MUSIC RECOMENDATION SYSTEM

https://www.kaggle.com/datasets/vatsalmavani/spotify-dataset

In [1]:
```
#importing all relevant libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.metrics.pairwise import cosine_similarity
import seaborn as sns
import statsmodels.api as sm
from warnings import filterwarnings
import os
from scipy.spatial.distance import pdist, squareform
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler

filterwarnings('ignore')
```

In [2]:
```
#Loading my dataset
data_main = pd.read_csv('top 100 streamed songs.csv').drop(columns=['id'])
data = data_main.drop(columns=['name'])
data_main.head()
```

Out[2]:

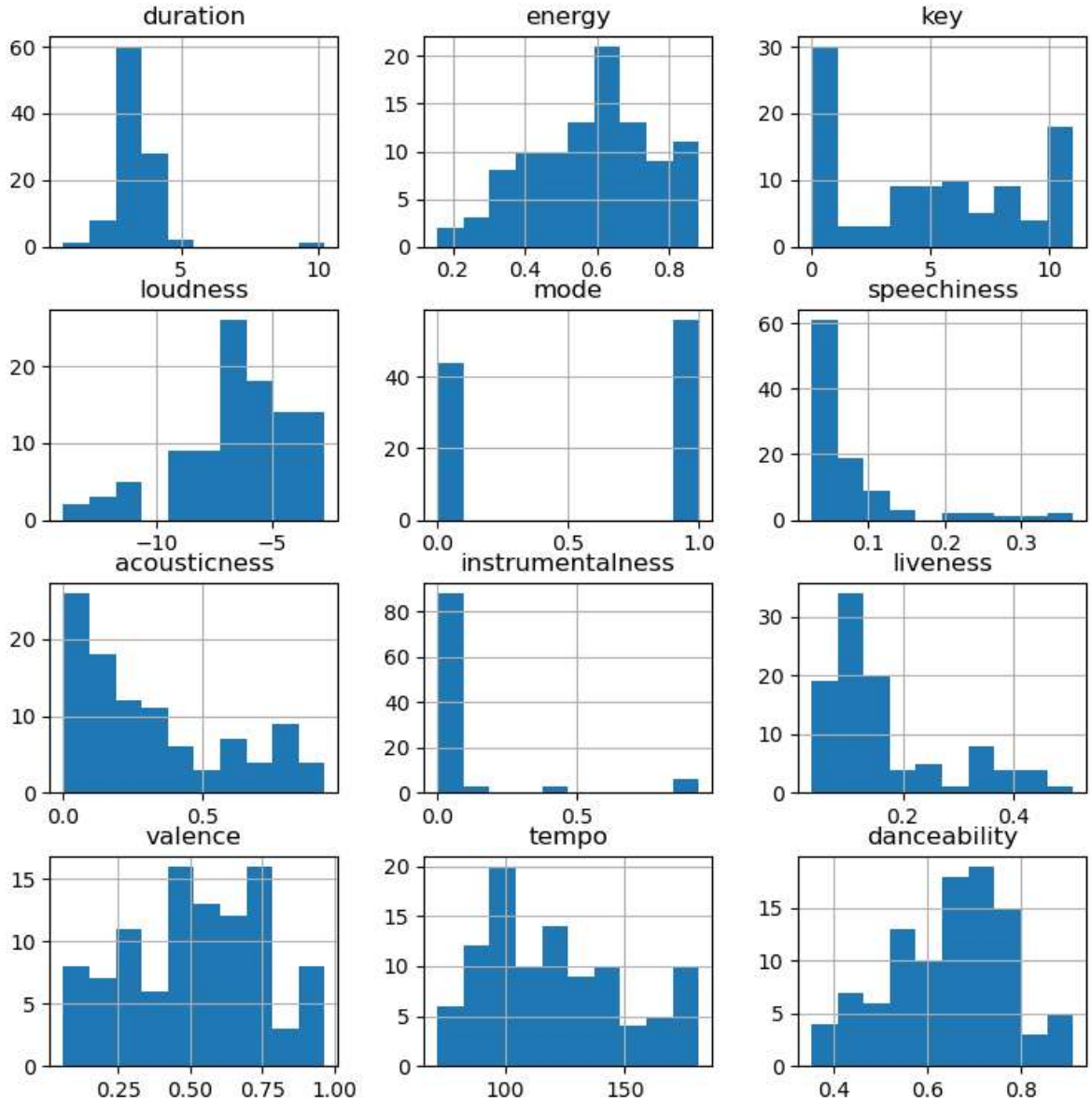
	name	duration	energy	key	loudness	mode	speechiness	acousticness	instrumentalne
0	Good 4 U Olivia Rodrigo	2.97	0.664	9	-5.044	1	0.1540	0.33500	0.0
1	Stay The Kid LAROI & Justin Bieber	2.30	0.506	8	-11.275	1	0.0589	0.37900	0.8
2	Levitating Dua Lipa feat. DaBaby	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.0
3	Peaches Justin Bieber feat. Daniel Caesar & Gi...	3.30	0.696	0	-6.181	1	0.1190	0.32100	0.0
4	Montero (Call Me By Your Name) Lil Nas X	2.30	0.503	8	-6.725	0	0.2200	0.29300	0.0

