Data-Driven Analysis of Customer Shopping Behavior

Project Overview

This analysis explores customer purchasing behavior based on 3,900 transactions spanning diverse product categories. The project aims to uncover actionable insights on spending habits, customer segments, product demand, and subscription behavior to inform strategic decision-making.

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)

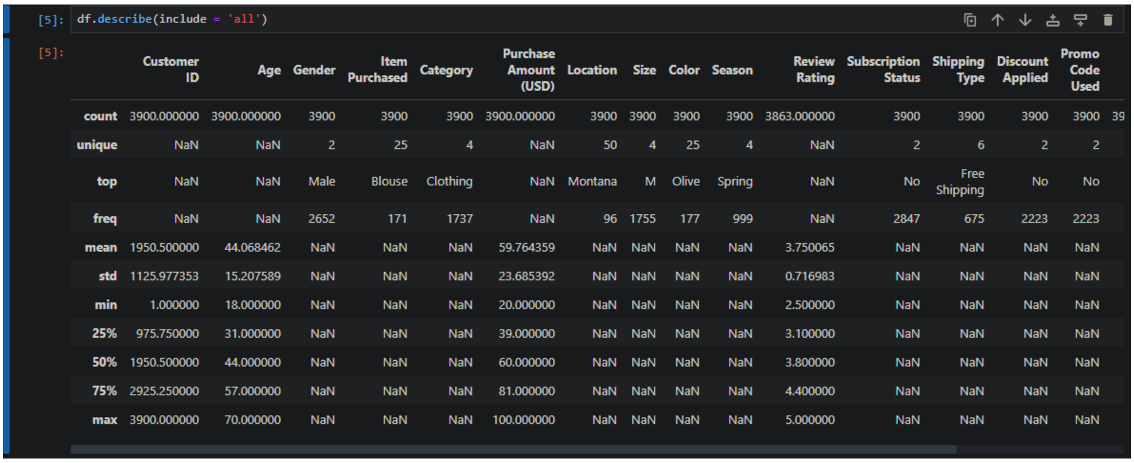
    - Shopping behavior (Discount Applied, Promo Code Used, Previous Purchases, Frequency of Purchases, Review Rating, Shipping Type)

    - Missing Data: 37 values in Review Rating column

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.



