Group Members

1. **Mohit Rajpurohit**

- **Roll Number:** [48]
- **Registration Number:** [12415859]

2. **Devanshu**

- **Roll Number:** [56]
- **Registration Number:** [12410207]

Gaming Industry Analysis

Description:

The objective is to understand the key patterns, trends, and distributions within the video game industry based on available data.

It includes:

- Data loading and preprocessing using **Pandas and NumPy**
- Statistical summary and descriptive analysis
- Visual exploration using **Matplotlib, Seaborn, and Folium**
- Identification of **correlations, outliers**, and key performance metrics

Video Games

Importing the Dependencies

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import folium
import warnings
warnings.filterwarnings('ignore')
pd.set_option("display.max_column",None)
```

Data Preprocessing

```
df = pd.read_csv("Video_Games.csv")

df.head()
```

```
   Rank                      Name Platform    Year         Genre
Publisher  \
0     1                Wii Sports      Wii  2006.0        Sports
Nintendo
1     2          Super Mario Bros.      NES  1985.0      Platform
Nintendo
2     3             Mario Kart Wii      Wii  2008.0        Racing
Nintendo
3     4          Wii Sports Resort      Wii  2009.0        Sports
Nintendo
4     5  Pokemon Red/Pokemon Blue       GB  1996.0  Role-Playing
Nintendo

   NA_Sales  EU_Sales  JP_Sales  Other_Sales  Global_Sales
0     41.49     29.02      3.77         8.46         82.74
1     29.08      3.58      6.81         0.77         40.24
2     15.85     12.88      3.79         3.31         35.82
3     15.75     11.01      3.28         2.96         33.00
4     11.27      8.89     10.22         1.00         31.37
```

```
df.describe()
```

```
               Rank          Year      NA_Sales      EU_Sales
JP_Sales  \
count  16598.000000  16327.000000  16598.000000  16598.000000
16598.000000
mean    8300.605254   2006.406443      0.264667      0.146652
0.077782
std     4791.853933      5.828981      0.816683      0.505351
0.309291
min        1.000000   1980.000000      0.000000      0.000000
0.000000
25%     4151.250000   2003.000000      0.000000      0.000000
0.000000
50%     8300.500000   2007.000000      0.080000      0.020000
0.000000
75%    12449.750000   2010.000000      0.240000      0.110000
0.040000
max    16600.000000   2020.000000     41.490000     29.020000
10.220000

        Other_Sales  Global_Sales
count  16598.000000  16598.000000
mean       0.048063      0.537441
std        0.188588      1.555028
min        0.000000      0.010000
25%        0.000000      0.060000
50%        0.010000      0.170000
75%        0.040000      0.470000
max       10.570000     82.740000
```

```
df.shape
```

```
(16598, 11)
```

```
df.isnull().sum()
```

```
Rank              0
Name              0
Platform          0
Year            271
Genre             0
Publisher        58
NA_Sales          0
EU_Sales          0
JP_Sales          0
Other_Sales       0
Global_Sales      0
dtype: int64
```

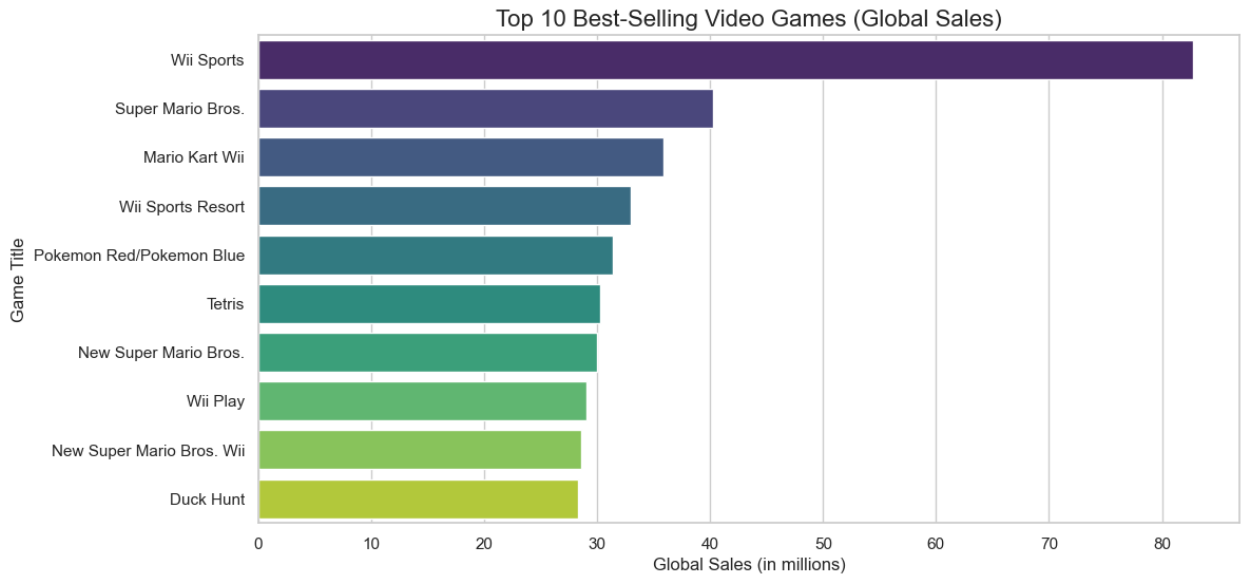
```
# Handle the missing values
df['Year'].fillna(df['Year'].mode()[0], inplace=True)

# Impute missing values in categorical columns with mode
df['Publisher'].fillna(df['Publisher'].mode()[0], inplace=True)
```

Analysis & Visualization

Bar Plot - Top 10 Best-Selling Video Games (Global Sales)

Which Video Games Have the Highest Global Sales of All Time?

```
# Set style for visuals
sns.set(style="whitegrid")
plt.figure(figsize=(12, 6))

