Customer Shopping Behavior Analysis

1. Project Overview

This project analyzes customer shopping behavior using transactional data from 3,900 purchases across various product categories. The goal is to uncover insights into spending patterns, customer segments, product preferences, and subscription behavior to guide strategic business decisions.

2. Dataset Summary

-Rows: 3,900

- Columns: 18

- Key Features:

- Customer demographics (Age, Gender, Location, Subscription Status)

- Purchase details (Item Purchased, Category, Purchase Amount, Season, Size, Color)

- Shopping behavior (Discount Applied, Promo Code Used, Previous Purchases Frequency of Purchases, Review Rating, Shipping Type)

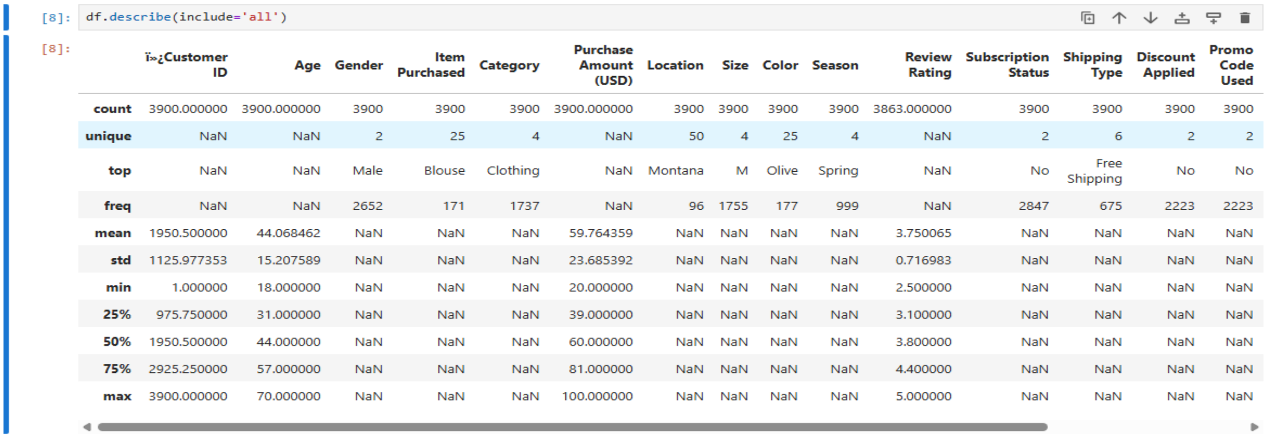
- Missing Data: 37 values in Review Rating column

3. Exploratory Data Analysis using Python

We began with data preparation and cleaning in Python:

● **Data Loading:** Imported the dataset using pandas.

● **Initial Exploration**: Used df.info() to check structure and .describe() for summary statistics



```
[8]: df.describe(include='all')
```

[8]:

	ï»¿Customer ID	Age	Gender	Item Purchased	Category	Purchase Amount (USD)	Location	Size	Color	Season	Review Rating	Subscription Status	Shipping Type	Discount Applied	Promo Code Used
count	3900.000000	3900.000000	3900	3900	3900	3900.000000	3900	3900	3900	3900	3863.000000	3900	3900	3900	3900
unique	NaN	NaN	2	25	4	NaN	50	4	25	4	NaN	2	6	2	2
top	NaN	NaN	Male	Blouse	Clothing	NaN	Montana	M	Olive	Spring	NaN	No	Free Shipping	No	No
freq	NaN	NaN	2652	171	1737	NaN	96	1755	177	999	NaN	2847	675	2223	2223
mean	1950.500000	44.068462	NaN	NaN	NaN	59.764359	NaN	NaN	NaN	NaN	3.750065	NaN	NaN	NaN	NaN
std	1125.977353	15.207589	NaN	NaN	NaN	23.685392	NaN	NaN	NaN	NaN	0.716983	NaN	NaN	NaN	NaN
min	1.000000	18.000000	NaN	NaN	NaN	20.000000	NaN	NaN	NaN	NaN	2.500000	NaN	NaN	NaN	NaN
25%	975.750000	31.000000	NaN	NaN	NaN	39.000000	NaN	NaN	NaN	NaN	3.100000	NaN	NaN	NaN	NaN
50%	1950.500000	44.000000	NaN	NaN	NaN	60.000000	NaN	NaN	NaN	NaN	3.800000	NaN	NaN	NaN	NaN
75%	2925.250000	57.000000	NaN	NaN	NaN	81.000000	NaN	NaN	NaN	NaN	4.400000	NaN	NaN	NaN	NaN
max	3900.000000	70.000000	NaN	NaN	NaN	100.000000	NaN	NaN	NaN	NaN	5.000000	NaN	NaN	NaN	NaN

