Importing Pakages

In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

from sklearn import preprocessing
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier, AdaBoostClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.decomposition import PCA
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split, GridSearchCV, cross_val_score
from sklearn.metrics import accuracy_score, confusion_matrix
```

Reading data

In [4]:
```
df = pd.read_csv('features_3_sec.csv')
df.head()
```

Out[4]:

	filename	length	chroma_stft_mean	chroma_stft_var	rms_mean	rms_var	spectral_centroid_mean	spectral_centroid_var	spe
0	blues.00000.0.wav	66149	0.335406	0.091048	0.130405	0.003521	1773.065032	167541.630869	
1	blues.00000.1.wav	66149	0.343065	0.086147	0.112699	0.001450	1816.693777	90525.690866	
2	blues.00000.2.wav	66149	0.346815	0.092243	0.132003	0.004620	1788.539719	111407.437613	
3	blues.00000.3.wav	66149	0.363639	0.086856	0.132565	0.002448	1655.289045	111952.284517	
4	blues.00000.4.wav	66149	0.335579	0.088129	0.143289	0.001701	1630.656199	79667.267654	

5 rows × 60 columns

In [6]:
```
df.shape
```

Out[6]:
```
(9990, 60)
```

In [7]:
```
df.columns.value_counts().sum()
```

Out[7]:
```
60
```

In [8]:
```
df.describe()
```

Out[8]:

	length	chroma_stft_mean	chroma_stft_var	rms_mean	rms_var	spectral_centroid_mean	spectral_centroid_var	spectral_ba
count	9990.0	9990.000000	9990.000000	9990.000000	9.990000e+03	9990.000000	9.990000e+03	
mean	66149.0	0.379534	0.084876	0.130859	2.676388e-03	2199.219431	4.166727e+05	
std	0.0	0.090466	0.009637	0.068545	3.585628e-03	751.860611	4.349644e+05	
min	66149.0	0.107108	0.015345	0.000953	4.379535e-08	472.741636	8.118813e+02	
25%	66149.0	0.315698	0.079833	0.083782	6.145900e-04	1630.680158	1.231961e+05	
50%	66149.0	0.384741	0.085108	0.121253	1.491318e-03	2208.628236	2.650692e+05	
75%	66149.0	0.442443	0.091092	0.176328	3.130862e-03	2712.581884	5.624152e+05	
max	66149.0	0.749481	0.120964	0.442567	3.261522e-02	5432.534406	4.794119e+06	

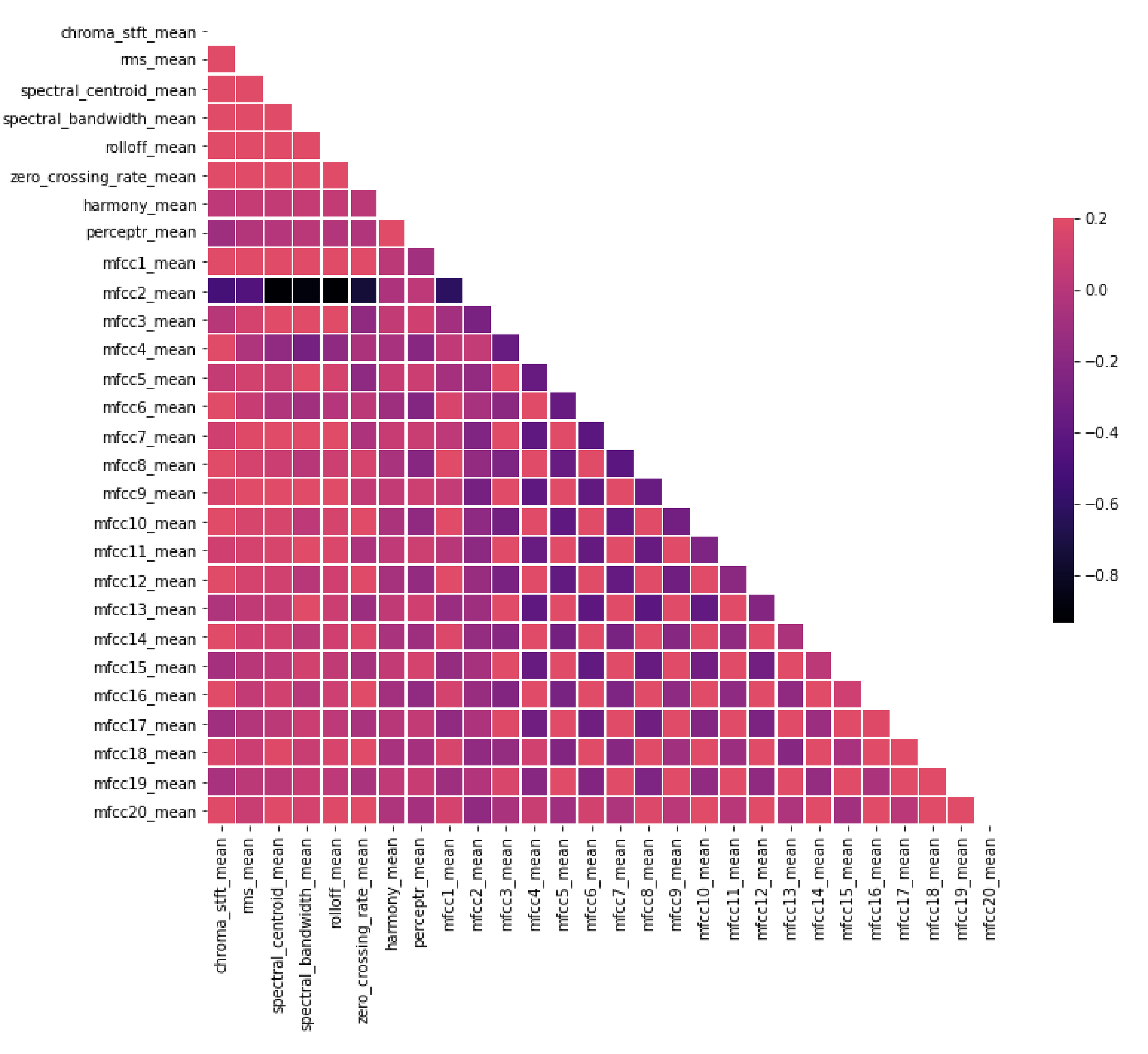
8 rows × 58 columns

Exploratory Data Analysis

In [9]:
```
mean_cols = [col for col in df.columns if 'mean' in col]
corr = df[mean_cols].corr()

