analysis

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1 Spotify and YouTube Music Data Analysis

This notebook performs an in-depth analysis of the combined Spotify and YouTube music dataset. The goal is to uncover insights into music popularity across these two major platforms, understand the characteristics of popular songs, and identify potential correlations between audio features and audience engagement.

1.1 Table of Contents

1.2 1. Data Loading and Initial Exploration

This section focuses on loading the dataset into a pandas DataFrame and performing initial checks to understand its structure, data types, and a glimpse of the raw data.

[2]:
```
import pandas as pd
df = pd.read_csv('Spotify Youtube Dataset.csv')
print("Dataset loaded successfully.")
```

```
Dataset loaded successfully.
```

1.2.1 Displaying the First Few Rows

Let's inspect the first few rows of the DataFrame to get a sense of the data structure and content.

[3]:
```
df.head()
```

[3]:
```
   Unnamed: 0    Artist                                        Url_spotify  \
0           0  Gorillaz  https://open.spotify.com/artist/3AA28KZvwAUcZu…
1           1  Gorillaz  https://open.spotify.com/artist/3AA28KZvwAUcZu…
2           2  Gorillaz  https://open.spotify.com/artist/3AA28KZvwAUcZu…
```

```
3           3  Gorillaz  https://open.spotify.com/artist/3AA28KZvwAUcZu…
4           4  Gorillaz  https://open.spotify.com/artist/3AA28KZvwAUcZu…

                                          Track  \
0                                 Feel Good Inc.
1                                Rhinestone Eyes
2  New Gold (feat. Tame Impala and Bootie Brown)
3                              On Melancholy Hill
4                                  Clint Eastwood

                                          Album Album_type  \
0                                    Demon Days      album
1                                  Plastic Beach      album
2  New Gold (feat. Tame Impala and Bootie Brown)     single
3                                  Plastic Beach      album
4                                       Gorillaz      album

                                    Uri  Danceability  Energy   Key  …  \
0  spotify:track:0d28khcov6AiegSCpG5TuT         0.818   0.705   6.0  …
1  spotify:track:1foMv2HQwfQ2vntFf9HFeG         0.676   0.703   8.0  …
2  spotify:track:64dLd6rVqDLtkXFYrEUHIU         0.695   0.923   1.0  …
3  spotify:track:0q6LuUqGLUiCPP1cbdwFs3         0.689   0.739   2.0  …
4  spotify:track:7yMiX7n9SBvadzox8T5jzT         0.663   0.694  10.0  …

                                    Url_youtube  \
0  https://www.youtube.com/watch?v=HyHNuVaZJ-k
1  https://www.youtube.com/watch?v=yYDmaexVHic
2  https://www.youtube.com/watch?v=qJa-VFwPpYA
3  https://www.youtube.com/watch?v=04mfKJWDSzI
4  https://www.youtube.com/watch?v=1V_xRb0x9aw

                                           Title   Channel        Views  \
0        Gorillaz - Feel Good Inc. (Official Video)  Gorillaz  693555221.0
1  Gorillaz - Rhinestone Eyes [Storyboard Film] (…  Gorillaz   72011645.0
2  Gorillaz - New Gold ft. Tame Impala & Bootie B…  Gorillaz    8435055.0
3    Gorillaz - On Melancholy Hill (Official Video)  Gorillaz  211754952.0
4        Gorillaz - Clint Eastwood (Official Video)  Gorillaz  618480958.0

       Likes  Comments                                        Description  \
0  6220896.0  169907.0  Official HD Video for Gorillaz' fantastic trac…
1  1079128.0   31003.0  The official video for Gorillaz - Rhinestone E…
2   282142.0    7399.0  Gorillaz - New Gold ft. Tame Impala & Bootie B…
3  1788577.0   55229.0  Follow Gorillaz online:\nhttp://gorillaz.com \…
4  6197318.0  155930.0  The official music video for Gorillaz - Clint …

   Licensed official_video        Stream
0     True           True  1.040235e+09
```

```
1      True           True  3.100837e+08
2      True           True  6.306347e+07
3      True           True  4.346636e+08
4      True           True  6.172597e+08

[5 rows x 28 columns]
```

1.2.2 Data Information

The `info()` method provides a concise summary of the DataFrame, including the number of entries, column names, non-null values, and data types.