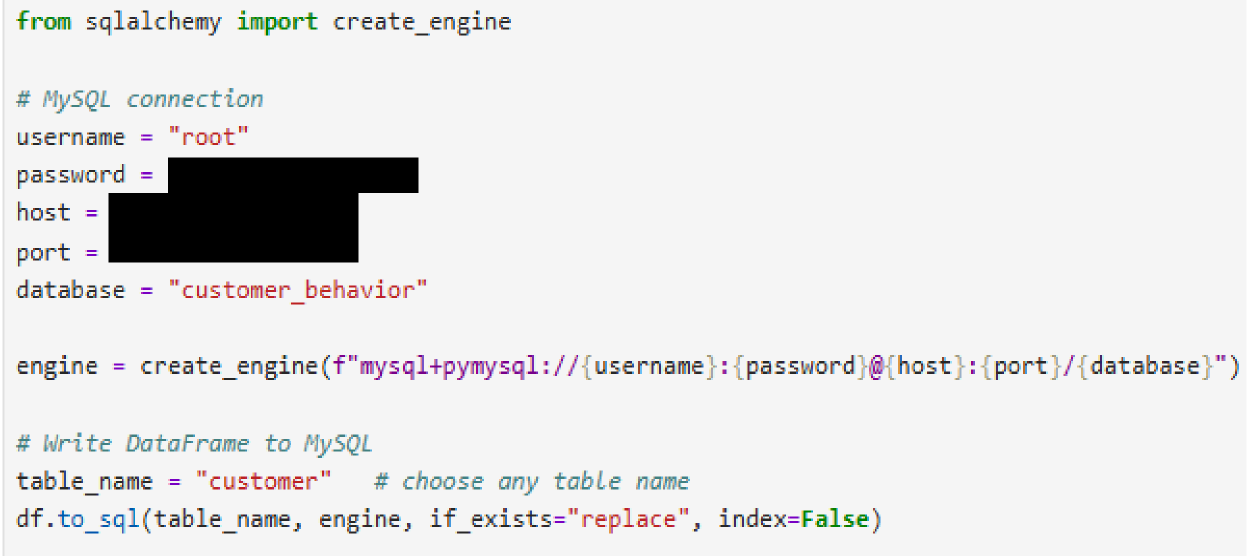
- **Missing Data Handling:** Checked for null values and imputed missing values in the Review Rating column using the median rating of each product category.

- **Column Standardization:** Renamed columns to snake case for better readability and documentation.

- **Feature Engineering:**
  - ○ Created **age_group** column by binning customer ages.
  - ○ Created **purchase_frequency_days** column from purchase data.

- **Data Consistency Check:** Verified if discount_applied and promo_code_used were redundant; dropped promo_code_used.

- **Database Integration:** Connected Python script to MySQL and loaded the cleaned DataFrame into the database for SQL analysis.

