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January 27, 2025

[1]:
```
# Import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[2]:
```
# Load datasets
customers_df = pd.read_csv('Customers.csv')
products_df = pd.read_csv('Products.csv')
transactions_df = pd.read_csv('Transactions.csv')
```

[3]:
```
# Display basic information
print("Basic information in Customers.csv:\n",customers_df.info())
print("\nBasic information in Products.csv:\n",products_df.info())
print("\nBasic information in Transactions.csv:\n",transactions_df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   CustomerID    200 non-null    object
 1   CustomerName  200 non-null    object
 2   Region        200 non-null    object
 3   SignupDate    200 non-null    object
dtypes: object(4)
memory usage: 6.4+ KB
Basic information in Customers.csv:
 None
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 4 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   ProductID    100 non-null    object 
 1   ProductName  100 non-null    object 
 2   Category     100 non-null    object 
 3   Price        100 non-null    float64
```

```
dtypes: float64(1), object(3)
memory usage: 3.3+ KB

Basic information in Products.csv:
 None
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 7 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   TransactionID    1000 non-null   object
 1   CustomerID       1000 non-null   object
 2   ProductID        1000 non-null   object
 3   TransactionDate  1000 non-null   object
 4   Quantity         1000 non-null   int64
 5   TotalValue       1000 non-null   float64
 6   Price            1000 non-null   float64
dtypes: float64(2), int64(1), object(4)
memory usage: 54.8+ KB

Basic information in Transactions.csv:
 None
```

[4]:
```
# Check for missing values
print("Missing values in Customers.csv:\n", customers_df.isnull().sum())
print("\nMissing values in Products.csv:\n", products_df.isnull().sum())
print("\nMissing values in Transactions.csv:\n", transactions_df.isnull().sum())
```

```
Missing values in Customers.csv:
 CustomerID      0
CustomerName    0
Region          0
SignupDate      0
dtype: int64

Missing values in Products.csv:
 ProductID      0
ProductName    0
Category       0
Price          0
dtype: int64

Missing values in Transactions.csv:
 TransactionID      0
CustomerID          0
ProductID           0
TransactionDate     0
Quantity            0
```

```
TotalValue         0
Price              0
dtype: int64
```

[5]:
```
# Check for duplicates
print("Duplicate rows in Customers.csv:", customers_df.duplicated().sum())
print("Duplicate rows in Products.csv:", products_df.duplicated().sum())
print("Duplicate rows in Transactions.csv:", transactions_df.duplicated().sum())
```

```
Duplicate rows in Customers.csv: 0
Duplicate rows in Products.csv: 0
Duplicate rows in Transactions.csv: 0
```

[6]:
```
# Display descriptive statistics
print("Descriptive statistics for Customers.csv:\n", customers_df.
 ↪describe(include='all'))
print("\nDescriptive statistics for Products.csv:\n", products_df.
 ↪describe(include='all'))
print("\nDescriptive statistics for Transactions.csv:\n", transactions_df.
 ↪describe())
```

```
Descriptive statistics for Customers.csv:
        CustomerID      CustomerName         Region  SignupDate
count         200               200            200         200
unique        200               200              4         179
top         C0001  Lawrence Carroll  South America  2024-11-11
freq            1                 1             59           3

Descriptive statistics for Products.csv:
        ProductID            ProductName Category       Price
count         100                    100      100  100.000000
unique        100                     66        4         NaN
top          P001  ActiveWear Smartwatch    Books         NaN
freq            1                      4       26         NaN
mean          NaN                    NaN      NaN  267.551700
std           NaN                    NaN      NaN  143.219383
min           NaN                    NaN      NaN   16.080000
25%           NaN                    NaN      NaN  147.767500
50%           NaN                    NaN      NaN  292.875000
75%           NaN                    NaN      NaN  397.090000
max           NaN                    NaN      NaN  497.760000

Descriptive statistics for Transactions.csv:
           Quantity   TotalValue       Price
count  1000.000000  1000.000000  1000.00000
mean      2.537000   689.995560   272.55407
std       1.117981   493.144478   140.73639
min       1.000000    16.080000    16.08000
```

