🎯 **Goal:** Analyze eCommerce transactions dataset, perform EDA, and derive actionable business insights to improve customer engagement and revenue growth.

📊 Steps

1. **Data Exploration and Cleaning**

- 📝 **Task:** Load and inspect `Customers.csv`, `Products.csv`, and `Transactions.csv`.
- 🔍 **Focus Areas:**
    - Handle missing values, duplicate records, and outliers.
    - Ensure correct data types for dates, prices, and quantities.

2. **Exploratory Data Analysis (EDA)**

- 📝 **Task:** Uncover trends and patterns.
- 📈 **Include:**
    - **Customer Analysis:** Signup trends, regional distribution, repeat customers.
    - **Product Analysis:** Most purchased categories, price distribution, and product popularity.
    - **Transaction Analysis:** Sales trends over time, high-value transactions, and quantity insights.
- 🧩 **Tools:** Pandas, Matplotlib, Seaborn, and Plotly for visualizations.

3. **Business Insights (5 Key Findings)**

Import Libraries

```
# Importing the libraries
# Data Handling
import pandas as pd
import numpy as np

# Visualization
import matplotlib.pyplot as plt
import seaborn as sns
color = sns.color_palette()
import plotly.graph_objects as go
from plotly.subplots import make_subplots
import plotly.express as px
import plotly.subplots as sp
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
customers = pd.read_csv("/content/drive/MyDrive/Zeotap/Customers.csv")
products = pd.read_csv("/content/drive/MyDrive/Zeotap/Products.csv")
transactions = pd.read_csv("/content/drive/MyDrive/Zeotap/Transactions.csv")

# Merge transactions with products to include product details
transactions_with_products = transactions.merge(products, on="ProductID", how="left")

# Merge transactions with customers to include customer details
df = transactions_with_products.merge(customers, on="CustomerID", how="left")
```

```
# Convert date columns to datetime format
df["TransactionDate"] = pd.to_datetime(df["TransactionDate"])
df["SignupDate"] = pd.to_datetime(df["SignupDate"])
```

```
df.head(5)
```

	TransactionID	CustomerID	ProductID	TransactionDate	Quantity	TotalValue	Price_x
0	T00001	C0199	P067	2024-08-25 12:38:23	1	300.68	300.68
1	T00112	C0146	P067	2024-05-27 22:23:54	1	300.68	300.68

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 13 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   datetime64[ns]
 4   Quantity         1000 non-null   int64
 5   TotalValue       1000 non-null   float64
 6   Price_x          1000 non-null   float64
 7   ProductName      1000 non-null   object
 8   Category         1000 non-null   object
 9   Price_y          1000 non-null   float64
 10  CustomerName     1000 non-null   object
 11  Region           1000 non-null   object
 12  SignupDate       1000 non-null   datetime64[ns]
dtypes: datetime64[ns](2), float64(3), int64(1), object(7)
memory usage: 101.7+ KB
```

```
df.nunique()
```

	0
TransactionID	1000
CustomerID	199
ProductID	100
TransactionDate	1000
Quantity	4
TotalValue	369
Price_x	100
ProductName	66
Category	4
Price_y	100
CustomerName	199
Region	4
SignupDate	178

dtype: int64

```
df.isnull().sum() # missing values
```

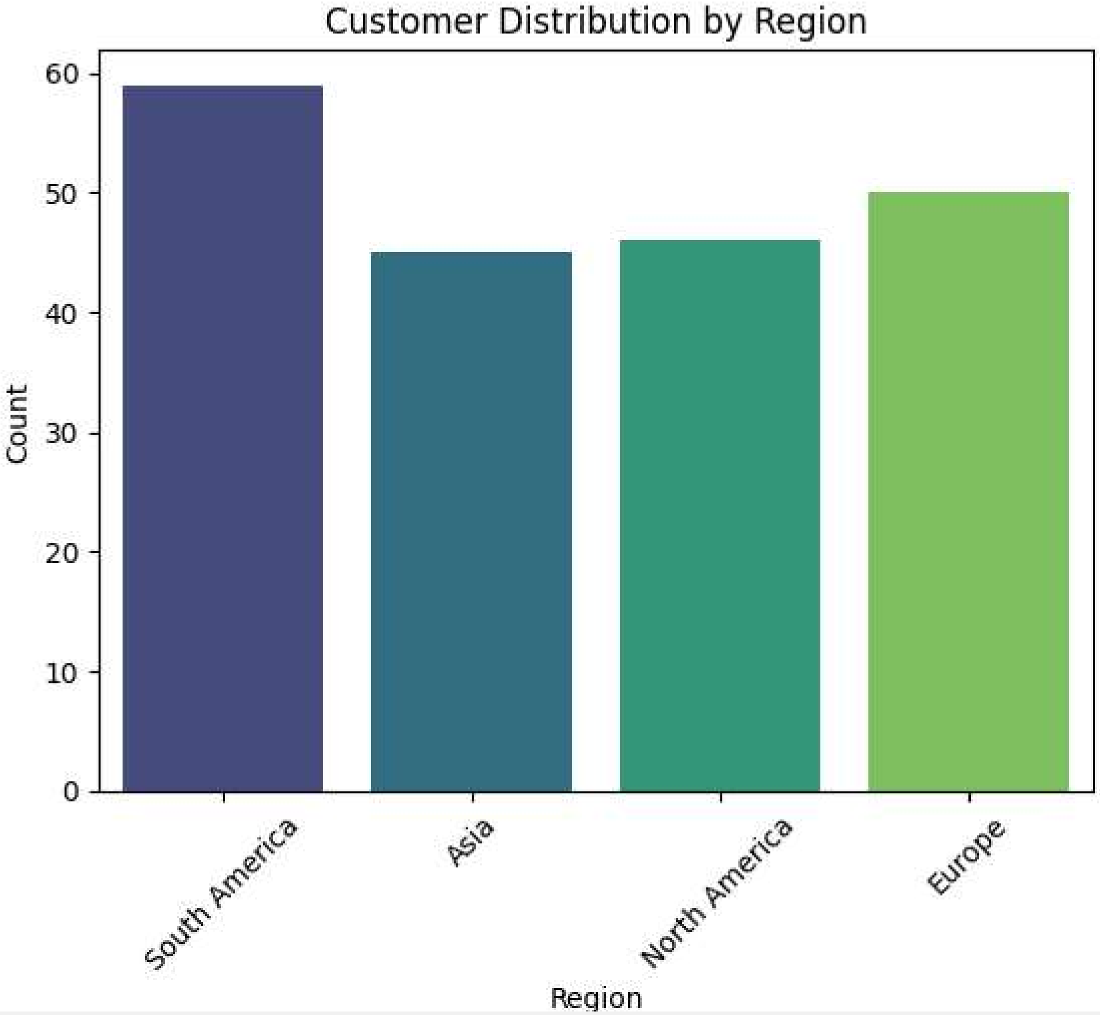
	0
TransactionID	0
CustomerID	0
ProductID	0
TransactionDate	0
Quantity	0
TotalValue	0
Price_x	0
ProductName	0
Category	0
Price_y	0
CustomerName	0
Region	0
SignupDate	0

dtype: int64

Univariate Analysis

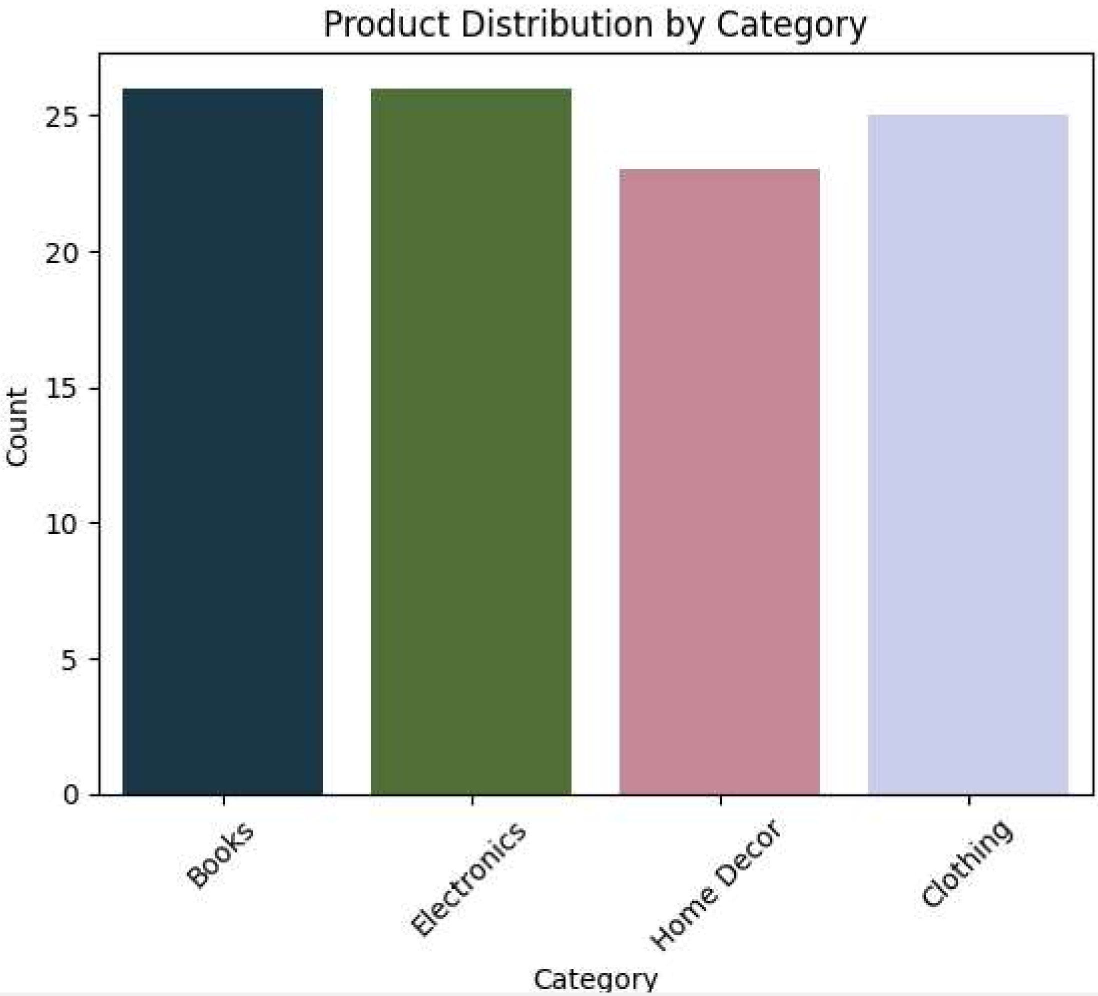
```
# Region distribution
sns.countplot(data=customers, x="Region", palette="viridis")
plt.title("Customer Distribution by Region")
plt.xlabel("Region")
plt.ylabel("Count")
plt.xticks(rotation=45)
plt.show()
```