mask = np.triu(np.ones_like(corr,  dtype = bool))
plt.figure(figsize = (12, 10))
print("mean_cols size:", len(mean_cols))
sns.heatmap(data = corr, mask = mask, vmax =.2, cmap = 'magma', linewidths = .5, center = 0, cbar_kws={
"shrink": .5})
plt.show()
```

```
mean_cols size: 28
```



MinMaxScaling

In [11]:
```
X = df.drop(['label'],axis = 1)
X = X.iloc[0:, 2:]
y = df['label']
transformer = preprocessing.MinMaxScaler()
x_trans = transformer.fit_transform(X)
X = pd.DataFrame(x_trans, columns = X.columns)
```

In [12]:
```
X.head()
```

Out[12]:

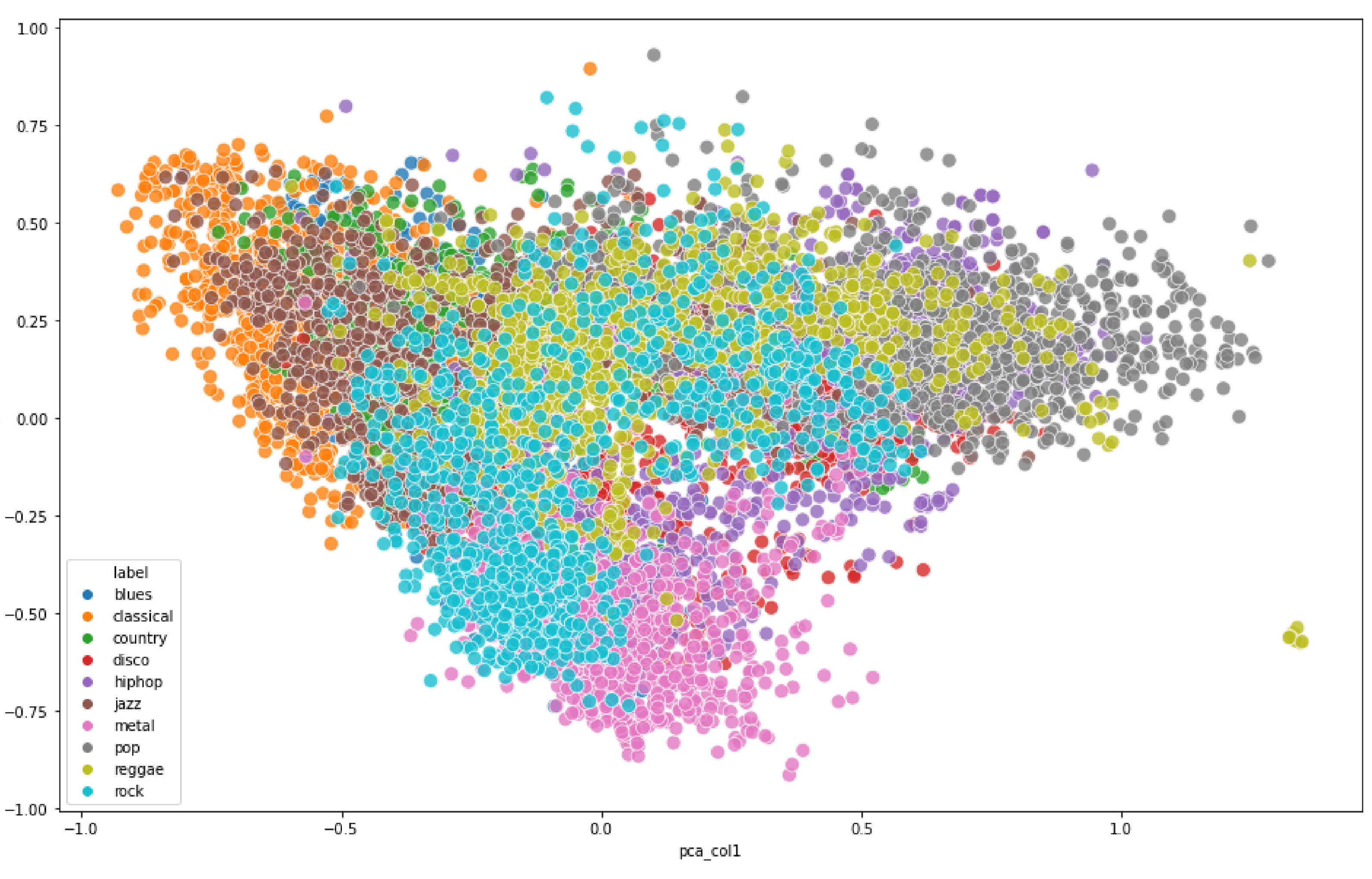
	chroma_stft_mean	chroma_stft_var	rms_mean	rms_var	spectral_centroid_mean	spectral_centroid_var	spectral_bandwidth_mean	spe
0	0.355399	0.716757	0.293133	0.107955	0.262173	0.034784	0.459205	
1	0.367322	0.670347	0.253040	0.044447	0.270969	0.018716	0.470831	
2	0.373159	0.728067	0.296753	0.141663	0.265293	0.023073	0.494051	
3	0.399349	0.677066	0.298024	0.075042	0.238427	0.023187	0.455246	
4	0.355668	0.689113	0.322308	0.052149	0.233460	0.016451	0.451651	

5 rows × 57 columns

In [13]:
```
# reduce the dimasion of our dataset to 2 for scatter plot using Principal Component Analysis
PCA_model = PCA(n_components=2)
df_min = PCA_model.fit_transform(X)
df_min = pd.DataFrame(df_min, columns = ['pca_col1', 'pca_col2'])
df_min = pd.concat([df_min, y], axis = 1)
```

In [14]:
```
plt.figure(figsize = (16, 10))
sns.scatterplot(x = df_min['pca_col1'], y = df_min['pca_col2'], data = df_min, hue = 'label', s = 100,
alpha = 0.8)
```

Out[14]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1eed95ca790>
```