# Top 10 games globally
top_games = df.sort_values(by="Global_Sales",
ascending=False).head(10)

# Barplot
sns.barplot(data=top_games, y="Name", x="Global_Sales",
palette="viridis")
plt.title("Top 10 Best-Selling Video Games (Global Sales)",
fontsize=16)
plt.xlabel("Global Sales (in millions)")
plt.ylabel("Game Title")
plt.show()
```



Pie Plot - Market Share of Game Genres by Global Sales

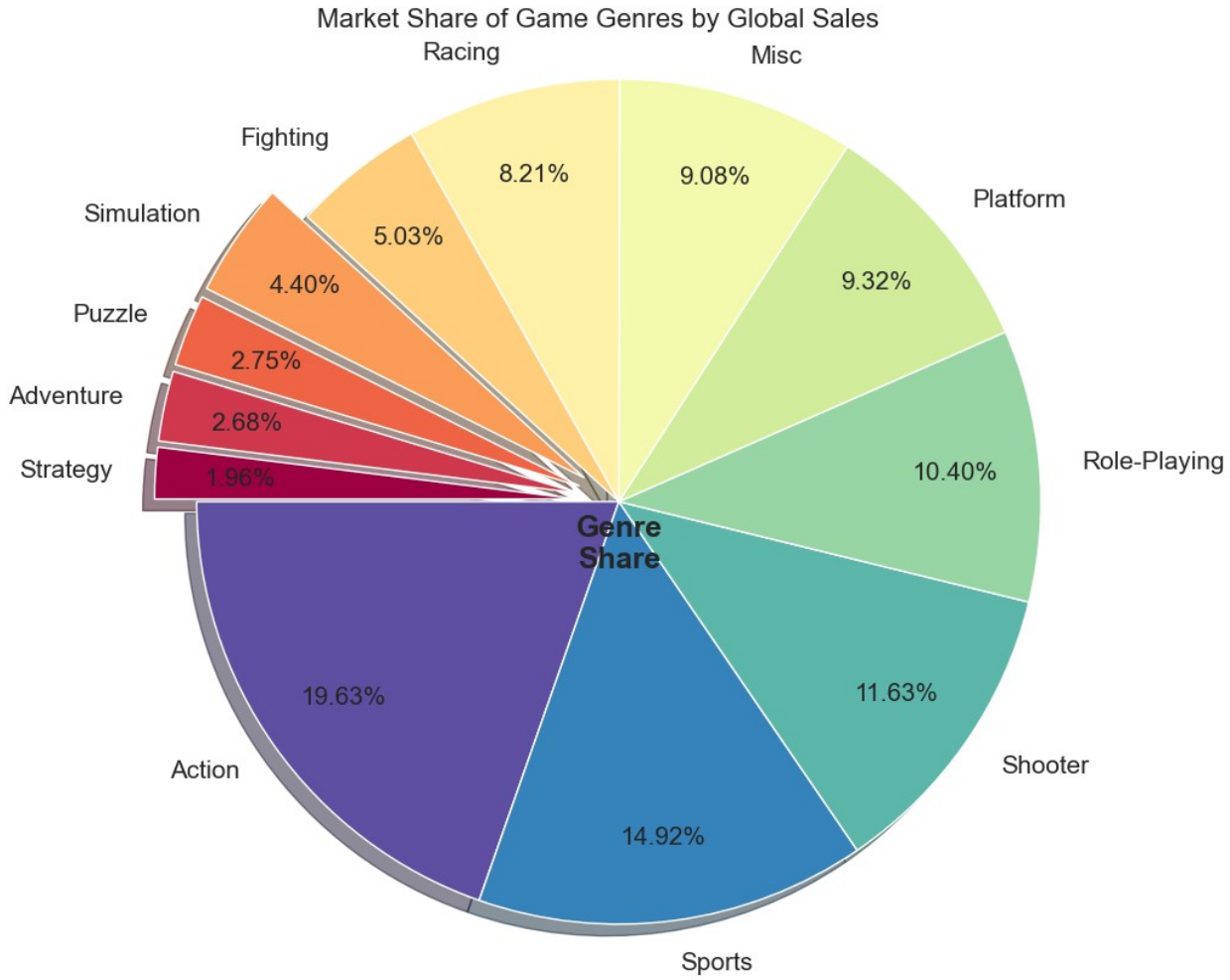
What is the Market Share of Each Video Game Genre Based on Global Sales?

```
genre_sales = df.groupby('Genre')
['Global_Sales'].sum().sort_values(ascending=False).reset_index()
genre_sales
```

	Genre	Global_Sales
0	Action	1751.18
1	Sports	1330.93
2	Shooter	1037.37
3	Role-Playing	927.37
4	Platform	831.37
5	Misc	809.96
6	Racing	732.04
7	Fighting	448.91
8	Simulation	392.20
9	Puzzle	244.95
10	Adventure	239.04
11	Strategy	175.12

```
# Prepare for pie chart
labels = genre_sales['Genre']
sizes = genre_sales['Global_Sales']
colors = plt.cm.Spectral_r(np.linspace(0, 1, len(sizes)))
explode_list = [0, 0, 0, 0, 0, 0, 0, 0, 0.1, 0.1, 0.1, 0.1]

# Plot as donut chart
plt.figure(figsize=(10, 10))
plt.pie(
    sizes,
```

```
    labels=labels,
    autopct='%0.2f%%',
    startangle=180,
    colors=colors,
    shadow=True,
    pctdistance=0.8,
    textprops={'fontsize': 15},
    explode=explode_list
)

plt.text(0, -0.1, 'Genre\nShare', ha='center', va='center',
fontsize=18, fontweight='bold')

plt.title("Market Share of Game Genres by Global Sales", fontsize=16)
plt.axis('equal')  # Equal aspect ratio ensures the pie chart is
circular.

plt.show()
```

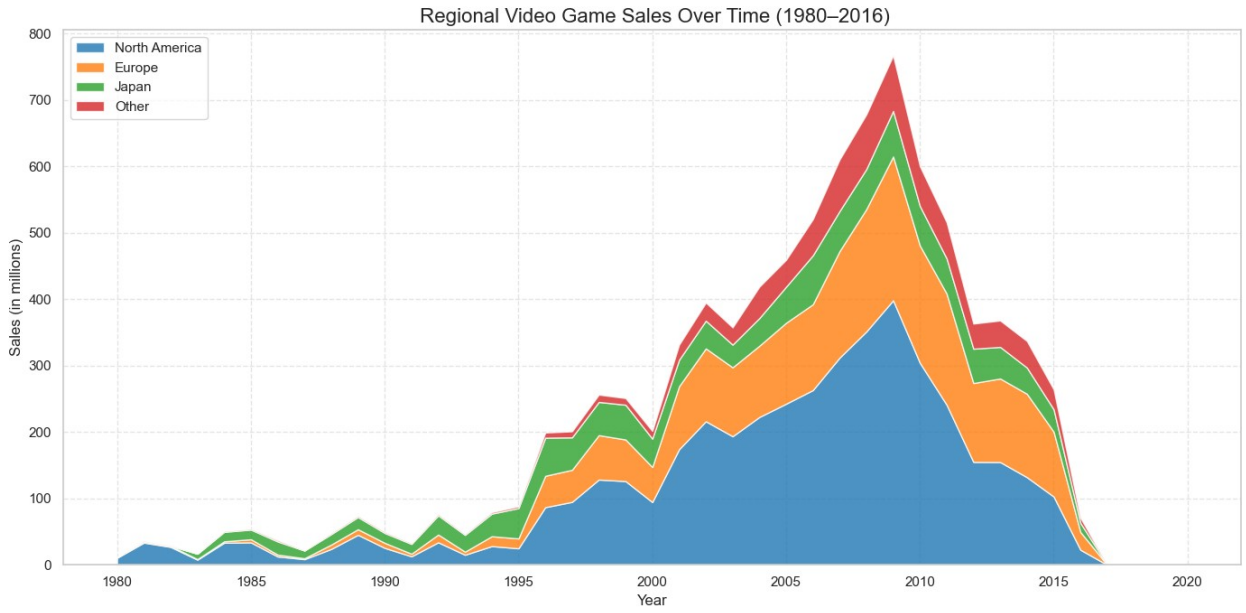


Stacked Area Chart - Regional Video Game Sales Over Time (1980–2016)