```
<ipython-input-16-d3b450509ee6>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0.

  sns.countplot(data=customers, x="Region", palette="viridis")
```

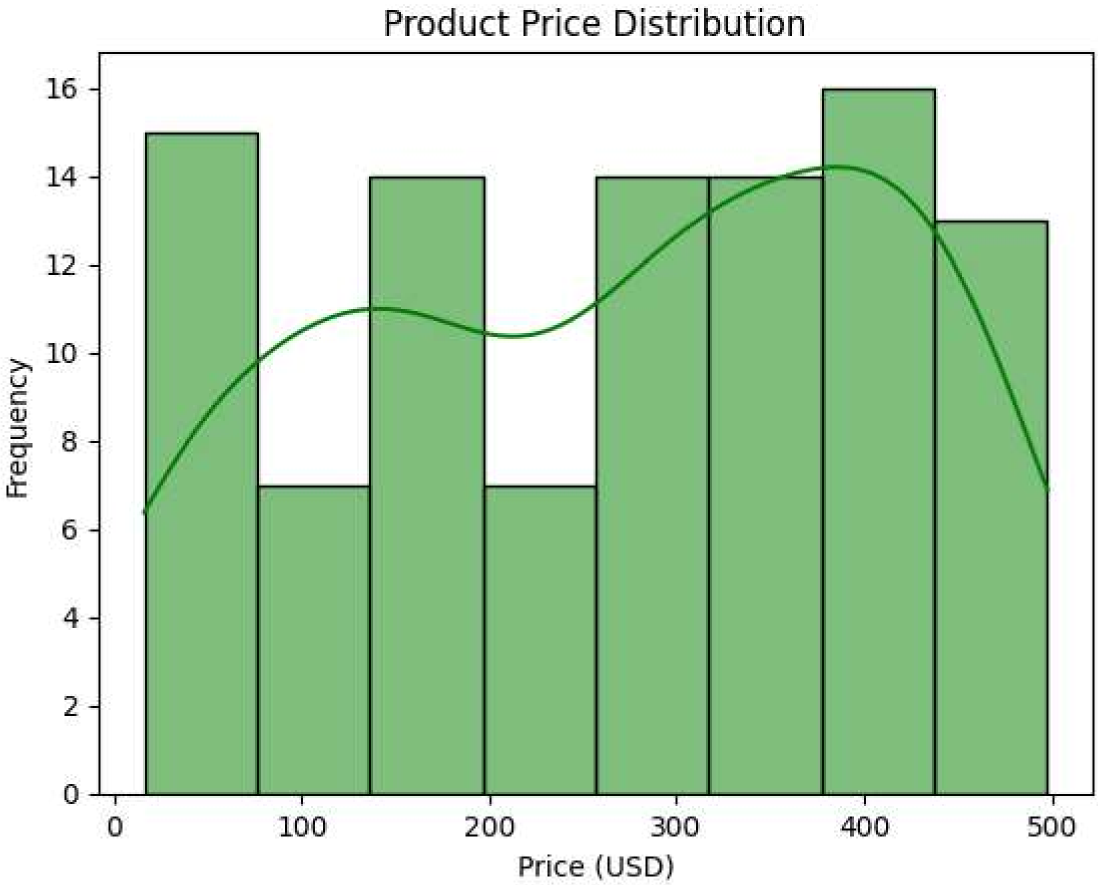


```
# Product Category Distribution
sns.countplot(data=products, x="Category", palette="cubehelix")
plt.title("Product Distribution by Category")
plt.xlabel("Category")
plt.ylabel("Count")
plt.xticks(rotation=45)
plt.show()
```

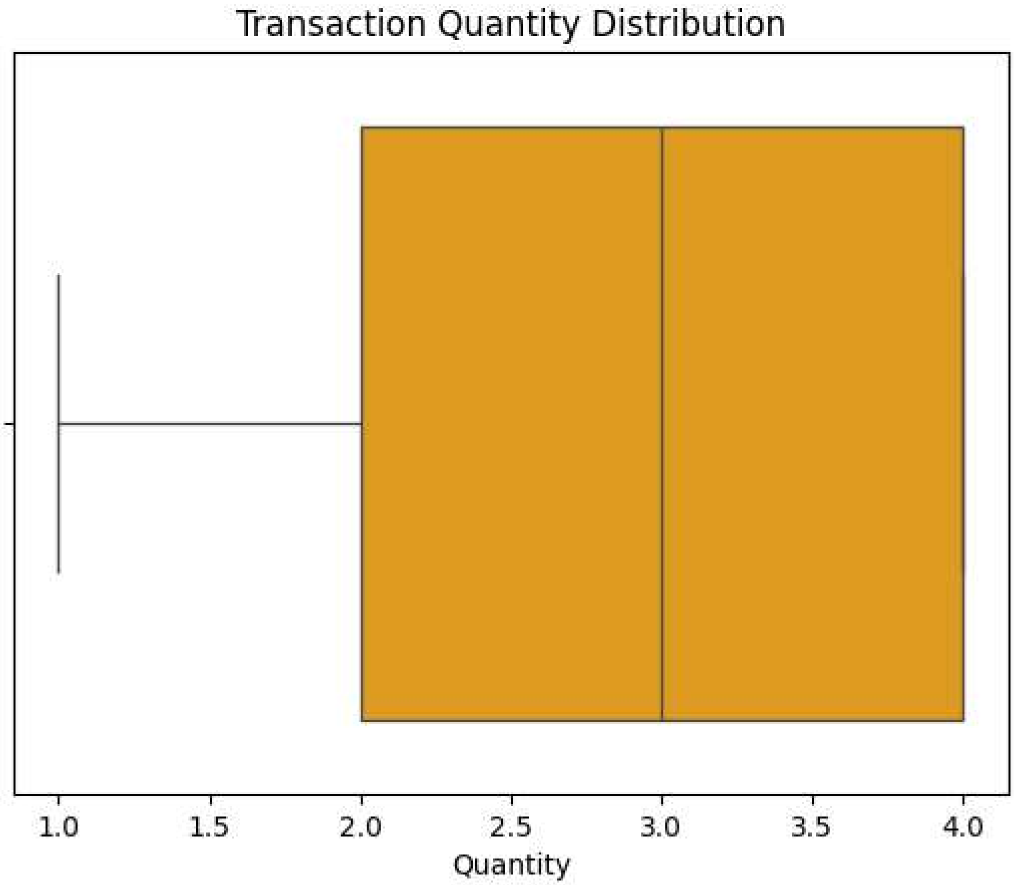
```
<ipython-input-17-49a31a92b194>:1: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0.

  sns.countplot(data=products, x="Category", palette="cubehelix")
```



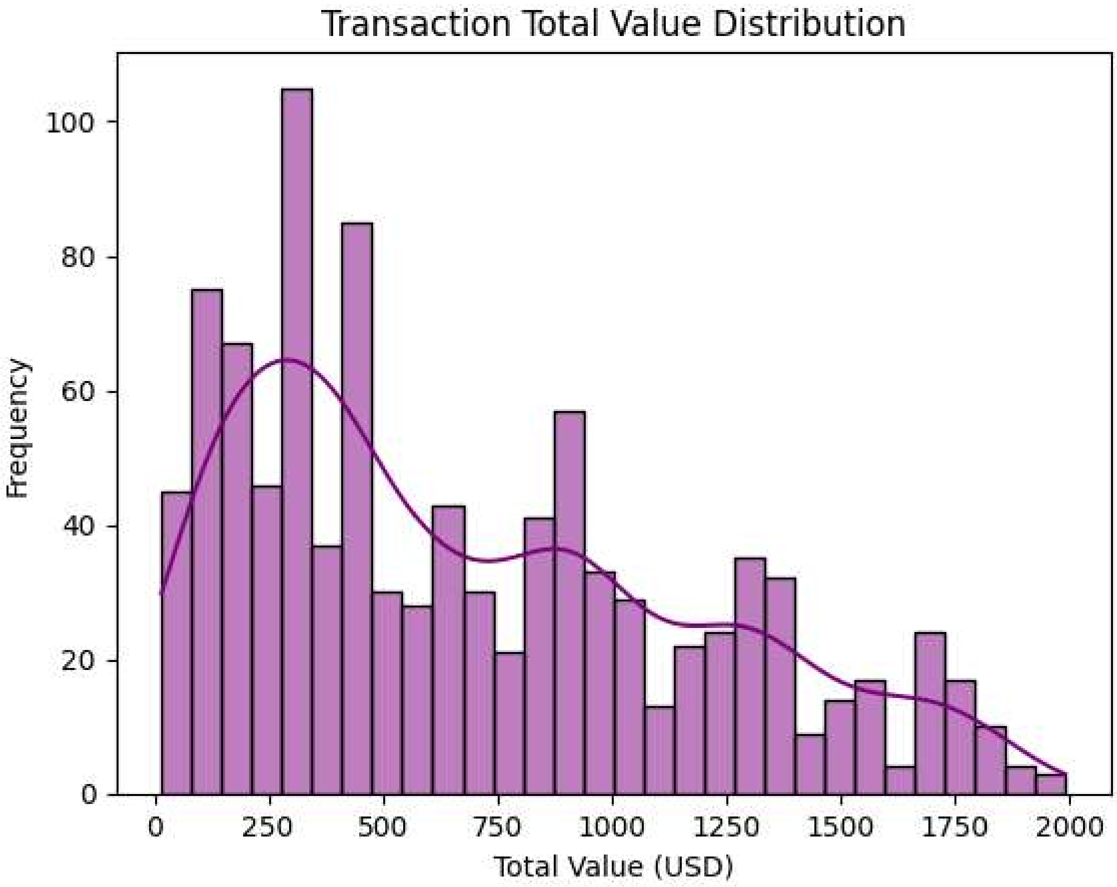
```
# Product Price Distribution
sns.histplot(products["Price"], kde=True, color="green")
plt.title("Product Price Distribution")
plt.xlabel("Price (USD)")
plt.ylabel("Frequency")
plt.show()
```