```
25%       2.000000   295.295000   147.95000
50%       3.000000   588.880000   299.93000
75%       4.000000  1011.660000   404.40000
max       4.000000  1991.040000   497.76000
```

[7]:
```
# Merge datasets for complete analysis
merged_df = transactions_df.merge(customers_df, on='CustomerID').
 ↪merge(products_df, on='ProductID')
merged_df
```

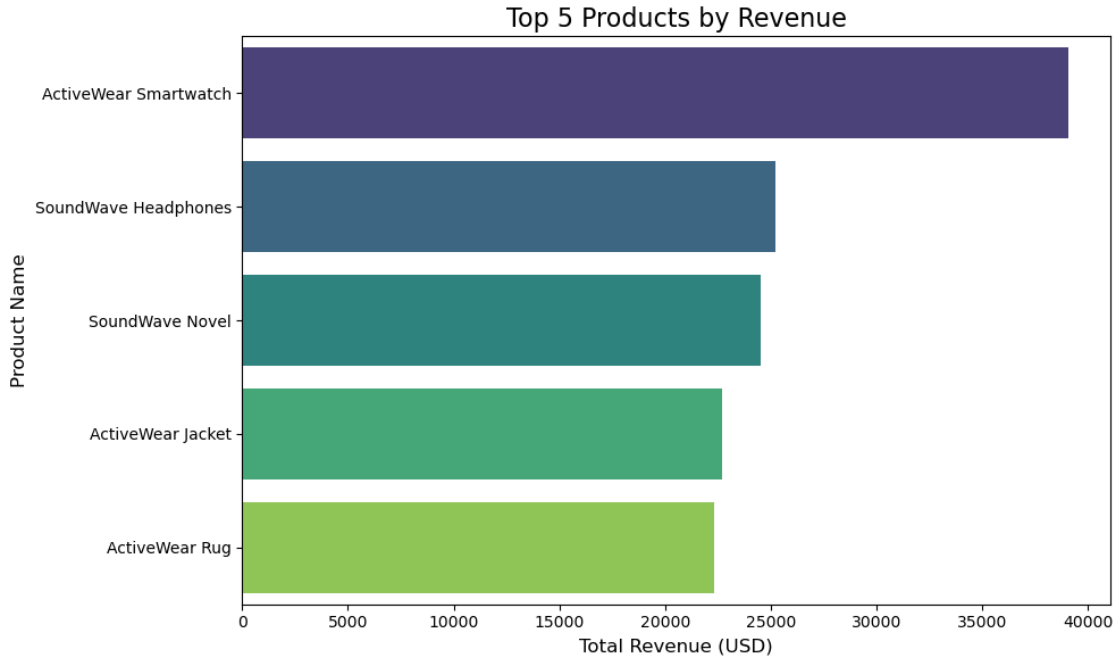
[7]:
```
    TransactionID CustomerID ProductID      TransactionDate  Quantity  \
0          T00001      C0199      P067  2024-08-25 12:38:23         1
1          T00112      C0146      P067  2024-05-27 22:23:54         1
2          T00166      C0127      P067  2024-04-25 07:38:55         1
3          T00272      C0087      P067  2024-03-26 22:55:37         2
4          T00363      C0070      P067  2024-03-21 15:10:10         3
..            …          …        …                   …        …
995        T00630      C0031      P093  2024-10-08 23:58:14         2
996        T00672      C0165      P044  2024-07-28 00:09:49         4
997        T00711      C0165      P044  2024-06-11 15:51:14         4
998        T00878      C0165      P044  2024-09-24 21:15:21         3
999        T00157      C0169      P044  2024-11-09 09:07:36         2

     TotalValue  Price_x     CustomerName         Region  SignupDate  \
0        300.68   300.68   Andrea Jenkins         Europe  2022-12-03
1        300.68   300.68  Brittany Harvey           Asia  2024-09-04
2        300.68   300.68  Kathryn Stevens         Europe  2024-04-04
3        601.36   300.68  Travis Campbell  South America  2024-04-11
4        902.04   300.68    Timothy Perez         Europe  2022-03-15
..          …      …              …            …          …
995      609.88   304.94      Tina Miller  South America  2024-04-11
996       75.28    18.82    Juan Mcdaniel  South America  2022-04-09
997       75.28    18.82    Juan Mcdaniel  South America  2022-04-09
998       56.46    18.82    Juan Mcdaniel  South America  2022-04-09
999       37.64    18.82    Jennifer Shaw  South America  2023-04-13