Modeling

In [16]:
```
# Encode label (y) with LabelEncoder and scalle data feature using MinMaxScaler
df['label'] = preprocessing.LabelEncoder().fit_transform(df['label'])
X = df.drop(['label', 'length', 'filename'], axis = 1)
scaller = preprocessing.MinMaxScaler()
X = pd.DataFrame(scaller.fit_transform(X), columns = X.columns)
y = df['label']
```

In [17]:
```
# split data in train en test set
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
```

In [18]:
```
# model fit function
def fit_model(model):
    model.fit(x_train, y_train)
    y_pred = model.predict(x_test)
    print(f"train_accuracy and val_accuracy for {model.__str__()} \n")
    print(model.score(x_train, y_train))
    print(accuracy_score(y_test, y_pred))
    print("-------------------------------- ","\n")
```

In [19]:
```
# list of estimators
models = [KNeighborsClassifier(n_neighbors=5),
          LogisticRegression(max_iter=1000),
          RandomForestClassifier(n_estimators=1000),
          DecisionTreeClassifier(),
          SVC() ]
```

In [20]:
```
# fit all model in our list estimators
for model in models:
    fit_model(model)
```

```
train_accuracy and val_accuracy for KNeighborsClassifier()

0.9471971971971972
0.9049049049049049
--------------------------------

train_accuracy and val_accuracy for LogisticRegression(max_iter=1000)

0.7040790790790791
0.6796796796796797
--------------------------------

train_accuracy and val_accuracy for RandomForestClassifier(n_estimators=1000)

0.9992492492492493
0.8838838838838838
--------------------------------

train_accuracy and val_accuracy for DecisionTreeClassifier()

0.9992492492492493
0.6381381381381381
--------------------------------

train_accuracy and val_accuracy for SVC()

0.7795295295295295
0.7397397397397397
--------------------------------
```

In [ ]:
```
# GriSeachCV for knn model
knn_grid_params = {'n_neighbors': np.arange(3, 50, 2),
                   'metric':['euclidean', 'manhattan']}
knn_grid = GridSearchCV(KNeighborsClassifier(), param_grid=knn_grid_params)
knn_grid.fit(x_train, y_train)
best_knn_model = knn_grid.best_estimator_
print(knn_grid.best_params_)
print("accuracy", knn_grid.best_score_)
print("val_accuracy", accuracy_score(y_test, best_knn_model.predict(x_test)))
# plot confusion matrix
conf_matrix = confusion_matrix(y_test, best_knn_model.predict(x_test))
plt.figure(figsize = (12,8))
print("confusion matrix")
sns.heatmap(conf_matrix, annot=True)
```

function to get the distance between feature vecotrs and find neighbors

In [2]:
```
def getNeighbors(trainingSet, instance, k):
    distances = []
    for x in range (len(trainingSet)):
        dist = distance(trainingSet[x], instance, k) + distance(instance, trainingSet[x], k)
        distances.append((trainingSet[x][2], dist))

    distances.sort(key=operator.itemgetter(1))
    neighbors = []
    for x in range(k):
        neighbors.append(distances[x][0])

    return neighbors
```

identify the class of the instance

In [3]:
```
def nearestClass(neighbors):
    classVote = {}

    for x in range(len(neighbors)):
        response = neighbors[x]
        if response in classVote:
            classVote[response] += 1
        else:
            classVote[response] = 1

    sorter = sorted(classVote.items(), key = operator.itemgetter(1), reverse=True)

    return sorter[0][0]
```

function to evaluate the model

In [4]:
```
def getAccuracy(testSet, prediction):
    correct = 0
    for x in range(len(testSet)):
        if testSet[x][-1] == predictions[x]:
            correct += 1

    return (1.0 * correct) / len(testSet)
```

In [ ]: