Spotify-EDA-DecisionTree

January 10, 2022

[1]:
```
import pandas as pd
import numpy as np

from sklearn import tree
from sklearn.tree import DecisionTreeClassifier, export_graphviz
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

from matplotlib import pyplot as plt
import seaborn as sns

import graphviz
import pydotplus
import io
import imageio

%matplotlib inline
```

1 Spotify Song Attributes EDA

- Import Dataset
- EDA to visualize data and observe structure
- Train a DecisionTreeClassifier
- Predict target using the trained classifier
- Dataset used from https://www.kaggle.com/geomack/spotifyclassification

[2]:
```
data = pd.read_csv('Spotify_data.csv')
```

[3]:
```
type(data)
```

[3]:
```
pandas.core.frame.DataFrame
```

[4]:
```
data.describe()
```

[4]:
```
        Unnamed: 0  acousticness  danceability   duration_ms       energy  \
count  2017.000000   2017.000000   2017.000000  2.017000e+03  2017.000000
```

```
mean   1008.000000      0.187590      0.618422  2.463062e+05     0.681577
std     582.402066      0.259989      0.161029  8.198181e+04     0.210273
min       0.000000      0.000003      0.122000  1.604200e+04     0.014800
25%     504.000000      0.009630      0.514000  2.000150e+05     0.563000
50%    1008.000000      0.063300      0.631000  2.292610e+05     0.715000
75%    1512.000000      0.265000      0.738000  2.703330e+05     0.846000
max    2016.000000      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
```

[5]:
```
# column target 1 = like 0 = dislike
data.head()
```

[5]:
```
   Unnamed: 0  acousticness  danceability  duration_ms  energy  \
0           0        0.0102         0.833       204600   0.434
1           1        0.1990         0.743       326933   0.359
2           2        0.0344         0.838       185707   0.412
3           3        0.6040         0.494       199413   0.338
4           4        0.1800         0.678       392893   0.561

   instrumentalness  key  liveness  loudness  mode  speechiness    tempo  \
0          0.021900    2    0.1650    -8.795     1       0.4310  150.062
1          0.006110    1    0.1370   -10.401     1       0.0794  160.083
2          0.000234    2    0.1590    -7.148     1       0.2890   75.044
3          0.510000    5    0.0922   -15.236     1       0.0261   86.468
4          0.512000    5    0.4390   -11.648     0       0.0694  174.004

   time_signature  valence  target      song_title            artist
0             4.0    0.286       1        Mask Off            Future
```

```
1             4.0    0.588       1         Redbone  Childish Gambino
2             4.0    0.173       1    Xanny Family            Future
3             4.0    0.230       1  Master Of None       Beach House
4             4.0    0.904       1  Parallel Lines       Junior Boys
```

[6]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2017 entries, 0 to 2016
Data columns (total 17 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Unnamed: 0        2017 non-null   int64
 1   acousticness      2017 non-null   float64
 2   danceability      2017 non-null   float64
 3   duration_ms       2017 non-null   int64
 4   energy            2017 non-null   float64
 5   instrumentalness  2017 non-null   float64
 6   key               2017 non-null   int64
 7   liveness          2017 non-null   float64
 8   loudness          2017 non-null   float64
 9   mode              2017 non-null   int64
 10  speechiness       2017 non-null   float64
 11  tempo             2017 non-null   float64
 12  time_signature    2017 non-null   float64
 13  valence           2017 non-null   float64
 14  target            2017 non-null   int64
 15  song_title        2017 non-null   object
 16  artist            2017 non-null   object
dtypes: float64(10), int64(5), object(2)
memory usage: 268.0+ KB
```

[7]:
```
train, test = train_test_split(data, test_size = 0.15)
```

[8]:
```
print("Training size: {}; Test size {}".format(len(train), len(test)))
```

```
Training size: 1714; Test size 303
```

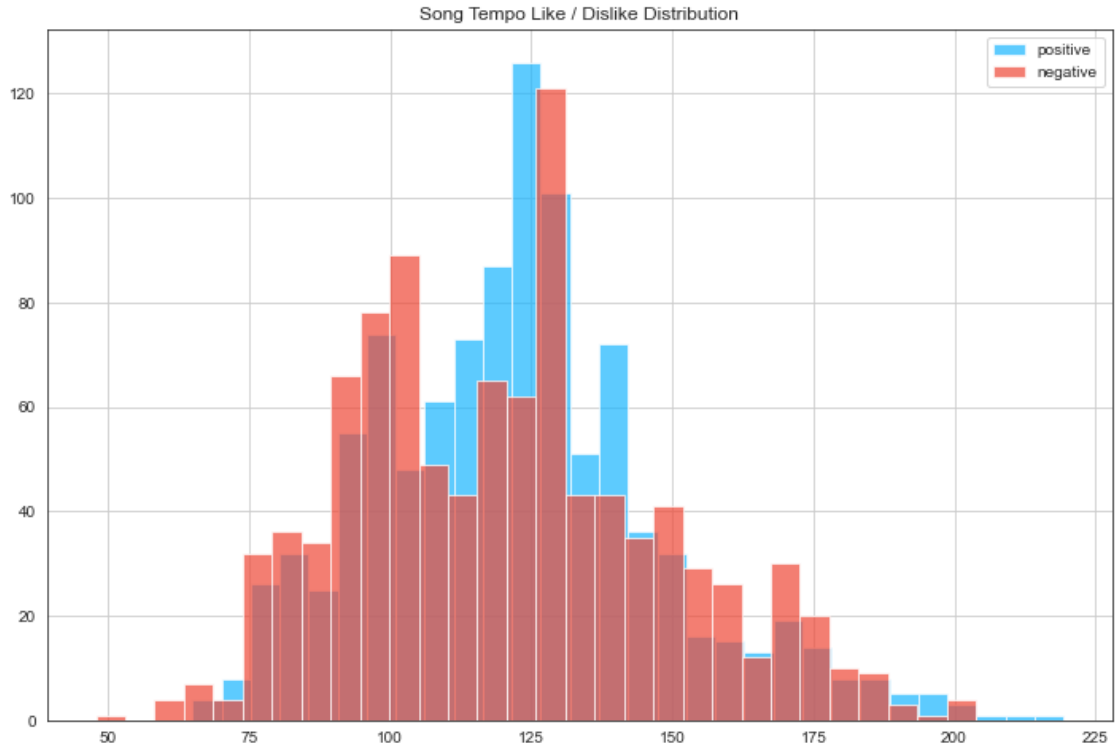
[9]:
```
# Custom Color Palette
red_blue = ["#19B5FE", "#EF4836"]
palette = sns.color_palette(red_blue)
sns.set_palette(palette)
sns.set_style("white")
```

[10]:
```
pos_tempo = data[data["target"] == 1]["tempo"]
neg_tempo = data[data["target"] == 0]["tempo"]
```

```
pos_dance = data[data["target"] == 1]["danceability"]
neg_dance = data[data["target"] == 0]["danceability"]

pos_duration = data[data["target"] == 1]["duration_ms"]
neg_duration = data[data["target"] == 0]["duration_ms"]

pos_loudness = data[data["target"] == 1]["loudness"]
neg_loudness = data[data["target"] == 0]["loudness"]

pos_speechiness = data[data["target"] == 1]["speechiness"]
neg_speechiness = data[data["target"] == 0]["speechiness"]

pos_valence = data[data["target"] == 1]["valence"]
neg_valence = data[data["target"] == 0]["valence"]

pos_energy = data[data["target"] == 1]["energy"]
neg_energy = data[data["target"] == 0]["energy"]

pos_acousticness = data[data["target"] == 1]["acousticness"]
neg_acousticness = data[data["target"] == 0]["acousticness"]

pos_key = data[data["target"] == 1]["key"]
neg_key = data[data["target"] == 0]["key"]

pos_instrumentalness = data[data["target"] == 1]["instrumentalness"]
neg_instrumentalness = data[data["target"] == 0]["instrumentalness"]
```

[11]:
```
# Visualizing the like/dislike distribution based on the song tempo
# User likes songs in the range of 100 - 150 bpm
fig = plt.figure(figsize=(12, 8))
plt.title("Song Tempo Like / Dislike Distribution")
pos_tempo.hist(alpha = 0.7, bins = 30, label = "positive")
neg_tempo.hist(alpha = 0.7, bins = 30, label = "negative")
plt.legend(loc = "upper right")
```

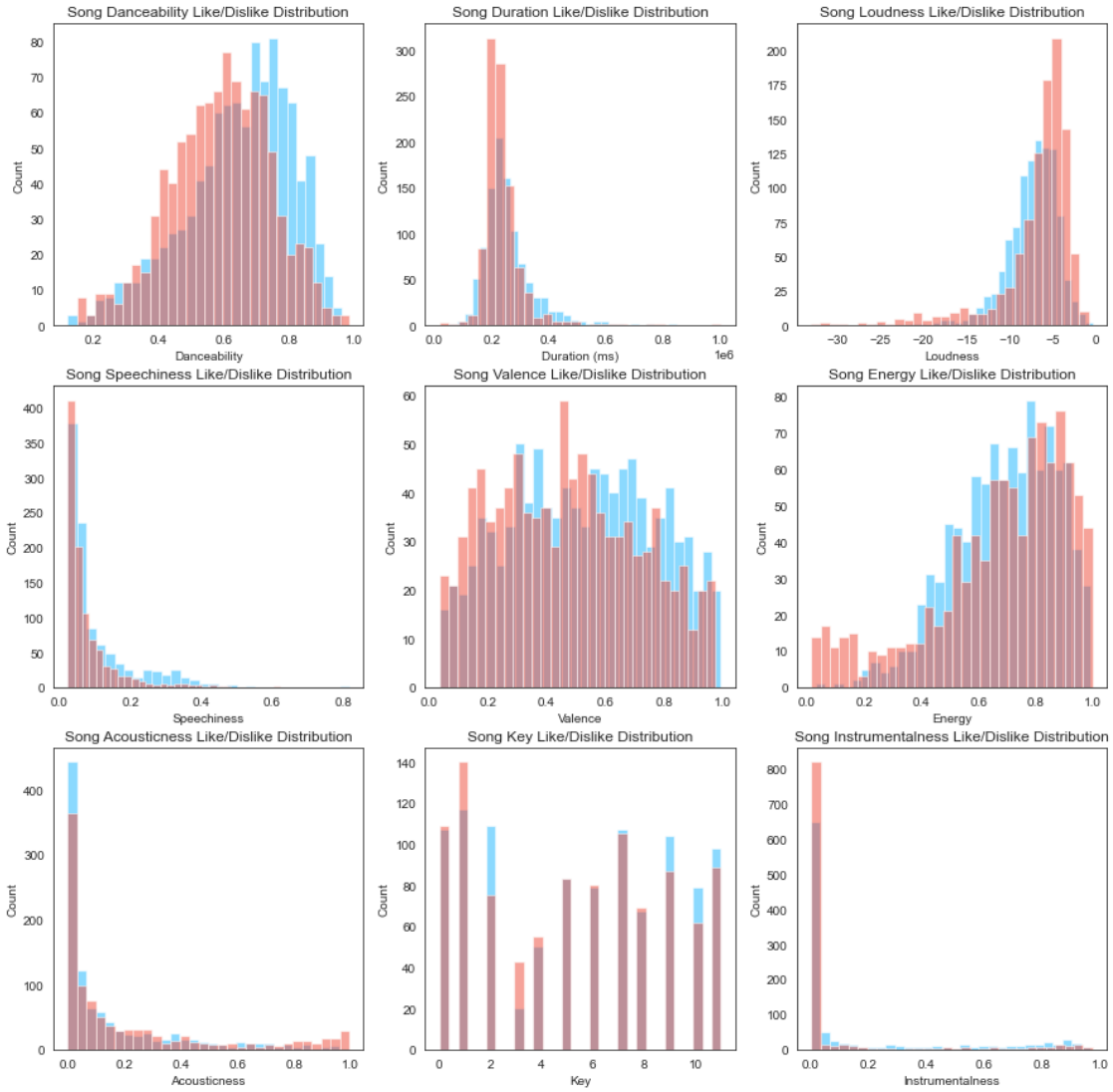
[11]:
```
<matplotlib.legend.Legend at 0x7f3bd2d8a280>
```



[12]:
```
fig, axs = plt.subplots(3, 3, figsize=(15, 15))

# Danceability
axs[0, 0].hist(pos_dance, alpha=0.5, bins=30)
axs[0, 0].hist(neg_dance, alpha=0.5, bins=30)
axs[0, 0].set_xlabel('Danceability')
axs[0, 0].set_ylabel('Count')
axs[0, 0].set_title('Song Danceability Like/Dislike Distribution')

# Duration
axs[0, 1].hist(pos_duration, alpha=0.5, bins=30)
axs[0, 1].hist(neg_duration, alpha=0.5, bins=30)
axs[0, 1].set_xlabel('Duration (ms)')
axs[0, 1].set_ylabel('Count')
axs[0, 1].set_title('Song Duration Like/Dislike Distribution')

# Loudness
axs[0, 2].hist(pos_loudness, alpha=0.5, bins=30)
axs[0, 2].hist(neg_loudness, alpha=0.5, bins=30)
axs[0, 2].set_xlabel('Loudness')
axs[0, 2].set_ylabel('Count')
axs[0, 2].set_title('Song Loudness Like/Dislike Distribution')
```

```
# Speechiness
axs[1, 0].hist(pos_speechiness, alpha=0.5, bins=30)
axs[1, 0].hist(neg_speechiness, alpha=0.5, bins=30)
axs[1, 0].set_xlabel('Speechiness')
axs[1, 0].set_ylabel('Count')
axs[1, 0].set_title('Song Speechiness Like/Dislike Distribution')

# Valence
axs[1, 1].hist(pos_valence, alpha=0.5, bins=30)
axs[1, 1].hist(neg_valence, alpha=0.5, bins=30)
axs[1, 1].set_xlabel('Valence')
axs[1, 1].set_ylabel('Count')
axs[1, 1].set_title('Song Valence Like/Dislike Distribution')

# Energy
axs[1, 2].hist(pos_energy, alpha=0.5, bins=30)
axs[1, 2].hist(neg_energy, alpha=0.5, bins=30)
axs[1, 2].set_xlabel('Energy')
axs[1, 2].set_ylabel('Count')
axs[1, 2].set_title('Song Energy Like/Dislike Distribution')

# Acousticness
axs[2, 0].hist(pos_acousticness, alpha=0.5, bins=30)
axs[2, 0].hist(neg_acousticness, alpha=0.5, bins=30)
axs[2, 0].set_xlabel('Acousticness')
axs[2, 0].set_ylabel('Count')
axs[2, 0].set_title('Song Acousticness Like/Dislike Distribution')

# Key
axs[2, 1].hist(pos_key, alpha=0.5, bins=30)
axs[2, 1].hist(neg_key, alpha=0.5, bins=30)
axs[2, 1].set_xlabel('Key')
axs[2, 1].set_ylabel('Count')
axs[2, 1].set_title('Song Key Like/Dislike Distribution')

# Instrumentalness
axs[2, 2].hist(pos_instrumentalness, alpha=0.5, bins=30)
axs[2, 2].hist(neg_instrumentalness, alpha=0.5, bins=30)
axs[2, 2].set_xlabel('Instrumentalness')
axs[2, 2].set_ylabel('Count')
axs[2, 2].set_title('Song Instrumentalness Like/Dislike Distribution')
```

[12]: `Text(0.5, 1.0, 'Song Instrumentalness Like/Dislike Distribution')`



2 Evaluation

- User preferes songs with high danceability
- User likes songs from 200.000 to 400.000 ms
- User dislikes songs on the extreme ends of loudness
- User prefers songs with not so much energy but dislikes songs with no energy
- The twelve keys are noted in a numerical form starting from 0 which represents the C key (https://developer.spotify.com/documentation/web-api/reference/#/operations/get-several-audio-features)
- E has the least amount of observations with the highest amount of dislike/like observations therefore the user does not enjoy songs in the key of E

3 Decision Tree

[13]:
```
c = DecisionTreeClassifier(min_samples_split=100)
```

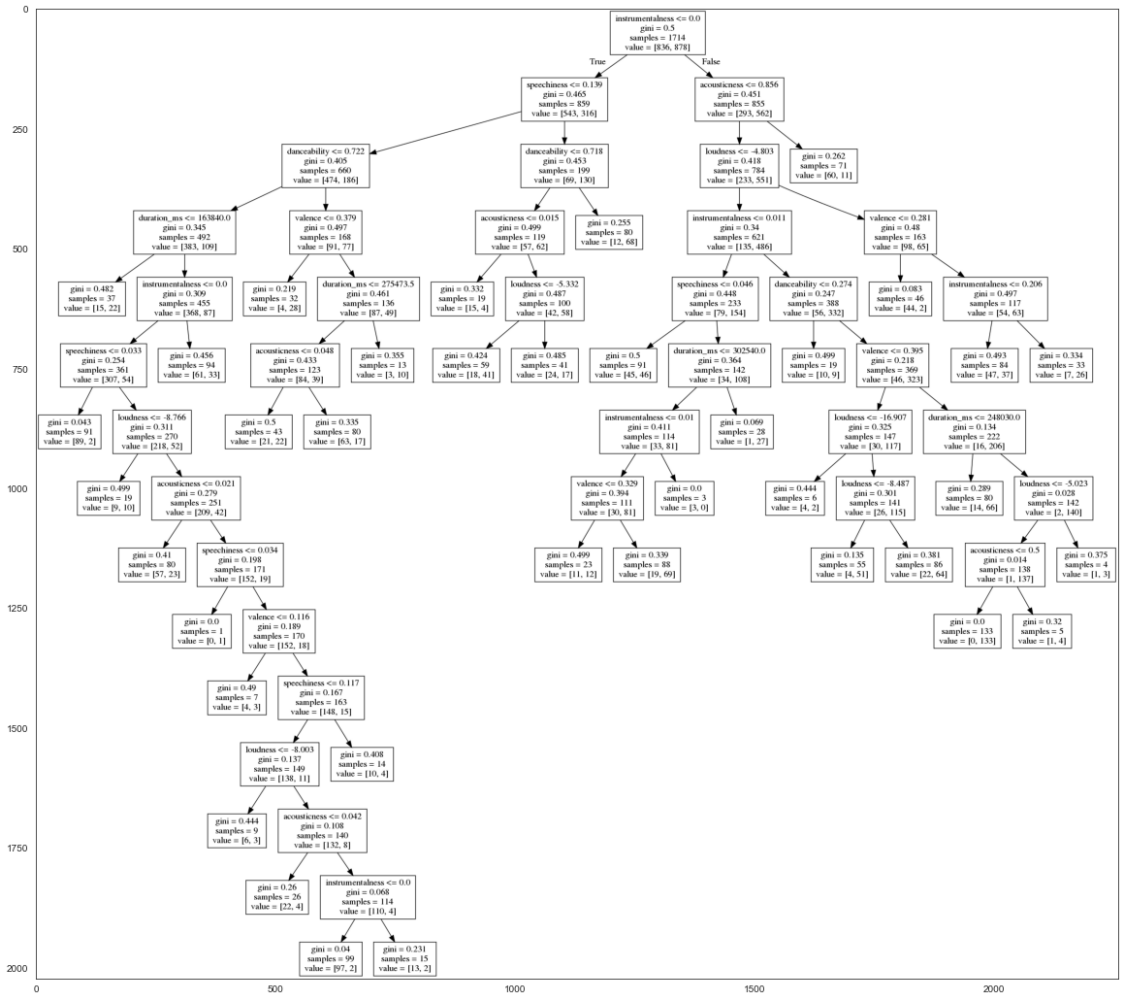
[14]:
```
features = ["danceability", "loudness", "valence", "instrumentalness",␣
↪"acousticness", "key", "speechiness", "duration_ms"]
```

[15]:
```
X_train = train[features]
y_train = train["target"]

X_test = test[features]
y_test = test["target"]
```

[16]:
```
dt = c.fit(X_train, y_train)
```

[17]:
```
def show_tree(tree, features, path):
    f = io.StringIO()
    export_graphviz(tree, out_file=f, feature_names=features)
    pydotplus.graph_from_dot_data(f.getvalue()).write_png(path)
    img = imageio.imread(path)
    plt.rcParams["figure.figsize"] = (20, 20)
    plt.imshow(img)
```

[18]:
```
show_tree(dt, features, "dec_tree_01.png")
```



[19]:
```
y_pred = c.predict(X_test)
```

[20]:
```
score = accuracy_score(y_test, y_pred) * 100
```

[21]:
```
print("Accuracy using Decision Tree:", round(score, 1), "%")
```

```
Accuracy using Decision Tree: 72.9 %
```