Final_Spotify_Final_Data_Analysis-github

October 3, 2023

0.1 Importing pandas,numpy,seaborn & matplotlib

[79]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[80]:
```
sns.set_style("darkgrid")
```

0.2 Data Importing -

[81]:
```
df = pd.read_csv(r"C:\Users\amitm\Desktop\data.csv")
df.drop("Unnamed: 0", axis = 1, inplace =True)
df.head()
```

[81]:

	acousticness	danceability	duration_ms	energy	instrumentalness	key	liveness	loudness	mode	speechiness	tempo	time_signature	valence	target	song_title	artist
0	0.0102	0.833	204600	0.434	0.021900	2	0.1650	-8.795	1	0.4310	150.062	4.0	0.286	1	Mask Off	Future
1	0.1990	0.743	326933	0.359	0.006110	1	0.1370	-10.401	1	0.0794	160.083	4.0	0.588	1	Redbone	Childish Gambino
2	0.0344	0.838	185707	0.412	0.000234	2	0.1590	-7.148	1	0.2890	75.044	4.0	0.173	1	Xanny Family	Future
3	0.6040	0.494	199413	0.338	0.510000	5	0.0922	-15.236	1	0.0261	86.468	4.0	0.230	1	Master Of None	Beach House
4	0.1800	0.678	392893	0.561	0.512000	5	0.4390	-11.648	0	0.0694	174.004	4.0	0.904	1	Parallel Lines	Junior Boys

[82]:
```
df.head()
```

[82]:
```
   acousticness  danceability  duration_ms  energy  instrumentalness  key  \
0        0.0102         0.833       204600   0.434          0.021900    2
1        0.1990         0.743       326933   0.359          0.006110    1
2        0.0344         0.838       185707   0.412          0.000234    2
3        0.6040         0.494       199413   0.338          0.510000    5
4        0.1800         0.678       392893   0.561          0.512000    5

   liveness  loudness  mode  speechiness    tempo  time_signature  valence  \
0    0.1650    -8.795     1       0.4310  150.062             4.0    0.286
1    0.1370   -10.401     1       0.0794  160.083             4.0    0.588
2    0.1590    -7.148     1       0.2890   75.044             4.0    0.173
3    0.0922   -15.236     1       0.0261   86.468             4.0    0.230
4    0.4390   -11.648     0       0.0694  174.004             4.0    0.904

   target      song_title            artist
0       1        Mask Off            Future
1       1         Redbone  Childish Gambino
2       1    Xanny Family            Future
3       1  Master Of None       Beach House
4       1  Parallel Lines       Junior Boys
```

0.3 data cleaning -

[83]:
```
df.isna().sum()
```

[83]:
```
acousticness        0
danceability        0
duration_ms         0
energy              0
instrumentalness    0
key                 0
liveness            0
loudness            0
mode                0
speechiness         0
tempo               0
time_signature      0
valence             0
target              0
song_title          0
artist              0
dtype: int64
```

[84]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2017 entries, 0 to 2016
Data columns (total 16 columns):
```

```
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   acousticness      2017 non-null   float64
 1   danceability      2017 non-null   float64
 2   duration_ms       2017 non-null   int64
 3   energy            2017 non-null   float64
 4   instrumentalness  2017 non-null   float64
 5   key               2017 non-null   int64
 6   liveness          2017 non-null   float64
 7   loudness          2017 non-null   float64
 8   mode              2017 non-null   int64
 9   speechiness       2017 non-null   float64
 10  tempo             2017 non-null   float64
 11  time_signature    2017 non-null   float64
 12  valence           2017 non-null   float64
 13  target            2017 non-null   int64
 14  song_title        2017 non-null   object
 15  artist            2017 non-null   object
dtypes: float64(10), int64(4), object(2)
memory usage: 252.2+ KB
```

[85]:
```
df.shape
```

[85]:
```
(2017, 16)
```

[86]:
```
df.columns
```

[86]:
```
Index(['acousticness', 'danceability', 'duration_ms', 'energy',
       'instrumentalness', 'key', 'liveness', 'loudness', 'mode',
       'speechiness', 'tempo', 'time_signature', 'valence', 'target',
       'song_title', 'artist'],
      dtype='object')
```

[87]:
```
len(df.columns)
```

[87]:
```
16
```

[88]:
```
df.describe()
```

[88]:

	acousticness	danceability	duration_ms	energy	\
count	2017.000000	2017.000000	2.017000e+03	2017.000000	
mean	0.187590	0.618422	2.463062e+05	0.681577	
std	0.259989	0.161029	8.198181e+04	0.210273	
min	0.000003	0.122000	1.604200e+04	0.014800	
25%	0.009630	0.514000	2.000150e+05	0.563000	
50%	0.063300	0.631000	2.292610e+05	0.715000	
75%	0.265000	0.738000	2.703330e+05	0.846000	
max	0.995000	0.984000	1.004627e+06	0.998000	

```
       instrumentalness          key     liveness     loudness         mode  \
count       2017.000000  2017.000000  2017.000000  2017.000000  2017.000000
mean           0.133286     5.342588     0.190844    -7.085624     0.612295
std            0.273162     3.648240     0.155453     3.761684     0.487347
min            0.000000     0.000000     0.018800   -33.097000     0.000000
25%            0.000000     2.000000     0.092300    -8.394000     0.000000
50%            0.000076     6.000000     0.127000    -6.248000     1.000000
75%            0.054000     9.000000     0.247000    -4.746000     1.000000
max            0.976000    11.000000     0.969000    -0.307000     1.000000