```
# Group by year and sum sales per region
region_sales = df.groupby('Year')[['NA_Sales', 'EU_Sales', 'JP_Sales',
'Other_Sales']].sum()
region_sales.head()
```

Year	NA_Sales	EU_Sales	JP_Sales	Other_Sales
1980.0	10.59	0.67	0.00	0.12
1981.0	33.40	1.96	0.00	0.32
1982.0	26.92	1.65	0.00	0.31
1983.0	7.76	0.80	8.10	0.14
1984.0	33.28	2.10	14.27	0.70

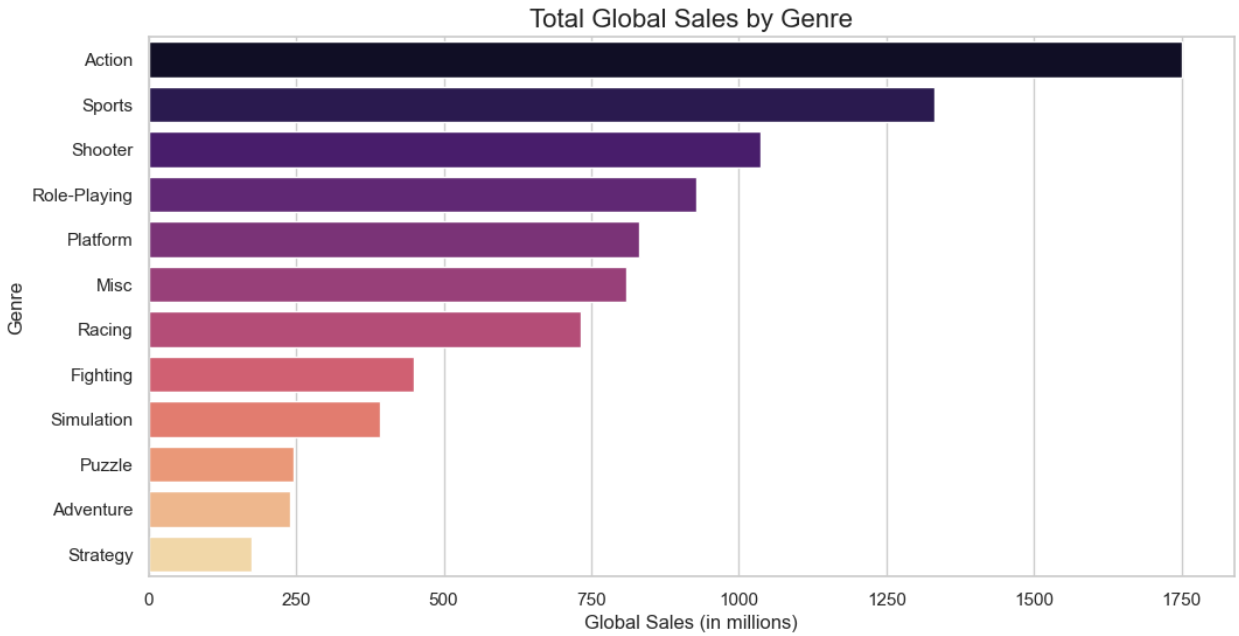
```
plt.figure(figsize=(14, 7))
plt.stackplot(region_sales.index,
              region_sales['NA_Sales'],
              region_sales['EU_Sales'],
              region_sales['JP_Sales'],
              region_sales['Other_Sales'],
              labels=['North America', 'Europe', 'Japan', 'Other'],
              alpha=0.8,
              colors=['#1f77b4', '#ff7f0e', '#2ca02c', '#d62728'])

# Chart aesthetics
plt.title(' Regional Video Game Sales Over Time (1980–2016)',
fontsize=16)
plt.xlabel('Year')
plt.ylabel('Sales (in millions)')
plt.legend(loc='upper left')
plt.grid(True, linestyle='--', alpha=0.5)
plt.tight_layout()
plt.show()
```



Total Global Sales by Genre

Which Video Game Genres Have Generated the Highest Global Sales?

```
genre_sales = df.groupby('Genre')
['Global_Sales'].sum().sort_values(ascending=False).reset_index()

# Plot
plt.figure(figsize=(12, 6))
sns.barplot(data=genre_sales, x='Global_Sales', y='Genre',
palette='magma')
plt.title("Total Global Sales by Genre", fontsize=16)
plt.xlabel("Global Sales (in millions)")
plt.ylabel("Genre")

plt.show()
```



Folium Map - Global Video Game Sales by Region

What is the geographical distribution of total video game sales across major regions?

```
region_coords = {
    'North America': (54.526, -105.2551),
    'Europe': (54.526, 15.2551),
    'Japan': (36.2048, 138.2529),
    'Other': (0.0, 20.0)
}

region_colors = {
    'North America': 'deepskyblue',
    'Europe': 'lime',
    'Japan': 'red',
    'Other': 'orange'
}


region_sales = {
    'North America': 140.5,
    'Europe': 110.3,
    'Japan': 45.8,
    'Other': 25.6
}

# Increased for better visibility on map
scale_factor = 0.3

m = folium.Map(location=[20, 0], zoom_start=2, tiles="CartoDB
```

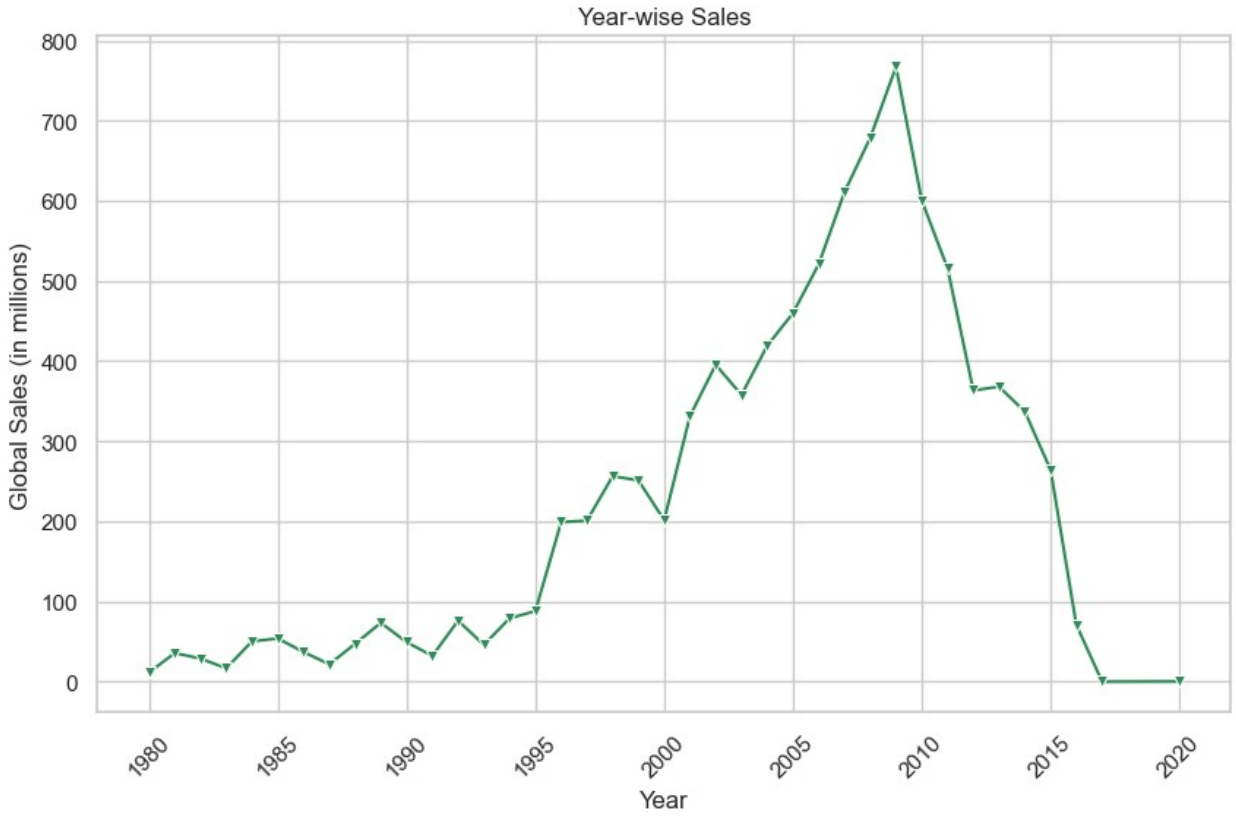
```
dark_matter")

for region, sales in region_sales.items():
    lat, lon = region_coords[region]
    color = region_colors[region]
    radius = sales * scale_factor

    folium.CircleMarker(
        location=(lat, lon),
        radius=radius,
        color='white',
        weight=2,
        fill=True,
        fill_color=color,
        fill_opacity=0.85,
        tooltip=f"{region}: {sales:.2f}M units"
    ).add_to(m)

m
```

```
<folium.folium.Map at 0x130b87620>
```

Line Plot - Year-Wise Sales

Yearly Sales Trends: How have video game sales evolved over the years? Are they increasing or decreasing?

```
year_sales = df.groupby('Year')['Global_Sales'].sum()

plt.figure(figsize=(10, 6))
sns.lineplot(x=year_sales.index, y=year_sales.values,  marker='v',
color='seagreen')
plt.title('Year-wise Sales')
plt.xlabel('Year')
plt.ylabel('Global Sales (in millions)')
plt.xticks(rotation=45)
plt.show()
```

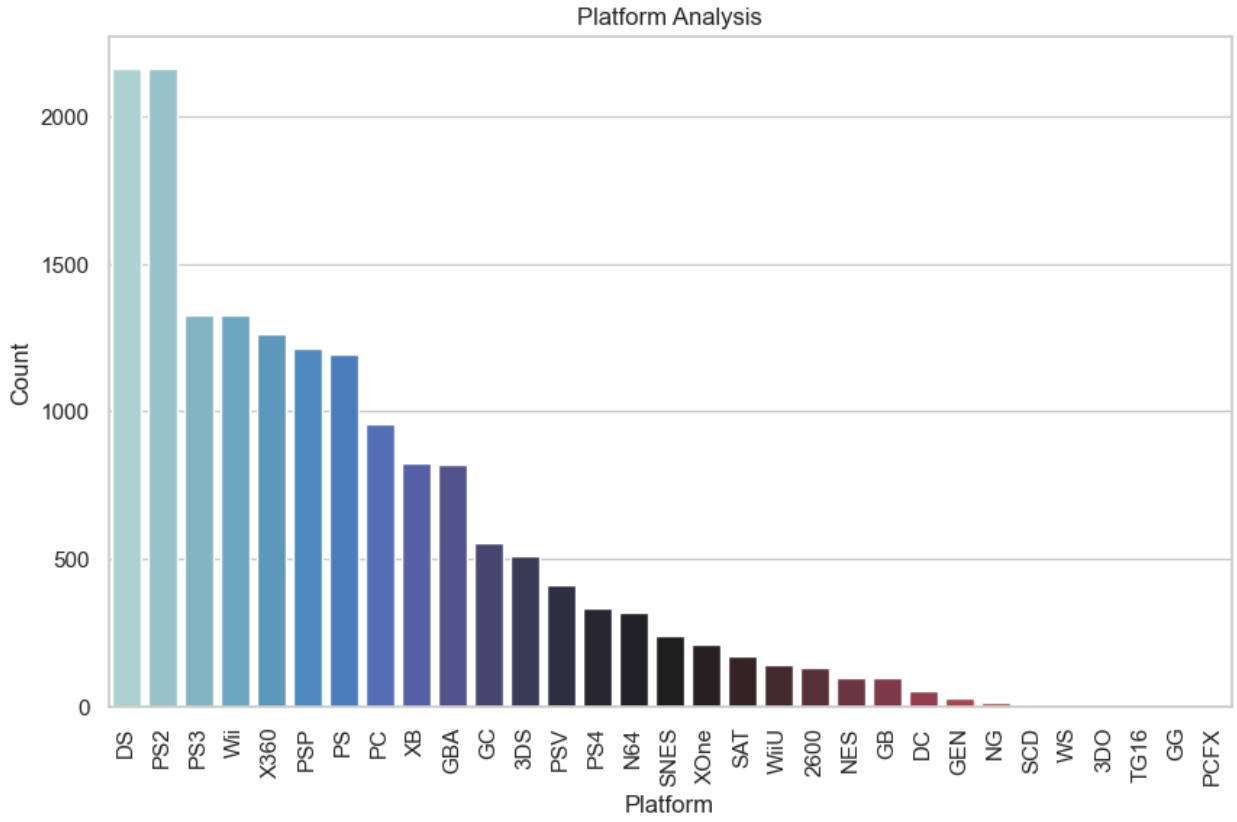


Bar Plot - Platform Analysis

Which Gaming Platforms Have the Most Game Releases?

This chart helps reveal how many games were released on each platform, highlighting the most supported or popular platforms among game developers.

```
platform_counts = df['Platform'].value_counts()

plt.figure(figsize=(10, 6))
sns.barplot(x=platform_counts.index, y=platform_counts.values,
palette="icefire")
plt.title('Platform Analysis')
plt.xlabel('Platform')
plt.ylabel('Count')
plt.xticks(rotation=90)
plt.show()
```

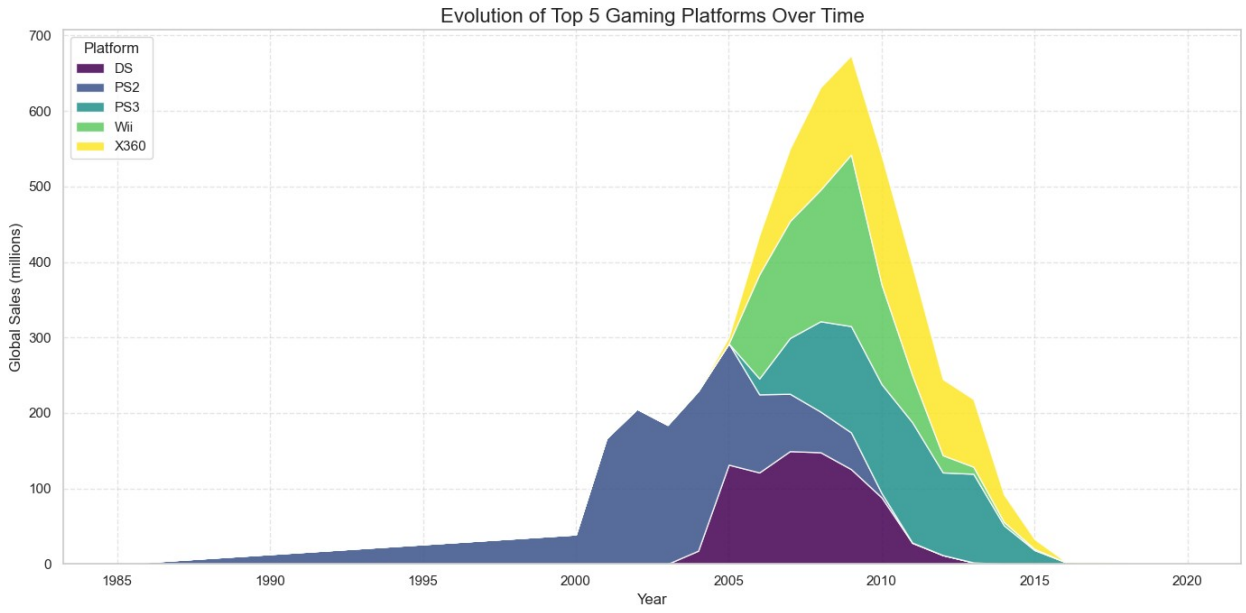


Stack Plot - Evolution of Top 5 Gaming Platforms Over Time

How Have Global Sales of the Top 5 Gaming Platforms Changed Over the Years?