                         ProductName     Category  Price_y
0    ComfortLiving Bluetooth Speaker  Electronics   300.68
1    ComfortLiving Bluetooth Speaker  Electronics   300.68
2    ComfortLiving Bluetooth Speaker  Electronics   300.68
3    ComfortLiving Bluetooth Speaker  Electronics   300.68
4    ComfortLiving Bluetooth Speaker  Electronics   300.68
..                               …         …      …
995                    TechPro Vase   Home Decor   304.94
996         ActiveWear Running Shoes     Clothing    18.82
997         ActiveWear Running Shoes     Clothing    18.82
998         ActiveWear Running Shoes     Clothing    18.82
```

```
999          ActiveWear Running Shoes      Clothing    18.82

[1000 rows x 13 columns]
```

[8]:
```python
# Business Insights
# Insight 1: Top 5 Products by Revenue
top_products = merged_df.groupby('ProductName')['TotalValue'].sum().
 ↪sort_values(ascending=False).head(5)
print("Top 5 Products by Revenue:\n", top_products)
```

```
Top 5 Products by Revenue:
 ProductName
ActiveWear Smartwatch    39096.97
SoundWave Headphones     25211.64
SoundWave Novel          24507.90
ActiveWear Jacket        22712.56
ActiveWear Rug           22314.43
Name: TotalValue, dtype: float64
```

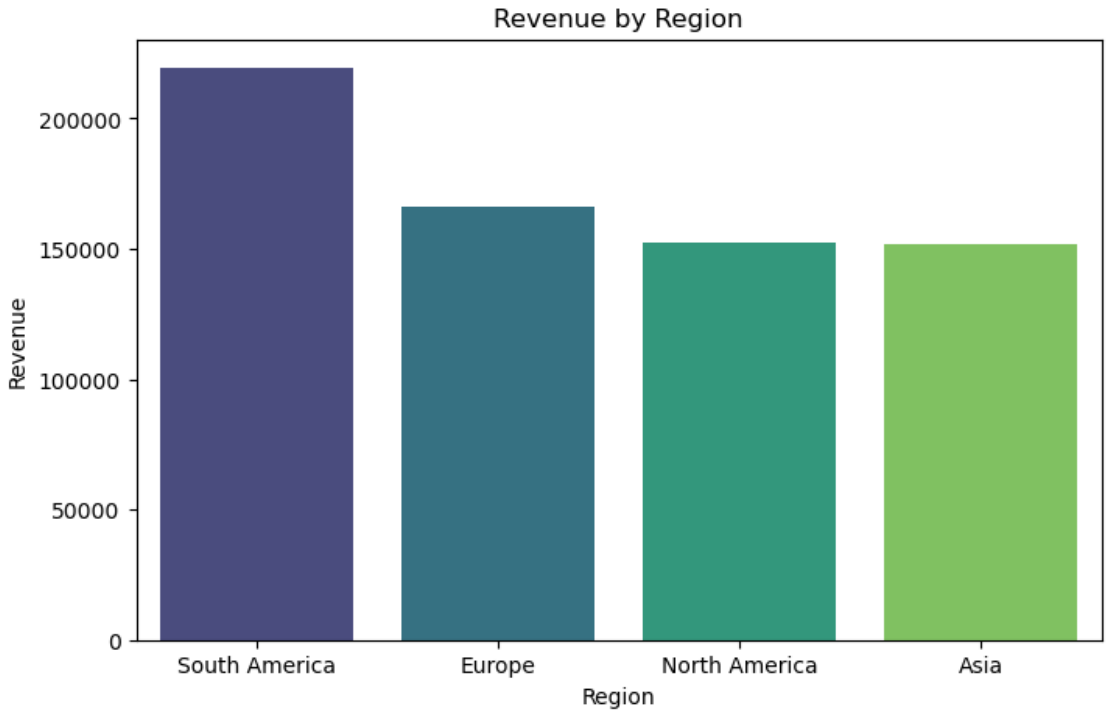
[9]:
```python
# Plot the data
plt.figure(figsize=(10, 6))
sns.barplot(x=top_products.values, y=top_products.index, palette="viridis")
plt.title("Top 5 Products by Revenue", fontsize=16)
plt.xlabel("Total Revenue (USD)", fontsize=12)
plt.ylabel("Product Name", fontsize=12)
plt.xticks(fontsize=10)
plt.yticks(fontsize=10)
plt.tight_layout()

