

## Problem Statement

A retail business serves a diverse customer base across multiple product categories, seasons, and purchasing patterns. Although the company collects detailed customer transaction data, it lacks clear visibility into how different customer segments behave and which factors most strongly influence purchasing decisions and repeat buying behavior.

Shifts in customer demographics, payment preferences, subscription usage, and promotional effectiveness have made it challenging for the business to identify high-value customers and optimize marketing strategies. As a result, customer engagement efforts remain broad and less targeted, limiting opportunities for improved retention and revenue growth.

The focus is on analyzing historical customer shopping data to uncover meaningful patterns in customer behavior. The insights generated aim to support data-driven decisions related to marketing optimization, customer engagement, and long-term business strategy.

## Business Objective

To analyze customer transaction data in order to identify purchasing trends, segment customers based on behavior, and generate actionable insights that support marketing optimization and customer retention initiatives.

## Deliverables

1. **Data Preparation & Analysis (Python)**
  - Cleaned and transformed customer transaction data and performed exploratory analysis to identify behavioral patterns.
2. **Analytical Queries & Insights (SQL)**
  - Executed structured queries to analyze customer segments, purchase frequency, spending behavior, and loyalty indicators.
3. **Interactive Dashboard (Power BI)**
  - Developed a business-focused dashboard highlighting key metrics, trends, and customer segments for stakeholders.
4. **Insights & Recommendations**
  - Summarized key findings and provided actionable business recommendations to improve customer engagement and marketing effectiveness.

# RETAIL CUSTOMER BEHAVIOR ANALYSIS

## 1. Project Overview

This project looks into retail customer shopping behavior using data from 3,900 purchases across different product categories. The aim is to uncover insights about spending habits, customer groups, product preferences, and subscription behavior to help guide business decisions.

## 2. Dataset Summary

- Rows: 3900
- Key Features:
  - Customer information (Age, Gender, Location, Subscription Status)
  - Purchase details (Item Purchased, Category, Purchase Amount, Season, Size, Colour)
  - Shopping behaviour (Discount Applied, Promo Code Used, Previous Purchases, Frequency of Purchases, Review Rating, Shipping Type)
- Missing Data: 37 missing values in the Review Rating column

## 3. Exploratory Data Analysis using Python

We started by preparing and cleaning the data in Python:

- Data Loading: We imported the dataset using pandas.
- Initial Exploration: Used `df.info()` to check the 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
<code>count</code>	3900.000000	3900.000000	3900	3900	3900	3900.000000	3900	3900	3900	3900	3863.000000	3900	3900	3900	3900
<code>unique</code>	NaN	NaN	2	25	4	NaN	50	4	25	4	NaN	2	6	2	2
<code>top</code>	NaN	NaN	Male	Blouse	Clothing	NaN	Montana	M	Olive	Spring	NaN	No	Free Shipping	No	No
<code>freq</code>	NaN	NaN	2652	171	1737	NaN	96	1755	177	999	NaN	2847	675	2223	2223
<code>mean</code>	1950.500000	44.068462	NaN	NaN	NaN	59.764359	NaN	NaN	NaN	NaN	3.750065	NaN	NaN	NaN	NaN
<code>std</code>	1125.977353	15.207589	NaN	NaN	NaN	23.685392	NaN	NaN	NaN	NaN	0.716983	NaN	NaN	NaN	NaN
<code>min</code>	1.000000	18.000000	NaN	NaN	NaN	20.000000	NaN	NaN	NaN	NaN	2.500000	NaN	NaN	NaN	NaN
<code>25%</code>	975.750000	31.000000	NaN	NaN	NaN	39.000000	NaN	NaN	NaN	NaN	3.100000	NaN	NaN	NaN	NaN
<code>50%</code>	1950.500000	44.000000	NaN	NaN	NaN	60.000000	NaN	NaN	NaN	NaN	3.800000	NaN	NaN	NaN	NaN
<code>75%</code>	2925.250000	57.000000	NaN	NaN	NaN	81.000000	NaN	NaN	NaN	NaN	4.400000	NaN	NaN	NaN	NaN
<code>max</code>	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

- **Handling Missing Data:** Checked for missing values and filled in the missing Review Rating data with the median rating of each product category.
- **Column Standardisation:** Renamed columns to snake case for clearer reading and better documentation.
- **Feature Engineering:**
  - Created an **age\_group** column by grouping customer ages.
  - Created a **purchase\_frequency\_days** column from purchase data.
- **Data Consistency Check:** Verified whether the columns **discount\_applied** and **promo\_code\_used** were redundant and removed **promo\_code\_used**.
- **Database Integration:** Connected the Python script to PostgreSQL and loaded the cleaned data into the database for SQL analysis.

#### 4. Exploratory Data Analysis using Python

- a. **Revenue by Gender** – Compared total revenue from male and 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 more than the average amount.

	<b>customer_id</b> 	<b>purchase_amount</b> 
	bigint	bigint
1	2	64
2	3	73
3	4	90
4	7	85
5	9	97
6	12	68
7	13	72

Total rows: 839    Query complete 00:00:00.090

- c. **Top 5 Products by Rating** – Found the top-rated products based on average review scores.

	<b>item_purchased</b> 	<b>Average Product Rating</b> 
	text	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 for Standard and Express shipping.

	<b>shipping_type</b> 	<b>round</b> 
	text	numeric
1	Standard	58.46
2	Express	60.48

- e. **Subscribers' vs Non-Subscribers** – Compared the average spend and total revenue between subscribed and non-subscribed customers.

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

- f. **Discount-Dependent Products** – Identified the five 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** – Grouped customers into New, Returning, and Loyal segments based on their purchase history.

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

- h. **Top 3 Products per Category** – Listed the top three products within each category.

	item_rank	category	item_purchased	total_orders
	bigint	text	text	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 if customers with more than five purchases are more likely to subscribe.

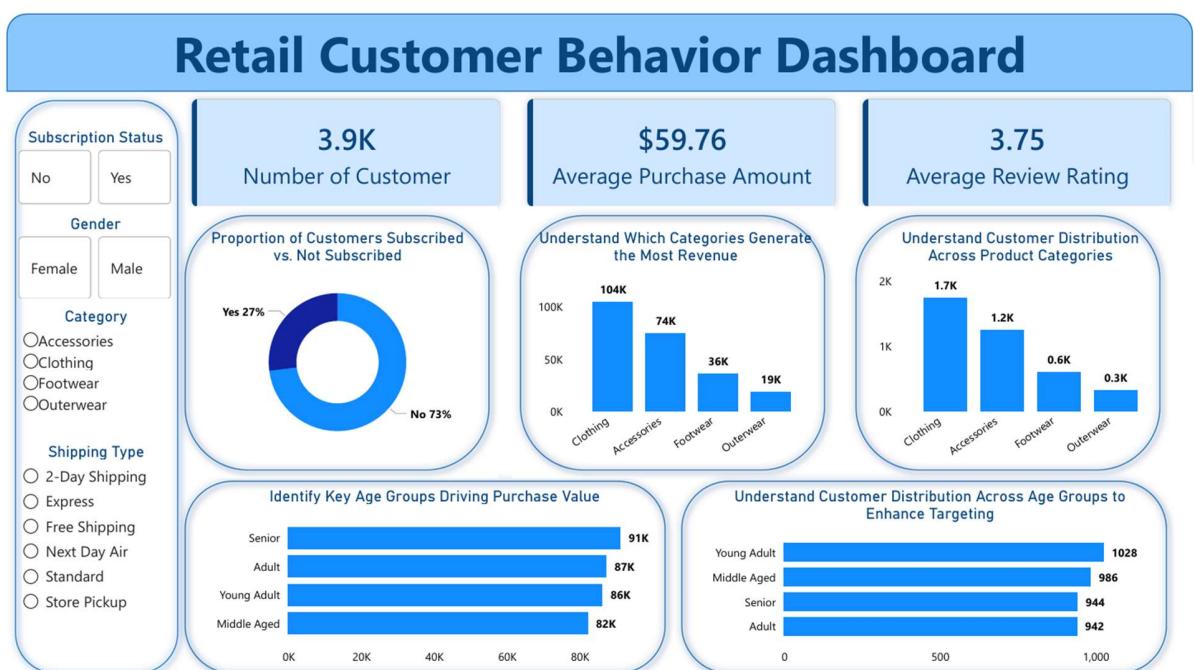
	subscription_status  text	repeat_buyers  bigint
1	No	2518
2	Yes	958

- j. **Revenue by Age Group** – Calculated the 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

## 5. Dashboard in Power BI

Created an interactive dashboard in Power BI to display the insights visually



## 6. Business Recommendations

- **Boost Subscriptions:** Offer exclusive benefits for subscribers to encourage more sign-ups.
- **Customer Loyalty Programs:** Reward repeat customers to help move them into the "Loyal" segment.
- **Review Discount Policy:** Find a balance between increasing sales through discounts and controlling profit margins.
- **Product Positioning:** Focus on highlighting the best-rated and best-selling products in marketing campaigns.
- **Targeted Marketing:** Focus marketing efforts on high-revenue age groups and customers who use express shipping.