       speechiness        tempo  time_signature      valence       target
count  2017.000000  2017.000000     2017.000000  2017.000000  2017.000000
mean      0.092664   121.603272        3.968270     0.496815     0.505702
std       0.089931    26.685604        0.255853     0.247195     0.500091
min       0.023100    47.859000        1.000000     0.034800     0.000000
25%       0.037500   100.189000        4.000000     0.295000     0.000000
50%       0.054900   121.427000        4.000000     0.492000     1.000000
75%       0.108000   137.849000        4.000000     0.691000     1.000000
max       0.816000   219.331000        5.000000     0.992000     1.000000
```

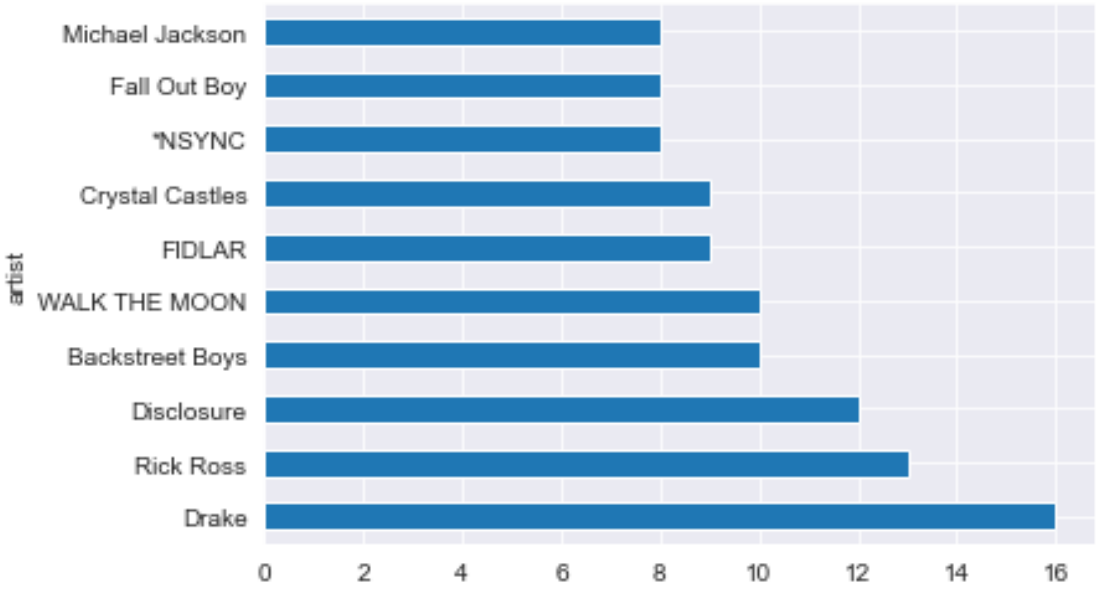
0.4 DATA ANALYSIS -

1 Top 10 Popular Artists?

[89]:
```
top_ten_artists = df.groupby("artist").count().sort_values(by="song_title",␣
↪ascending=False)["song_title"][:10]
top_ten_artists
```

[89]:
```
artist
Drake              16
Rick Ross          13
Disclosure         12
Backstreet Boys    10
WALK THE MOON      10
FIDLAR              9
Crystal Castles     9
*NSYNC              8
Fall Out Boy        8
Michael Jackson     8
Name: song_title, dtype: int64
```

[90]:
```
top_ten_artists.plot.barh()
plt.show()
```



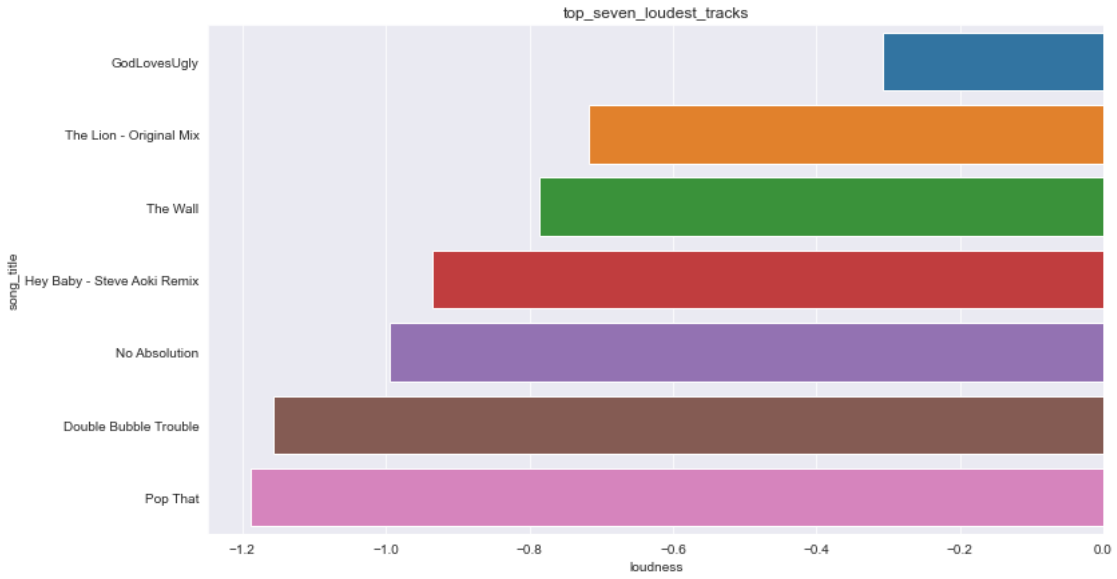
1.1 Top 7 Loudest tracks?

[91]:
```
top_seven_loudest_tracks = df[["loudness", "song_title"]].
 ↪sort_values(by="loudness",ascending = False)[:7]
top_seven_loudest_tracks
```

[91]:

	loudness	song_title
195	-0.307	GodLovesUgly
636	-0.718	The Lion - Original Mix
1443	-0.787	The Wall
2010	-0.935	Hey Baby - Steve Aoki Remix
1299	-0.994	No Absolution
205	-1.157	Double Bubble Trouble
629	-1.188	Pop That

[92]:
```
plt.figure(figsize=(12,7))
sns.barplot(x="loudness" , y= "song_title",data =top_seven_loudest_tracks)
plt.title("top_seven_loudest_tracks")
plt.show()
```



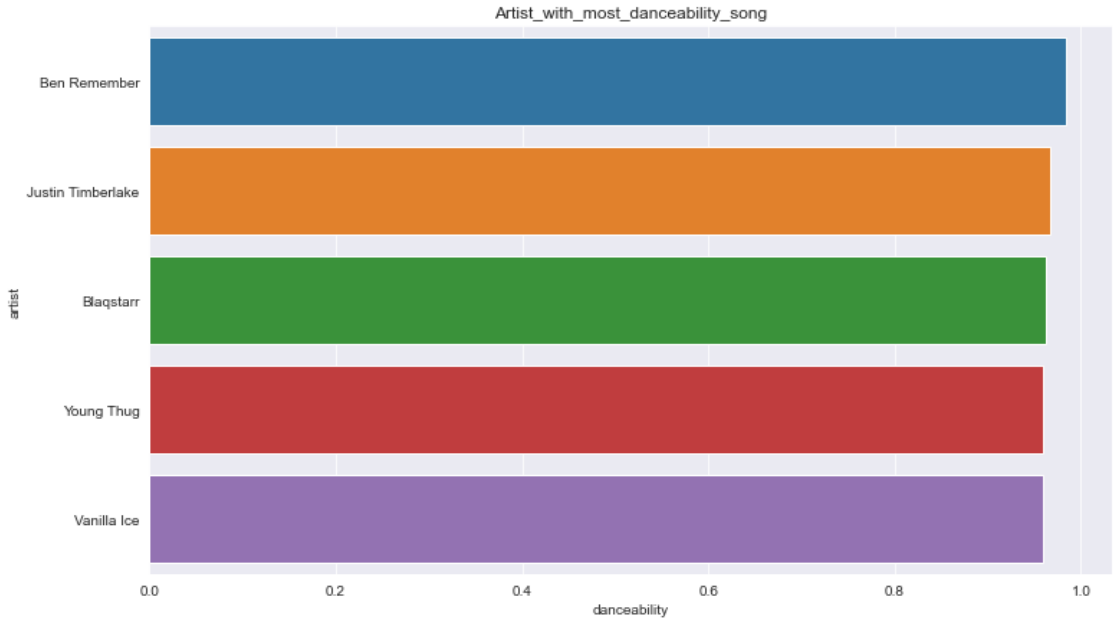
1.2 Artists with more danceability songs?

[93]:
```
top_five_artists_danceable_songs=df[["artist", "song_title", "danceability"]].
  ↪sort_values(by="danceability",ascending=False)[:5]
top_five_artists_danceable_songs
```

[93]:

	artist	song_title	danceability
1433	Ben Remember	Flashwind - Radio Edit	0.984
1901	Justin Timberlake	SexyBack	0.967
604	Blaqstarr	Check Me Out Like	0.962
32	Young Thug	Best Friend	0.959
1957	Vanilla Ice	Ice Ice Baby	0.959

[94]:
```
plt.figure(figsize=(12,7))
sns.barplot(x="danceability" , y= "artist", data␣
  ↪=top_five_artists_danceable_songs)
plt.title("Artist_with_most_danceability_song")
plt.show()
```



1.3 Top 10 Instrumental songs?

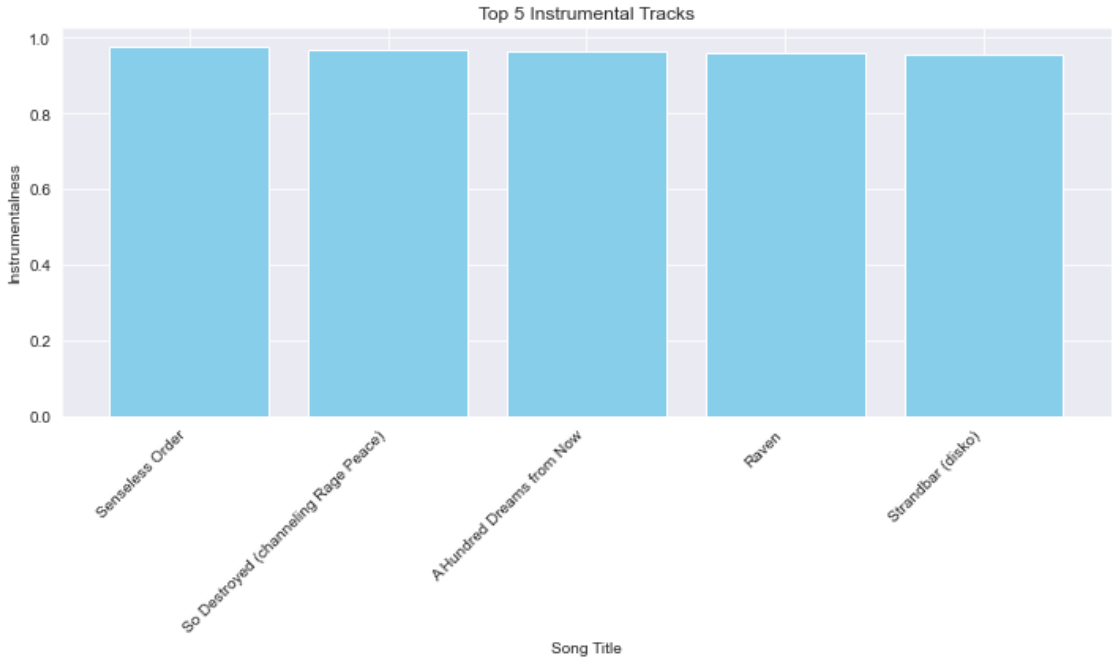
[95]:
```
top_ten_instrumental_tracks = df[["song_title", "artist", "instrumentalness"]].
 ↪sort_values(by="instrumentalness",ascending = False) [:5]
top_ten_instrumental_tracks
```

[95]:

	song_title	artist	instrumentalness
1313	Senseless Order	Signs of the Swarm	0.976
271	So Destroyed (channeling Rage Peace)	Prince Rama	0.968
1575	A Hundred Dreams from Now	Ray Bryant	0.964
1619	Raven	John Dahlbäck	0.958
725	Strandbar (disko)	Todd Terje	0.957

[121]:
```
song_titles = top_ten_instrumental_tracks["song_title"]
instrumentalness_values = top_ten_instrumental_tracks["instrumentalness"]
# Creating a bar chart
plt.figure(figsize=(10, 6))
plt.bar(song_titles, instrumentalness_values, color='skyblue')
plt.xlabel("Song Title")
```

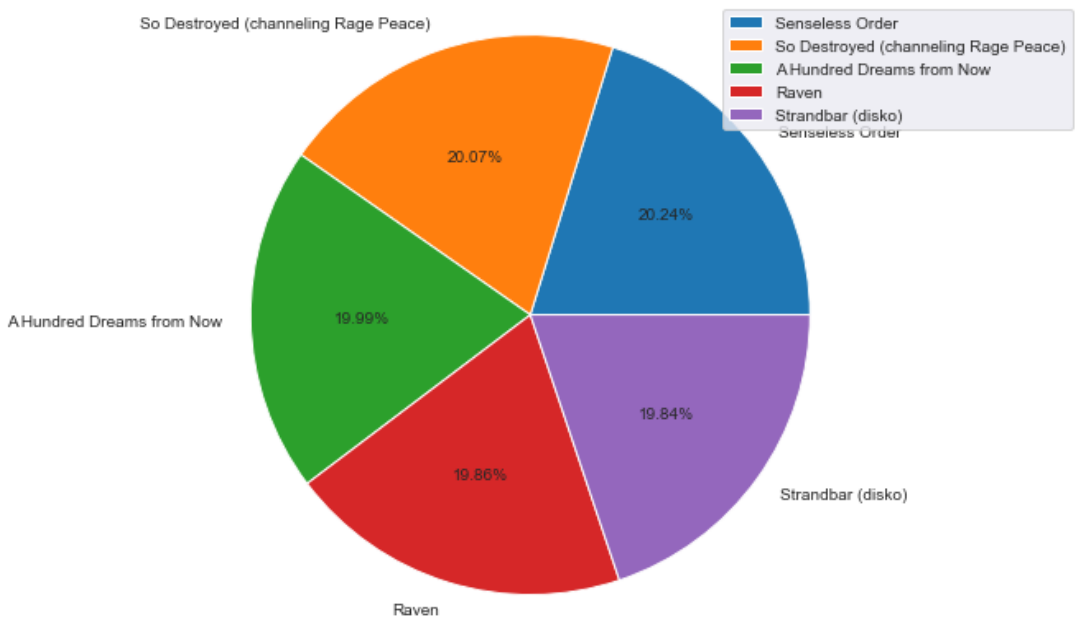
```
plt.ylabel("Instrumentalness")
plt.title("Top 5 Instrumental Tracks")
plt.xticks(rotation=45, ha="right")
# Showing the plot
plt.tight_layout()
plt.show()
```



[97]:
```
data = top_ten_instrumental_tracks["instrumentalness"]
```

1.4 Top 5 instrumental songs - visualizing via pie chart-

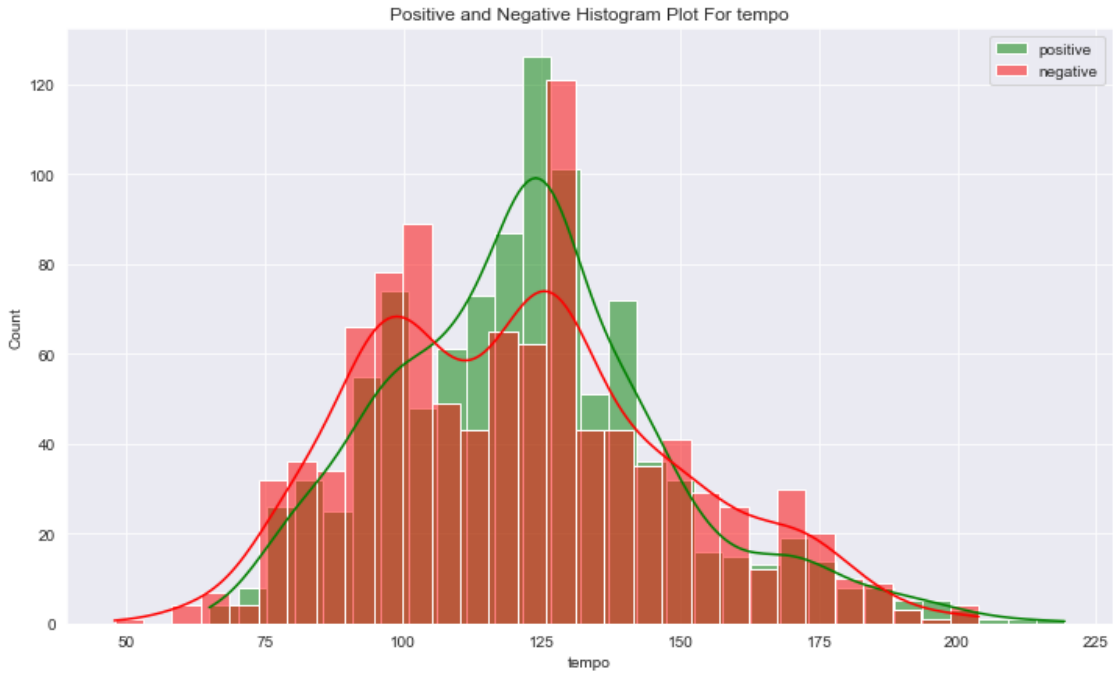
[98]:
```
plt.figure(figsize=(12, 7))
plt.pie(data, autopct='%1.2f%%',labels = top_ten_instrumental_tracks.song_title)
plt.axis('equal')
plt.legend(top_ten_instrumental_tracks.song_title, loc="best")
plt.show()
```

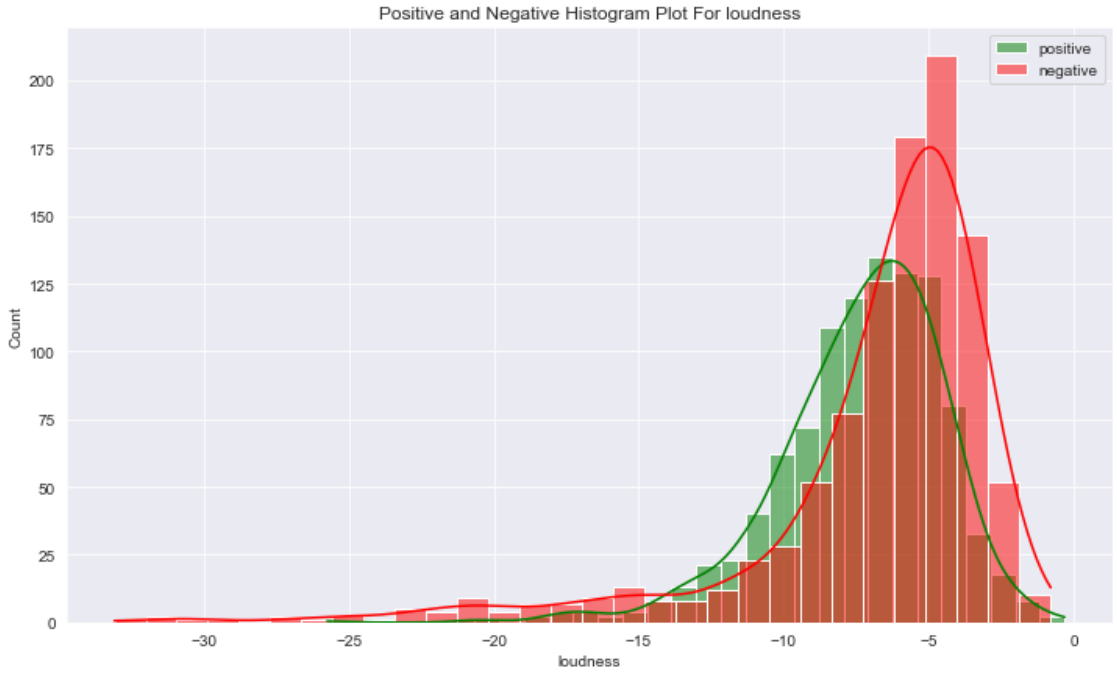


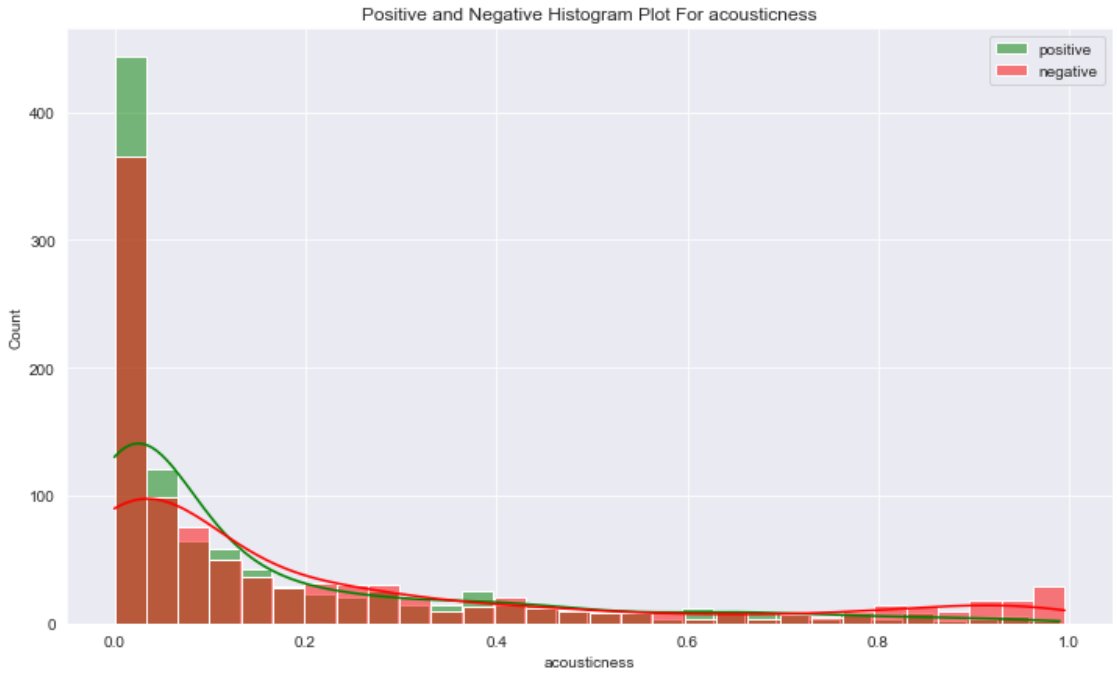
1.5 Multiple feature plot-

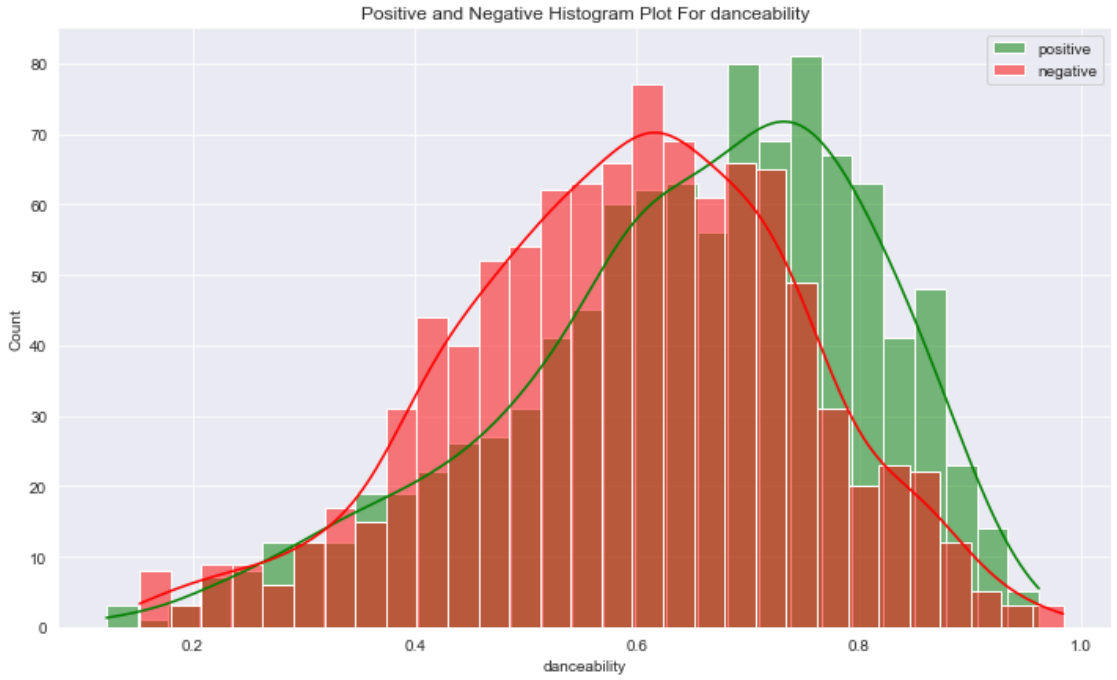
[102]:
```
interest_feature_cols =␣
↪["tempo","loudness","acousticness","danceability","duration_ms","energy","instrumentalness"
                          "liveness","speechiness","valence"]
```

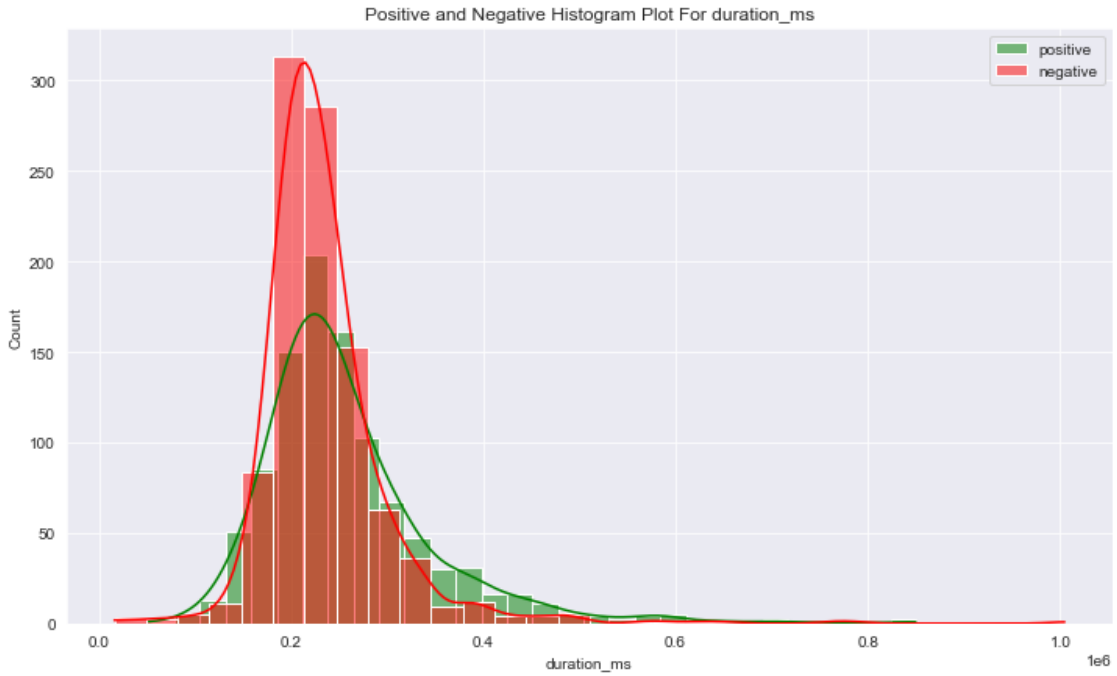
[103]:
```
for feature_col in interest_feature_cols:
    pos_data = df[df["target"] == 1][feature_col]
    neg_data = df[df["target"] == 0][feature_col]

    plt.figure(figsize=(12, 7))

    sns.histplot(pos_data, bins=30, label="positive", color="green", kde=True)
    sns.histplot(neg_data, bins=30, label="negative", color="red", kde=True)

    plt.legend(loc="upper right")
    plt.title(f"Positive and Negative Histogram Plot For {feature_col}")
    plt.show()
```

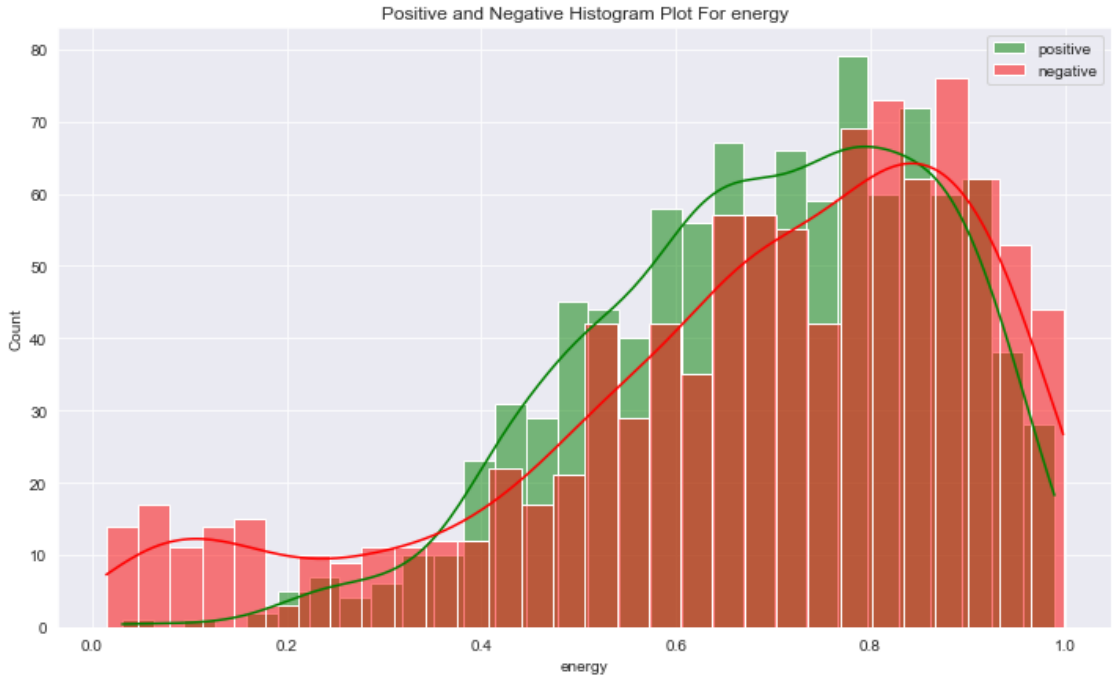

Positive and Negative Histogram Plot For tempo
positive
negative
Count
tempo
0
20
40
60
80
100
120
50
75
100
125
150
175
200
225

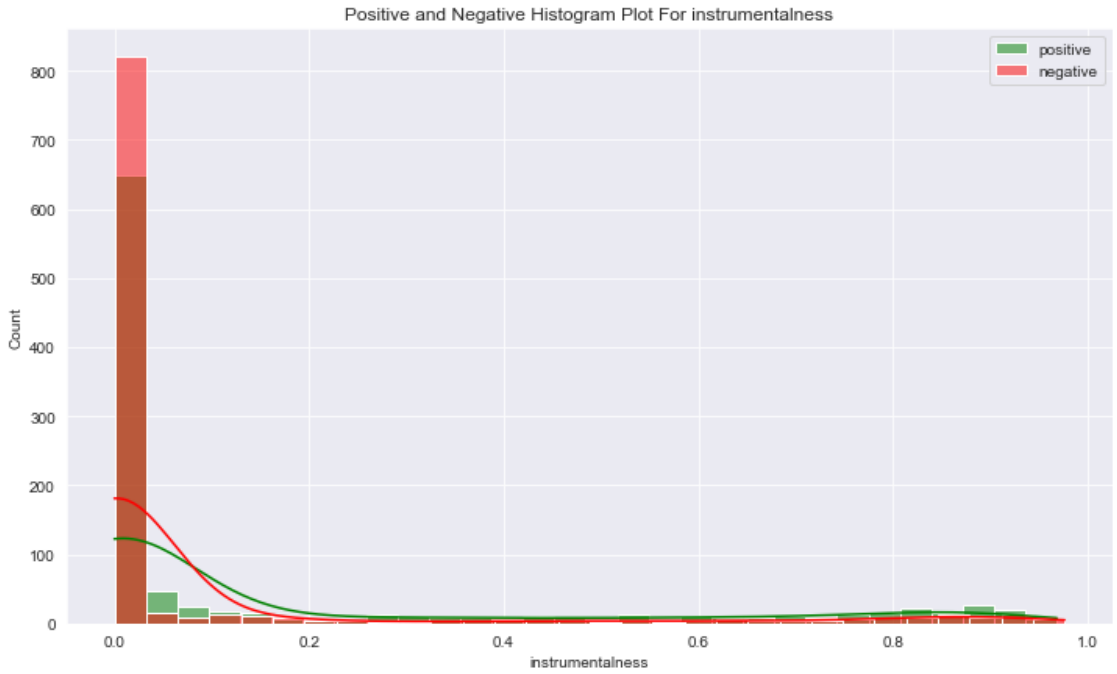

Positive and Negative Histogram Plot For loudness
positive
negative
Count
loudness
0
25
50
75
100
125
150
175
200
−30
−25
−20
−15
−10
−5
0

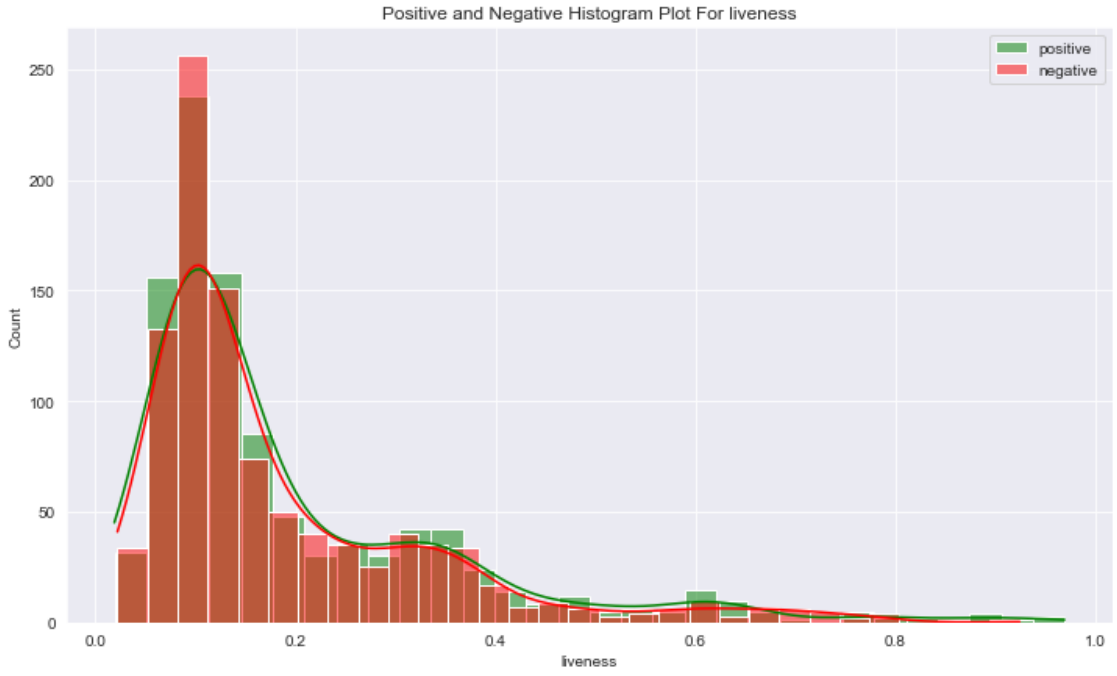

Positive and Negative Histogram Plot For acousticness
positive
negative
Count
acousticness
0
100
200
300
400
0.0
0.2
0.4
0.6
0.8
1.0

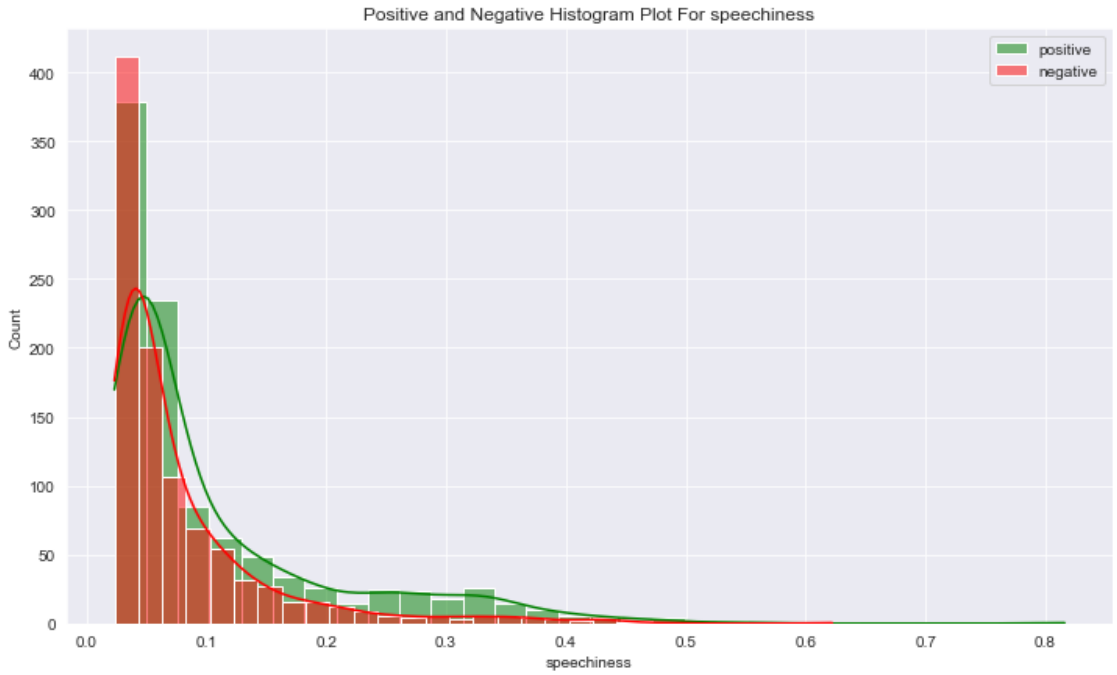

Positive and Negative Histogram Plot For danceability
positive
negative
Count
danceability
0
10
20
30
40
50
60
70
80
0.2
0.4
0.6
0.8
1.0

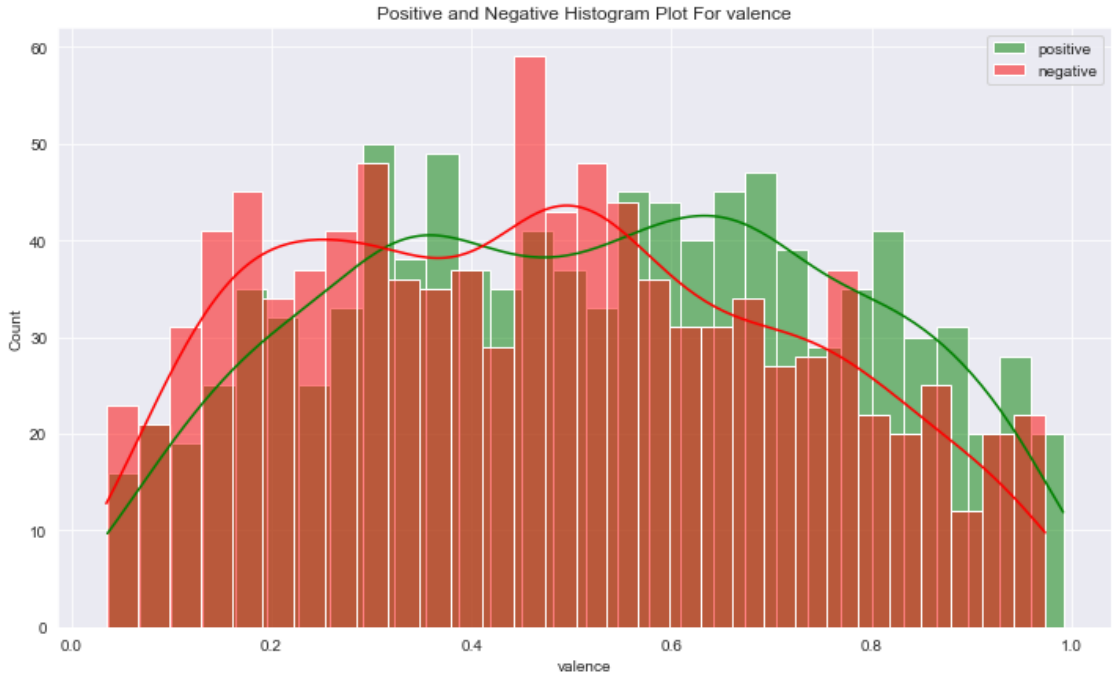

Positive and Negative Histogram Plot For duration_ms
positive
negative
Count
duration_ms
1e6


Positive and Negative Histogram Plot For energy
positive
negative
Count
energy


Positive and Negative Histogram Plot For instrumentalness
positive
negative
Count
instrumentalness
0
100
200
300
400
500
600
700
800
0.0
0.2
0.4
0.6
0.8
1.0


Positive and Negative Histogram Plot For liveness
positive
negative
Count
liveness
0
50
100
150
200
250
0.0
0.2
0.4
0.6
0.8
1.0


Positive and Negative Histogram Plot For speechiness
positive
negative
Count
speechiness
0
50
100
150
200
250
300
350
400
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8


Positive and Negative Histogram Plot For valence
positive
negative
Count
valence
0
10
20
30
40
50
60
0.0
0.2
0.4
0.6
0.8
1.0

1.6 Top 10 energetic tracks?

[104]:
```
top_ten_energetic_tracks = df[["energy", "song_title","artist"]].
 ↪sort_values(by="energy",ascending = True)[:10]
top_ten_energetic_tracks
```

[104]:
```
      energy                                          song_title  \
1594  0.0148           Lyric Pieces, Book I Op. 12: I. Arietta
1595  0.0156  String Quartet No. 4 in C Major, D. 46: II. An…
1537  0.0161                                       Blue in Green
1598  0.0230  Piano Quartet in E flat, Op.47: 3. Andante can…
1596  0.0288           8 Fantasiestücke, Op.12 : 1. Des Abends
1545  0.0291                             Blue and Sentimental
1530  0.0295                          I'm a Fool to Want You
1531  0.0302         I Was So Young, and You Were So Beautiful
817   0.0310  Mozart: Requiem in D Minor, K. 626: VIII. Lacr…
1876  0.0347           Nocturne No.1 In B Flat Minor, Op.9 No.1

                     artist
1594          Edvard Grieg
1595        Franz Schubert
1537           Miles Davis
1598       Robert Schumann
1596       Robert Schumann
1545           Julian Dash
1530      Passport Quartet
1531          Bill Charlap
817   Nikolaus Harnoncourt
1876       Frédéric Chopin
```

1.7 most popular artist?

[105]:
```
artist_counts = df["artist"].value_counts()
most_popular_artist = artist_counts.idxmax()
song_count = artist_counts.max()
print(f"The most popular artist is {most_popular_artist} with {song_count}␣
 ↪songs.")
```

```
The most popular artist is Drake with 16 songs.
```

[106]:
```
df.head()
```

[106]:
```
   acousticness  danceability  duration_ms  energy  instrumentalness  key  \
0        0.0102         0.833       204600   0.434          0.021900    2
1        0.1990         0.743       326933   0.359          0.006110    1
2        0.0344         0.838       185707   0.412          0.000234    2
3        0.6040         0.494       199413   0.338          0.510000    5
4        0.1800         0.678       392893   0.561          0.512000    5
```

```
   liveness  loudness  mode  speechiness    tempo  time_signature  valence  \
0    0.1650    -8.795     1       0.4310  150.062             4.0    0.286
1    0.1370   -10.401     1       0.0794  160.083             4.0    0.588
2    0.1590    -7.148     1       0.2890   75.044             4.0    0.173
3    0.0922   -15.236     1       0.0261   86.468             4.0    0.230
4    0.4390   -11.648     0       0.0694  174.004             4.0    0.904

   target      song_title            artist
0       1        Mask Off            Future
1       1         Redbone  Childish Gambino
2       1    Xanny Family            Future
3       1  Master Of None       Beach House
4       1  Parallel Lines       Junior Boys
```

1.8 Most Common Song or most trending song?

[107]:
```
common_duration = df["duration_ms"].value_counts().idxmax()
most_common_song = df[df["duration_ms"] == common_duration]["song_title"].
 ↪iloc[0]
print("Most Common Duration:", common_duration, "seconds")
print("Top 1 Song with this Duration:", most_common_song)
```

```
Most Common Duration: 192000 seconds
Top 1 Song with this Duration: Kerosene
```

1.9 top 10 tracks with most valence

2 handling ERRORS

[110]:
```
# Renaming
df.rename(columns={'valence': 'new_valence'}, inplace=True)
```

[111]:
```
df.columns
```

[111]:
```
Index(['acousticness', 'danceability', 'duration_ms', 'energy',
       'instrumentalness', 'key', 'liveness', 'loudness', 'mode',
       'speechiness', 'tempo', 'time_signature', 'new_valence', 'target',
       'song_title', 'artist'],
      dtype='object')
```

[122]:
```
# Sorting the DataFrame by the "new_valence" column in descending order
top_ten_tracks = df.sort_values(by="new_valence",␣
 ↪ascending=False)[["song_title", "new_valence"]][:5]
# Displaying the top ten tracks
print(top_ten_tracks)
```

```
                                      song_title  new_valence
460                        Abataka - Original Mix        0.992
912           I'm Walkin' - 2002 Digital Remaster        0.975
1966  To Roz Bikini (Itsy, Bitsy, Teenie, Weenie)        0.974
207                                   Look at You        0.973
48                          Azon de ma gnin kpevi        0.973
```

[113]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2017 entries, 0 to 2016
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   acousticness      2017 non-null   float64
 1   danceability      2017 non-null   float64
 2   duration_ms       2017 non-null   int64
 3   energy            2017 non-null   float64
 4   instrumentalness  2017 non-null   float64
 5   key               2017 non-null   int64
 6   liveness          2017 non-null   float64
 7   loudness          2017 non-null   float64
 8   mode              2017 non-null   int64
 9   speechiness       2017 non-null   float64
 10  tempo             2017 non-null   float64
 11  time_signature    2017 non-null   float64
 12  new_valence       2017 non-null   float64
 13  target            2017 non-null   int64
 14  song_title        2017 non-null   object
 15  artist            2017 non-null   object
dtypes: float64(10), int64(4), object(2)
memory usage: 252.2+ KB
```

3 most trending genre?

[123]:
```
# Assuming i have already loaded my data into a DataFrame named 'df'
# Defining a function to apply the DAX formula to each row
def calculate_genre(row):
    if row['danceability'] >= 0.7 and row['energy'] >= 0.7:
        return "High Energy Dance"
    elif row['acousticness'] >= 0.7:
        return "Low Energy Acoustic"
    elif row['new_valence'] >= 0.7:
        return "Happy Pop"
    elif row['new_valence'] < 0.3:
        return "Sad Pop"
    elif row['instrumentalness'] >= 0.5:
```

```
        return "Instrumental"
    elif row['speechiness'] >= 0.5:
        return "Spoken Word"
    elif row['tempo'] > 120:
        return "Upbeat"
    else:
        return "Other"

# Applying the DAX formula to create the 'genre' column
df['genre'] = df.apply(calculate_genre, axis=1)
```

[124]:
```
df.columns
```

[124]:
```
Index(['acousticness', 'danceability', 'duration_ms', 'energy',
       'instrumentalness', 'key', 'liveness', 'loudness', 'mode',
       'speechiness', 'tempo', 'time_signature', 'new_valence', 'target',
       'song_title', 'artist', 'genre'],
      dtype='object')
```

3.1 Merging the current dataset with the genre dataset which i created using DAX func on POWER BI

[125]:
```
xlsx_file_path = r'C:\Users\amitm\Desktop\Spotify_EDA\COUNT OF TRACKS BY GENRE.
↪xlsx'

# Loading the Excel data into a DataFrame
df_power_bi = pd.read_excel(xlsx_file_path)

# Checking the first few rows of the DataFrame to ensure it loaded correctly
print(df_power_bi.head())
```

```
              genre  song_title
0            Upbeat         407
1           Sad Pop         391
2             Other         339
3         Happy Pop         324
4  High Energy Dance         310
```

[126]:
```
# Merging the two DataFrames on the 'genre' column
merged_df = df.merge(df_power_bi, on='genre', how='left')
```

[118]:
```
print(merged_df.shape)
```

```
(2017, 18)
```

[127]:
```
print(merged_df.head())
```

```
   acousticness  danceability  duration_ms  energy  instrumentalness  key  \
0        0.0102         0.833       204600   0.434          0.021900    2
```

```
1         0.1990         0.743       326933   0.359          0.006110    1
2         0.0344         0.838       185707   0.412          0.000234    2
3         0.6040         0.494       199413   0.338          0.510000    5
4         0.1800         0.678       392893   0.561          0.512000    5

   liveness  loudness  mode  speechiness    tempo  time_signature  \
0    0.1650    -8.795     1       0.4310  150.062             4.0
1    0.1370   -10.401     1       0.0794  160.083             4.0
2    0.1590    -7.148     1       0.2890   75.044             4.0
3    0.0922   -15.236     1       0.0261   86.468             4.0
4    0.4390   -11.648     0       0.0694  174.004             4.0

   new_valence  target    song_title_x            artist      genre  \
0        0.286       1        Mask Off            Future    Sad Pop
1        0.588       1         Redbone  Childish Gambino     Upbeat
2        0.173       1    Xanny Family            Future    Sad Pop
3        0.230       1  Master Of None       Beach House    Sad Pop
4        0.904       1  Parallel Lines       Junior Boys  Happy Pop

   song_title_y
0           391
1           407
2           391
3           391
4           324
```

[119]:
```python
# Defining the criteria and corresponding genre labels
criteria = [
    (merged_df['tempo'] > 120),
    (merged_df['danceability'] >= 0.7) & (merged_df['energy'] >= 0.7),
    (merged_df['acousticness'] >= 0.7),
    (merged_df['new_valence'] >= 0.7),
    (merged_df['new_valence'] < 0.3),
    (merged_df['instrumentalness'] >= 0.5),
    (merged_df['speechiness'] >= 0.5)
]
genre_labels = [
    "Upbeat",
    "High Energy Dance",
    "Low Energy Acoustic",
    "Happy Pop",
    "Sad Pop",
    "Instrumental",
    "Spoken Word"
]

# Creating a new column 'popularity_score' based on the criteria and labels
```

```
merged_df['popularity_score'] = np.select(criteria, genre_labels,␣
  ↪default="Other")
# Counting the occurrences of each genre in 'popularity_score' to find the most␣
  ↪trending genre
most_trending_genre = merged_df['popularity_score'].value_counts().idxmax()
print("Most Trending Genre:", most_trending_genre)
```

```
Most Trending Genre: Upbeat
```

[120]:
```
# Listing all the column names in the DataFrame
column_names = df.columns.tolist()
print("Column Names:")
for column_name in column_names:
    print(column_name)
```

```
Column Names:
acousticness
danceability
duration_ms
energy
instrumentalness
key
liveness
loudness
mode
speechiness
tempo
time_signature
new_valence
target
song_title
artist
genre
```

[77]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2017 entries, 0 to 2016
Data columns (total 17 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   acousticness      2017 non-null   float64
 1   danceability      2017 non-null   float64
 2   duration_ms       2017 non-null   int64
 3   energy            2017 non-null   float64
 4   instrumentalness  2017 non-null   float64
 5   key               2017 non-null   int64
 6   liveness          2017 non-null   float64
 7   loudness          2017 non-null   float64
```

```
 8   mode              2017 non-null   int64
 9   speechiness       2017 non-null   float64
 10  tempo             2017 non-null   float64
 11  time_signature    2017 non-null   float64
 12  new_valence       2017 non-null   float64
 13  target            2017 non-null   int64
 14  song_title        2017 non-null   object
 15  artist            2017 non-null   object
 16  genre             2017 non-null   object
dtypes: float64(10), int64(4), object(3)
memory usage: 268.0+ KB
```

[128]:
```
import os
os.getcwd()
```

[128]:
```
'C:\\Users\\amitm'
```

3.2 THANKYOU!