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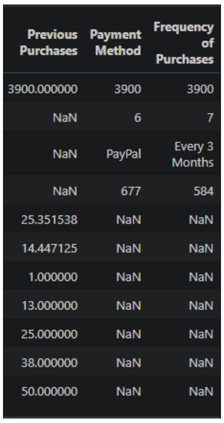
[5]: df.describe(include = 'all')
```

[5]:

	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	39
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	

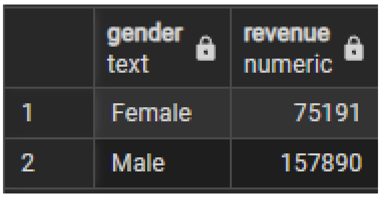


Previous Purchases	Payment Method	Frequency of Purchases
3900.000000	3900	3900
NaN	6	7
NaN	PayPal	Every 3 Months
NaN	677	584
25.351538	NaN	NaN
14.447125	NaN	NaN
1.000000	NaN	NaN
13.000000	NaN	NaN
25.000000	NaN	NaN
38.000000	NaN	NaN
50.000000	NaN	NaN

- 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 PostgreSQL and loaded the cleaned DataFrame into the database for SQL analysis.

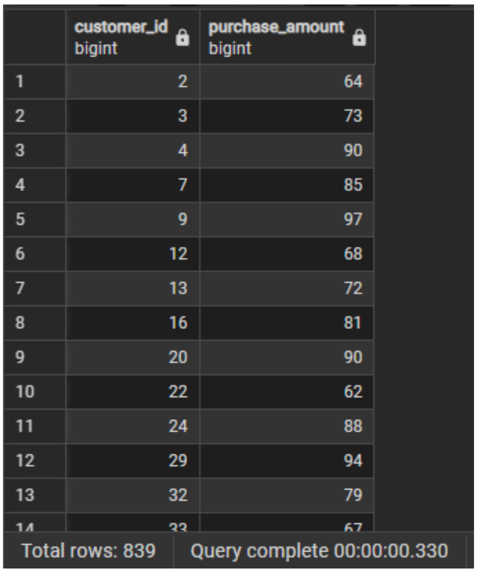
Data Analysis using SQL (Business Transactions)

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



	gender text	revenue numeric
1	Female	75191
2	Male	157890

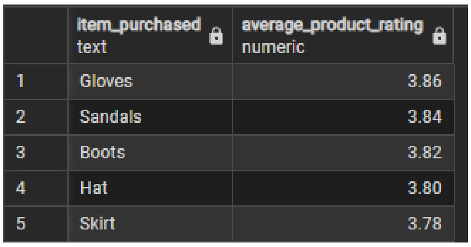
2. High-Spending Discount Users – Identified customers who used discounts but still spent above the average purchase amount.



	customer_id bigint	purchase_amount bigint
1	2	64
2	3	73
3	4	90
4	7	85
5	9	97
6	12	68
7	13	72
8	16	81
9	20	90
10	22	62
11	24	88
12	29	94
13	32	79
14	33	67

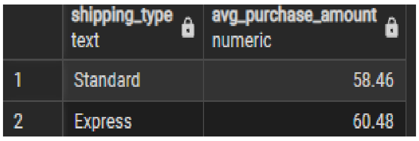
Total rows: 839 Query complete 00:00:00.330

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



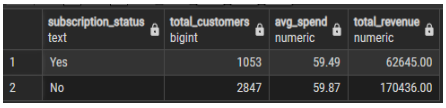
	item_purchased text	average_product_rating numeric
1	Gloves	3.86
2	Sandals	3.84
3	Boots	3.82
4	Hat	3.80
5	Skirt	3.78

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



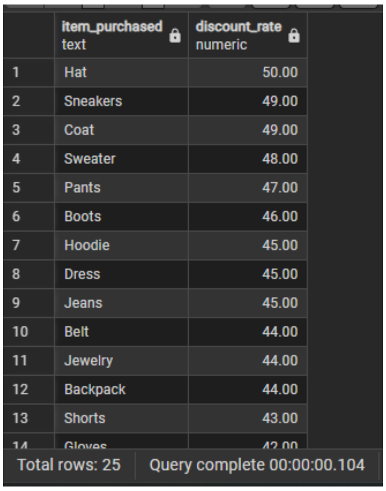
	shipping_type text	avg_purchase_amount numeric
1	Standard	58.46
2	Express	60.48

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



	subscription_status text	total_customers bigint	avg_spend numeric	total_revenue numeric
1	Yes	1053	59.49	62645.00
2	No	2847	59.87	170436.00

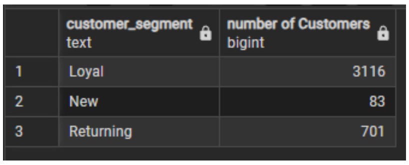
6. Discount-Dependent Products – Identified 5 products with the highest percentage of discounted purchases.



	item_purchased text	discount_rate numeric
1	Hat	50.00
2	Sneakers	49.00
3	Coat	49.00
4	Sweater	48.00
5	Pants	47.00
6	Boots	46.00
7	Hoodie	45.00
8	Dress	45.00
9	Jeans	45.00
10	Belt	44.00
11	Jewelry	44.00
12	Backpack	44.00
13	Shorts	43.00
14	Gloves	42.00

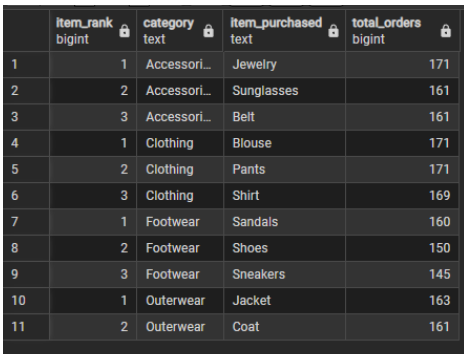
Total rows: 25 Query complete 00:00:00.104

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



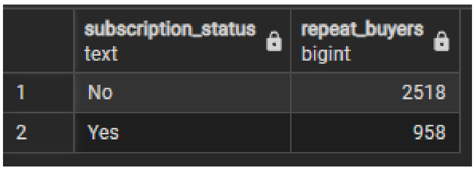
	customer_segment text	number of Customers bigint
1	Loyal	3116
2	New	83
3	Returning	701

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



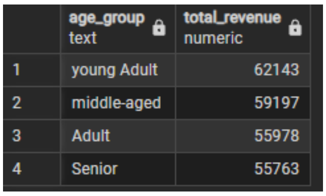
	item_rank bigint	category text	item_purchased text	total_orders bigint
1	1	Accessori…	Jewelry	171
2	2	Accessori…	Sunglasses	161
3	3	Accessori…	Belt	161
4	1	Clothing	Blouse	171
5	2	Clothing	Pants	171
6	3	Clothing	Shirt	169
7	1	Footwear	Sandals	160
8	2	Footwear	Shoes	150
9	3	Footwear	Sneakers	145
10	1	Outerwear	Jacket	163
11	2	Outerwear	Coat	161

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



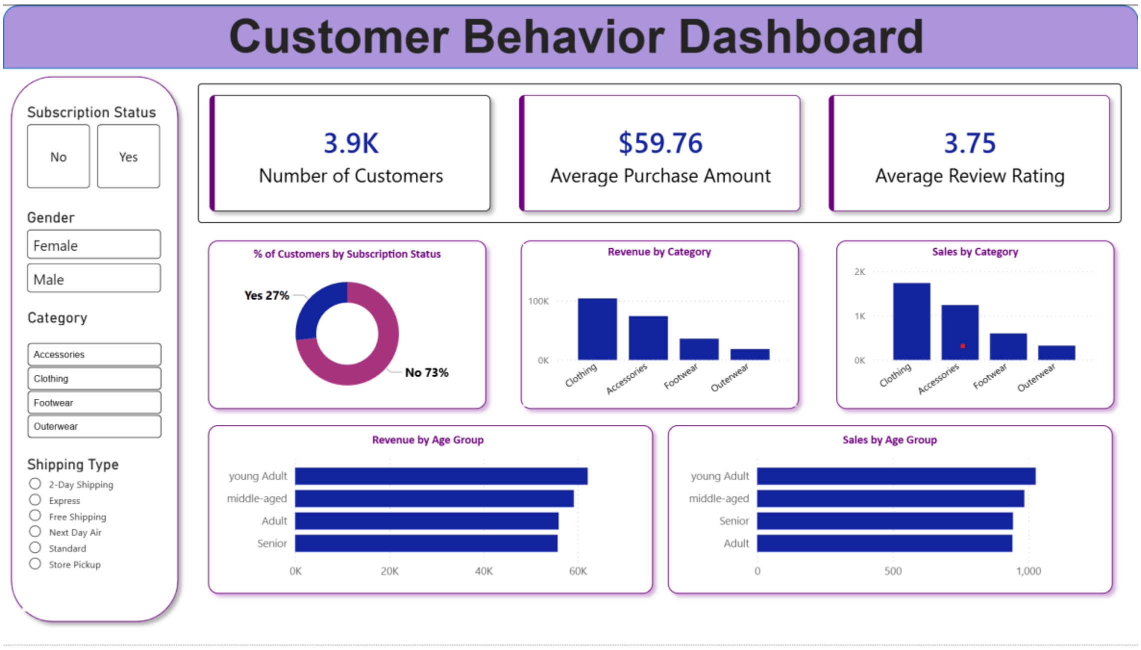
	subscription_status text	repeat_buyers bigint
1	No	2518
2	Yes	958

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



	age_group text	total_revenue numeric
1	young Adult	62143
2	middle-aged	59197
3	Adult	55978
4	Senior	55763

Dashboard in Power BI



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