

Customer Shopping Behavior Analysis

Business Problem Statement

A leading retail company wants to better understand its customers' shopping behavior in order to improve sales, customer satisfaction, and long-term loyalty. The management team has noticed changes in purchasing patterns across demographics, product categories, and sales channels (online vs. offline). They are particularly interested in uncovering which factors, such as discounts, reviews, seasons, or payment preferences, drive consumer decisions and repeat purchases.

The main business question to answer in this analysis is:

"How can the company leverage consumer shopping data to identify trends, improve customer engagement, and optimize marketing and product strategies?"

Tools Used:

- **Python (pandas):** data cleaning and preprocessing
- **SQL:** data exploration, aggregation, and business insights extraction
- **Power BI:** visualization of key metrics and interactive dashboard creation

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.

	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

Promo Code Used	Previous Purchases	Payment Method	Frequency of Purchases
3900	3900.000000	3900	3900
2	Nan	6	7
No	Nan	PayPal	Every 3 Months
2223	Nan	677	584
Nan	25.351538	Nan	Nan
Nan	14.447125	Nan	Nan
Nan	1.000000	Nan	Nan
Nan	13.000000	Nan	Nan
Nan	25.000000	Nan	Nan
Nan	38.000000	Nan	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.

4. Data Analysis using SQL

I performed structures analysis in PosgreSQL to answer key business questions:

- a) **Revenue by Gender** - Compared total revenue generated by male vs. female customers.

	gender text	revenue numeric
1	Female	75191
2	Male	157890

- b) **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
15	35	91

- c) **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

- d) **Shipping Type Comparison** – Compared average purchase amounts between Standard and Express shipping.

	shipping_type 	Average purchase amount 
	text	numeric
1	Standard	58.46
2	Express	60.48

- e) **Subscribers vs. Non-Subscribers** – Compared average spend and total revenue across subscription status.

	subscription_status 	Total customers 	avg_spend 	total_revenue 
	text	bigint	numeric	numeric
1	Yes	1053	59.49	62645
2	No	2847	59.87	170436

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

	item_purchased 	discount_rate 
	text	numeric
1	Hat	50.00
2	Sneakers	49.66
3	Coat	49.07
4	Sweater	48.17
5	Pants	47.37

- g) **Customer Segmentation** – Classified customers into New, Returning, and Loyal segments based on purchase history.

	customer_segment text	Count of segment bigint
1	Loyal	3116
2	Returning	701
3	New	83

- h) **Top 3 Products per Category** – Listed the most purchased products within each category.

	item_rank bigint	category text	item_purchased text	number_of_purchases 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

- i) **Repeat Buyers & Subscriptions** – Checked whether customers with >5 purchases are more likely to subscribe.

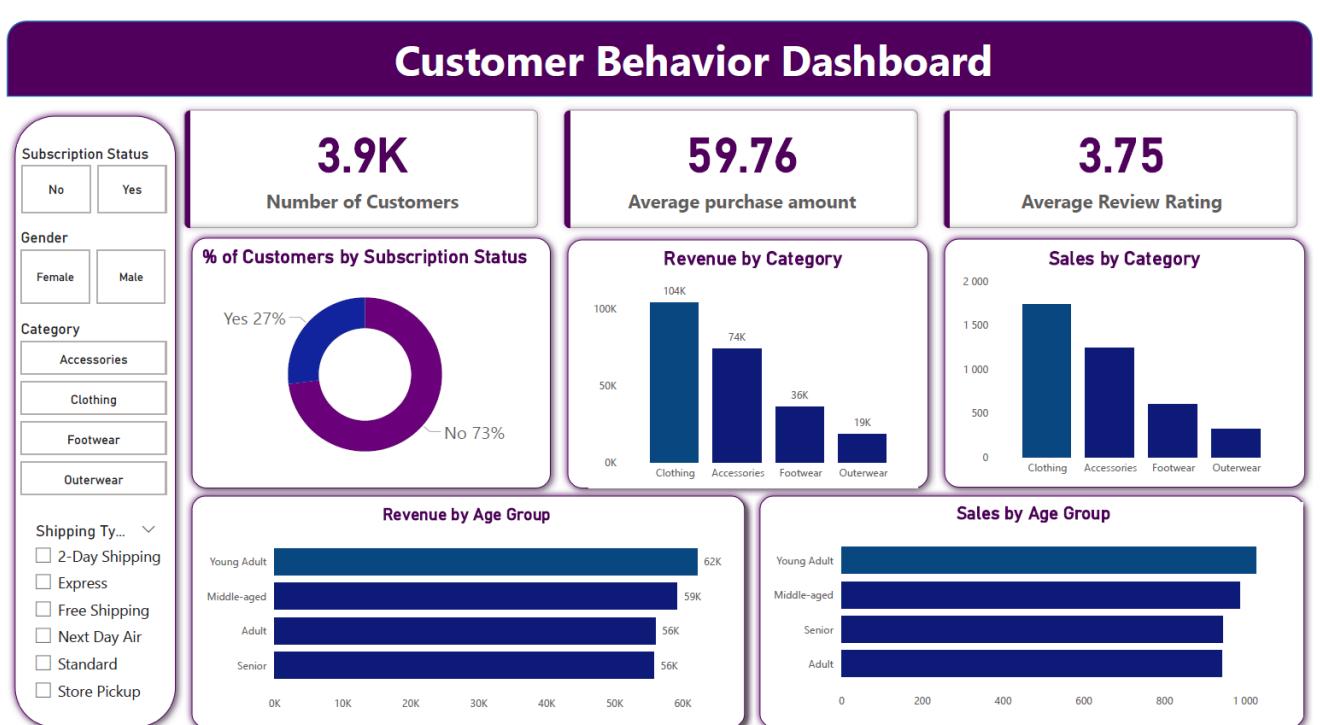
	subscription_status text	Repeat buyers bigint
1	No	2518
2	Yes	958

- j) **Revenue by Age Group** – Calculated total revenue contribution of each age group.

	age_group text	total_revenue numeric
1	Young Adult	62143.00
2	Middle-aged	59197.00
3	Adult	55978.00
4	Senior	55763.00

5. Dashboard in PowerBI

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



6. Business recommendations

1. **Target high-value segments:** direct marketing and product strategies toward age groups and customer categories that consistently generate the highest revenue and purchase volume.
2. **Boost subscriptions:** promote exclusive benefits for subscribers.
3. **Optimize discount policies:** identify products which truly benefit from discounts. Apply them strategically to low-performing categories rather than across the board.
4. **Product positioning:** promote best-selling products in marketing campaigns to boost overall sales.
5. **Customer loyalty programs:** with over 80% of customers classified as loyal, the company should maintain engagement through exclusive offers while introducing initiatives to attract new customers: referral bonuses or first-purchase discounts.