PS4 Games Sales Analysis Report

Objective

The primary goal of this analysis is to explore and extract valuable insights from the sales data of PS4 games. This includes understanding global and regional sales trends, identifying top-performing games, genres, and publishers, and visualizing key patterns in the data. Specifically, the objectives are:

- Identify the top 5 best-selling games globally.
- Compare regional sales (North America, Europe, Japan, and Rest of the World) for each genre to understand market preferences.
- Find the publisher with the highest total global sales.
- Analyze the year with the highest number of game releases.
- Determine the most popular genre globally based on total sales.
- Identify the game with the highest sales in Japan compared to other regions.
- Examine if there is a correlation between sales in North America and Europe.
- Compare the sales growth trend for "Action" and "Shooter" genres over the years.
- Identify the top publisher in terms of sales for each region.
- Visualize the distribution of global sales to identify patterns and outliers.

Import necessary libraries

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')  # Suppress warnings for cleaner
output
```

Load the dataset

```
df = pd.read_csv('PS4_GamesSales.csv', encoding='unicode_escape')
```

Display the first five rows of the dataset

```
print("First 5 rows of the dataset:")
df.head()
```

```
First 5 rows of the dataset:

                        Game    Year            Genre        Publisher
\
0         Grand Theft Auto V  2014.0           Action  Rockstar Games

1  Call of Duty: Black Ops 3  2015.0          Shooter       Activision
```

```
2      Red Dead Redemption 2  2018.0  Action-Adventure  Rockstar Games
3         Call of Duty: WWII  2017.0           Shooter      Activision
4                    FIFA 18  2017.0            Sports       EA Sports

   North America  Europe  Japan  Rest of World  Global
0           6.06    9.71   0.60           3.02   19.39
1           6.18    6.05   0.41           2.44   15.09
2           5.26    6.21   0.21           2.26   13.94
3           4.67    6.21   0.40           2.12   13.40
4           1.27    8.64   0.15           1.73   11.80
```

Check for missing values

```python
print("\nMissing values before handling:")
missing_values = df.isnull().sum()
missing_values
```

```
Missing values before handling:

Game               0
Year             209
Genre              0
Publisher        209
North America      0
Europe             0
Japan              0
Rest of World      0
Global             0
dtype: int64
```

Handle missing values

```python
df['Publisher'].fillna('Unknown', inplace=True)
df['Year'].fillna(df['Year'].median(), inplace=True)
```

Convert 'Year' column to integer

```python
df['Year'] = df['Year'].astype(int)
```

Recheck missing values

```python
print("\nMissing values after handling:")
missing_values_after = df.isnull().sum()
print(missing_values_after)
```

```
Missing values after handling:
Game             0
Year             0
Genre            0
Publisher        0
North America    0
Europe           0
Japan            0
Rest of World    0
Global           0
dtype: int64
```

Check for duplicate rows

```
duplicates = df.duplicated().sum()
print(f"\nNumber of duplicate rows: {duplicates}")


Number of duplicate rows: 0
```

Remove outliers using IQR

```
sales_columns = ['North America', 'Europe', 'Japan', 'Rest of World',
'Global']
Q1 = df[sales_columns].quantile(0.25)
Q3 = df[sales_columns].quantile(0.75)
IQR = Q3 - Q1
```

Filter the dataset to remove outliers

```
df_filtered = df[~((df[sales_columns] < (Q1 - 1.5 * IQR)) |
(df[sales_columns] > (Q3 + 1.5 * IQR))).any(axis=1)]
print(f"\nNumber of rows after removing outliers:
{df_filtered.shape[0]}")
print(f"Final shape of the dataset: {df_filtered.shape}")


Number of rows after removing outliers: 793
Final shape of the dataset: (793, 9)
```

Validate the cleaned data

```
print("\nDataset after cleaning:")
df_filtered.head()


Dataset after cleaning:

                                     Game  Year             Genre  \
178                 The LEGO Movie Videogame  2014  Action-Adventure
```

```
183                            METRO 2033  2014           Shooter
186     Plants vs Zombies: Garden Warfare  2014           Shooter
191  Plants vs. Zombies: Garden Warfare 2  2016           Shooter
197                            L.A. Noire  2017         Adventure

                                  Publisher  North America  Europe
Japan  \
178  Warner Bros. Interactive Entertainment           0.26    0.32
0.01
183                             Deep Silver           0.22    0.31
0.05
186                         Electronic Arts           0.24    0.30
0.01
191                         Electronic Arts           0.22    0.31
0.00
197                          Rockstar Games           0.18    0.32
0.00

     Rest of World  Global
178           0.11    0.71
183           0.10    0.68
186           0.11    0.66
191           0.10    0.63
197           0.10    0.60
```

1. Top 5 Best-Selling Games Globally

This list showcases the top-selling games globally, providing insights into successful titles that could guide future development strategies.

```python
top_5_games = df_filtered.nlargest(5, 'Global', keep='all')
print("\nTop 5 Best-Selling Games Globally:")
top_5_games[['Game', 'Global']]
```

```
Top 5 Best-Selling Games Globally:

                                     Game  Global
178              The LEGO Movie Videogame    0.71
183                            METRO 2033    0.68
186     Plants vs Zombies: Garden Warfare    0.66
191  Plants vs. Zombies: Garden Warfare 2    0.63
197                            L.A. Noire    0.60
```

2. Regional Sales Comparison by Genre

Game genre preferences vary by region, with North America and Europe favoring "Action" and "Shooter" genres, while Japan leans towards "Role-Playing" games, highlighting the need for market-specific strategies.

```
regional_sales_by_genre = df_filtered.groupby('Genre')[['North
America', 'Europe', 'Japan', 'Rest of World']].sum()
print("\nRegional Sales by Genre:")
regional_sales_by_genre
```

```
Regional Sales by Genre:

                  North America  Europe  Japan  Rest of World
Genre
Action                     6.33    4.38   1.68           2.20
Action-Adventure           1.50    1.43   0.28           0.60
Adventure                  2.30    1.65   0.43           0.81
Fighting                   1.07    0.62   0.66           0.32
MMO                        0.23    0.24   0.12           0.10
Misc                       1.18    0.78   0.37           0.40
Music                      1.09    0.90   0.08           0.42
Party                      0.04    0.00   0.00           0.01
Platform                   1.80    1.82   0.10           0.72
Puzzle                     0.28    0.16   0.00           0.10
Racing                     1.48    2.02   0.14           0.67
Role-Playing               2.66    2.16   1.58           1.00
Shooter                    3.53    3.30   0.34           1.34
Simulation                 0.77    0.65   0.07           0.31
Sports                     1.33    1.40   0.11           0.55
Strategy                   0.57    0.22   0.23           0.17
Visual Novel               0.20    0.02   0.19           0.05
```

3. Publisher with the Highest Global Sales

Activision leads the gaming industry in global sales, emphasizing its significant influence and market dominance.

```
publisher_global_sales = df_filtered.groupby('Publisher')
['Global'].sum().sort_values(ascending=False)
top_publisher = publisher_global_sales.idxmax()
print(f"\nPublisher with Highest Total Global Sales: {top_publisher}
with sales {publisher_global_sales[top_publisher]}")
```

```
Publisher with Highest Total Global Sales: Activision with sales 4.87
```

4. Year with the Highest Number of Game Releases

2016 saw a peak in game releases, indicating a high point in the PS4 market’s activity during that year.

```
games_per_year =
df_filtered['Year'].value_counts().sort_values(ascending=False)
top_year = games_per_year.idxmax()
print(f"\nYear with the Highest Number of Game Releases: {top_year}
({games_per_year[top_year]} games)")


Year with the Highest Number of Game Releases: 2016 (365 games)
```

5. Most Popular Genre Globally by Total Sales

The "Action" genre is the most popular globally, underscoring its broad appeal across diverse markets.

```
genre_global_sales = df_filtered.groupby('Genre')
['Global'].sum().sort_values(ascending=False)
popular_genre = genre_global_sales.idxmax()
print(f"\nMost Popular Genre Globally: {popular_genre} with sales
{genre_global_sales[popular_genre]}")


Most Popular Genre Globally: Action with sales 14.72
```

6. Game with the Highest Sales in Japan Compared to Other Regions

Games like Resident Evil Zero and Disgaea 5 performed strongly in Japan, revealing regional preferences for niche genres.

```
highest_japan_game = df_filtered.nlargest(1, 'Japan', keep='all')
print("\nGame with the Highest Sales in Japan Compared to Other
Regions:")
highest_japan_game[['Game', 'Japan', 'North America', 'Europe', 'Rest
of World', 'Global']]


Game with the Highest Sales in Japan Compared to Other Regions:

                                                Game  Japan  North
America  \
252                                Resident Evil Zero   0.07
0.07
259                  Disgaea 5: Alliance of Vengeance   0.07
0.15
298  New Danganronpa V3: Minna no Koroshiai Shin Gakki   0.07
0.09
367                        Valkyria: Azure Revolution   0.07
0.04
```

```
373  Atelier Sophie: The Alchemist of the Mysteriou...   0.07
0.04
380          Yonmegami Online: Cyber Dimension Neptune   0.07
0.06
386                        Guilty Gear Xrd -Revelator-   0.07
0.06
393                              Samurai Warriors 4-II   0.07
0.04
402                   Utawarerumono: Futari no Hakuoro   0.07
0.05
404                   Utawarerumono: Itsuwari no Kamen   0.07
0.05
411                        Samurai Warriors 4: Empires   0.07
0.03
485                                    Project Setsuna   0.07
0.00
487  Fortune Street: Dragon Quest & Final Fantasy 3...   0.07
0.00
496                  Kamen Rider: Battride War Genesis   0.07
0.00
498                            City Shrouded in Shadow   0.07
0.00
506                                      Steins;Gate 0   0.07
0.00

     Europe  Rest of World  Global
252    0.18           0.05    0.37
259    0.08           0.05    0.35
298    0.05           0.03    0.25
367    0.03           0.02    0.16
373    0.03           0.01    0.15
380    0.00           0.01    0.14
386    0.00           0.01    0.14
393    0.02           0.01    0.13
402    0.00           0.01    0.13
404    0.00           0.01    0.13
411    0.01           0.01    0.12
485    0.00           0.00    0.07
487    0.00           0.00    0.07
496    0.00           0.00    0.07
498    0.00           0.00    0.07
506    0.00           0.00    0.07
```

7. Correlation Between Sales in North America and Europe

The strong positive correlation (0.66) between sales in North America and Europe suggests that consumer behaviors in these regions are similar, supporting unified marketing strategies.

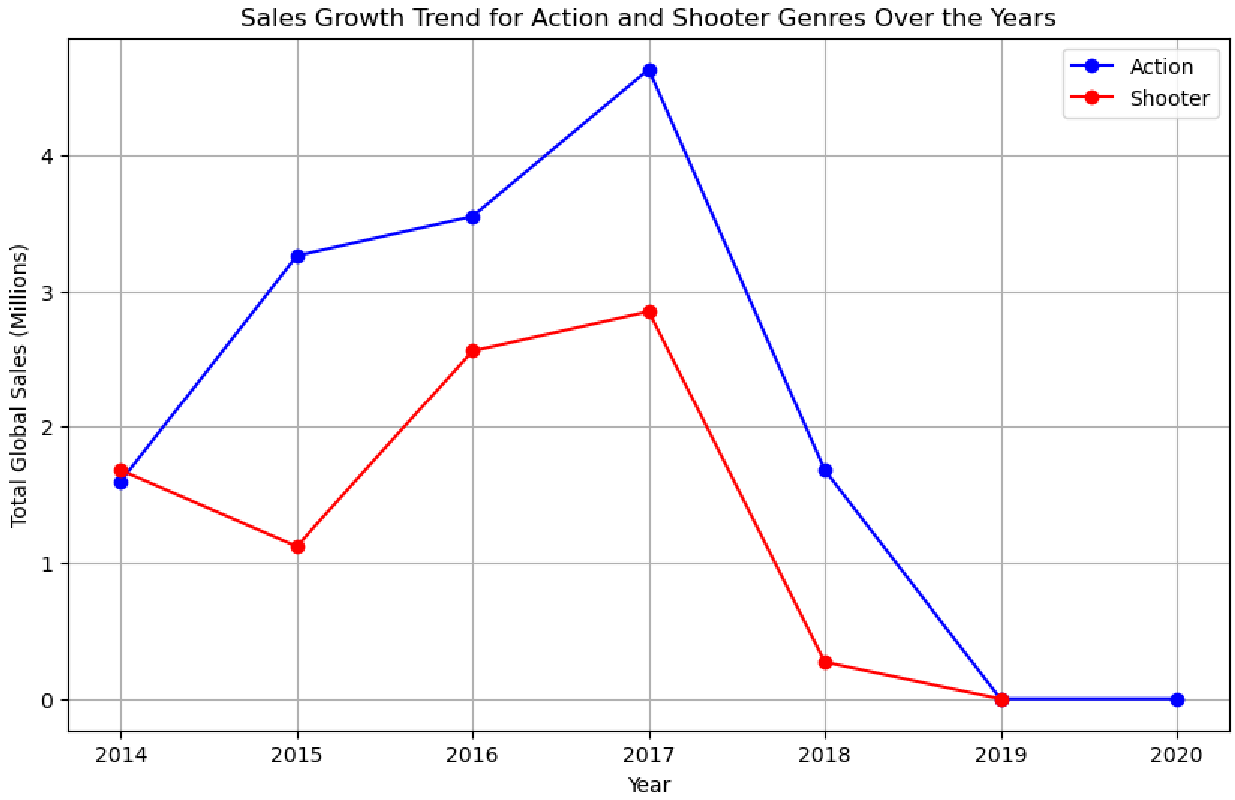
```
sales_correlation = df_filtered[['North America', 'Europe']].corr()
print("\nCorrelation between Sales in North America and Europe:")
sales_correlation
```

```
Correlation between Sales in North America and Europe:

               North America    Europe
North America       1.000000  0.664908
Europe              0.664908  1.000000
```

8. Sales Growth Trend for Action and Shooter Genres

The "Action" genre maintained consistent high sales, while "Shooter" genre sales fluctuated, suggesting that action games are more stable in the market.

```
action_sales = df_filtered[df_filtered['Genre'] ==
'Action'].groupby('Year')['Global'].sum()
shooter_sales = df_filtered[df_filtered['Genre'] ==
'Shooter'].groupby('Year')['Global'].sum()

plt.figure(figsize=(10, 6))
plt.plot(action_sales.index, action_sales.values, label='Action',
color='blue', marker='o')
plt.plot(shooter_sales.index, shooter_sales.values, label='Shooter',
color='red', marker='o')
plt.title('Sales Growth Trend for Action and Shooter Genres Over the
Years')
plt.xlabel('Year')
plt.ylabel('Total Global Sales (Millions)')
plt.legend()
plt.grid(True)
plt.show()
```



9. Top Publisher in Sales for Each Region

Activision leads in most regions, while Tecmo Koei stands out in Japan, highlighting regional differences in publisher dominance.

```
top_publishers_by_region = df_filtered.groupby('Publisher')[['North
America', 'Europe', 'Japan', 'Rest of World']].sum().idxmax()
print("\nTop Publisher in Terms of Sales for Each Region:")
top_publishers_by_region
```

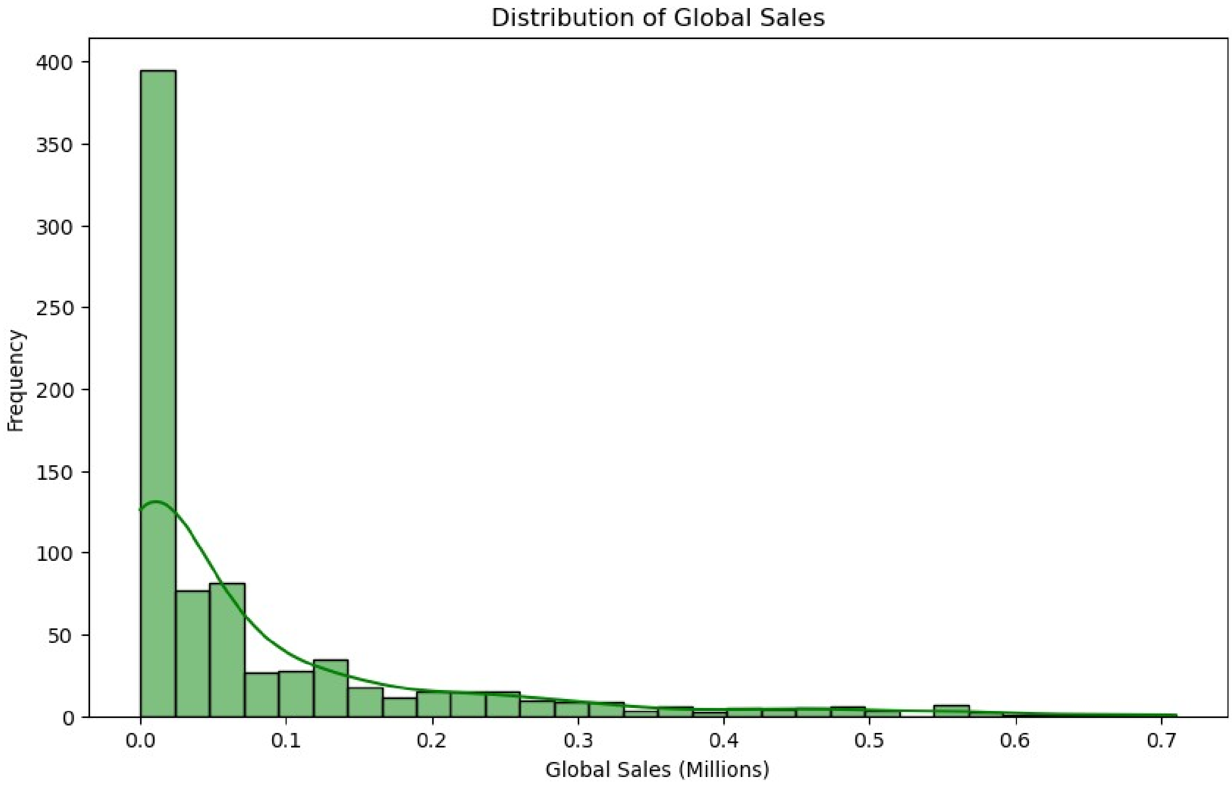
```
Top Publisher in Terms of Sales for Each Region:

North America    Activision
Europe           Activision
Japan            Tecmo Koei
Rest of World    Activision
dtype: object
```

10. Visualization of Global Sales Distribution

- Histogram of global sales distribution.

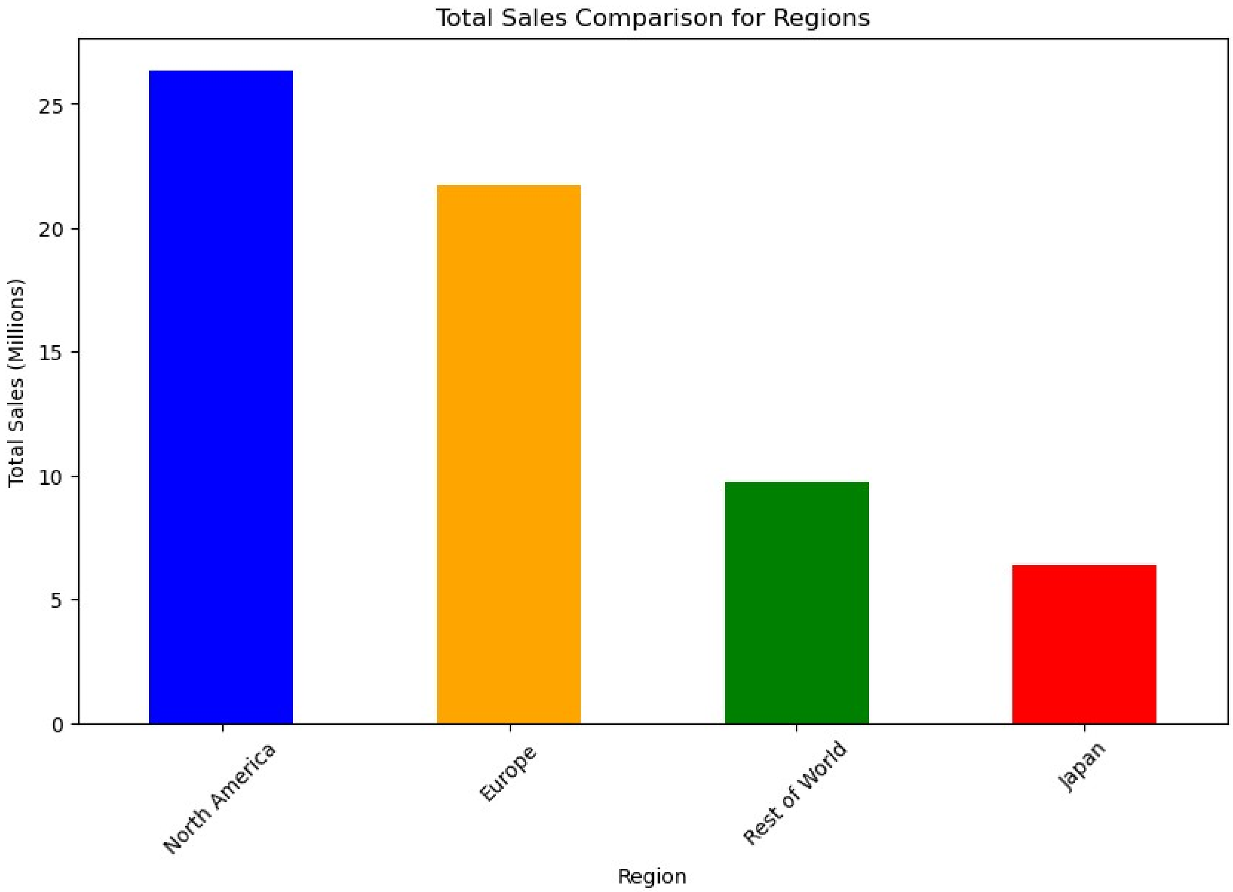
```
plt.figure(figsize=(10, 6))
sns.histplot(df_filtered['Global'], kde=True, bins=30, color='green')
```

```
plt.title('Distribution of Global Sales')
plt.xlabel('Global Sales (Millions)')
plt.ylabel('Frequency')
plt.show()
```



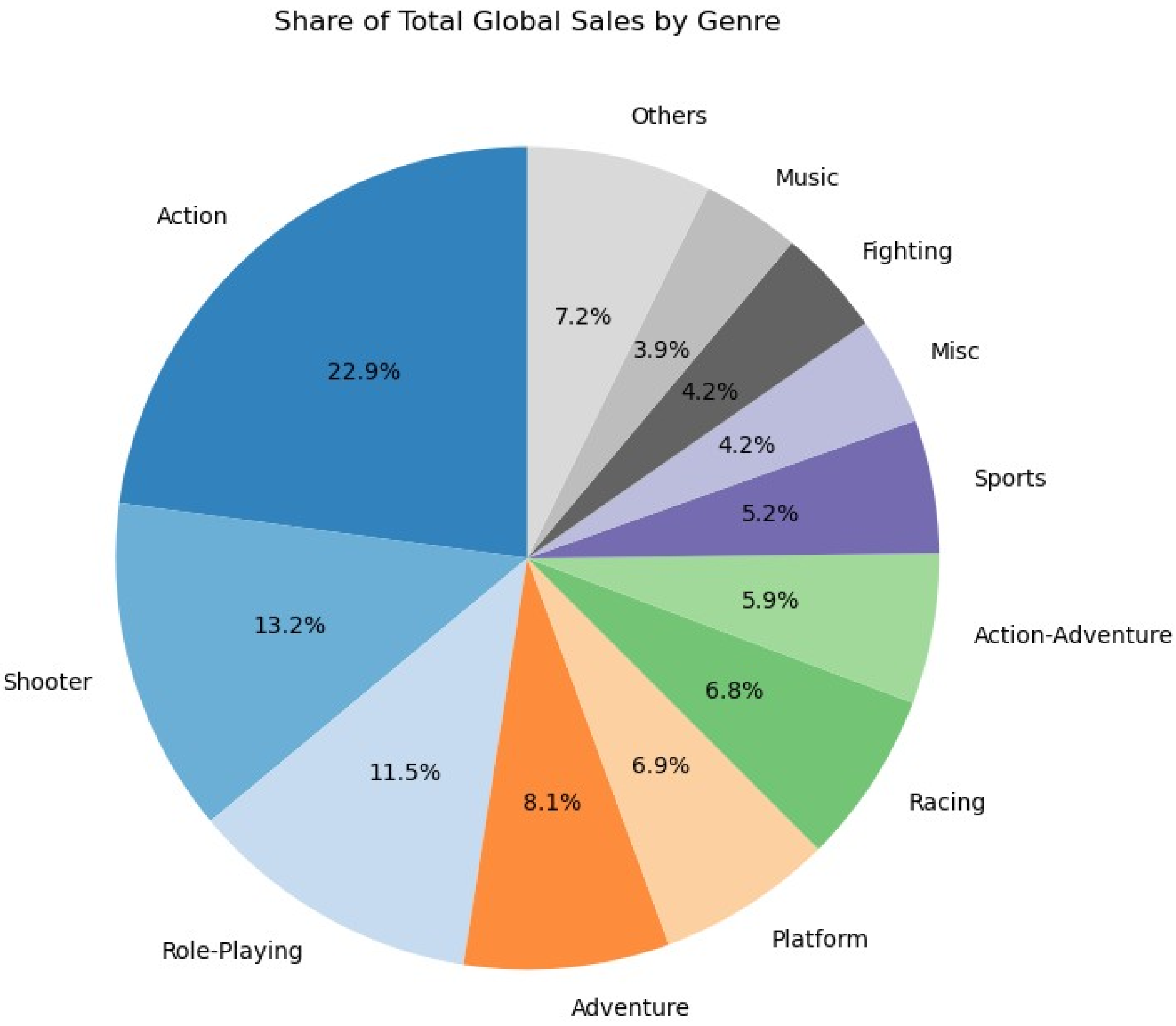
- Bar chart comparing total sales by region.

```
total_sales_by_region = df_filtered[['North America', 'Europe',
'Japan', 'Rest of World']].sum().sort_values(ascending=False)

# Plotting the bar chart
total_sales_by_region.plot(kind='bar', color=['blue', 'orange',
'green', 'red'], figsize=(10, 6))

# Adding title, labels, and rotating x-axis
plt.title('Total Sales Comparison for Regions')
plt.xlabel('Region')
plt.ylabel('Total Sales (Millions)')
plt.xticks(rotation=45)

# Displaying the chart
plt.show()
```



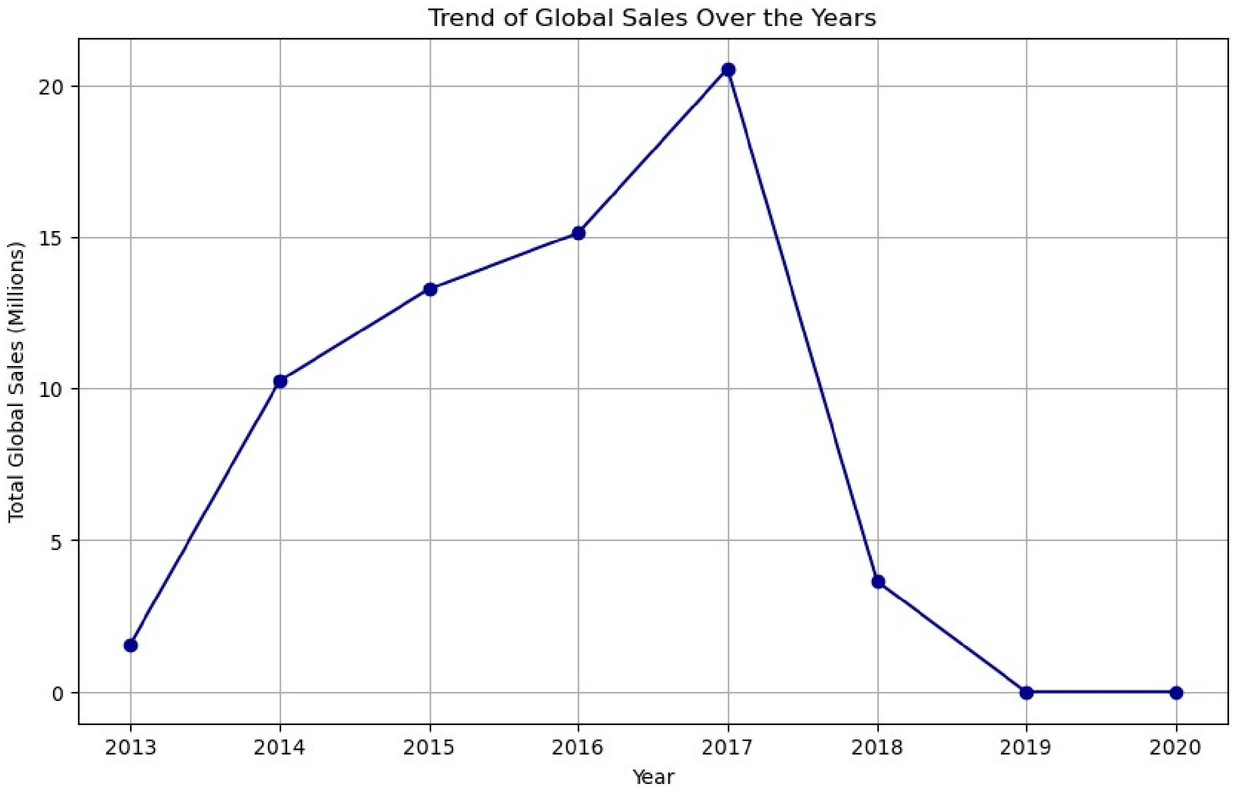
- Pie chart for the share of global sales by genre.

```
genre_sales_share = genre_global_sales / genre_global_sales.sum()

# Combine genres with sales less than 2.9% into 'Others'
threshold = 0.029  # 2.9%
filtered_genre_sales = genre_sales_share[genre_sales_share >=
threshold]
other_sales = genre_sales_share[genre_sales_share < threshold].sum()

# Combine 'Others' with the filtered genres
filtered_genre_sales = pd.concat([filtered_genre_sales,
pd.Series({'Others': other_sales})])

# Plot the pie chart
plt.figure(figsize=(8, 8))
filtered_genre_sales.plot(kind='pie', autopct='%1.1f%%',
startangle=90, colormap='tab20c')
plt.title('Share of Total Global Sales by Genre')
plt.ylabel('')
plt.show()
```



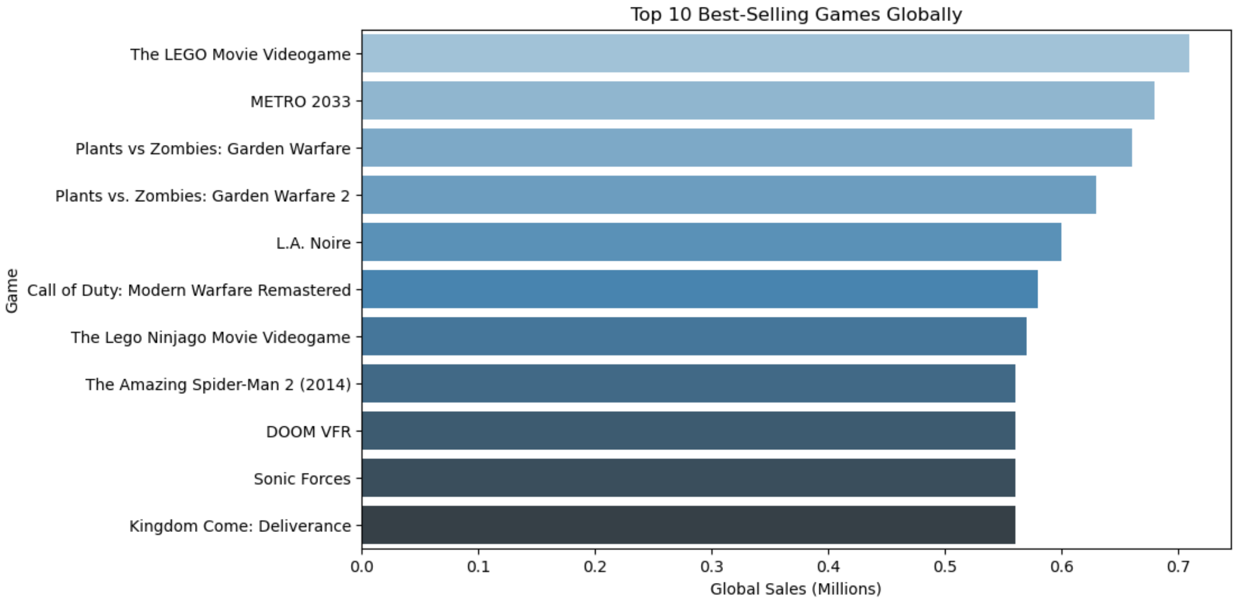
- Line chart for the trend of global sales over the years.

```
global_sales_trend = df_filtered.groupby('Year')['Global'].sum()
plt.figure(figsize=(10, 6))
plt.plot(global_sales_trend.index, global_sales_trend.values,
marker='o', color='darkblue')
plt.title('Trend of Global Sales Over the Years')
plt.xlabel('Year')
plt.ylabel('Total Global Sales (Millions)')
plt.grid(True)
plt.show()
```



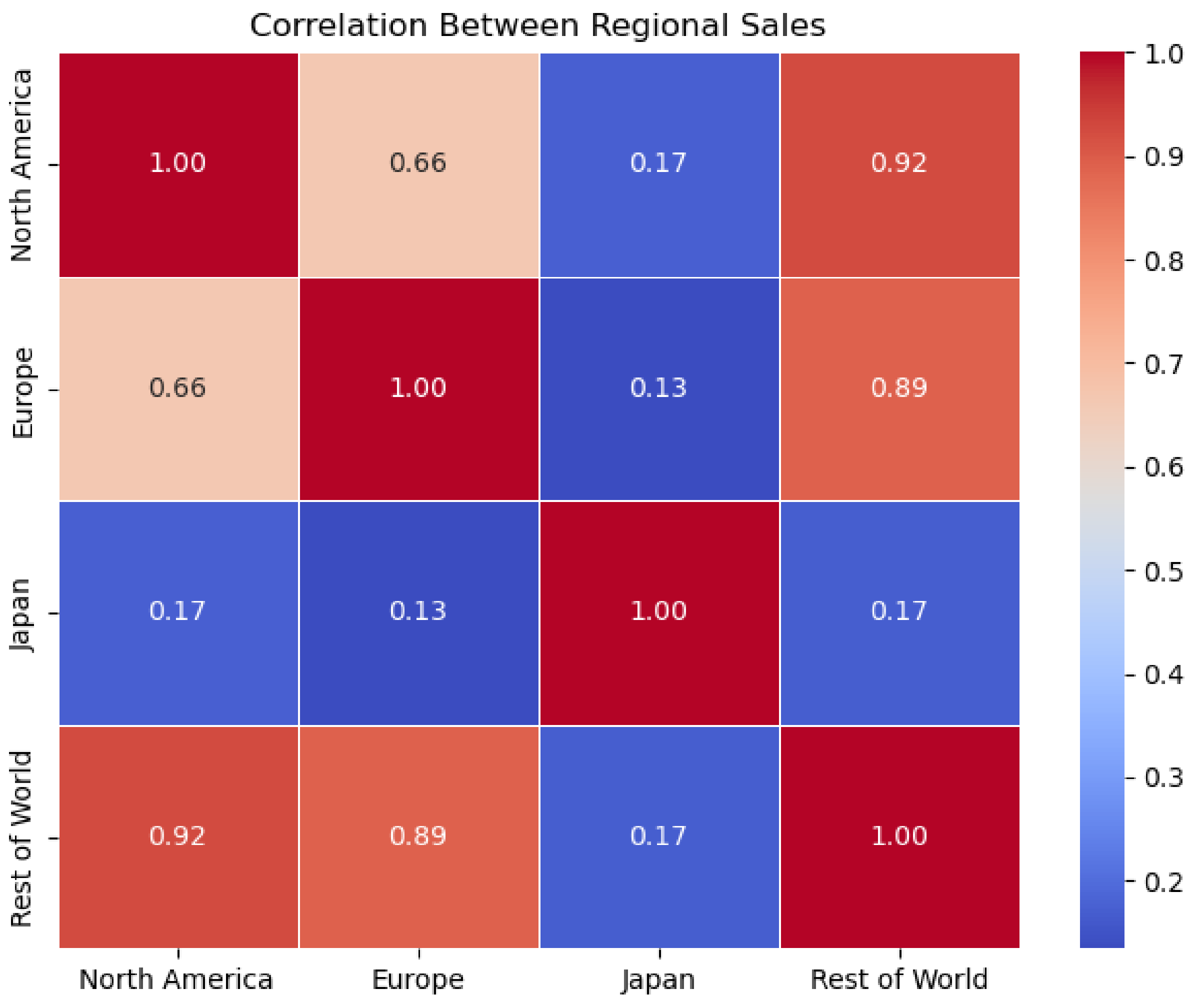
- Horizontal bar chart for the top 10 best-selling games globally.

```
top_10_games = df_filtered.nlargest(10, 'Global', keep='all')
plt.figure(figsize=(10, 6))
sns.barplot(x='Global', y='Game', data=top_10_games,
palette='Blues_d')
plt.title('Top 10 Best-Selling Games Globally')
plt.xlabel('Global Sales (Millions)')
plt.ylabel('Game')
plt.show()
```



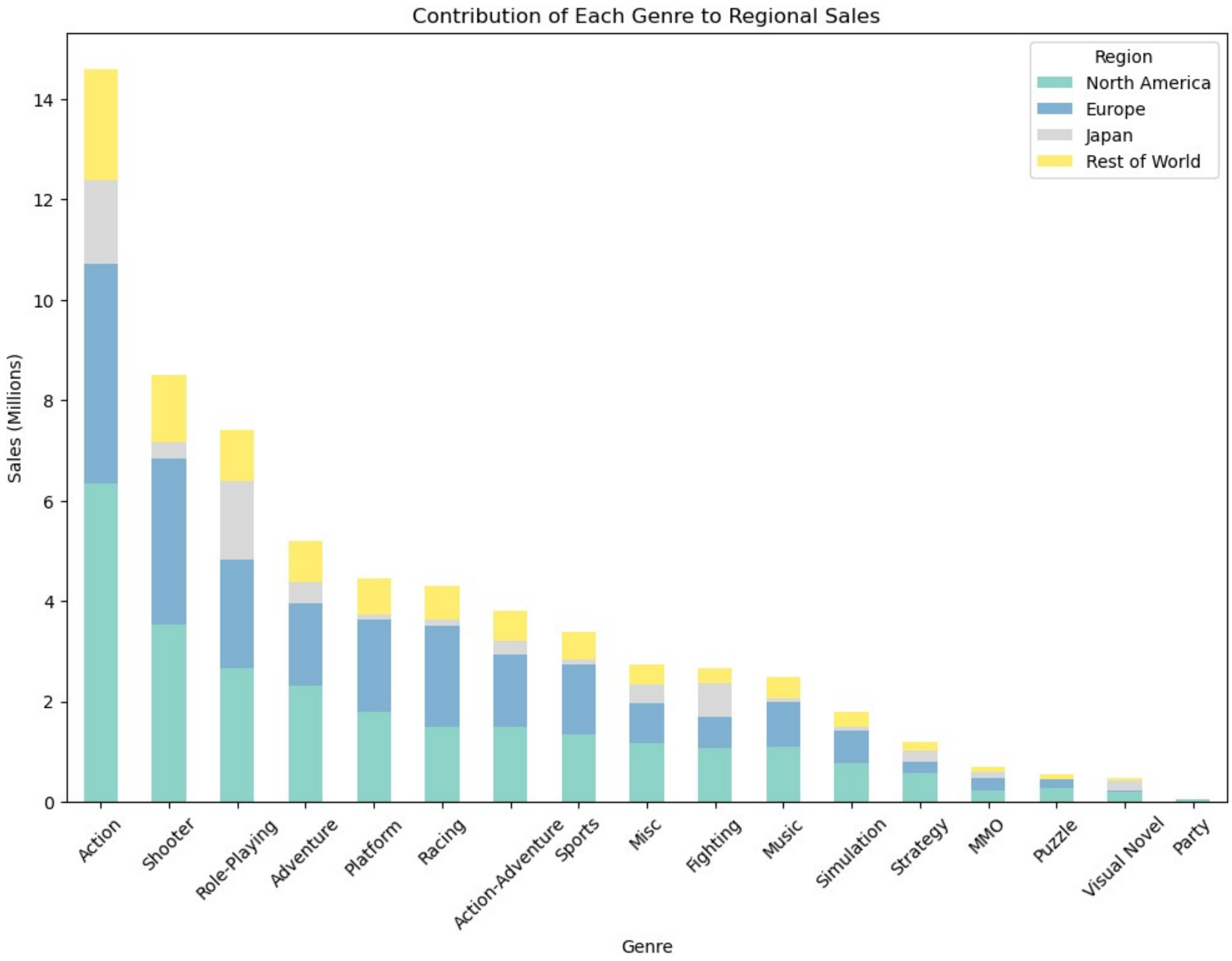
- Heatmap for correlation between regional sales.

```
region_sales_corr = df_filtered[['North America', 'Europe', 'Japan',
'Rest of World']].corr()
plt.figure(figsize=(8, 6))
sns.heatmap(region_sales_corr, annot=True, cmap='coolwarm', fmt='.2f',
linewidths=0.5)
plt.title('Correlation Between Regional Sales')
plt.show()
```



- Stacked bar chart showing genre contributions to regional sales.

```
total_sales_by_genre = regional_sales_by_genre.sum(axis=1)

# Sort the genres in descending order of total sales
sorted_genres =
total_sales_by_genre.sort_values(ascending=False).index

# Reorder the regional_sales_by_genre DataFrame based on the sorted
genres
regional_sales_by_genre = regional_sales_by_genre.loc[sorted_genres]

# Plot the stacked bar chart
regional_sales_by_genre.plot(kind='bar', stacked=True, figsize=(12,
8), colormap='Set3')
plt.title('Contribution of Each Genre to Regional Sales')
plt.xlabel('Genre')
plt.ylabel('Sales (Millions)')
plt.xticks(rotation=45)
plt.legend(title='Region')
plt.show()
```



Reflections

1. Insights and Patterns

- The "Action" genre dominated global sales, while "Role-Playing" games performed exceptionally well in Japan.
- Activision’s dominance in most regions highlights its strong global presence.

2. Surprises in the Data

- Japan’s unique preferences for "Role-Playing" and niche genres stood out.
- The strong correlation between North America and Europe sales indicates similar consumer behavior.

3. Challenges and Solutions

- Missing Values: Addressed by using median imputation for "Year" and "Unknown" for "Publisher."
- Outliers: Managed through the Interquartile Range (IQR) method.

4. Real-World Applications

- Insights can guide publishers in targeting specific regions with preferred genres.
- Developers can focus on trends such as the popularity of "Action" and "Shooter" games.

5. Skills and Knowledge Improved

- Improved data cleaning and preprocessing skills.
- Enhanced visualization techniques using Seaborn and Matplotlib.
- Better understanding of correlation and sales trend analysis.

Conclusion

This analysis provided a comprehensive exploration of PS4 game sales, uncovering valuable insights into global and regional trends, popular genres, and publisher performance. These findings can inform strategic decision-making for game publishers and developers, helping them better understand market dynamics and consumer preferences.