# Show the plot
plt.show()
```



[10]:
```
# Insight 2: Revenue by Region
revenue_by_region = merged_df.groupby('Region')['TotalValue'].sum().
 ↪sort_values(ascending=False)
print("Revenue by Region:\n", revenue_by_region)
```

```
Revenue by Region:
 Region
South America    219352.56
Europe           166254.63
North America    152313.40
Asia             152074.97
Name: TotalValue, dtype: float64
```

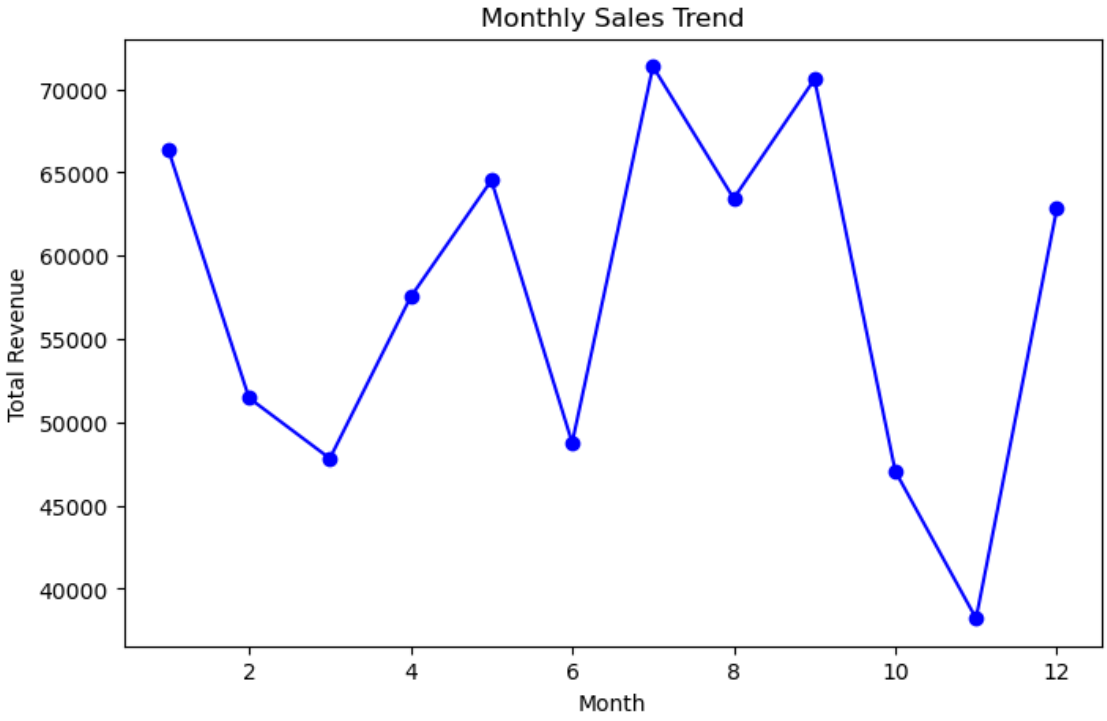
[11]:
```
# Revenue by Region
plt.figure(figsize=(8, 5))
sns.barplot(x=revenue_by_region.index, y=revenue_by_region.values,␣
 ↪palette="viridis")
plt.title('Revenue by Region')
plt.xlabel('Region')
plt.ylabel('Revenue')
plt.show()
```



[12]:
```
# Insight 3: Monthly Sales Trend
merged_df['TransactionDate'] = pd.to_datetime(merged_df['TransactionDate'])
merged_df['Month'] = merged_df['TransactionDate'].dt.month
monthly_sales = merged_df.groupby('Month')['TotalValue'].sum()
print("Monthly Sales Trend:\n", monthly_sales)

# Monthly Sales Trend
plt.figure(figsize=(8, 5))
monthly_sales.plot(kind='line', marker='o', color='b')
plt.title('Monthly Sales Trend')
plt.xlabel('Month')
plt.ylabel('Total Revenue')
plt.show()
```

```
Monthly Sales Trend:
 Month
1     66376.39
2     51459.27
3     47828.73
4     57519.06
5     64527.74
6     48771.18
7     71366.39
8     63436.74
```

```
9     70603.75
10    47063.22
11    38224.37
12    62818.72
Name: TotalValue, dtype: float64
```

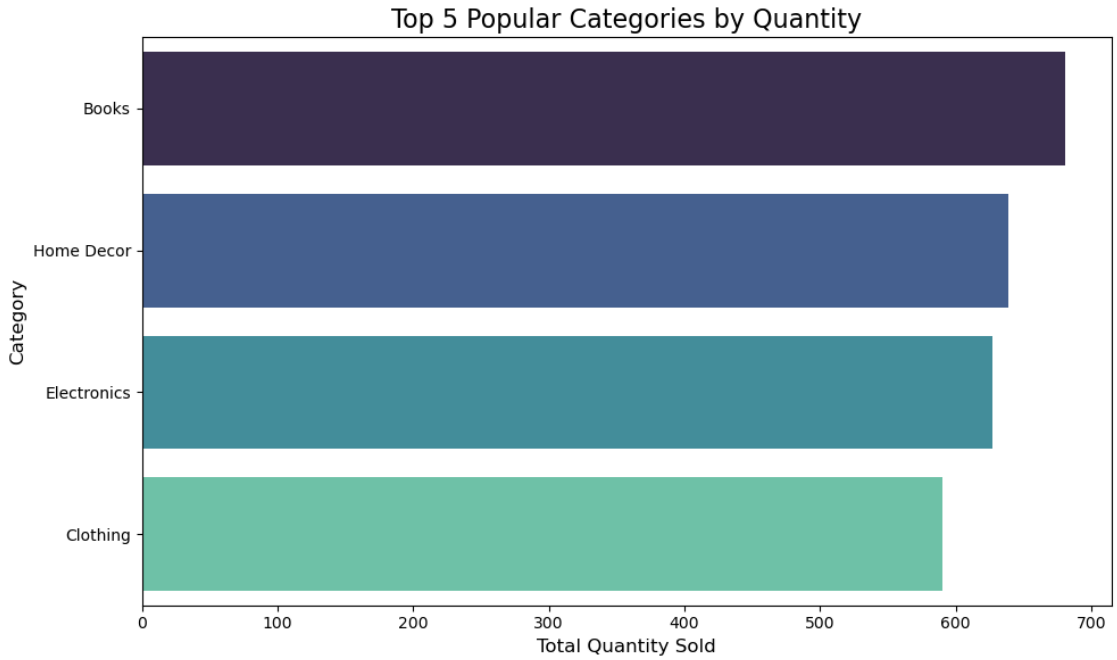


[13]:
```
# Insight 4: Popular Categories
popular_categories = merged_df.groupby('Category')['Quantity'].sum().
  ↪sort_values(ascending=False).head(5)
print("Top 5 Popular Categories:\n", popular_categories)
```

```
Top 5 Popular Categories:
 Category
Books          681
Home Decor     639
Electronics    627
Clothing       590
Name: Quantity, dtype: int64
```

[14]:
```
# Visualization for Popular Categories
plt.figure(figsize=(10, 6))
sns.barplot(x=popular_categories.values, y=popular_categories.index,␣
  ↪palette="mako")
plt.title("Top 5 Popular Categories by Quantity", fontsize=16)
```

```
plt.xlabel("Total Quantity Sold", fontsize=12)
plt.ylabel("Category", fontsize=12)
plt.xticks(fontsize=10)
plt.yticks(fontsize=10)
plt.tight_layout()
plt.show()
```

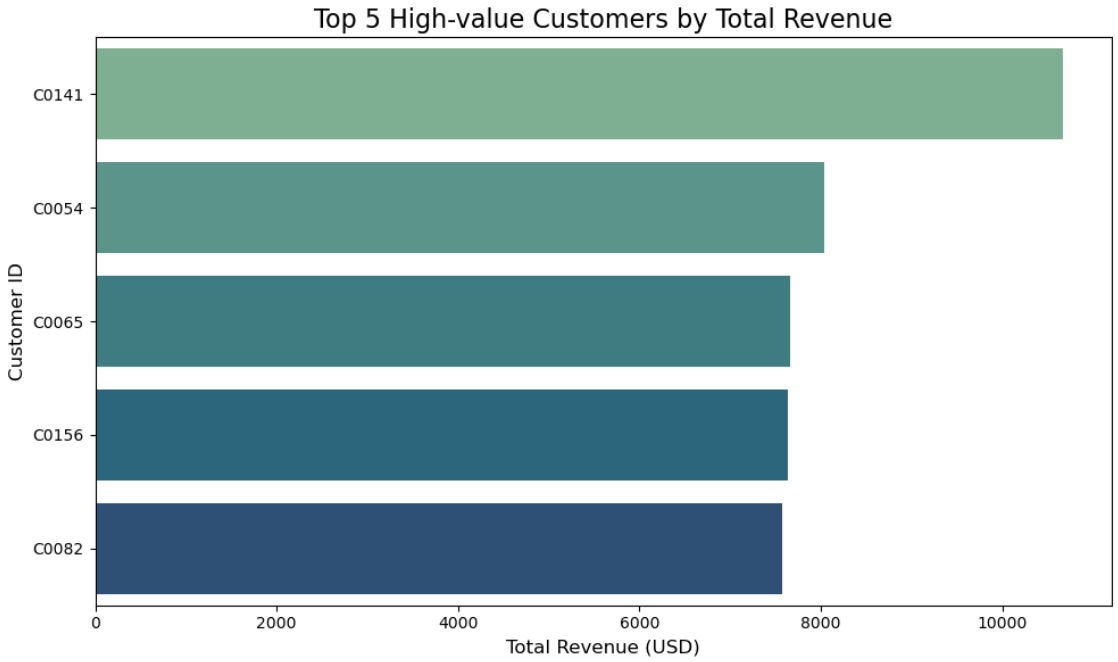


[15]:
```
# Insight 5: High-value Customers
high_value_customers = merged_df.groupby('CustomerID')['TotalValue'].sum().
  ↪sort_values(ascending=False).head(5)
print("Top 5 High-value Customers:\n", high_value_customers)
```

```
Top 5 High-value Customers:
 CustomerID
C0141    10673.87
C0054     8040.39
C0065     7663.70
C0156     7634.45
C0082     7572.91
Name: TotalValue, dtype: float64
```

[16]:
```
# Visualization for High-value Customers
plt.figure(figsize=(10, 6))
sns.barplot(x=high_value_customers.values, y=high_value_customers.index,␣
  ↪palette="crest")
```

```
plt.title("Top 5 High-value Customers by Total Revenue", fontsize=16)
plt.xlabel("Total Revenue (USD)", fontsize=12)
plt.ylabel("Customer ID", fontsize=12)
plt.xticks(fontsize=10)
plt.yticks(fontsize=10)
plt.tight_layout()
plt.show()
```



0.1 Business Insights

- ActiveWear Smartwatch ,Jacket and Rug has more revenue comapared to SoundWave Headphones and Novel it means that customer like activewear
- C0141,C0054,C0065 ,C0156 and C0082 are top 5 high value customers in total revenue we have to focus on other customer to maximize profit.
- Top categories are Books,Home Decor, Electronics and Clothing we have to focus on this also tried to increase the sell of other categories of
- Month like 3,6,10 and 11 has low sales we have to focus on month 10 and 11 which has low sales for improve sales.
- South America , Europe,North America and Asia are highest sales region. We have to focus on region like africa and also increase sales in asia and north america

[ ]: