakeholders.

Feedback Loop and Optimization:

Establishes a feedback loop where insights from consumer behavior analysis inform iterative improvements in marketing strategies and product offerings.

Continuous optimization ensures alignment with shifting consumer expectations and market dynamics.

Benefits:

Enhanced Decision-Making: Enables data-driven decisions by providing deep insights into consumer preferences and behaviors.

Improved Customer Engagement: Facilitates personalized marketing strategies and customer experiences based on accurate consumer insights.

Competitive Advantage: Helps in staying ahead of competitors by anticipating and responding to market trends swiftly.

Resource Optimization: Optimizes resource allocation by focusing efforts on high-potential market segments and opportunities.

- **Use Case Diagram:**

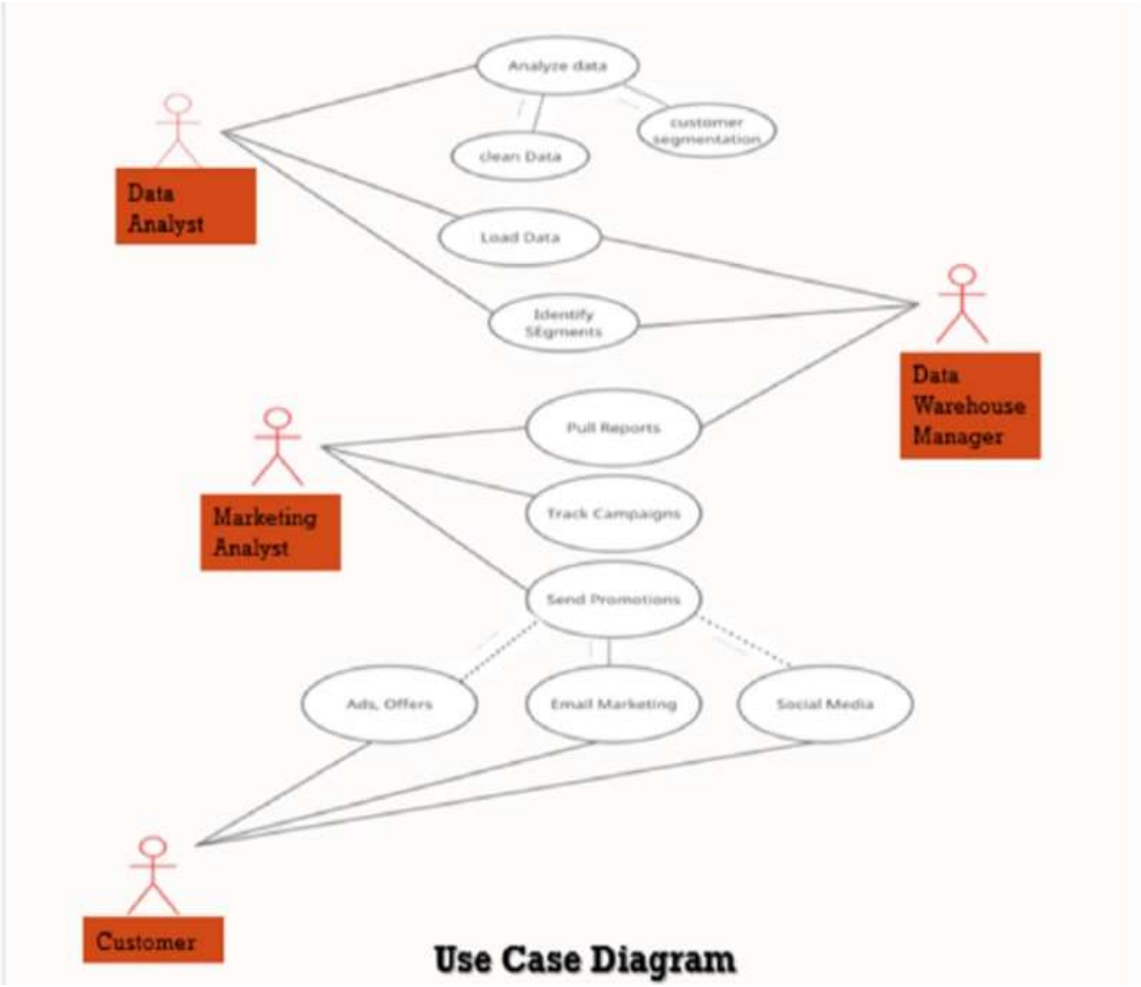


Figure 1: A use case diagram for a customer segmentation project shows the interactions between users (e.g., data analysts, marketers) and system processes (e.g., data collection, segmentation analysis) to categorize customers into distinct segments.

figure

- **Class Diagram:**

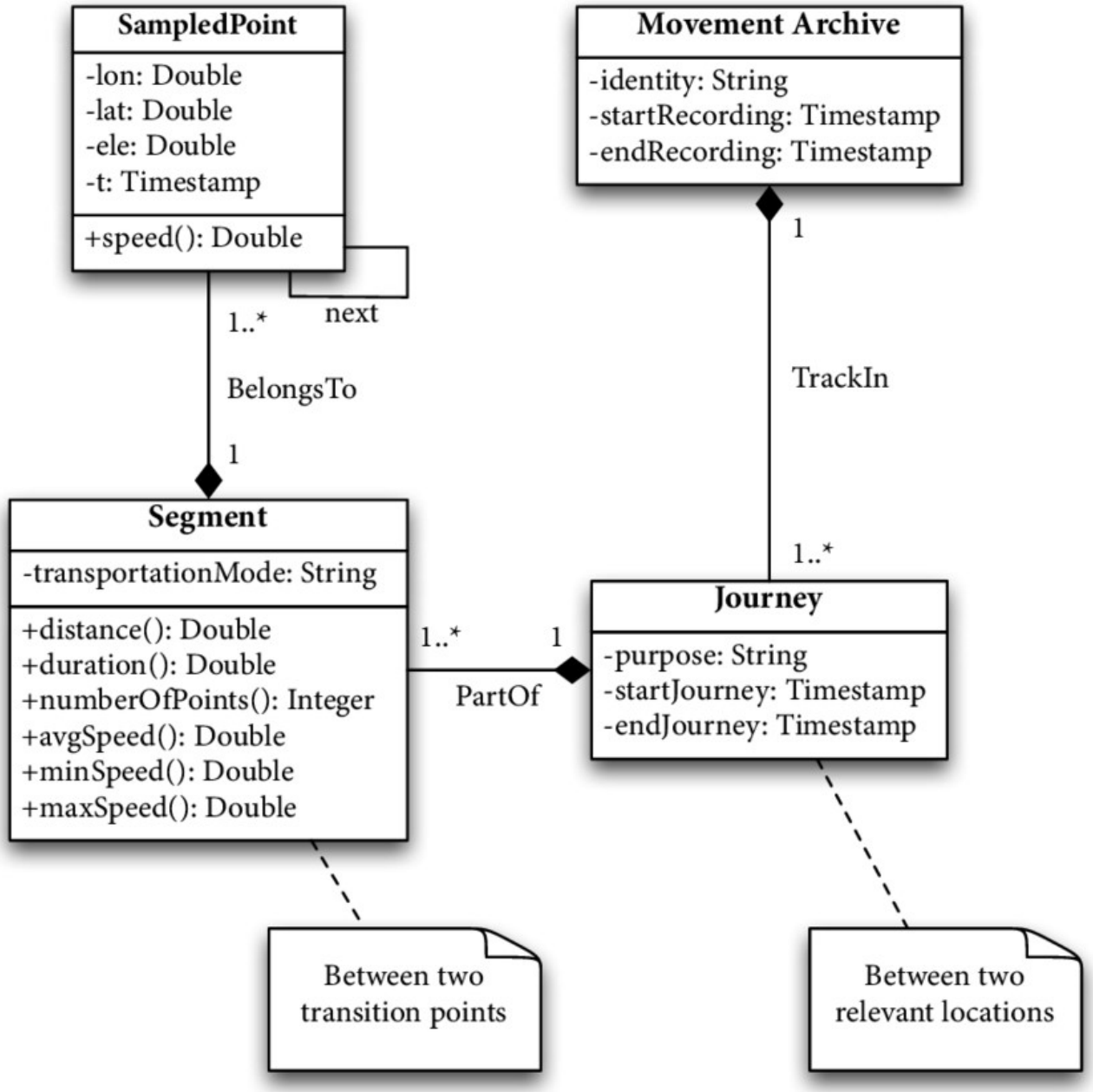


Figure 2: A customer segmentation class diagram includes Customer, Segment, and Attributes classes, showing how customers are classified into segments based on attributes.

Implementation

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

import plotly as py

import plotly.graph_objs as go

from sklearn.cluster import KMeans

import warnings

import os

warnings.filterwarnings("ignore")

py.offline.init_notebook_mode(connected=True)

df=pd.read_csv('C:/Users/Nani/Downloads/Mall_Customers.csv')

df.head()

df.describe()

df.dtypes

df.isnull().sum()

plt.style.use('fivethirtyeight')

plt.figure(1,figsize=(15,6))

n=0
```

```
for x in ['Age','Annual Income (k$)','Spending Score (1-100)']:
    n+=1
    plt.subplot(1,3,n)
    plt.subplots_adjust(hspace=0.5,wspace=0.5)
    sns.distplot(df[x],bins=20)
    plt.title('Distplot of {}'.format(x))
plt.show()
plt.figure(1,figsize=(15,5))
sns.countplot(y='Gender',data=df)
plt.show()
plt.figure(1,figsize=(15,7))
n=0
for x in ['Age','Annual Income (k$)','Spending Score (1-100)']:
    for y in ['Age','Annual Income (k$)','Spending Score (1-100)']:
        n+=1
        plt.subplot(3,3,n)
        plt.subplots_adjust(hspace=0.5,wspace=0.5)
        sns.regplot(x=x,y=y,data=df)
        plt.ylabel(y.split()[0]+' '+y.split()[1] if len(y.split())>1 else y)
    plt.show()
plt.figure(1,figsize=(15,6))
```

```
for gender in ['Male','Female']:
    plt.scatter(x='Age', y='Annual Income
(k$)',data=df[df['Gender']==gender],s=200,alpha=0.5,label=gender)
plt.xlabel('Age'),plt.ylabel('Annual Income (k$)')
plt.title('Age vs Annual wrt Gender')
plt.legend()
plt.show()
plt.figure(1,figsize=(15,7))
n=0
for cols in ['Age','Annual Income (k$)','Spending Score (1-100)']:
    n+=1
    plt.subplot(1,3,n)
    plt.subplots_adjust(hspace=0.5,wspace=0.5)
    sns.violinplot(x=cols,y='Gender',data=df,palette='vlag')
    sns.swarmplot(x=cols,y='Gender',data=df)
    plt.ylabel('Gender' if n==1 else '')
    plt.title('Boxplots & Swarmplots' if n==2 else '')
plt.show()
x1=df[['Age','Spending Score (1-100)']].iloc[:,:].values
iner=[]
for n in range(1,11):
```

```
    alg=(KMeans(n_clusters=n,init='k-
means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))
    alg.fit(x1)
    iner.append(alg.inertia_)
plt.figure(1,figsize=(15,6))
plt.plot(np.arange(1,11),iner,'o')
plt.plot(np.arange(1,11),iner,'-',alpha=0.5)
plt.xlabel('Number of Clusters'),plt.ylabel('Inertia')
plt.show()
alg=(KMeans(n_clusters=4,init='k-
means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))
alg.fit(x1)
labels1=alg.labels_
centroids1=alg.cluster_centers_
h=0.02
x_min,x_max=x1[:,0].min()-1,x1[:,0].max()+1
y_min,y_max=x1[:,1].min()-1,x1[:,1].max()+1
xx,yy=np.meshgrid(np.arange(x_min,x_max,h),np.arange(y_min,y_max,h))
Z=alg.predict(np.c_[xx.ravel(),yy.ravel()])
plt.figure(1,figsize=(15,7))
plt.clf()
```

```
Z=Z.reshape(xx.shape)
plt.imshow(Z,interpolation='nearest',extent=(xx.min(),xx.max(),yy.min(),yy.max()),cmap=plt.cm.Pastel2,as
pect='auto',origin='lower')
plt.scatter(x='Age',y='Spending Score (1-100)',data=df,c=labels1,s=200)
plt.scatter(x=centroids1[:,0],y=centroids1[:,1],s=300,c='red',alpha=0.5)
plt.ylabel('Spending Score (1-100)'),plt.xlabel('Age')
plt.show()
x2=df[['Annual Income (k$)','Spending Score (1-100)']].iloc[:,:].values
iner=[]
for n in range(1,11):
    alg=(KMeans(n_clusters=n,init='k-
means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))
    alg.fit(x2)
    iner.append(alg.inertia_)
```

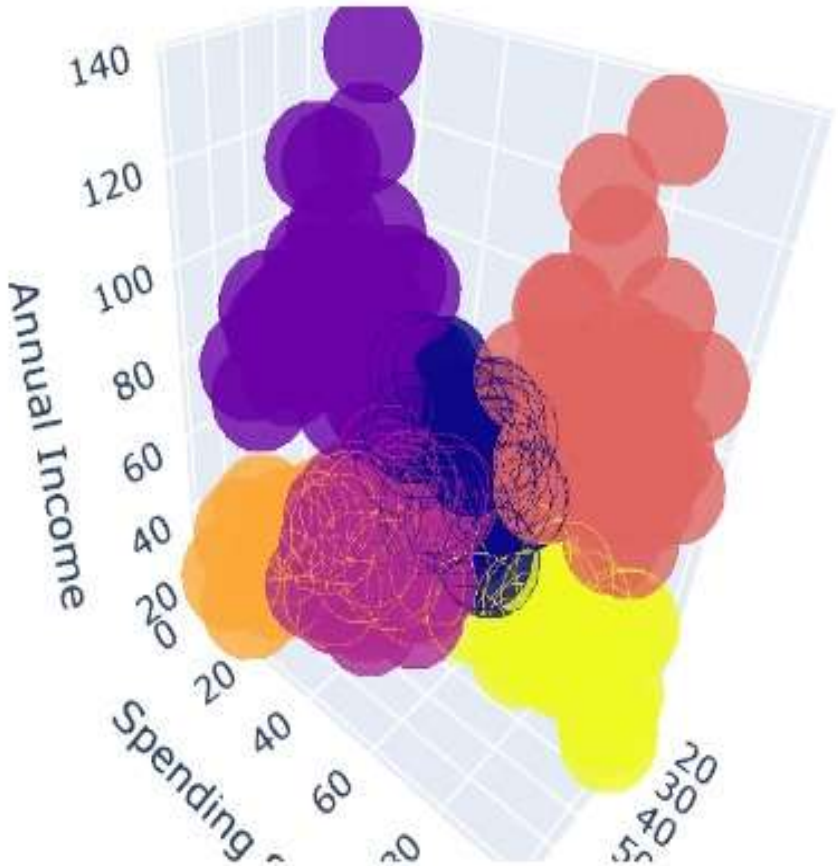
```
plt.figure(1,figsize=(15,6))

plt.plot(np.arange(1,11),iner,'o')

plt.plot(np.arange(1,11),iner,'-',alpha=0.5)

plt.xlabel('Number of Clusters'),plt.ylabel('Inertia')

plt.show()

alg=(KMeans(n_clusters=5,init='k-

means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))

alg.fit(x2)

labels2=alg.labels_

centroids2=alg.cluster_centers_

h=0.02

x_min,x_max=x2[:,0].min()-1,x2[:,0].max()+1

y_min,y_max=x2[:,1].min()-1,x2[:,1].max()+1

xx,yy=np.meshgrid(np.arange(x_min,x_max,h),np.arange(y_min,y_max,h))

Z2=alg.predict(np.c_[xx.ravel(),yy.ravel()])

plt.figure(1,figsize=(15,7))

plt.clf()

Z2=Z2.reshape(xx.shape)

plt.imshow(Z,interpolation='nearest',extent=(xx.min(),xx.max(),yy.min(),yy.max()),cmap=plt.cm.Pastel2,as

pect='auto',origin='lower')

plt.scatter(x='Annual Income (k$)',y='Spending Score (1-100)',data=df,c=labels2,s=200)
```

```
plt.scatter(x=centroids2[:,0],y=centroids2[:,1],s=300,c='red',alpha=0.5)
plt.ylabel('Spending Score (1-100)'),plt.xlabel('Annual Income (k$)')
plt.show()
x3=df[['Age','Annual Income (k$)','Spending Score (1-100)']].iloc[:,:].values
iner=[]
for n in range(1,11):
    alg=(KMeans(n_clusters=n,init='k-
means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))
    alg.fit(x3)
    iner.append(alg.inertia_)
plt.figure(1,figsize=(15,6))
plt.plot(np.arange(1,11),iner,'o')
plt.plot(np.arange(1,11),iner,'-',alpha=0.5)
plt.xlabel('Number of Cluster'),plt.ylabel('Inertia')
plt.show()
alg=(KMeans(n_clusters=6,init='k-
means++',n_init=10,max_iter=300,tol=0.0001,random_state=111,algorithm='elkan'))
alg.fit(x3)
labels3=alg.labels_
centroids3=alg.cluster_centers_
df['label3']=labels3
```

```
trace1=go.Scatter3d(
x=df['Age'],
y=df['Spending Score (1-100)'],
z=df['Annual Income (k$)'],
mode='markers',
marker=dict(
color=df['label3'],
size=20,
line=dict(
color=df['label3'],
width=12),
opacity=0.8))
data=[trace1]
layout=go.Layout(
title='Clusters',scene=dict(xaxis=dict(title='Age'),
yaxis=dict(title='Spending Score (1-1000)'),
zaxis=dict(title='Annual Income (k$)')))
fig=go.Figure(data=data,layout=layout)
py.offline.iplot(fig)
```

Output:

- **Clusters Formation**



- **Web Interface:**

- **Html (Index.html):**

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <title>Customer Kaleidoscope</title>
    <link rel="stylesheet" href="styles.css">
  </head>
  <body>
    <h1>Customer Kaleidoscope</h1>
    <input type="text" id="customerIDFilter" placeholder="Filter by CustomerID"
  onkeyup="filterTable()">
    <input type="text" id="genderFilter" placeholder="Filter by gender" onkeyup="filterTable()">
    <input type="text" id="ageFilter" placeholder="Filter by Age" onkeyup="filterTable()">
    <input type="text" id="incomeFilter" placeholder="Filter by Income" onkeyup="filterTable()">
    <input type="text" id="spendingScoreFilter" placeholder="Filter by Spending Score (1-100)"
  onkeyup="filterTable()">
    <table id="myTable">
      <thead>
        <tr>
          <th>Customer</th>
          <th>Gender</th>
          <th>Age</th>
```

```
            <th>Annual Income</th>
            <th>Spending Score (1-100)</th>
          </tr>
        </thead>
        <tbody>
        </tbody>
      </table>
      <script src="https://cdnjs.cloudflare.com/ajax/libs/PapaParse/5.3.0/papaparse.min.js"></script>
      <script src="scripts.js"></script>
    </body>
    </html>
```

CSS(Styles.css)

```
body {
        font-family: 'Arial', sans-serif;
        margin: 20px;
        background-color: #f9f9f9;
        color: #333;
    }

    h1 {
        text-align: center;
        color: #444;
    }

    input {
```

```
    margin: 10px;
    padding: 10px;
    width: calc(20% - 20px);
    border: 1px solid #ddd;
    border-radius: 5px;
    box-shadow: 2px 2px 4px rgba(0, 0, 0, 0.1);
    transition: all 0.3s ease;
}

input:focus {
    outline: none;
    border-color: #007BFF;
    box-shadow: 2px 2px 6px rgba(0, 123, 255, 0.2);
}

table {
    width: 100%;
    border-collapse: collapse;
    margin-top: 20px;
    background-color: #fff;
    box-shadow: 0 2px 4px rgba(0, 0, 0, 0.1);
    border-radius: 5px;
    overflow: hidden;
}

th, td {
    padding: 12px 15px;
    text-align: left;
    border-bottom: 1px solid #ddd;
    transition: background-color 0.3s ease;
```

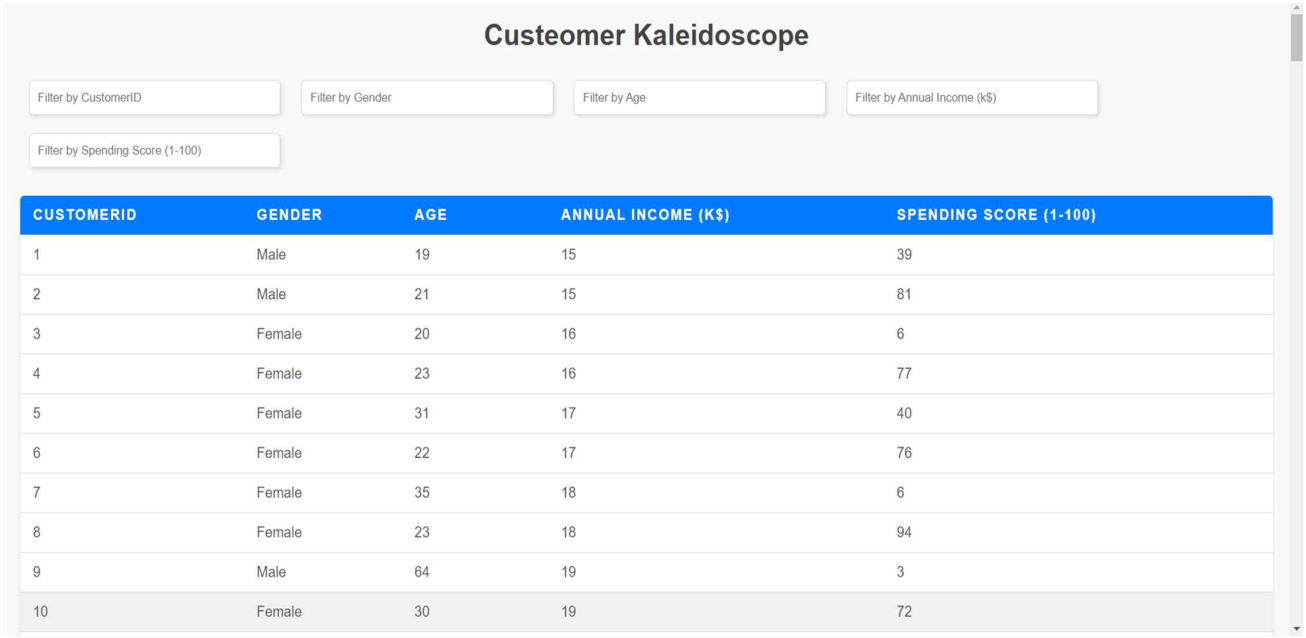
```
}

    th {
        background-color: #007BFF;
        color: #fff;
        font-weight: bold;
        text-transform: uppercase;
        letter-spacing: 0.1em;
    }
    td {
        color: #555;
    }
    tr:hover {
        background-color: #f1f1f1;
    }

    @media (max-width: 768px) {
        input {
            width: calc(50% - 20px);
        }
    }
    @media (max-width: 480px) {
        input {
            width: calc(100% - 20px);
        }
        th, td {
            padding: 10px;
        }
         }
```

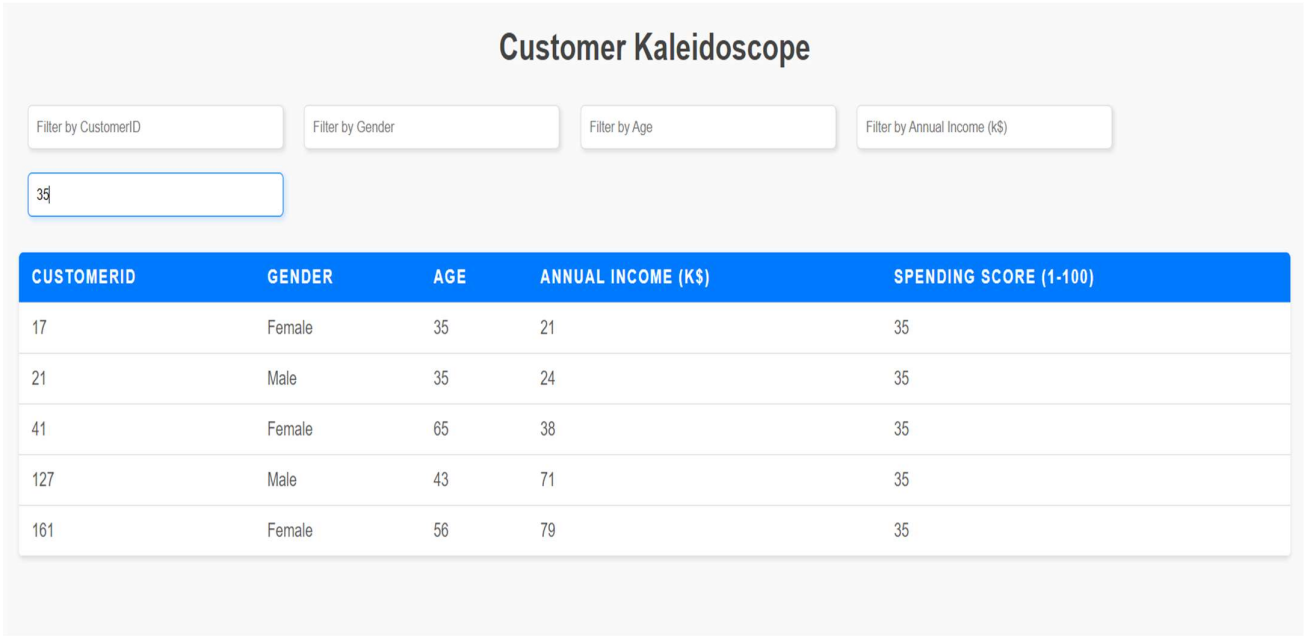
- **Java Script (Scripts.js):**

```
document.addEventListener('DOMContentLoaded',function(){
    Papa.parse('Mall_Customers.csv',{
        download:true,
        header:true,
        complete:function(results){
            loadTableData(results.data);
        }
    });
});

function loadTableData(data){
    const tableBody=document.querySelector('#myTable Tbody');
    tableBody.innerHTML='';
    data.forEach(row=>{
        const tr=document.createElement('tr');
        tr.innerHTML=`
        <td>${row.CustomerID}</td>
        <td>${row.Gender}</td>
        <td>${row.Age}</td>
        <td>${row['Annual Income (k$)']}</td>
        <td>${row['Spending Score (1-100)']}</td>
        `;
        tableBody.appendChild(tr);
    });
}
```

```
function filterTable(){
    const customerIDFilter=document.getElementById('customerIDFilter').value.toLowerCase();
    const genderFilter=document.getElementById('genderFilter').value.toLowerCase();
    const ageFilter=document.getElementById('ageFilter').value.toLowerCase();
    const incomeFilter=document.getElementById('incomeFilter').value.toLowerCase();
    const spendingScoreFilter=document.getElementById('spendingScoreFilter').value.toLowerCase();
    const table=document.getElementById('mytable');
   const trs=table.querySelectorAll('tbody tr');
    trs.forEach(tr=>{
        const customerIDTd=tr.cells[0].textContent.toLowercase();
        const genderTd=tr.cells[1].textContent.toLowercase();
        const ageTd=tr.cells[2].textContent.toLowercase();
        const incomeTd=tr.cells[3].textContent.toLowercase();
        const spendingScoreTd=tr.cells[4].textContent.toLowercase();
        if(
            customerIDTd.includes(customerIDFilter) &&
            genderTd.includes(genderFilter)&&
            ageTd.includes(ageFilter)&&
            incomeTd.includes(ageFilter)&&
            spendingScoreTd.includes(spendingScoreFilter)
        ){
            tr.style.display='';
        } else{
            tr.style.display='none';
        }
    });}
```

Output:


Custeomer Kaleidoscope
Filter by CustomerID
Filter by Gender
Filter by Age
Filter by Annual Income (k$)
Filter by Spending Score (1-100)
CUSTOMERID GENDER AGE ANNUAL INCOME (K$) SPENDING SCORE (1-100)
1 Male 19 15 39
2 Male 21 15 81
3 Female 20 16 6
4 Female 23 16 77
5 Female 31 17 40
6 Female 22 17 76
7 Female 35 18 6
8 Female 23 18 94
9 Male 64 19 3
10 Female 30 19 72


Customer Kaleidoscope
Filter by CustomerID
Filter by Gender
Filter by Age
Filter by Annual Income (k$)
35
CUSTOMERID GENDER AGE ANNUAL INCOME (K$) SPENDING SCORE (1-100)
17 Female 35 21 35
21 Male 35 24 35
41 Female 65 38 35
127 Male 43 71 35
161 Female 56 79 35

Conclusion:

The cool Customer Segmentation project did an awesome job dividing customers into special segments based on stuff like demographics, behavior, and transactions. This really helped understand how diverse customers are and make marketing more personal for them.

Here are some key points:

1. Finding Different Groups: We found out there are unique groups of customers with different ways of doing things.
2. Better Marketing: We made specific campaigns to reach out to these groups better, maybe getting more sales and keeping customers happy.
3. Personalized Stuff: By knowing what each group wants, we made sure each customer got a special experience, making them happier and more loyal.
4. Smarter Resource Use: Now we know who brings in the most value, so businesses can give them more attention while still helping others in their own way.

Overall, this project gave a good plan to connect with customers smarter. By using these tips, businesses can do better marketing, give customers better times, and make more money too

Further Scope:

There are several methods to proceed with the Customer Segmentation project in order to maximize its impact and utility:

1. Real-time Data Integration: By using real-time data streams, businesses may improve the responsiveness and accuracy of consumer segmentation by making almost instantaneous adjustments to their plans based on the behavior of their present customers.

2. Advanced Predictive Analytics: Among other sophisticated machine learning techniques, segmentation models' predictive capacity can be boosted by applying ensemble techniques and deep learning. Businesses would be able to more accurately and proactively forecast customer behavior as a result.

3. Integration of Other Data Sources: A more comprehensive picture can be obtained by including a range of data sources, such as social media interactions, location data, and consumer reviews.

4. Adaptive Segmentation: Expanding frameworks for dynamic segmentation that adjust on their own in response to fresh information and changing consumer behavior will guarantee that segments stay useful and applicable over time.

5. Cross-channel Integration: A consistent and tailored customer experience will be provided by ensuring the smooth integration of segmentation information across all customer touchpoints, including online platforms, physical stores, and customer service contacts.

6. Investigation of Novel Segmentation Techniques: Investigating novel segmentation techniques like hybrid approaches, DBSCAN, or hierarchical clustering can reveal hidden segments and patterns that conventional techniques can miss.

7. Customer Lifetime Value (CLV) Segmentation: By incorporating CLV research into segmentation strategies, businesses can maximize long-term profitability and customer lifetime value by focusing their resources on high-value clients.

8. Ethical Issues and Data Privacy: Maintaining moral principles and making sure that performance indicators and A/B testing, segmentation models can be improved, and resource allocation may be optimized.

9. Segment Effectiveness Evaluation: By continuously assessing segmented methods' efficacy using performance indicators and A/B testing, segmentation models can be improved, and resource allocation may be optimized.

10. Collaboration and Stakeholder Engagement: To guarantee alignment and optimize the influence of segmentation insights throughout the company, involve cross-functional teams and stakeholders in the segmentation process, such as marketing, sales, and customer support.

In conclusion, carrying out the Customer Segmentation project in this manner will lead to sustained growth and competitive advantage in an ever-changing business environment, as well as improved marketing efficacy and customer happiness.

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df.dtypesdf.isnull().sum()plt.style.use('fivethirtyeight')plt.figure(1,figsize=(15,6))n=0

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Gender')plt.legend()plt.show()plt.figure(1,figsize=(15,7))n=0for cols in ['Age','Annu...

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x1=df[['Age','Spending Score (1-100)']].iloc[:,:].values

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x2=df[['Annual Income (k$)','Spending Score (1-100)']].iloc[:,:].values

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