In [25]:

```
# Author : Amir Shokri
# github link : https://github.com/amirshnll/Guitar-Chords-finger-positions
# dataset link : http://archive.ics.uci.edu/ml/datasets/Guitar+Chords+finger+p
ositions
# email : amirsh.nll@gmail.com
```

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns

import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from pandas.plotting import scatter_matrix
chord= pd.read_csv('chord-fingers.csv')
chord.head()
```

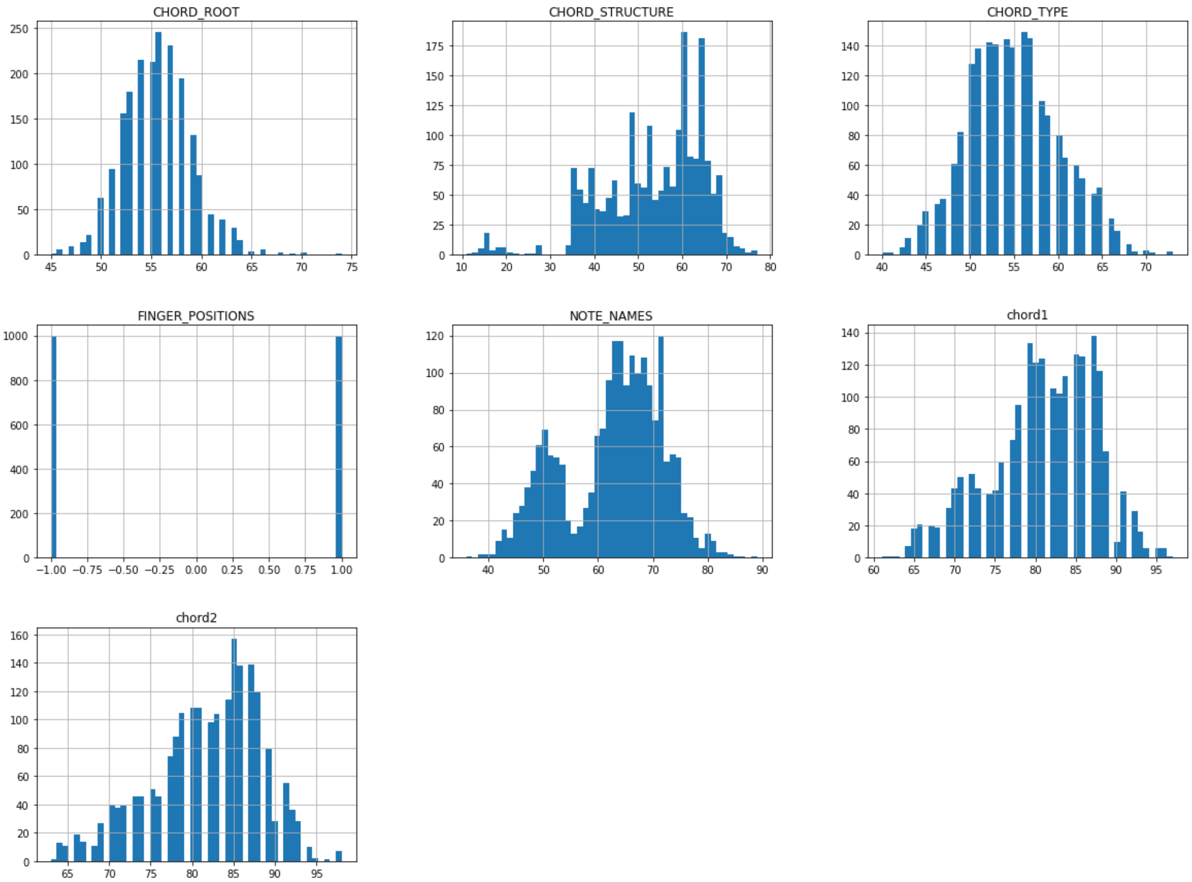
Out[1]:

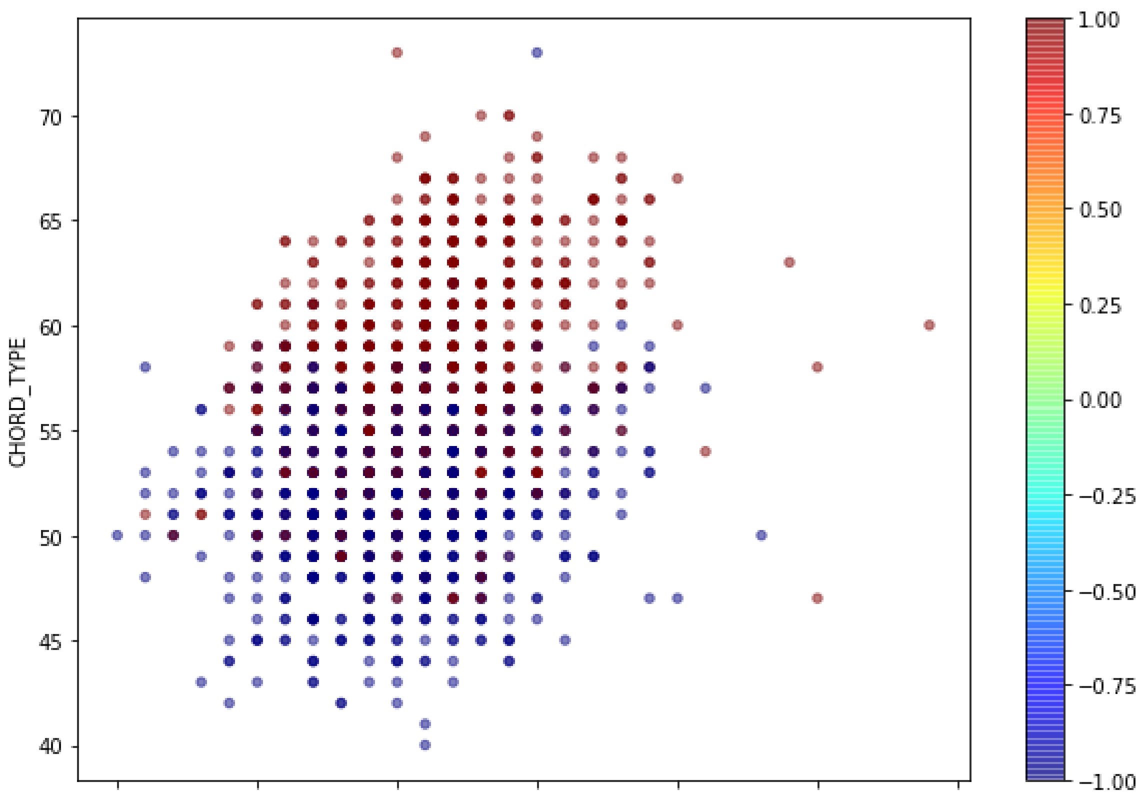
	CHORD_ROOT	CHORD_TYPE	CHORD_STRUCTURE	NOTE_NAMES	chord1	chord2	FINGEI
64	56	61	66	71	82	81	
68	57	61	65	71	85	85	
63	60	60	67	76	85	84	
61	60	68	62	77	90	80	
63	65	60	63	77	81	87	

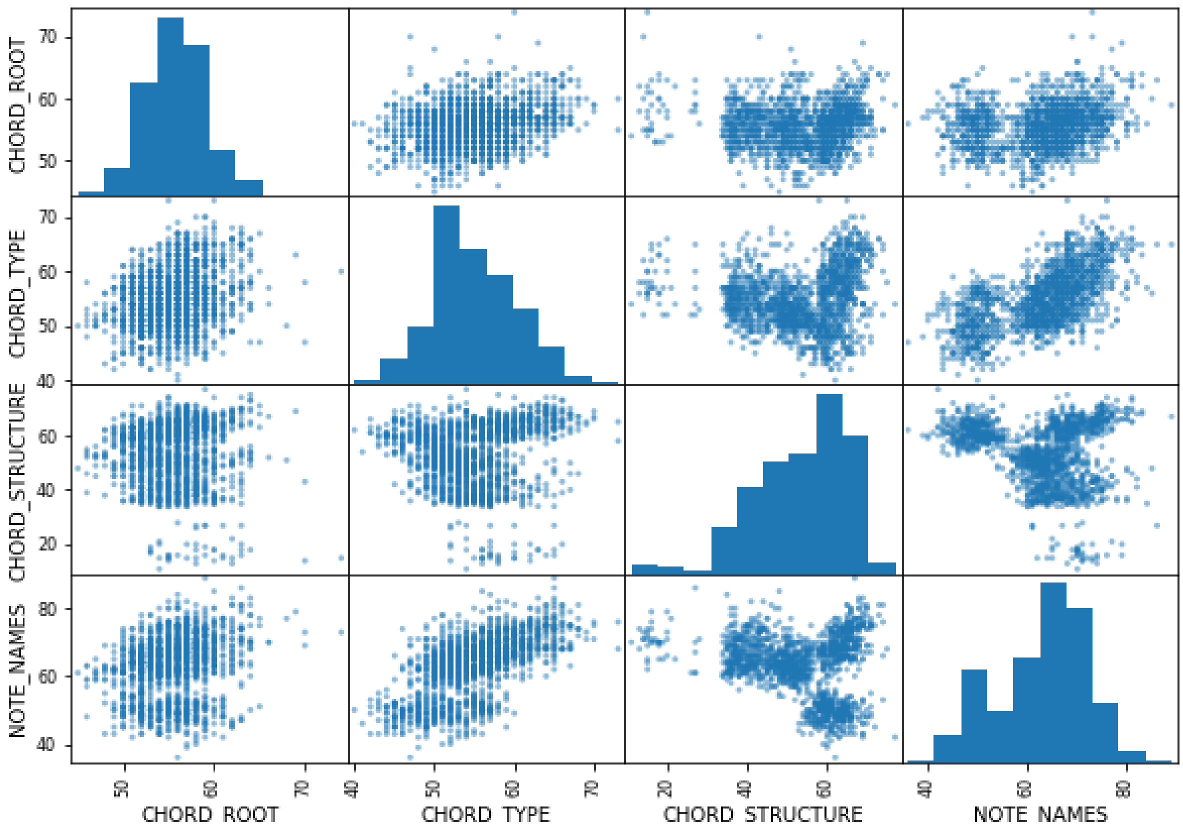
In [2]:
```
#chord.tail()
#chord.shape
#chord[:7]
chord.info()
#chord.columns
#chord['A'].unique()
#chord['B'].unique()
#chd['C'].unique()
#chord['D'].unique()
#chord['E'].unique()
#chord['F'].unique()
#chord['G'].unique()
#chord['ROOM'].unique()
#chord['A'].value_counts()
#chord['B'].value_counts()
#chord['C'].value_counts()
#chord['D'].value_counts()
#chord['E'].value_counts()
#chord['F'].value_counts()
#chord['G'].value_counts()
#chord['ROOM'].value_counts()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2000 entries, 64 to 59
Data columns (total 7 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   CHORD_ROOT        2000 non-null   int64
 1   CHORD_TYPE        2000 non-null   int64
 2   CHORD_STRUCTURE   2000 non-null   int64
 3   NOTE_NAMES        2000 non-null   int64
 4   chord1            2000 non-null   int64
 5   chord2            2000 non-null   int64
 6   FINGER_POSITIONS  2000 non-null   int64
dtypes: int64(7)
memory usage: 125.0 KB
```

In [3]:
```
chord.describe()
chord.hist(bins=50 , figsize=(20,15))
plt.show()
train_set,test_set=train_test_split(chord,test_size=0.2,random_state=42)
test_set.shape
data=train_set.copy()
#data.head(42)
#standard correlation coefficient

data.plot(kind="scatter",x="CHORD_ROOT",y="CHORD_TYPE",
         # s=data["B"]/2,label="",
          c=data["FINGER_POSITIONS"],cmap=plt.get_cmap("jet"),
          figsize=(10,7),alpha=0.5)

corr_matrix=data.corr()
corr_matrix["FINGER_POSITIONS"].sort_values(ascending=False)
#scatter_matrix
feature=["CHORD_ROOT","CHORD_TYPE","CHORD_STRUCTURE","NOTE_NAMES"]
scatter_matrix(data[feature],figsize=(10,7))
plt.show()
```


CHORD_ROOT
CHORD_STRUCTURE
CHORD_TYPE
FINGER_POSITIONS
NOTE_NAMES
chord1
chord2


CHORD_TYPE



In [4]:
```
y=data.FINGER_POSITIONS
x_data=data.drop(columns=['FINGER_POSITIONS'])
print(x_data)
```

```
    CHORD_ROOT  CHORD_TYPE  CHORD_STRUCTURE  NOTE_NAMES  chord1  chord2
37          54          47               36          63      70      70
58          59          59               65          65      82      94
42          54          58               41          63      75      78
37          56          57               39          61      72      74
64          57          63               59          68      82      83
..         ...         ...              ...         ...     ...     ...
51          57          51               51          65      80      80
51          59          51               48          67      79      79
17          56          54               36          66      73      77
52          53          56               49          62      83      80
51          54          52               57          62      79      79

[1600 rows x 6 columns]
```

In [5]:
```
data = (x_data - np.min(x_data)) / (np.max(x_data) - np.min(x_data)).values
data.head()
```

Out[5]:

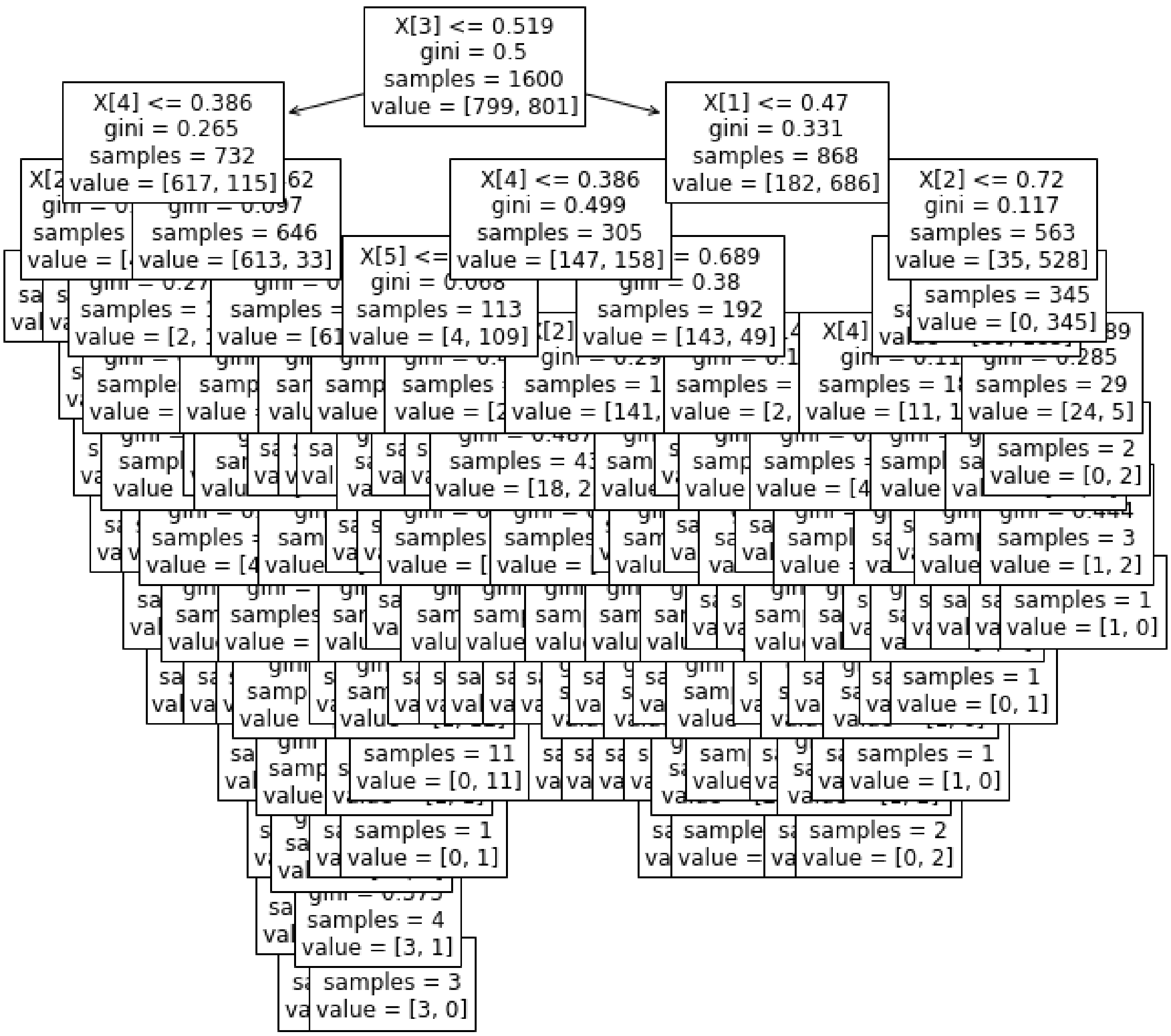
	CHORD_ROOT	CHORD_TYPE	CHORD_STRUCTURE	NOTE_NAMES	chord1	chord2
37	0.310345	0.212121	0.378788	0.509434	0.228571	0.200000
58	0.482759	0.575758	0.818182	0.547170	0.571429	0.885714
42	0.310345	0.545455	0.454545	0.509434	0.371429	0.428571
37	0.379310	0.515152	0.424242	0.471698	0.285714	0.314286
64	0.413793	0.696970	0.727273	0.603774	0.571429	0.571429

In [6]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(data,y,test_size = 0.2,ran
dom_state=150)
print("x_train: ",x_train.shape)
print("x_test: ",x_test.shape)
print("y_train: ",y_train.shape)
print("y_test: ",y_test.shape)
```

```
x_train:  (1280, 6)
x_test:  (320, 6)
y_train:  (1280,)
y_test:  (320,)
```

In [7]:

```
# Import Decision Tree Classifier
from sklearn.tree import DecisionTreeClassifier
from sklearn import metrics
from sklearn import preprocessing
from sklearn.metrics import accuracy_score
clf = DecisionTreeClassifier()
clf = clf.fit(x_train,y_train)
from sklearn import tree
plt.figure(figsize=(10,10))
temp = tree.plot_tree(clf.fit(data,y), fontsize=12)
plt.show()
```



In [8]:

```
#knn
```

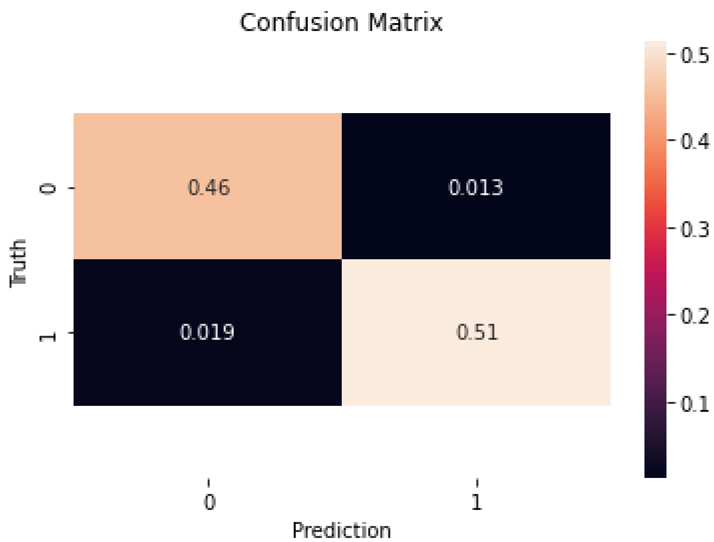
In [9]:

```
from sklearn.neighbors import KNeighborsClassifier
K = 5
knn = KNeighborsClassifier(n_neighbors=K)
knn.fit(x_train, y_train.ravel())
y_pred=knn.predict(x_test)

print("When K = {} neighnors , KNN test accuracy: {}".format(K, knn.score(x_te
st, y_test)))
print("When K = {} neighnors , KNN train accuracy: {}".format(K, knn.score(x_t
rain, y_train)))

ran = np.arange(1,30)
train_list = []
test_list = []
for i,each in enumerate(ran):
    knn = KNeighborsClassifier(n_neighbors=each)
    knn.fit(x_train, y_train.ravel())
    test_list.append(knn.score(x_test, y_test))
    train_list.append(knn.score(x_train, y_train))


print("Best test score is {} , K = {}".format(np.max(test_list), test_list.ind
ex(np.max(test_list))+1))
print("Best train score is {} , K = {}".format(np.max(train_list), train_list.
index(np.max(train_list))+1))
```

```
When K = 5 neighnors , KNN test accuracy: 0.96875
When K = 5 neighnors , KNN train accuracy: 0.9875
Best test score is 0.971875 , K = 16
Best train score is 1.0 , K = 1
```

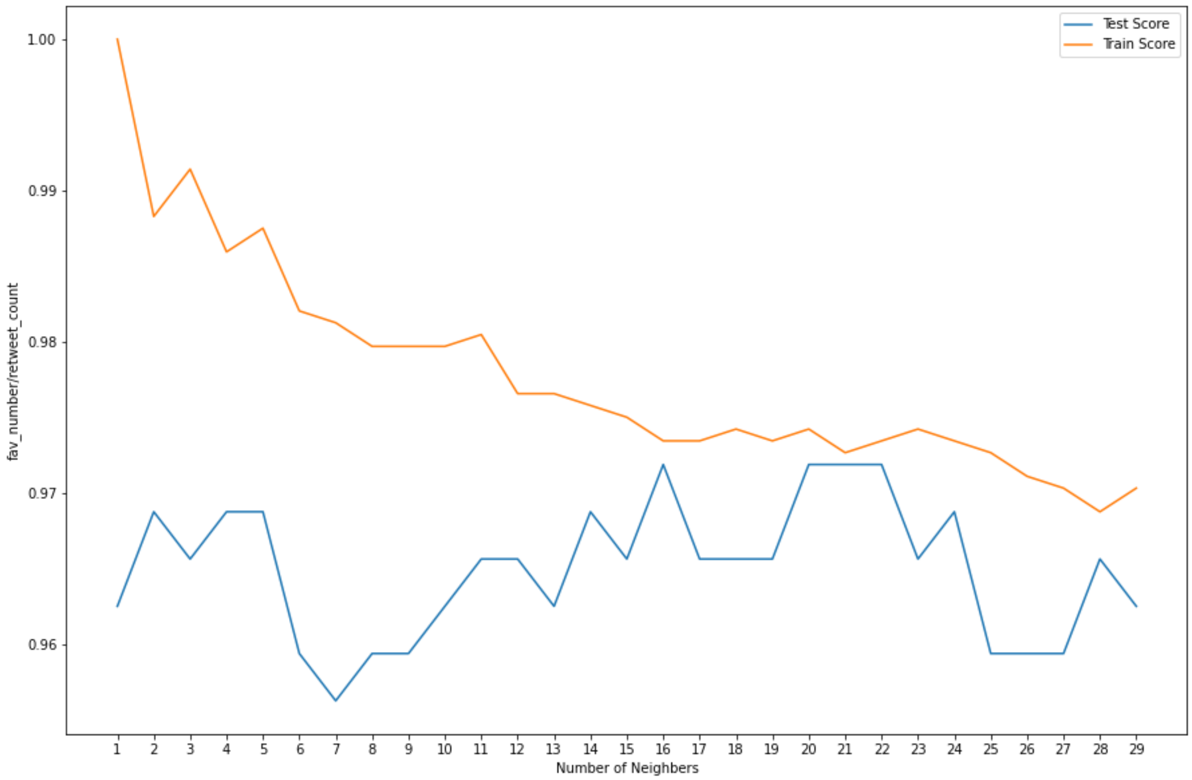
In [10]:

```
from sklearn.metrics import confusion_matrix as cm
cm(y_test, y_pred)
ax=sns.heatmap(cm(y_test, y_pred)/sum(sum(cm(y_test, y_pred))), annot=True)
b, t=ax.get_ylim()
ax.set_ylim(b+.5, t-.5)
plt.title('Confusion Matrix')
plt.ylabel('Truth')
plt.xlabel('Prediction')
plt.show();
```

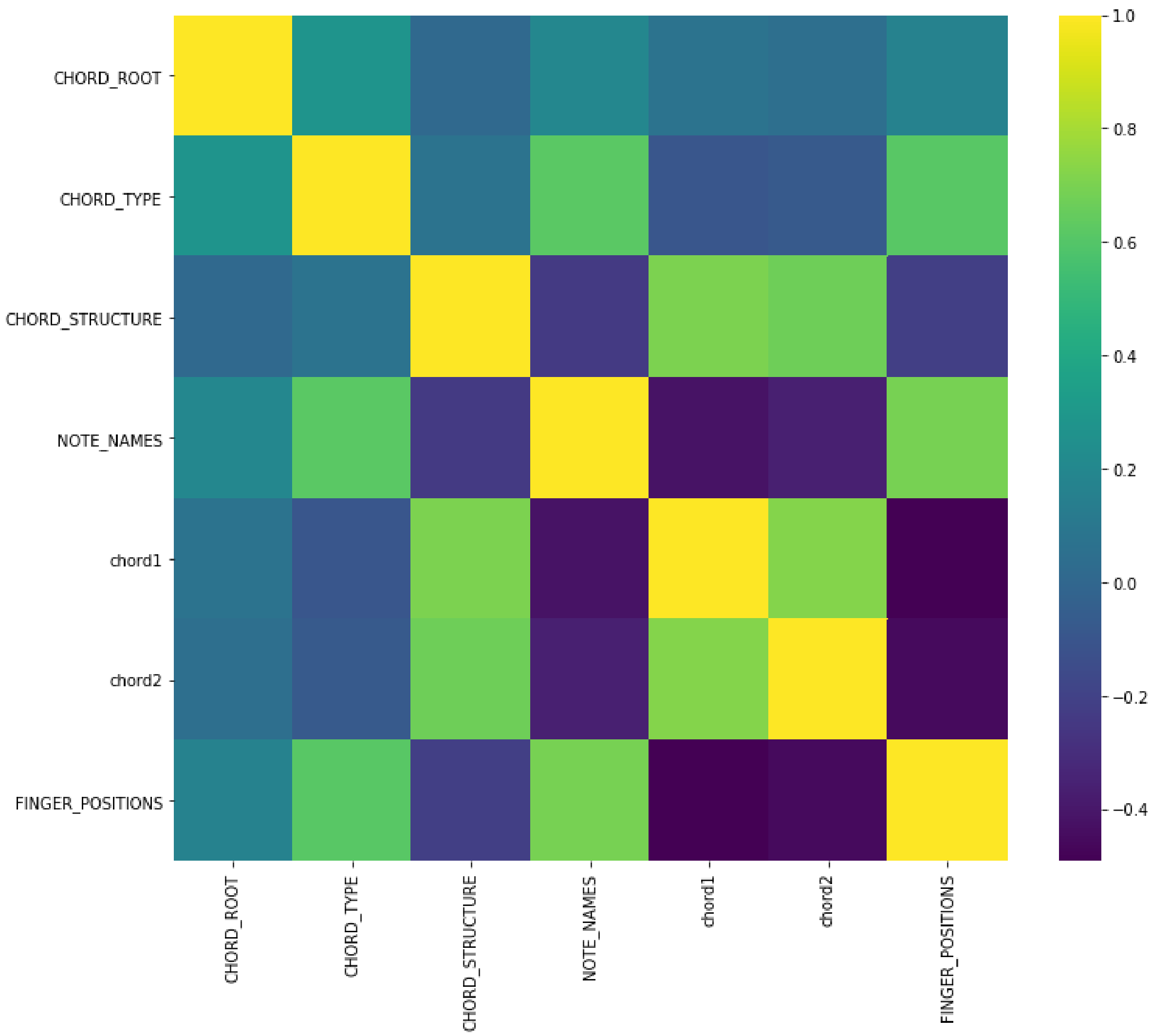


In [11]:

```
plt.figure(figsize=[15,10])
plt.plot(ran,test_list,label='Test Score')
plt.plot(ran,train_list,label = 'Train Score')
plt.xlabel('Number of Neighbers')
plt.ylabel('fav_number/retweet_count')
plt.xticks(ran)
plt.legend()
plt.show()
```



In [12]:
```
plt.figure(figsize=(12,10))
sns.heatmap(chord.corr(), cmap='viridis');
```



In [13]:
```
#mlp
```

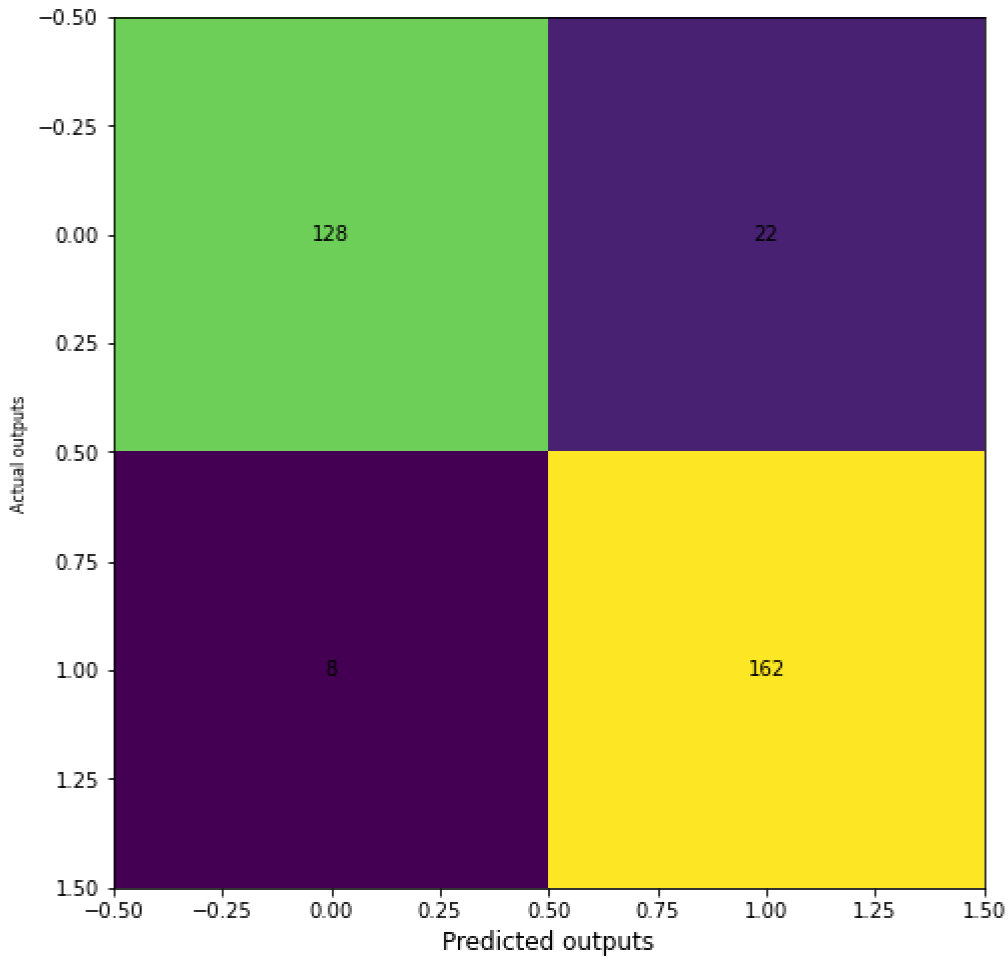
In [14]:
```
from sklearn.linear_model import Perceptron
clf = Perceptron(tol=1e-3, random_state=0)
clf.fit(x_train, y_train)
y_pred = clf.predict(x_test)
```

In [15]:

```
from sklearn.metrics import classification_report
print(classification_report(y_test, clf.predict(x_test)))
print('Accuracy of logistic regression classifier on test set: {:.2f}'.format(
clf.score(x_test, y_test)))
```

```
              precision    recall  f1-score   support

          -1       0.94      0.85      0.90       150
           1       0.88      0.95      0.92       170

    accuracy                           0.91       320
   macro avg       0.91      0.90      0.91       320
weighted avg       0.91      0.91      0.91       320

Accuracy of logistic regression classifier on test set: 0.91
```

In [16]:
```
from sklearn.metrics import classification_report, confusion_matrix
cm = confusion_matrix(y_test, y_pred)
fig, ax = plt.subplots(figsize=(8, 8))
ax.imshow(cm)
ax.grid(False)
ax.set_xlabel('Predicted outputs', fontsize=12, color='black')
ax.set_ylabel('Actual outputs', fontsize=8, color='black')
for i in range(2):
    for j in range(2):
        ax.text(j, i, cm[i, j], ha='center', va='center', color='black')
plt.show()
```



In [17]:
```
# Naive Bayes
```

In [18]:
```
from sklearn.naive_bayes import GaussianNB
nb = GaussianNB()
nb.fit(x_train, y_train.ravel())
print("Naive Bayes test accuracy: ", nb.score(x_test, y_test))
```

```
Naive Bayes test accuracy:  0.91875
```

In [19]:
```
#logistic_regression
```

In [20]:
```
from sklearn.linear_model import LogisticRegression
lr = LogisticRegression(solver='lbfgs')
lr.fit(x_train, y_train.ravel())
y_pred = lr.predict(x_test)
```

In [21]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test, lr.predict(x_test)))
print('Accuracy of logistic regression classifier on test set: {:.2f}'.format(
lr.score(x_test, y_test)))
```

```
              precision    recall  f1-score   support

          -1       0.91      0.89      0.90       150
           1       0.90      0.92      0.91       170

    accuracy                           0.91       320
   macro avg       0.91      0.91      0.91       320
weighted avg       0.91      0.91      0.91       320

Accuracy of logistic regression classifier on test set: 0.91
```

In [22]:
```
from sklearn.linear_model import LogisticRegression
lr = LogisticRegression(solver='lbfgs')
lr.fit(x_train, y_train.ravel())
y_pred = lr.predict(x_test)
```

In [23]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test, lr.predict(x_test)))
print('Accuracy of logistic regression classifier on test set: {:.2f}'.format(
lr.score(x_test, y_test)))
```

```
              precision    recall  f1-score   support

          -1       0.91      0.89      0.90       150
           1       0.90      0.92      0.91       170

    accuracy                           0.91       320
   macro avg       0.91      0.91      0.91       320
weighted avg       0.91      0.91      0.91       320

Accuracy of logistic regression classifier on test set: 0.91
```

In [24]:
```
from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
logit_roc_auc = roc_auc_score(y_test, lr.predict(x_test))
fpr, tpr, thresholds = roc_curve(y_test, lr.predict_proba(x_test)[:,1])
plt.figure()
plt.plot(fpr, tpr, label='Logistic Regression (area = %0.2f)' % logit_roc_auc)
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating divorce')
plt.legend(loc="lower right")
plt.savefig('Log_ROC')
plt.show()
```