```
# Get top 5 platforms by global sales
top_platforms = df.groupby('Platform')
['Global_Sales'].sum().sort_values(ascending=False).head(5).index.toli
st()

# Filter data for only top platforms
filtered_df = df[df['Platform'].isin(top_platforms)]

# Group by Year and Platform
platform_yearly_sales = filtered_df.groupby(['Year', 'Platform'])
['Global_Sales'].sum().unstack().fillna(0)

# Ensure platforms are in the correct order (matching DataFrame
columns)
ordered_platforms = platform_yearly_sales.columns.tolist()

# Generate colors using a colormap
```

```
colors = plt.get_cmap("viridis")(np.linspace(0, 1,
len(ordered_platforms)))

# Plotting the stackplot
plt.figure(figsize=(14, 7))
plt.stackplot(platform_yearly_sales.index,
              [platform_yearly_sales[platform] for platform in
ordered_platforms],
              labels=ordered_platforms,
              colors=colors,
              alpha=0.85)

# Chart styling
plt.title("Evolution of Top 5 Gaming Platforms Over Time",
fontsize=16)
plt.xlabel("Year")
plt.ylabel("Global Sales (millions)")
plt.legend(title="Platform", loc="upper left")
plt.grid(True, linestyle='--', alpha=0.5)
plt.tight_layout()
plt.show()
```



Heatmap - Correlation Map

How Are the Numerical Features in the Dataset Correlated With Each Other?

This correlation heatmap helps identify relationships between numerical variables, such as how strongly things like critic score, user score, or global sales are related.

```
numerical_data=df.select_dtypes(include=[np.number])
plt.figure(figsize=(12,6))
sns.heatmap(data=numerical_data.corr(), annot=True)
plt.title('Correlation Map')
plt.show()
```

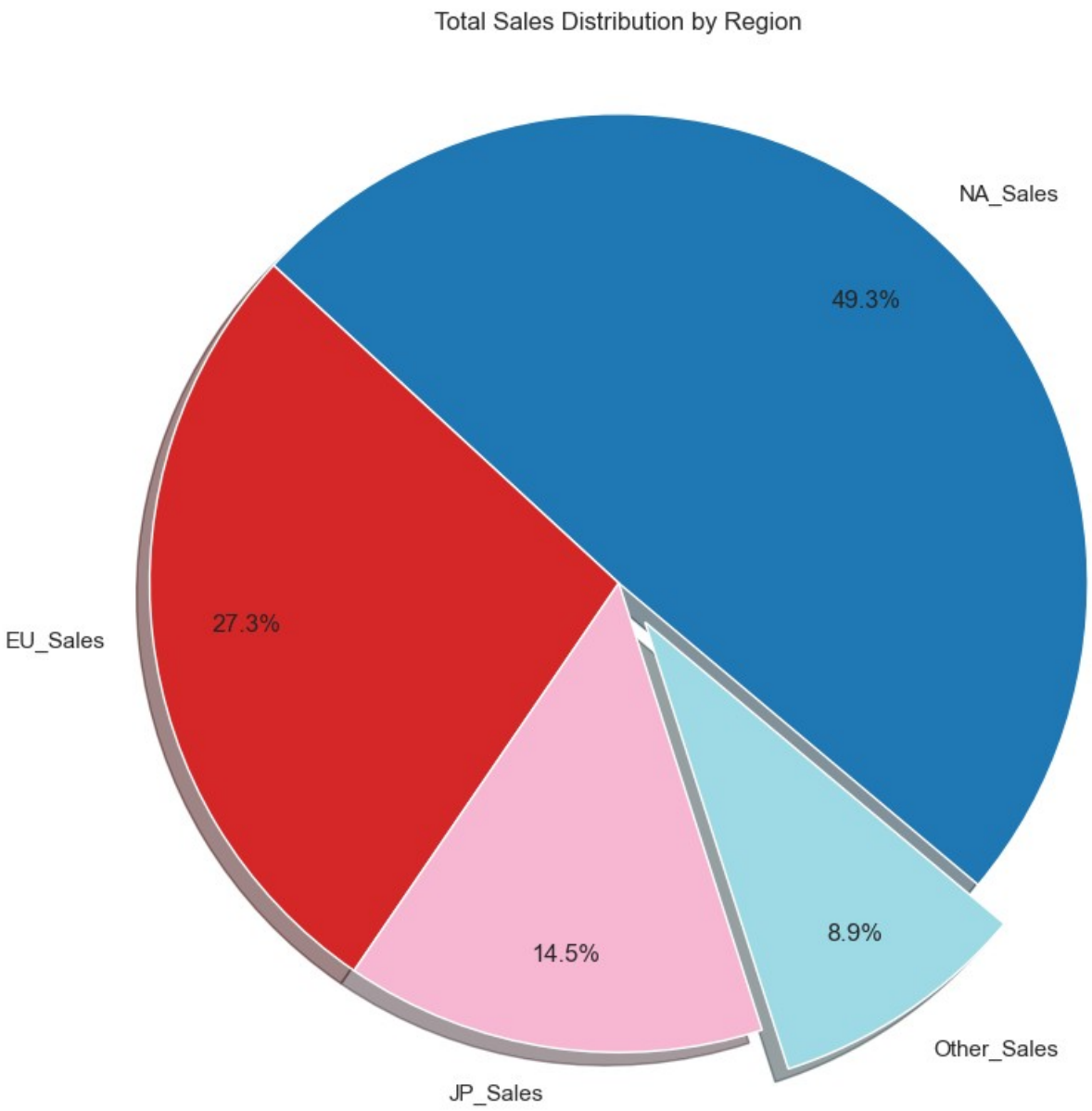
Pie Plot - Sales by Region

Which region (North America, Europe, Japan, Rest of the World) contributes the most to global video game sales?

```
region_sales=df[['NA_Sales','EU_Sales','JP_Sales','Other_Sales']].sum(
)
region_sales
```

```
NA_Sales       4392.95
EU_Sales       2434.13
JP_Sales       1291.02
Other_Sales     797.75
dtype: float64
```

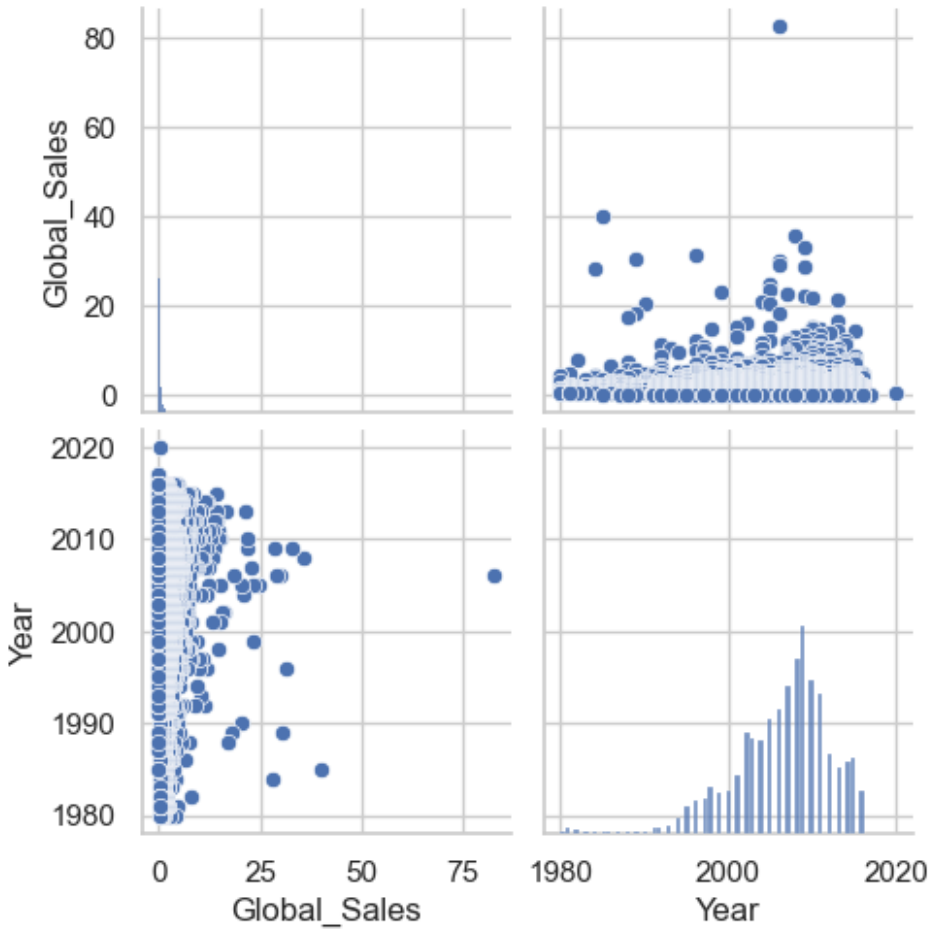
```
labels = region_sales.index
sizes = region_sales.values
colors = plt.cm.tab20(np.linspace(0, 1, len(sizes)))


explode_list = [0, 0, 0, 0.1]

plt.figure(figsize=(8, 8))
plt.pie(sizes,
        labels=labels,
        autopct='%1.1f%%',
        colors=colors,
        shadow=True,
        pctdistance=0.8,
        startangle=320,
        explode=explode_list
)
plt.title('Total Sales Distribution by Region')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a
circle.
plt.tight_layout()
plt.show()
```



Pair Plot - Relationships Between Year and Global Sales

What relationships or patterns can be observed between global sales, release year, and publishers of video games?

```
sns.pairplot(df[['Global_Sales', 'Year', 'Publisher']])
plt.show()
```

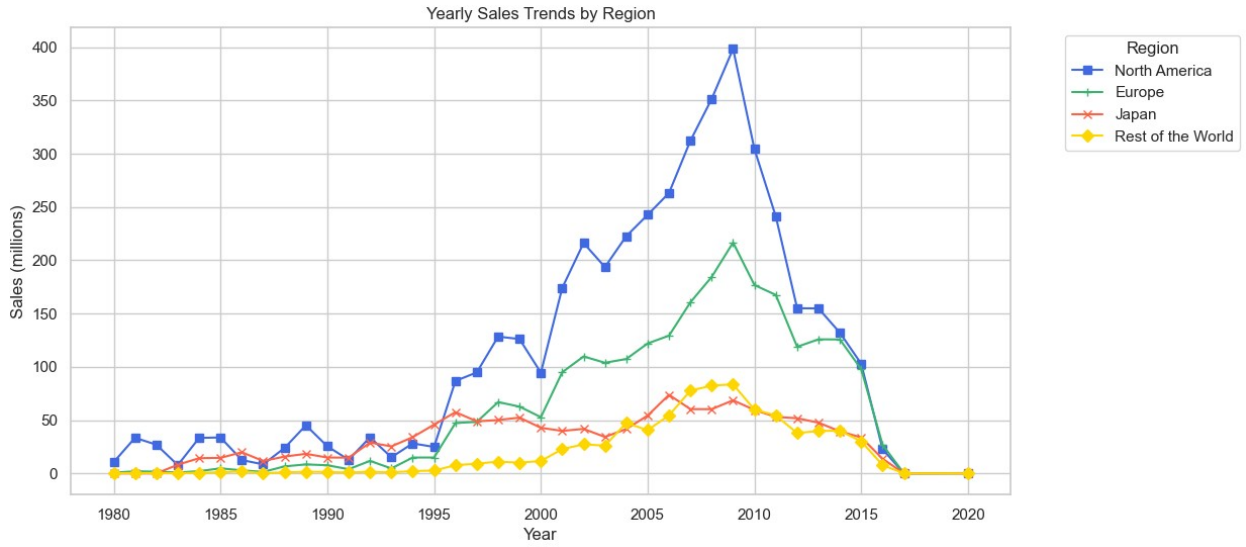


Multi-Line Plot - Yearly Sales by Region

How have the sales trends evolved over the years in each region?

```
yearly_sales_by_region = df.groupby('Year')[['NA_Sales',
'EU_Sales','JP_Sales', 'Other_Sales']].sum()

# Create line plots to visualize yearly sales trends in each region
plt.figure(figsize=(12, 6))
plt.plot(yearly_sales_by_region.index,
yearly_sales_by_region['NA_Sales'],label='North America', marker='s',
color='royalblue')
plt.plot(yearly_sales_by_region.index,
yearly_sales_by_region['EU_Sales'],label='Europe', marker='+',
color='mediumseagreen')
plt.plot(yearly_sales_by_region.index,
yearly_sales_by_region['JP_Sales'],label='Japan', marker='x',
color='tomato')
plt.plot(yearly_sales_by_region.index,
yearly_sales_by_region['Other_Sales'],label='Rest of the World',
marker='D', color='gold')
```

```
plt.xlabel('Year')
plt.ylabel('Sales (millions)')
plt.title('Yearly Sales Trends by Region')
plt.legend(title='Region', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.grid(True)
plt.show()
```

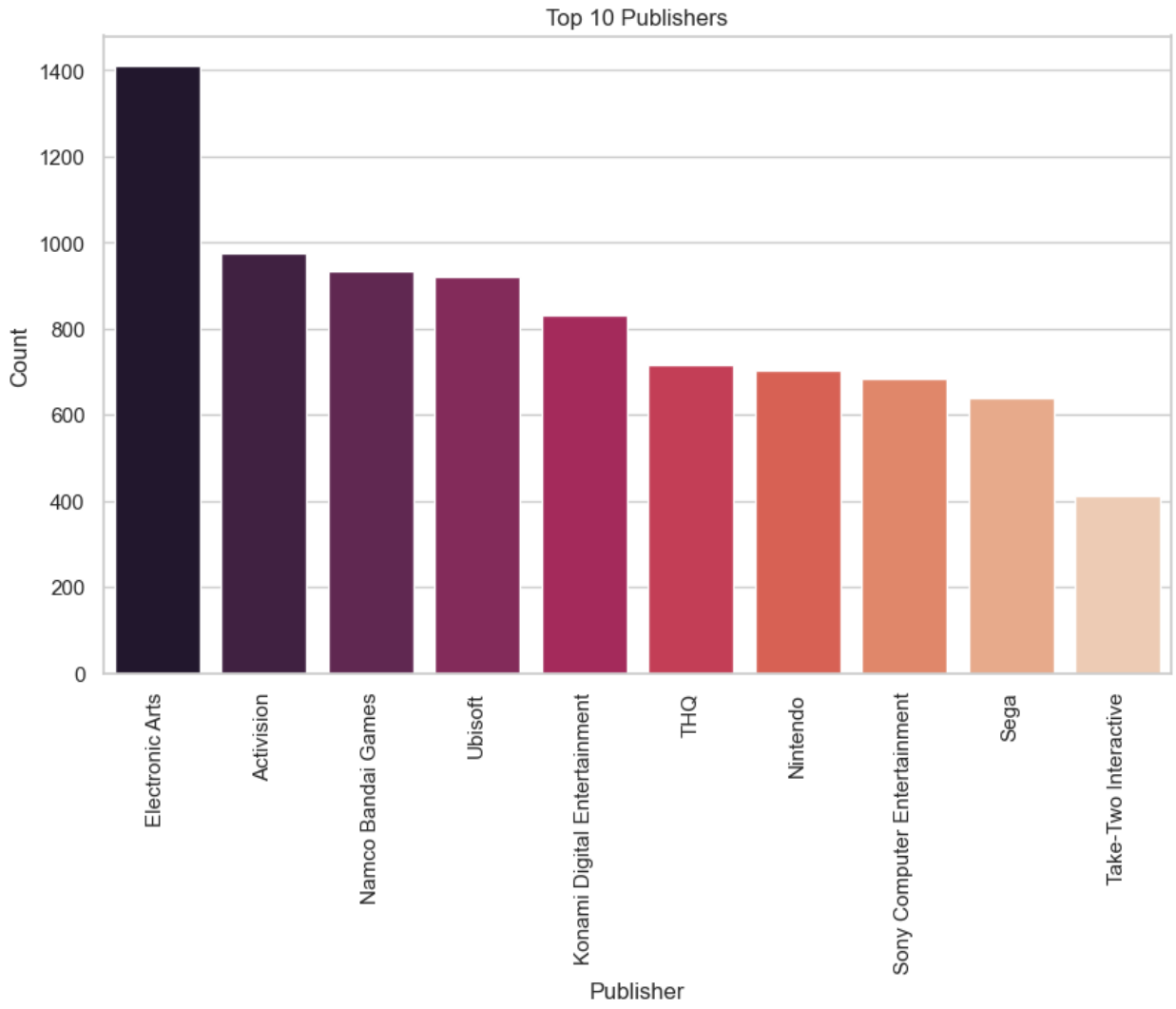


Bar Plot - Top 10 Publishers

Which Publishers Have Released the Most Video Games?

This bar chart shows the top 10 publishers based on the number of games they have released, helping to identify the most prolific companies in the video game industry.

```
top_publishers = df['Publisher'].value_counts().head(10)

plt.figure(figsize=(10, 6))
sns.barplot(x=top_publishers.index,
y=top_publishers.values,palette="rocket")
plt.title('Top 10 Publishers')
plt.xlabel('Publisher')
plt.ylabel('Count')
plt.xticks(rotation=90)
plt.show()
```

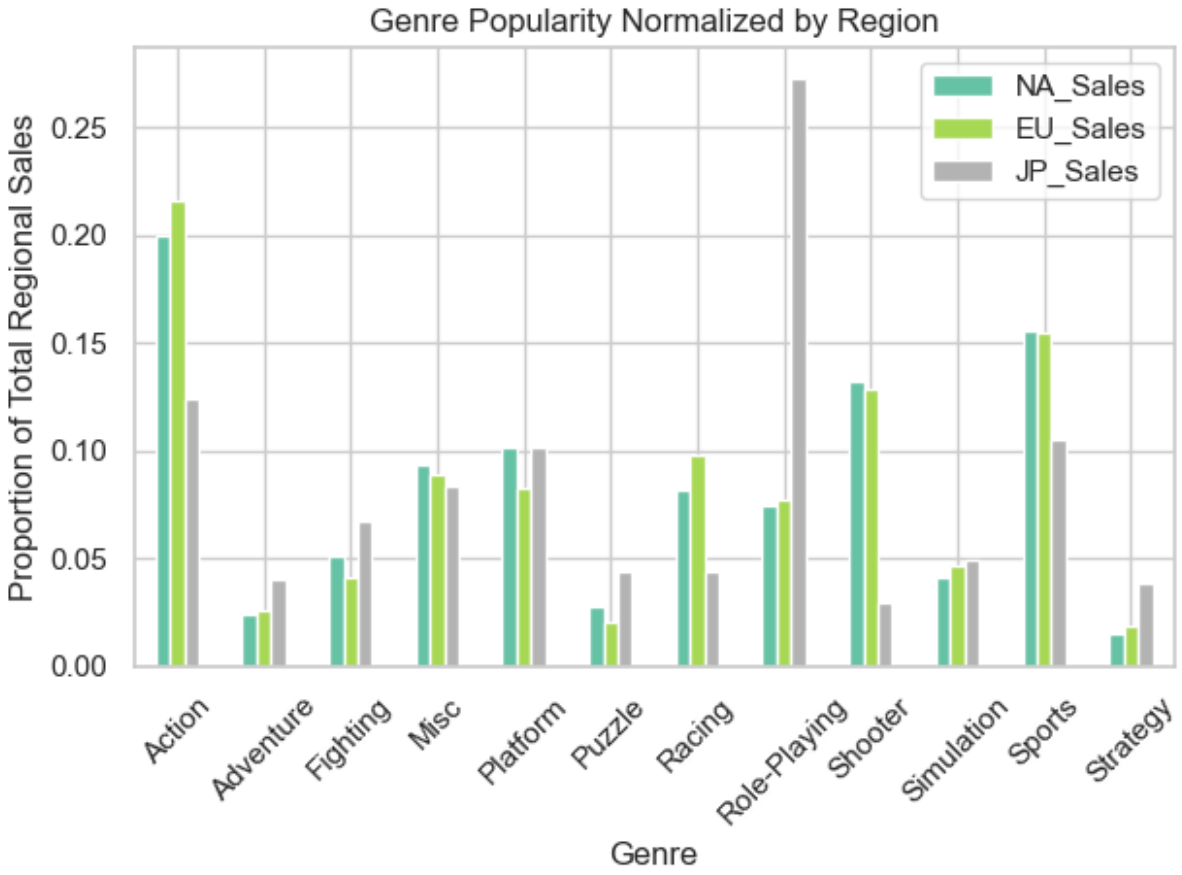


Bar Plot - Region-wise Genre Dominance (Normalized)

How does the popularity of video game genres vary across different regions?

```
region_genre = df.groupby("Genre")[["NA_Sales", "EU_Sales",
"JP_Sales"]].sum()
region_genre_normalized = region_genre.div(region_genre.sum(axis=0),
axis=1)

plt.figure(figsize=(12,6))
region_genre_normalized.plot(kind="bar", stacked=False,
colormap="Set2")
plt.title("Genre Popularity Normalized by Region")
plt.ylabel("Proportion of Total Regional Sales")
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

```
<Figure size 1200x600 with 0 Axes>
```

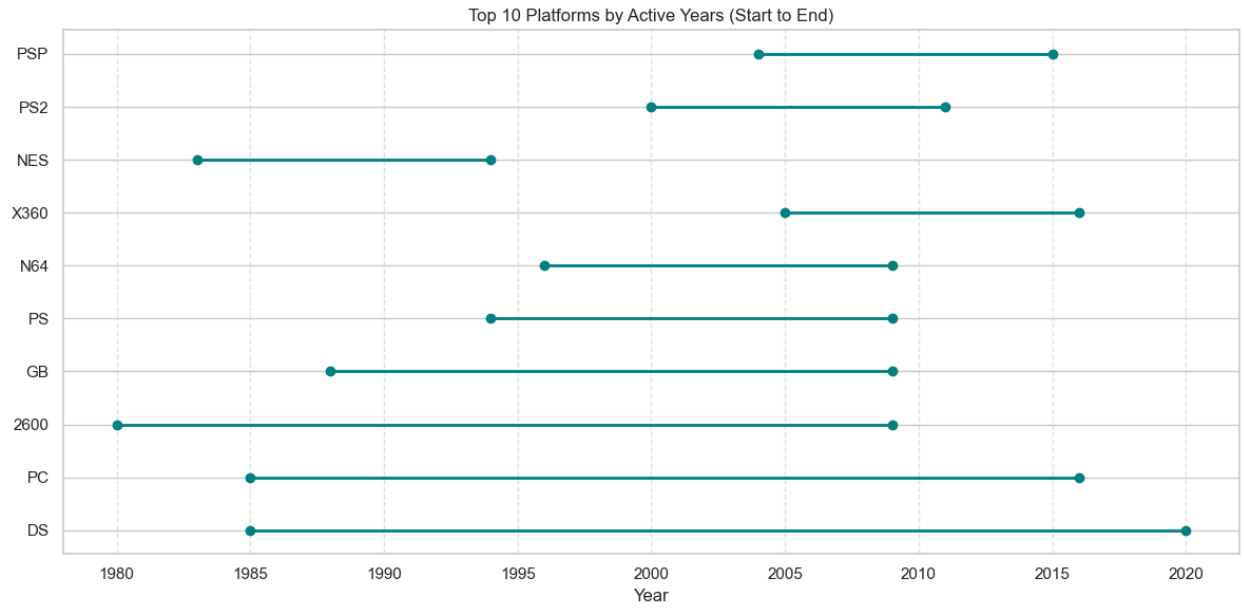


Timeline plot - Platform Lifespan Analysis

Which platforms dominated the gaming market for the longest period?

```
platform_lifespan = df.dropna(subset=["Year"]).groupby("Platform")
["Year"].agg(["min", "max"])
platform_lifespan["Lifespan"] = platform_lifespan["max"] -
platform_lifespan["min"]
platform_lifespan_sorted = platform_lifespan.sort_values("Lifespan",
ascending=False).head(10)

# Reset index to use platform names for plotting
platform_lifespan_sorted = platform_lifespan_sorted.reset_index()

# Timeline-style plot
plt.figure(figsize=(12,6))
for i, row in platform_lifespan_sorted.iterrows():
    plt.plot([row["min"], row["max"]], [i, i], marker='o',
color='teal', linewidth=2)
```

```
plt.yticks(range(len(platform_lifespan_sorted)),
platform_lifespan_sorted["Platform"])
plt.xlabel("Year")
plt.title("Top 10 Platforms by Active Years (Start to End)")
plt.grid(axis='x', linestyle='--', alpha=0.6)
plt.tight_layout()
plt.show()
```

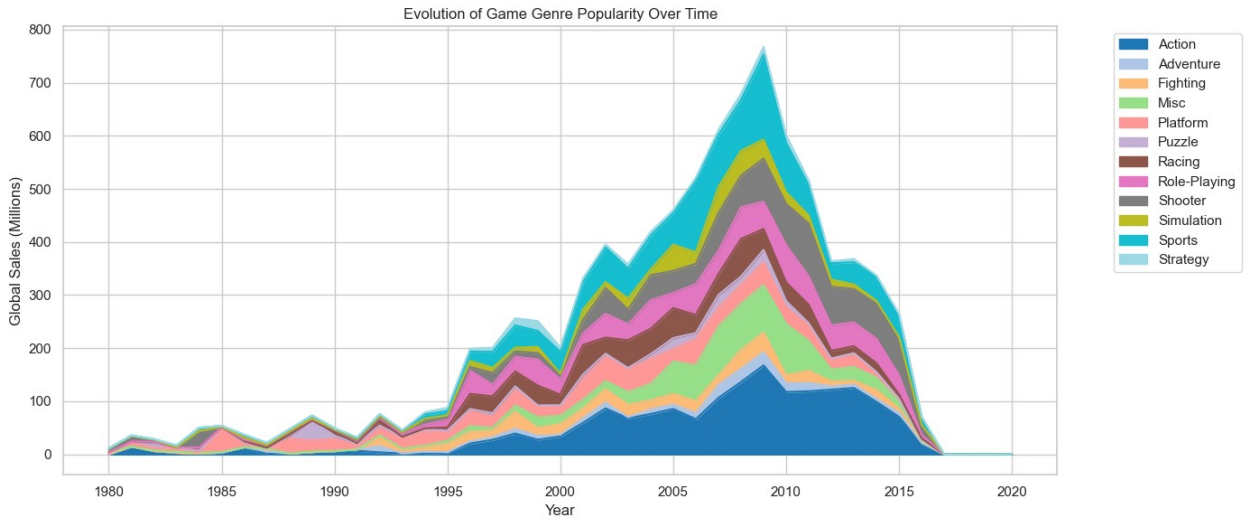


Stacked Area Chart - Genre Evolution Over Years

What trends can be observed in genre popularity from year to year in the gaming industry?

```
genre_evolution = df.dropna(subset=["Year"]).groupby(["Year",
"Genre"])["Global_Sales"].sum().reset_index()
genre_pivot = genre_evolution.pivot(index="Year", columns="Genre",
values="Global_Sales").fillna(0)

plt.figure(figsize=(14,6))
genre_pivot.plot(kind="area", stacked=True, colormap="tab20",
figsize=(14,6))
plt.title("Evolution of Game Genre Popularity Over Time")
plt.xlabel("Year")
plt.ylabel("Global Sales (Millions)")
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.tight_layout()
plt.show()
```

```
<Figure size 1400x600 with 0 Axes>
```



Insights from Video Game Industry Visualizations - Key Insights

Top-Selling Games:

- Wii Sports, Super Mario Bros., and Mario Kart Wii are among the highest globally sold games.
- Nintendo leads with multiple entries in the top 10, showing its strong influence over the years.

Genre Market Share:

- Action games dominate global sales, contributing over 20% to total sales.
- Sports, Shooter, and Role-Playing games follow as top genres.
- Puzzle, Strategy, and Adventure genres have niche but consistent markets.

Regional Sales Patterns:

- North America is the largest consumer of video games, followed by Europe and Japan.
- Japan was dominant in the 80s and 90s but saw a decline over time.
- Sales peaked- around 2008–2009, possibly due to the success of the Wii, PS3, and Xbox 360.

Genre Popularity by Region:

- Japan prefers Role-Playing games.
- North America and Europe favor Action and Sports genres.
- Regional tastes highlight the need for localized content strategies.

Platform Trends:

- Platforms like PS2, DS, and Wii had the most game releases.
- Platforms like Atari 2600 and Genesis had the longest active lifespans.
- A shift from older consoles to modern systems like PS4 and Xbox One is visible.

Publisher Influence:

- Electronic Arts (EA) released the highest number of games, followed by Activision and Nintendo.
- Annual sports franchises heavily influence publisher statistics.

Year-wise Sales Trends:

- Sales showed significant growth from 1995 to 2008.
- A noticeable decline post-2010 hints at changes in consumer habits and market saturation.

Correlation Analysis:

- Strong positive correlations between regional sales and global sales.
- Japan shows slightly weaker correlation, indicating distinct consumer behavior.

Anomalies & Observations:

- Sales spikes in 1983 and 2008 stand out due to industry shifts or hit releases.
- "Other" regions, though smaller, have seen steady growth since 2000.

Overall Summary

The visual analysis of video game data from 1980 to 2020 reveals clear industry patterns and regional preferences. Nintendo consistently dominated global sales, especially with family-friendly titles. Action and sports games led the genre race, while different regions showed unique tastes—Japan leaning toward role-playing and North America favoring action-heavy titles. Platform analysis showcased generational shifts from early consoles to modern platforms, with sales peaking around 2008. The dominance of publishers like EA and Activision reflects market consolidation. Despite a decline in recent years, video game sales have left an enduring mark, and the insights drawn from these visualizations help us better understand the evolution and drivers of the gaming industry.