In [3]:
```
#viewing the first rows in our dataset
data.head()
```

Out[3]:

	duration	energy	key	loudness	mode	speechiness	acousticness	instrumentalness	livenes
0	2.97	0.664	9	-5.044	1	0.1540	0.33500	0.000	0.084
1	2.30	0.506	8	-11.275	1	0.0589	0.37900	0.868	0.110
2	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.000	0.067
3	3.30	0.696	0	-6.181	1	0.1190	0.32100	0.000	0.420
4	2.30	0.503	8	-6.725	0	0.2200	0.29300	0.000	0.405

In [4]:
```
#plotting distribution plots of our data
data.hist(figsize = (9,9));
```



In [5]:
```
#having a general description of our data
data.describe().T
```

Out[5]:

	count	mean	std	min	25%	50%	75%	
duration	100.0	3.404900	0.927022	0.73000	2.910000	3.3700	3.630000	10
energy	100.0	0.587650	0.168273	0.15700	0.477750	0.6090	0.707750	0
key	100.0	5.050000	3.825420	0.00000	1.000000	5.0000	8.000000	11
loudness	100.0	-6.577120	2.447338	-14.06700	-7.676250	-6.2625	-4.786750	-2
mode	100.0	0.560000	0.498888	0.00000	0.000000	1.0000	1.000000	1
speechiness	100.0	0.075461	0.068065	0.02530	0.036100	0.0518	0.080650	0
acousticness	100.0	0.314539	0.281076	0.00028	0.090750	0.2385	0.519750	0
instrumentalness	100.0	0.070682	0.221947	0.00000	0.000000	0.0000	0.000083	0
liveness	100.0	0.161737	0.112657	0.03410	0.088375	0.1200	0.205250	0
valence	100.0	0.517354	0.237512	0.05920	0.329000	0.5420	0.711500	0
tempo	100.0	121.548260	29.148613	71.88400	97.476250	117.0375	141.733750	180
danceability	100.0	0.647900	0.126942	0.35200	0.566750	0.6635	0.734000	0

Approach 1: Recomendation with Eucledian Distance

In [ ]:
```

```

In [6]:
```
#select features
data_features = data.iloc[:,1:]
#scale
data_features_scaled =  StandardScaler().fit_transform(data_features)

def n_nearest_row(dataframe,input_row,n=5):
    print("Input song:\n",pd.DataFrame(data.iloc[input_row,:]).T)

    distances = pdist(dataframe.values, metric='euclidean')
    dist_matrix = squareform(distances)
    distances_from_input_row = pd.DataFrame(dist_matrix)[input_row].sort_value

    distances_from_input_row = distances_from_input_row[1:n+1].sort_index()
    nearest_rows = data_main[data.index.isin(distances_from_input_row.index)]

    output_df = pd.concat((nearest_rows,distances_from_input_row),axis=1)

    columns = list(data_main.columns)
    columns.append("distance")
    output_df.columns=columns

    return output_df



nearest_5_row = n_nearest_row(data_features,96) # we will examine the first ir
print("\n\nNearest songs: ")
nearest_5_row
```

```
Input song:
     duration  energy   key  loudness  mode  speechiness  acousticness  \
96       3.37   0.748  11.0    -5.922   0.0       0.0589         0.305

    instrumentalness  liveness  valence    tempo  danceability
96               0.0    0.0811    0.964  163.984         0.672


Nearest songs:
```

Out[6]:

	name	duration	energy	key	loudness	mode	speechiness	acousticness	instrumentaln
0	Good 4 U Olivia Rodrigo	2.97	0.664	9	-5.044	1	0.1540	0.3350	0.000
1	Stay The Kid LAROI & Justin Bieber	2.30	0.506	8	-11.275	1	0.0589	0.3790	0.868
47	Cover Me In Sunshine P!nk & Willow Sage Hart	2.37	0.488	5	-11.276	1	0.0568	0.0142	0.900
58	Stressed Out twenty one pilots	3.37	0.637	4	-5.677	0	0.1410	0.0462	0.000
80	rockstar (feat. 21 Savage) Post Malone	3.64	0.520	5	-6.136	0	0.0712	0.1240	0.000

In [7]:
```
data_main.shape
```

Out[7]: (100, 13)

In [8]:
```
data.shape
```

Out[8]: (100, 12)

Aproach2: Recomendation withK-Nearest

in order to find the optimal values of K for our classification, we used KMeans from the scikit-learn library and the elbow visualizer for the yellow brick bibrary.

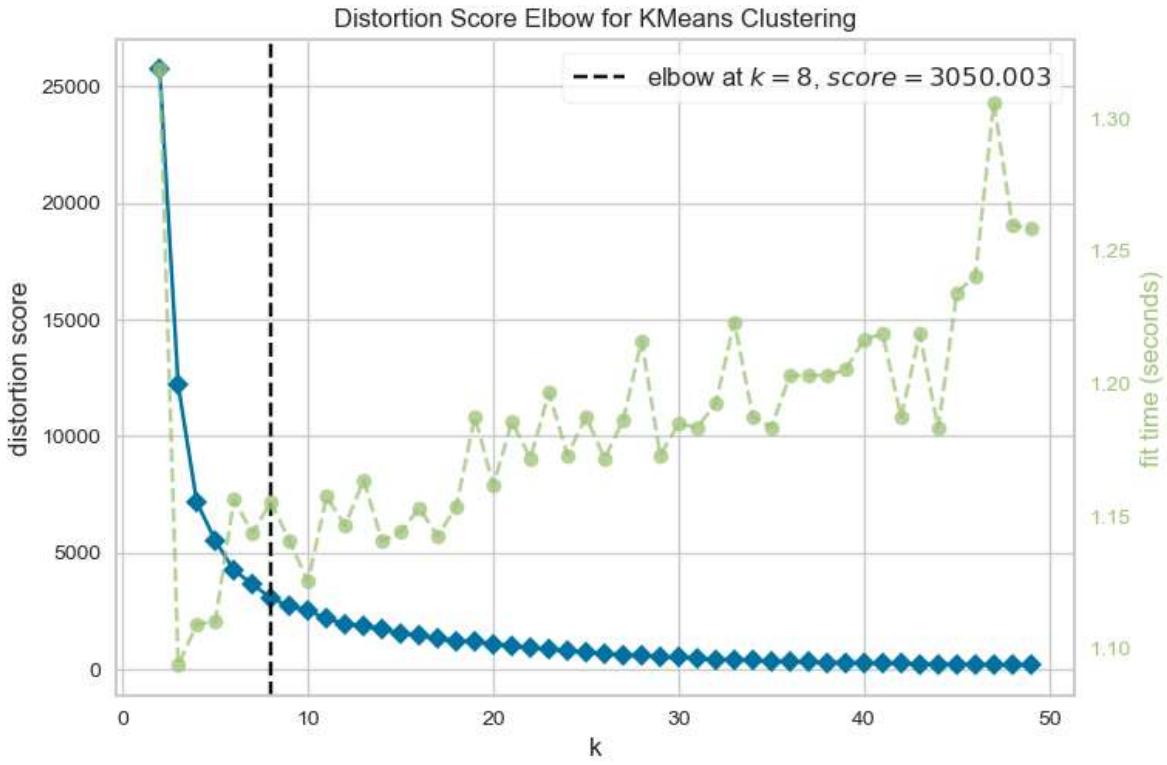
In [9]:
```
!pip install yellowbrick
```

```
Requirement already satisfied: yellowbrick in c:\users\lenovo\anaconda3\lib
\site-packages (1.5)
Requirement already satisfied: numpy>=1.16.0 in c:\users\lenovo\anaconda3\li
b\site-packages (from yellowbrick) (1.23.5)
Requirement already satisfied: cycler>=0.10.0 in c:\users\lenovo\anaconda3\l
ib\site-packages (from yellowbrick) (0.11.0)
Requirement already satisfied: matplotlib!=3.0.0,>=2.0.2 in c:\users\lenovo
\anaconda3\lib\site-packages (from yellowbrick) (3.7.0)
Requirement already satisfied: scipy>=1.0.0 in c:\users\lenovo\anaconda3\lib
\site-packages (from yellowbrick) (1.10.0)
Requirement already satisfied: scikit-learn>=1.0.0 in c:\users\lenovo\anacon
da3\lib\site-packages (from yellowbrick) (1.2.1)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\lenovo\anaconda3
\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (1.0.5)
Requirement already satisfied: pillow>=6.2.0 in c:\users\lenovo\anaconda3\li
b\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (9.4.0)
Requirement already satisfied: packaging>=20.0 in c:\users\lenovo\anaconda3
\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (22.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\lenovo\anaconda
3\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (1.4.4)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\lenovo\anaconda
3\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (4.25.0)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\lenovo\anaco
nda3\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (2.8.2)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\lenovo\anaconda3
\lib\site-packages (from matplotlib!=3.0.0,>=2.0.2->yellowbrick) (3.0.9)
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\lenovo\anaco
nda3\lib\site-packages (from scikit-learn>=1.0.0->yellowbrick) (2.2.0)
Requirement already satisfied: joblib>=1.1.1 in c:\users\lenovo\anaconda3\li
b\site-packages (from scikit-learn>=1.0.0->yellowbrick) (1.2.0)
Requirement already satisfied: six>=1.5 in c:\users\lenovo\anaconda3\lib\sit
e-packages (from python-dateutil>=2.7->matplotlib!=3.0.0,>=2.0.2->yellowbric
k) (1.16.0)
```

In [10]:
```
from sklearn.cluster import KMeans
from yellowbrick.cluster import KElbowVisualizer

kmeans = KMeans()
visualizer = KElbowVisualizer(kmeans, k=(2,50))

visualizer.fit(data_features)
visualizer.poof();
```



after fitting the visualizer to our features, we are able to determine the optimal value of k to 8.

In [11]:
```
kmeans = KMeans(n_clusters=8)
kmeans.fit(data_features)
data_groups = pd.concat((data_main, pd.DataFrame(kmeans.labels_,columns=['Grou
data_groups.head(5)
```

Out[11]:

	name	duration	energy	key	loudness	mode	speechiness	acousticness	instrumentalne
0	Good 4 U Olivia Rodrigo	2.97	0.664	9	-5.044	1	0.1540	0.33500	0.0
1	Stay The Kid LAROI & Justin Bieber	2.30	0.506	8	-11.275	1	0.0589	0.37900	0.8
2	Levitating Dua Lipa feat. DaBaby	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.0
3	Peaches Justin Bieber feat. Daniel Caesar & Gi...	3.30	0.696	0	-6.181	1	0.1190	0.32100	0.0
4	Montero (Call Me By Your Name) Lil Nas X	2.30	0.503	8	-6.725	0	0.2200	0.29300	0.0

In [12]:
```
group5 = data_groups[data_groups['Group']==5]
group5
```

Out[12]:

	name	duration	energy	key	loudness	mode	speechiness	acousticness	instrument
2	Levitating Dua Lipa feat. DaBaby	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.
13	Beautiful Mistakes (feat. Megan Thee Stallion)...	3.79	0.676	10	-5.483	1	0.0270	0.03770	0.
18	Fiel Los Legendarios, Wisin & Jhay Cortez	4.27	0.430	6	-7.477	0	0.0255	0.73500	0.
22	Levitating (feat. DaBaby) Dua Lipa	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.
26	Famous Friends Chris Young + Kane Brown	2.74	0.513	6	-8.619	1	0.0311	0.10100	0.
32	Levitating Dua Lipa	3.38	0.825	6	-3.787	0	0.0601	0.00883	0.
36	Tusa KAROL G & Nicki Minaj	3.37	0.701	2	-3.275	1	0.2830	0.30800	0.
41	Therefore I Am Billie Eilish	2.91	0.340	11	-7.773	0	0.0697	0.21800	0.
49	The Woo (feat. 50 Cent & Roddy Ricch) Pop Smoke	3.36	0.618	1	-5.655	1	0.1040	0.02210	0.
51	You Right Doja Cat & The Weeknd	2.95	0.360	6	-11.212	1	0.0279	0.91800	0.
57	Pretend CNCO	3.34	0.883	11	-3.862	0	0.1030	0.28400	0.
59	Therefore I Am Billie Eilish	2.91	0.340	11	-7.773	0	0.0697	0.21800	0.
63	Heather Conan Gray	3.30	0.425	5	-7.301	1	0.0333	0.58400	0.
67	Dance Monkey Tones And I	3.49	0.588	6	-6.400	0	0.0924	0.69200	0.
68	Shallow Lady Gaga & Bradley Cooper	3.60	0.385	7	-6.362	1	0.0308	0.37100	0.

	name	duration	energy	key	loudness	mode	speechiness	acousticness	instrument
69	Memories Maroon 5	3.16	0.327	11	-7.241	1	0.0557	0.84100	0.
75	Talking to the Moon Acoustic Bruno Mars	3.63	0.333	1	-6.423	0	0.0310	0.86700	0.
97	Therefore I Am Billie Eilish	2.91	0.340	11	-7.773	0	0.0697	0.21800	0.

Applying PCA in our dataset

```
by appling pca in the dataset may be very isefull.
```

In [13]:
```
plt.rcParams['figure.figsize']=(12,6)
pca = PCA().fit(data_features_scaled)

plt.ylabel('cumulative variance')
plt.title('the number of components / variance')
plt.xlabel('number of components')

x = np.arange(1, 12)
y = np.cumsum(pca.explained_variance_ratio_)

plt.xticks(x)
plt.yticks(y)

plt.plot(x, y, marker='o', linestyle='-', color='b')

plt.hlines(y, 0, x, linestyle='--')
plt.vlines(x, 0, y, linestyle='--')

plt.show()
```