```
# Transaction Quantity
sns.boxplot(data=transactions, x="Quantity", color="orange")
plt.title("Transaction Quantity Distribution")
plt.xlabel("Quantity")
plt.show()
```



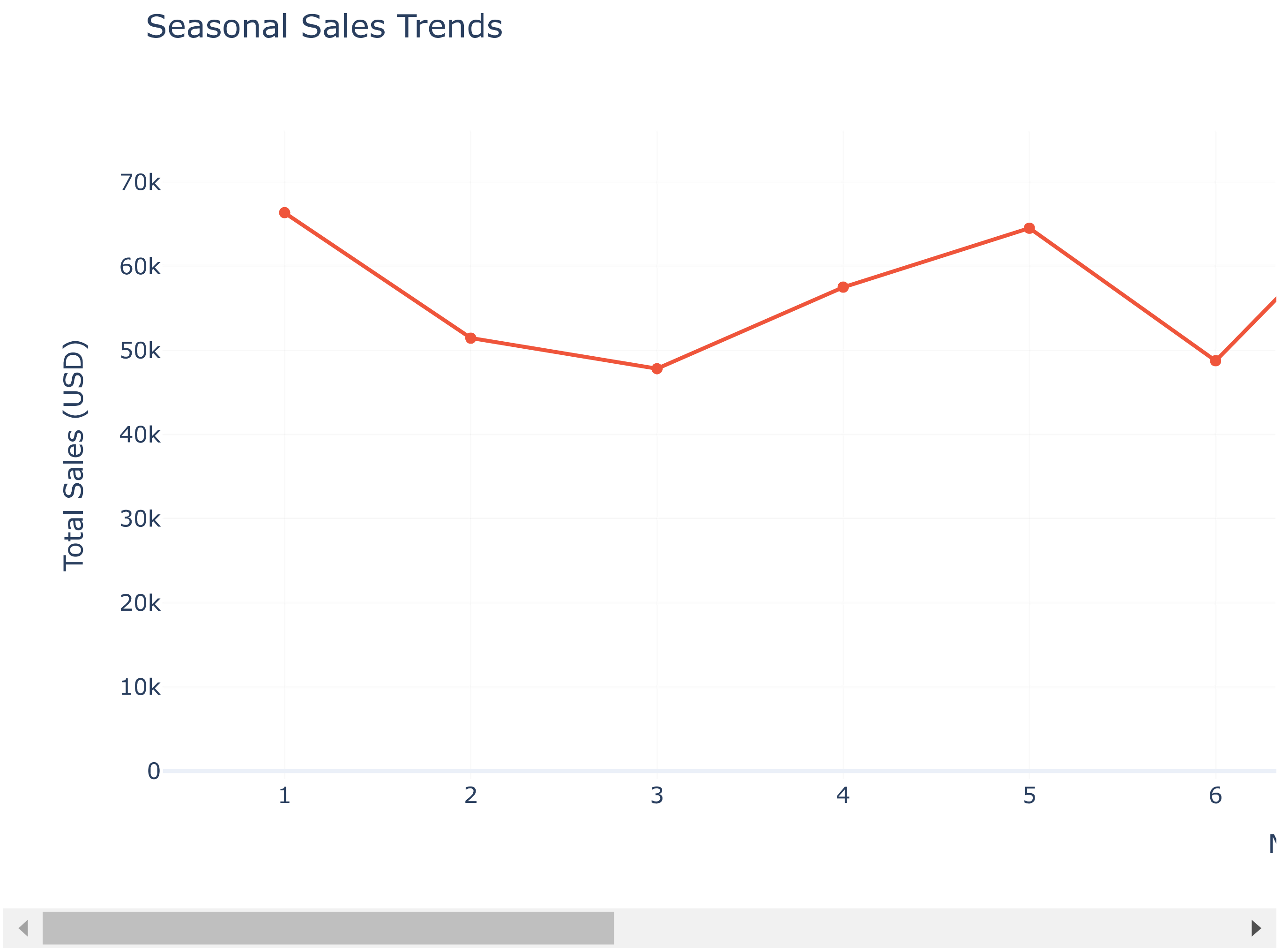
```
# Total Transaction Value
sns.histplot(transactions["TotalValue"], kde=True, color="purple", bins=30)
plt.title("Transaction Total Value Distribution")
plt.xlabel("Total Value (USD)")
plt.ylabel("Frequency")
plt.show()
```



Bivariate Analysis

Seasonal Sales Trends

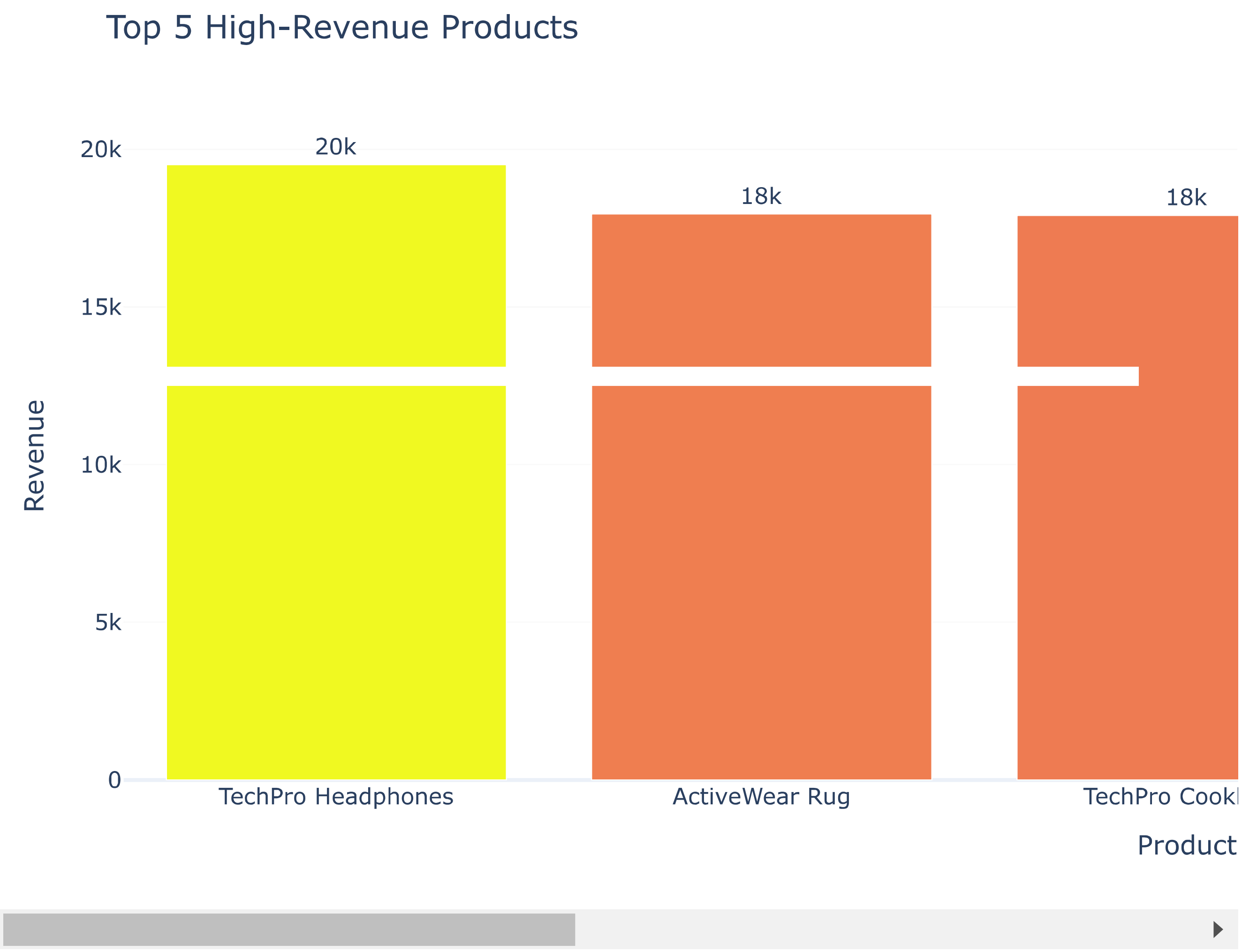
```
df["Month"] = df["TransactionDate"].dt.month
df["Year"] = df["TransactionDate"].dt.year

monthly_sales = df.groupby(["Year", "Month"])["TotalValue"].sum().reset_index()


fig = px.line(
    monthly_sales,
    x="Month",
    y="TotalValue",
    color="Year",
    title="Seasonal Sales Trends",
    labels={"TotalValue": "Total Sales", "Month": "Month"},
    markers=True,
)

fig.update_layout(
    xaxis=dict(tickmode="linear", tick0=1, dtick=1),
    yaxis_title="Total Sales (USD)",
    xaxis_title="Month",
    template="plotly_white",
)
fig.show()
```



Identify High-Revenue Products

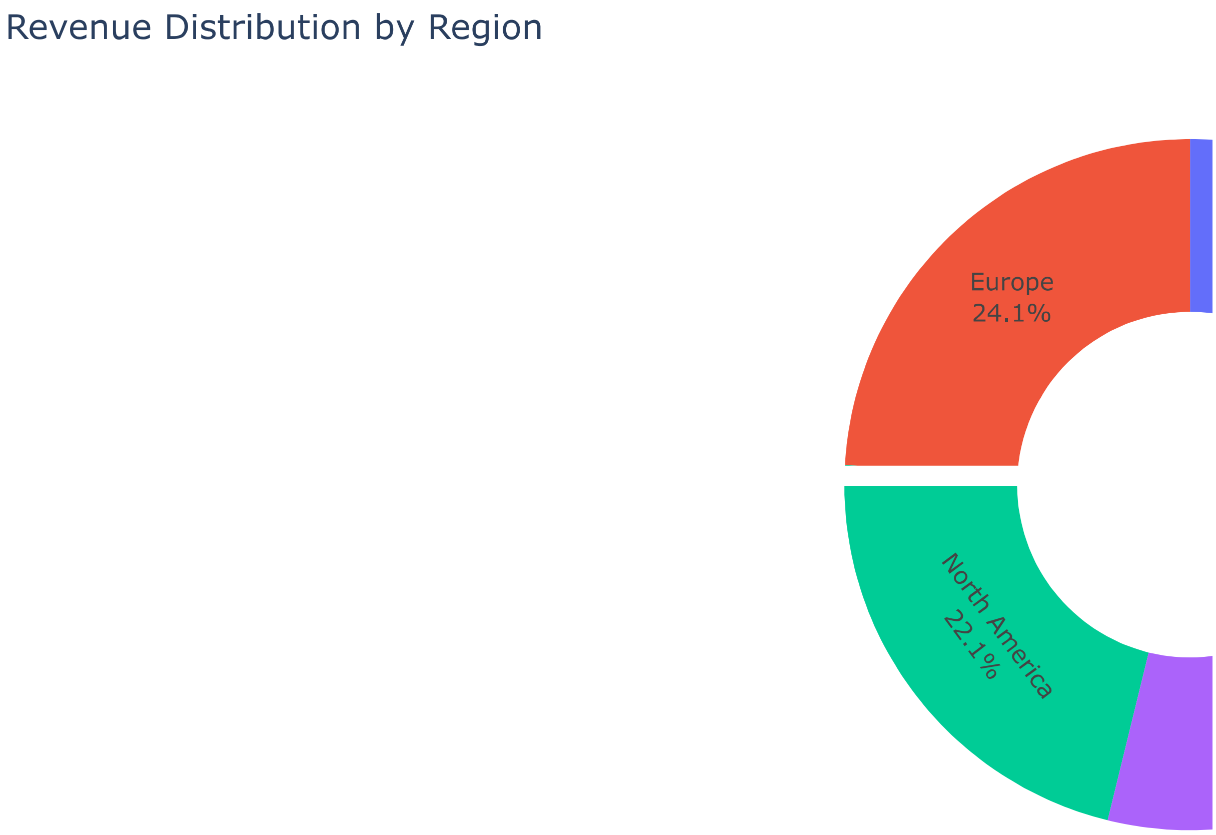
```
product_sales = final_data.groupby(["ProductID", "ProductName"])["TotalValue"].sum().reset_i
product_sales = product_sales.sort_values(by="TotalValue", ascending=False).head(5)

fig = px.bar(
    product_sales,
    x="ProductName",
    y="TotalValue",
    title="Top 5 High-Revenue Products",
    labels={"TotalValue": "Total Revenue (USD)", "ProductName": "Product Name"},
    color="TotalValue",
    text="TotalValue",
)
```

```
fig.update_traces(texttemplate='%{text:.2s}', textposition='outside')
fig.update_layout(template="plotly_white", xaxis_title="Product", yaxis_title="Revenue")
fig.show()
```



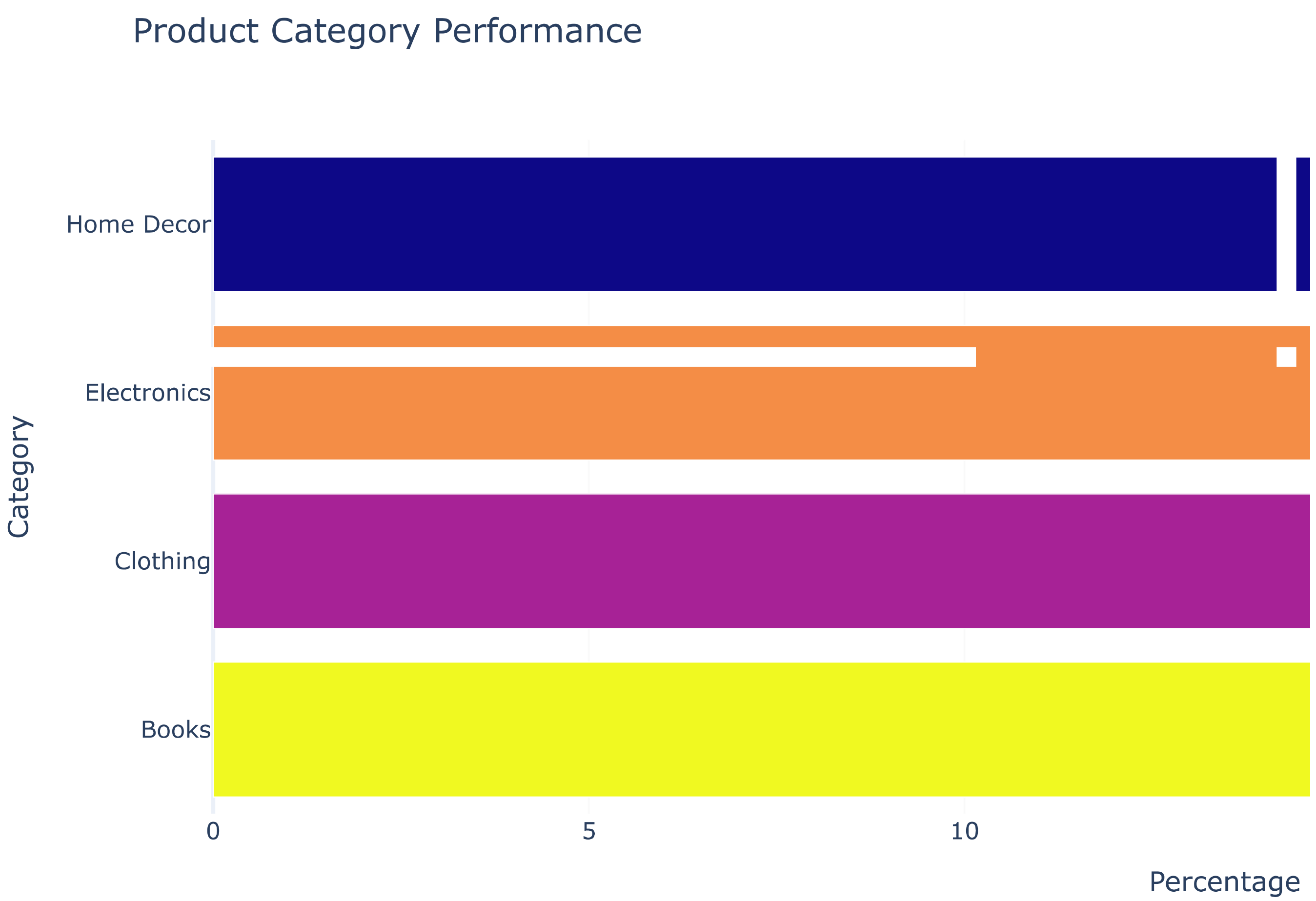
Customer Segmentation by Region

```
region_sales = final_data.groupby("Region").agg({
    "TotalValue": "sum",  # Total revenue
    "CustomerID": "nunique"  # Unique customers
}).reset_index()

region_sales["AvgSpendingPerCustomer"] = region_sales["TotalValue"] / region_sales["Customer

fig = px.pie(
    region_sales,
    values="TotalValue",
    names="Region",
    title="Revenue Distribution by Region",
    hole=0.5,
    labels={"TotalValue": "Revenue (USD)", "Region": "Region"},
)

fig.update_traces(textinfo="percent+label")
fig.update_layout(template="plotly_white")
fig.show()
```



Product Category Performance

```
category_sales = final_data.groupby("Category")["TotalValue"].sum().reset_index()
category_sales["PercentageContribution"] = (category_sales["TotalValue"] / category_sales[
fig = px.bar(
    category_sales,
    x="PercentageContribution",
    y="Category",
    title="Product Category Performance",
    labels={"PercentageContribution": "Contribution (%)", "Category": "Product Category"},
    orientation="h",
    color="PercentageContribution",
    text="PercentageContribution",
)

fig.update_traces(texttemplate='%{text:.1f}%', textposition="inside")
fig.update_layout(template="plotly_white", xaxis_title="Percentage Contribution", yaxis_ti
```


Product Category Performance
Category
Home Decor
Electronics
Clothing
Books
Percentage