[4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20718 entries, 0 to 20717
Data columns (total 28 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Unnamed: 0        20718 non-null  int64
 1   Artist            20718 non-null  object
 2   Url_spotify       20718 non-null  object
 3   Track             20718 non-null  object
 4   Album             20718 non-null  object
 5   Album_type        20718 non-null  object
 6   Uri               20718 non-null  object
 7   Danceability      20716 non-null  float64
 8   Energy            20716 non-null  float64
 9   Key               20716 non-null  float64
 10  Loudness          20716 non-null  float64
 11  Speechiness       20716 non-null  float64
 12  Acousticness      20716 non-null  float64
 13  Instrumentalness  20716 non-null  float64
 14  Liveness          20716 non-null  float64
 15  Valence           20716 non-null  float64
 16  Tempo             20716 non-null  float64
 17  Duration_ms       20716 non-null  float64
 18  Url_youtube       20248 non-null  object
 19  Title             20248 non-null  object
 20  Channel           20248 non-null  object
 21  Views             20248 non-null  float64
 22  Likes             20177 non-null  float64
 23  Comments          20149 non-null  float64
 24  Description       19842 non-null  object
 25  Licensed          20248 non-null  object
 26  official_video    20248 non-null  object
 27  Stream            20142 non-null  float64
dtypes: float64(15), int64(1), object(12)
```

```
memory usage: 4.4+ MB
```

1.3 2. Missing Values Analysis

It's crucial to identify and handle missing values as they can affect the accuracy of our analysis. This section checks for any null values across all columns.

[5]:
```
df.isnull().sum()
```

[5]:
```
Unnamed: 0            0
Artist                0
Url_spotify           0
Track                 0
Album                 0
Album_type            0
Uri                   0
Danceability          2
Energy                2
Key                   2
Loudness              2
Speechiness           2
Acousticness          2
Instrumentalness      2
Liveness              2
Valence               2
Tempo                 2
Duration_ms           2
Url_youtube         470
Title               470
Channel             470
Views               470
Likes               541
Comments            569
Description         876
Licensed            470
official_video      470
Stream              576
dtype: int64
```

1.4 3. Descriptive Statistics

The `describe()` method generates descriptive statistics that summarize the central tendency, dispersion, and shape of a dataset's distribution, excluding `NaN` values.

[6]:
```
df.describe()
```

[6]:
```
          Unnamed: 0  Danceability        Energy           Key      Loudness  \
count  20718.000000  20716.000000  20716.000000  20716.000000  20716.000000
```

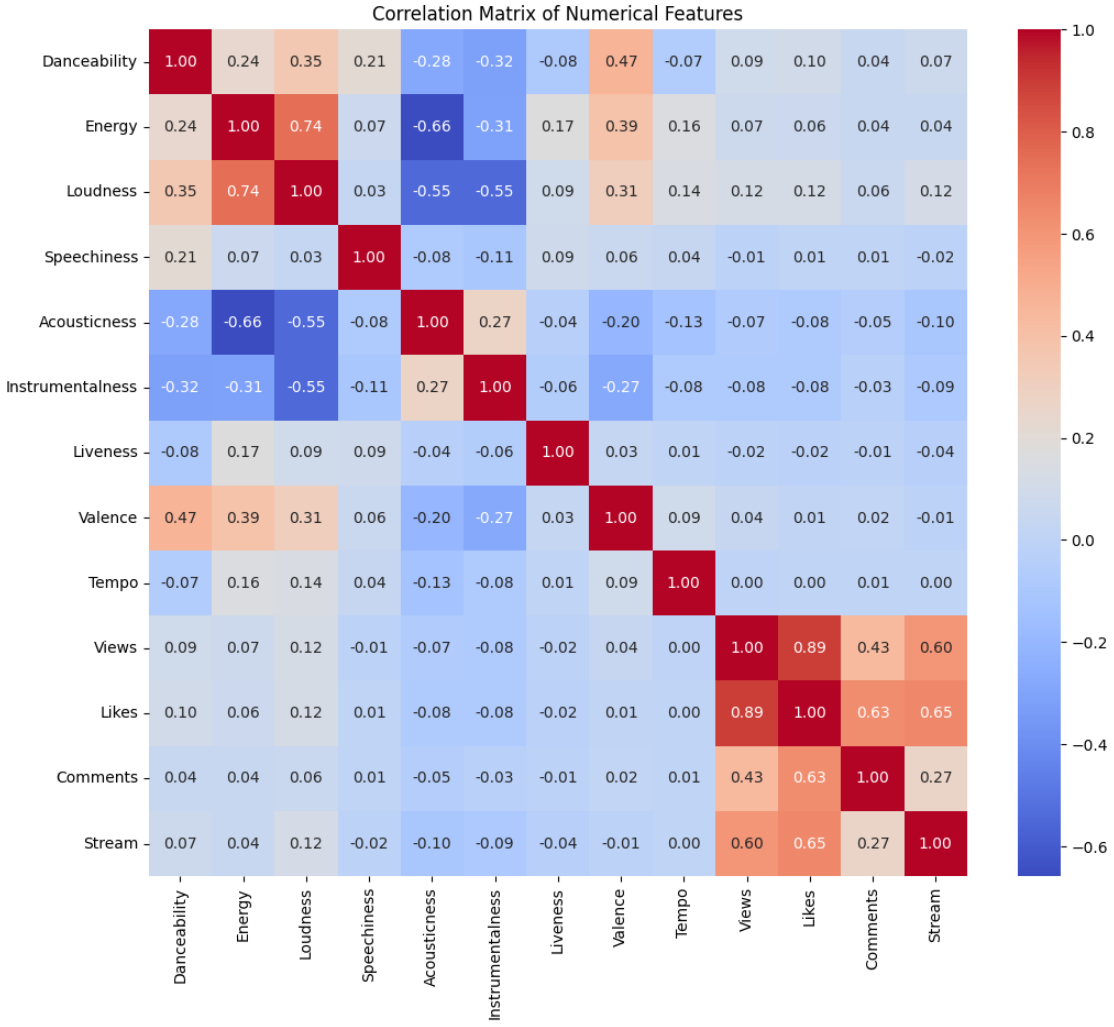
```
mean   10358.500000      0.619777      0.635250      5.300348     -7.671680
std     5980.915774      0.165272      0.214147      3.576449      4.632749
min        0.000000      0.000000      0.000020      0.000000    -46.251000
25%     5179.250000      0.518000      0.507000      2.000000     -8.858000
50%    10358.500000      0.637000      0.666000      5.000000     -6.536000
75%    15537.750000      0.740250      0.798000      8.000000     -4.931000
max    20717.000000      0.975000      1.000000     11.000000      0.920000

        Speechiness  Acousticness  Instrumentalness      Liveness  \
count  20716.000000  20716.000000      20716.000000  20716.000000
mean       0.096456      0.291535          0.055962      0.193521
std        0.111960      0.286299          0.193262      0.168531
min        0.000000      0.000001          0.000000      0.014500
25%        0.035700      0.045200          0.000000      0.094100
50%        0.050500      0.193000          0.000002      0.125000
75%        0.103000      0.477250          0.000463      0.237000
max        0.964000      0.996000          1.000000      1.000000

             Valence         Tempo   Duration_ms         Views         Likes  \
count  20716.000000  20716.000000  2.071600e+04  2.024800e+04  2.017700e+04
mean       0.529853    120.638340  2.247176e+05  9.393782e+07  6.633411e+05
std        0.245441     29.579018  1.247905e+05  2.746443e+08  1.789324e+06
min        0.000000      0.000000  3.098500e+04  0.000000e+00  0.000000e+00
25%        0.339000     97.002000  1.800095e+05  1.826002e+06  2.158100e+04
50%        0.537000    119.965000  2.132845e+05  1.450110e+07  1.244810e+05
75%        0.726250    139.935000  2.524430e+05  7.039975e+07  5.221480e+05
max        0.993000    243.372000  4.676058e+06  8.079649e+09  5.078865e+07

           Comments        Stream
count  2.014900e+04  2.014200e+04
mean   2.751899e+04  1.359422e+08
std    1.932347e+05  2.441321e+08
min    0.000000e+00  6.574000e+03
25%    5.090000e+02  1.767486e+07
50%    3.277000e+03  4.968298e+07
75%    1.436000e+04  1.383581e+08
max    1.608314e+07  3.386520e+09
```

1.5 4. Correlation Analysis

Understanding the relationships between different features is crucial. This section computes and visualizes the correlation matrix for numerical features, highlighting how Spotify audio features relate to YouTube engagement metrics.

[7]:
```
import matplotlib.pyplot as plt
import seaborn as sns
```

```
correlation_matrix = df[["Danceability", "Energy", "Loudness", "Speechiness",␣
 ↪"Acousticness", "Instrumentalness", "Liveness", "Valence", "Tempo", "Views",␣
 ↪"Likes", "Comments", "Stream"]].corr()
plt.figure(figsize=(12, 10))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt='.2f')
plt.title('Correlation Matrix of Numerical Features')
plt.show()
```

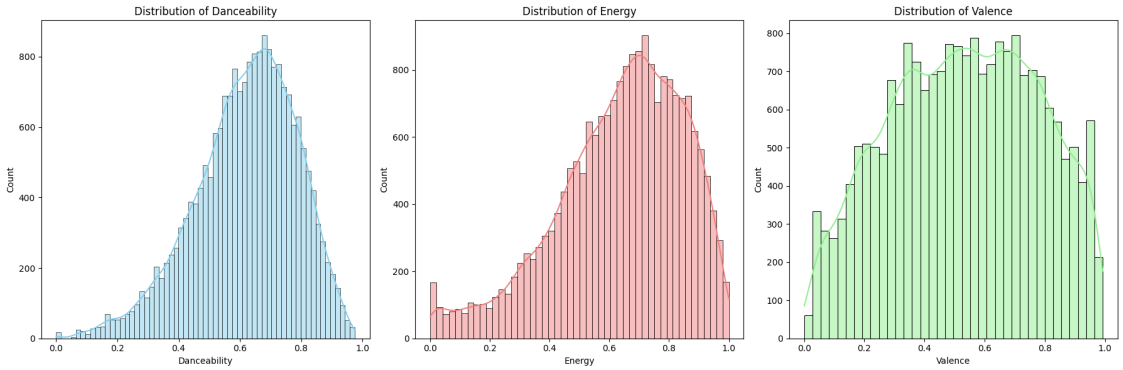


1.6 5. Distribution of Key Audio Features

Visualizing the distribution of key audio features helps us understand the general characteristics of the songs in our dataset. We'll plot histograms for Danceability, Energy, and Valence.

[8]:
```
fig, axes = plt.subplots(1, 3, figsize=(18, 6))
sns.histplot(df['Danceability'], ax=axes[0], kde=True, color='skyblue')
```

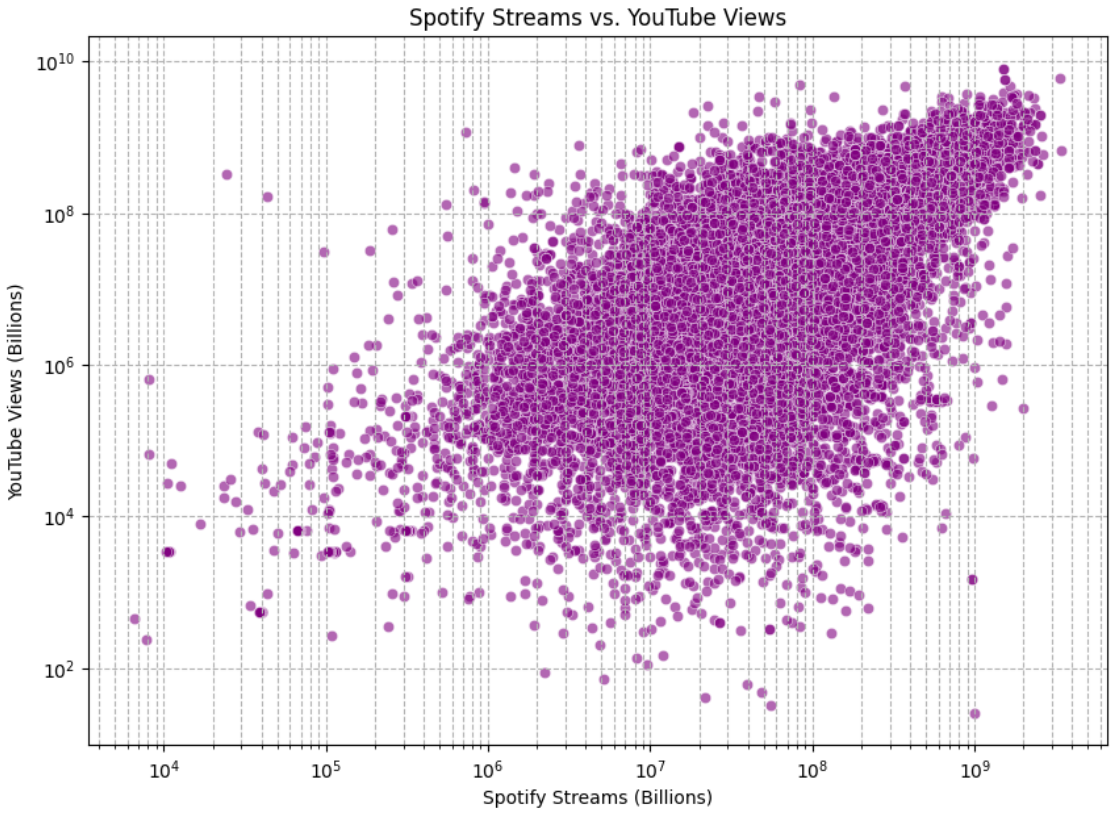
```
axes[0].set_title('Distribution of Danceability')
sns.histplot(df['Energy'], ax=axes[1], kde=True, color='lightcoral')
axes[1].set_title('Distribution of Energy')
sns.histplot(df['Valence'], ax=axes[2], kde=True, color='lightgreen')
axes[2].set_title('Distribution of Valence')
plt.tight_layout()
plt.show()
```



1.7 6. Relationship between Spotify Streams and YouTube Views

This section explores the relationship between a song's popularity on Spotify (Streams) and its engagement on YouTube (Views). A scatter plot will help visualize this correlation.

[9]:
```
plt.figure(figsize=(10, 7))
sns.scatterplot(data=df, x='Stream', y='Views', alpha=0.6, color='purple')
plt.title('Spotify Streams vs. YouTube Views')
plt.xlabel('Spotify Streams (Billions)')
plt.ylabel('YouTube Views (Billions)')
plt.xscale('log')
plt.yscale('log')
plt.grid(True, which="both", ls="--", c="0.7")
plt.show()
```



1.8 7. Top Songs/Artists by Streams and Views

Identifying the top-performing songs and artists on both platforms provides insights into what resonates with audiences. We'll look at the top 10 songs by Spotify Streams and YouTube Views.

[10]:
```
# Top 10 Songs by Spotify Streams
top_spotify_songs = df.nlargest(10, 'Stream')[['Artist', 'Track', 'Stream']]
print("Top 10 Songs by Spotify Streams:")
print(top_spotify_songs)

# Top 10 Songs by YouTube Views
top_youtube_songs = df.nlargest(10, 'Views')[['Artist', 'Track', 'Views']]
print("Top 10 Songs by YouTube Views:")
print(top_youtube_songs)
```

```
Top 10 Songs by Spotify Streams:
                Artist                                          Track  \
15250        The Weeknd                                 Blinding Lights
12452        Ed Sheeran                                    Shape of You
19186     Lewis Capaldi                                Someone You Loved
17937       Post Malone                     rockstar (feat. 21 Savage)
17445          Swae Lee  Sunflower - Spider-Man: Into the Spider-Verse
```

```
17938       Post Malone  Sunflower - Spider-Man: Into the Spider-Verse
13503             Drake                                      One Dance
16028            Halsey                                         Closer
16099  The Chainsmokers                                         Closer
14030   Imagine Dragons                                       Believer

             Stream
15250  3.386520e+09
12452  3.362005e+09
19186  2.634013e+09
17937  2.594927e+09
17445  2.538330e+09
17938  2.538330e+09
13503  2.522432e+09
16028  2.456205e+09
16099  2.456205e+09
14030  2.369272e+09
Top 10 Songs by YouTube Views:
             Artist                                Track         Views
1147     Luis Fonsi                             Despacito  8.079649e+09
365    Daddy Yankee                             Despacito  8.079647e+09
12452    Ed Sheeran                         Shape of You  5.908398e+09
14580  Charlie Puth  See You Again (feat. Charlie Puth)  5.773798e+09
12469   Wiz Khalifa  See You Again (feat. Charlie Puth)  5.773797e+09
20303     CoComelon                    Wheels on the Bus  4.898831e+09
10686   Mark Ronson      Uptown Funk (feat. Bruno Mars)  4.821016e+09
8937            PSY                Gangnam Style (   )  4.679767e+09
9569       Maroon 5                               Sugar  3.817733e+09
13032    Katy Perry                                Roar  3.725749e+09
```

1.9 8. Audio Features vs. Popularity

This section investigates how specific audio features might influence a song's popularity on Spotify and YouTube. We'll use scatter plots to visualize these relationships.

[11]:
```python
# Danceability vs. Streams
plt.figure(figsize=(10, 6))
sns.scatterplot(data=df, x='Danceability', y='Stream', alpha=0.6)
plt.title('Danceability vs. Spotify Streams')
plt.xlabel('Danceability')
plt.ylabel('Spotify Streams')
plt.show()

# Energy vs. Views
plt.figure(figsize=(10, 6))
sns.scatterplot(data=df, x='Energy', y='Views', alpha=0.6, color='red')
plt.title('Energy vs. YouTube Views')
plt.xlabel('Energy')
```

```
plt.ylabel('YouTube Views')
plt.show()
```