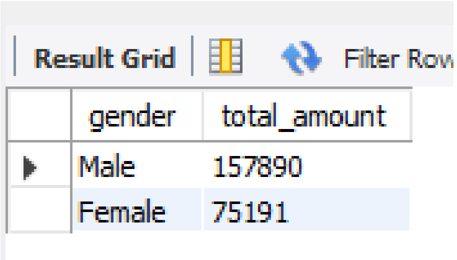


```
from sqlalchemy import create_engine

# MySQL connection
username = "root"
password = [redacted]
host = [redacted]
port =
database = "customer_behavior"

engine = create_engine(f"mysql+pymysql://{username}:{password}@{host}:{port}/{database}")

# Write DataFrame to MySQL
table_name = "customer"    # choose any table name
df.to_sql(table_name, engine, if_exists="replace", index=False)
```

4. Data Analysis using SQL (Business Transactions)

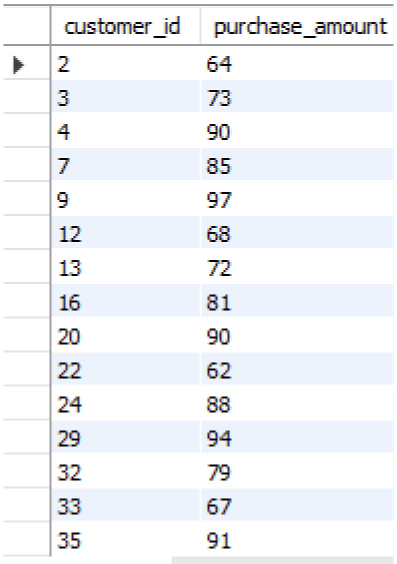
We performed structured analysis in MySQL to answer key business questions:

1. **Revenue by Gender –** Compared total revenue generated by male vs. female customers.



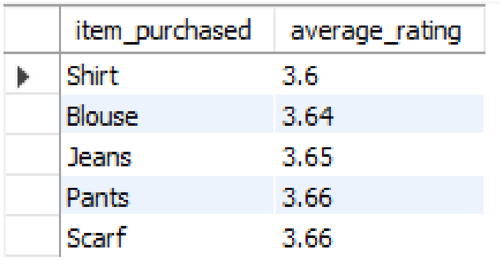
gender	total_amount
Male	157890
Female	75191

2. High-Spending Discount Users – Identified customers who used discounts but still spent above the average purchase amount.



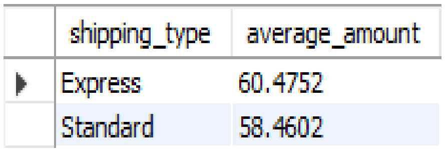
customer_id	purchase_amount
2	64
3	73
4	90
7	85
9	97
12	68
13	72
16	81
20	90
22	62
24	88
29	94
32	79
33	67
35	91

3. Top 5 Products by Rating – Found products with the highest average review ratings.



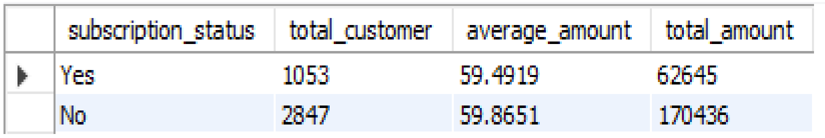
item_purchased	average_rating
Shirt	3.6
Blouse	3.64
Jeans	3.65
Pants	3.66
Scarf	3.66

4. Shipping Type Comparison – Compared average purchase amounts between Standard and Express shipping.



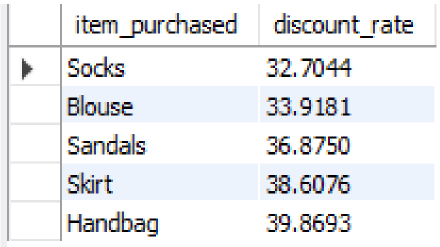
shipping_type	average_amount
Express	60.4752
Standard	58.4602

5. Subscribers vs. Non-Subscribers – Compared average spend and total revenue across subscription status.



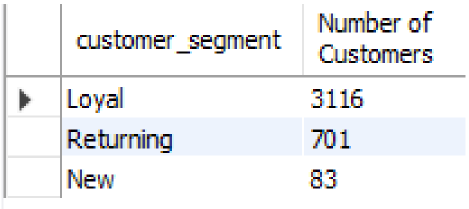
subscription_status	total_customer	average_amount	total_amount
Yes	1053	59.4919	62645
No	2847	59.8651	170436

6. Discount-Dependent Products – Identified 5 products with the highest percentage of discounted purchases.



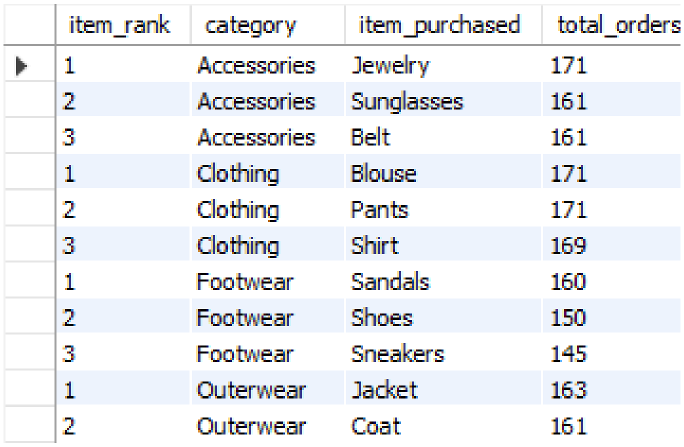
item_purchased	discount_rate
Socks	32.7044
Blouse	33.9181
Sandals	36.8750
Skirt	38.6076
Handbag	39.8693

7. Customer Segmentation – Classified customers into New, Returning, and Loyal segments based on purchase history.



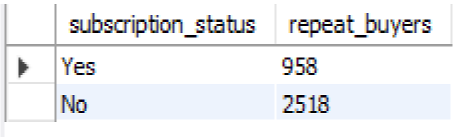
customer_segment	Number of Customers
Loyal	3116
Returning	701
New	83

8. Top 3 Products per Category – Listed the most purchased products within each category.



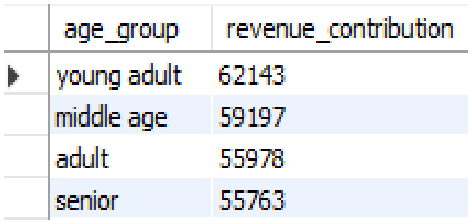
item_rank	category	item_purchased	total_orders
1	Accessories	Jewelry	171
2	Accessories	Sunglasses	161
3	Accessories	Belt	161
1	Clothing	Blouse	171
2	Clothing	Pants	171
3	Clothing	Shirt	169
1	Footwear	Sandals	160
2	Footwear	Shoes	150
3	Footwear	Sneakers	145
1	Outerwear	Jacket	163
2	Outerwear	Coat	161

9. Repeat Buyers & Subscriptions – Checked whether customers with >5 purchases are more likely to subscribe.



subscription_status	repeat_buyers
Yes	958
No	2518

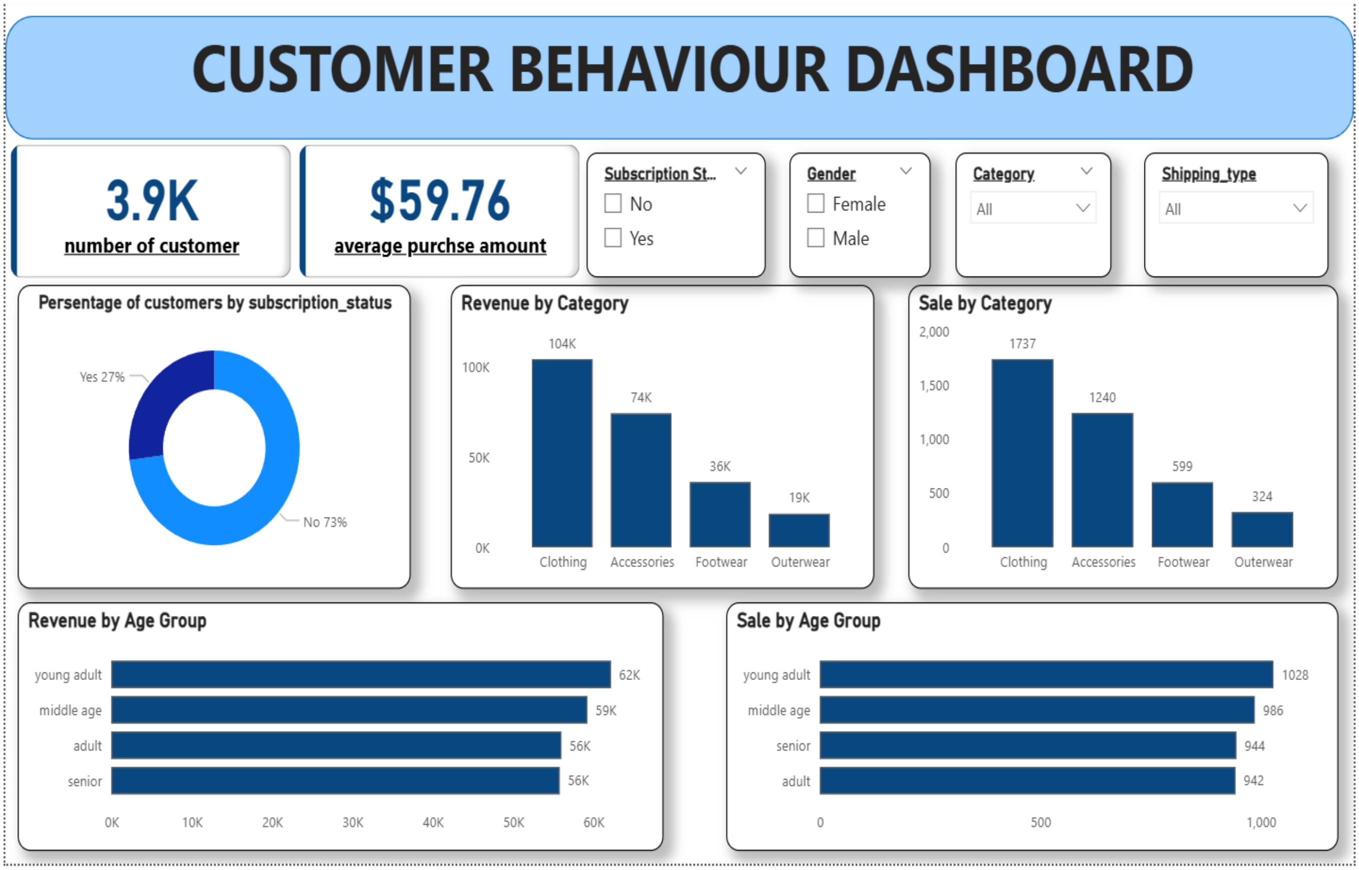
10. Revenue by Age Group – Calculated total revenue contribution of each age group.



age_group	revenue_contribution
young adult	62143
middle age	59197
adult	55978
senior	55763

5. Dashboard in Power BI

Finally, we built an interactive dashboard in Power BI to present insights visually.



CUSTOMER BEHAVIOUR DASHBOARD

3.9K
number of customer

$59.76
average purchse amount

Subscription St...
□ No
□ Yes

Gender
□ Female
□ Male

Category
All

Shipping_type
All

6. Business Recommendations

● Boost Subscriptions – Promote exclusive benefits for subscribers.

● Customer Loyalty Programs – Reward repeat buyers to move them into the “Loyal” segment.

● Review Discount Policy – Balance sales boosts with margin control.

● Product Positioning – Highlight top-rated and best-selling products in campaigns.

● Targeted Marketing – Focus efforts on high-revenue age groups and express-shipping users.