MT18052_Quiz_3

November 8, 2019

```
In [135]: import numpy as np
          import pandas as pd
          from sklearn.model_selection import KFold
          from sklearn.model_selection import cross_val_score
          from sklearn.metrics import confusion_matrix, accuracy_score
          import warnings
          warnings.filterwarnings('ignore')
          import matplotlib.pyplot as plt
```

```
In [52]: data = pd.read_csv("./Telco_Data.csv")
```

```
In [3]: data.head()
```

```
Out[3]:    customerID  gender  SeniorCitizen Partner Dependents  tenure PhoneService  \
        0  7590-VHVEG  Female              0     Yes         No       1           No
        1  5575-GNVDE    Male              0      No         No      34          Yes
        2  3668-QPYBK    Male              0      No         No       2          Yes
        3  7795-CFOCW    Male              0      No         No      45           No
        4  9237-HQITU  Female              0      No         No       2          Yes

              MultipleLines InternetService OnlineSecurity  ... DeviceProtection  \
        0  No phone service             DSL             No  ...               No
        1                No             DSL            Yes  ...              Yes
        2                No             DSL            Yes  ...               No
        3  No phone service             DSL            Yes  ...              Yes
        4                No     Fiber optic             No  ...               No

          TechSupport StreamingTV StreamingMovies        Contract PaperlessBilling  \
        0          No          No              No  Month-to-month              Yes
        1          No          No              No        One year               No
        2          No          No              No  Month-to-month              Yes
        3         Yes          No              No        One year               No
        4          No          No              No  Month-to-month              Yes

                     PaymentMethod MonthlyCharges  TotalCharges Churn
        0           Electronic check          29.85         29.85    No
        1               Mailed check          56.95        1889.5    No
        2               Mailed check          53.85        108.15   Yes
```

```
        3  Bank transfer (automatic)          42.30       1840.75    No
        4           Electronic check          70.70        151.65   Yes

        [5 rows x 21 columns]
```

```
In [54]: # data = data.drop(columns=['customerID'])
```

```
In [55]: label = data.Churn
         data = data.drop(columns=['Churn'])
```

```
In [56]: for i in data.keys():
             print (i , " : ",len(set(data[i])))
```

```
gender  :  2
SeniorCitizen  :  2
Partner  :  2
Dependents  :  2
tenure  :  73
PhoneService  :  2
MultipleLines  :  3
InternetService  :  3
OnlineSecurity  :  3
OnlineBackup  :  3
DeviceProtection  :  3
TechSupport  :  3
StreamingTV  :  3
StreamingMovies  :  3
Contract  :  3
PaperlessBilling  :  2
PaymentMethod  :  4
MonthlyCharges  :  1585
TotalCharges  :  6531
```

```
In [6]: # y
```

```
In [7]: totalcharges = np.array(data.TotalCharges)
```

```
In [13]:
```

```
In [ ]:
```

```
In [11]: missing = []
         summ= 0.0
         for i in range(len(totalcharges)):
             try:
                 totalcharges[i] = float(totalcharges[i])
                 summ+=float(totalcharges[i])
             except:
                 missing.append(i)
```

```
In [12]: for i in missing:
             totalcharges[i] = summ/(len(totalcharges)-len(missing))

In [57]: totalcharges = list(map(float,totalcharges))

In [58]: data['TotalCharges'] = totalcharges

In [59]: data['MonthlyCharges'] = list(map(float,data['MonthlyCharges']))

In [17]: # data.to_csv('Telco_Data_2.csv',index=False)

In [30]: data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 20 columns):
gender              7043 non-null object
SeniorCitizen       7043 non-null int64
Partner             7043 non-null object
Dependents          7043 non-null object
tenure              7043 non-null int64
PhoneService        7043 non-null object
MultipleLines       7043 non-null object
InternetService     7043 non-null object
OnlineSecurity      7043 non-null object
OnlineBackup        7043 non-null object
DeviceProtection    7043 non-null object
TechSupport         7043 non-null object
StreamingTV         7043 non-null object
StreamingMovies     7043 non-null object
Contract            7043 non-null object
PaperlessBilling    7043 non-null object
PaymentMethod       7043 non-null object
MonthlyCharges      7043 non-null float64
TotalCharges        7043 non-null float64
Churn               7043 non-null object
dtypes: float64(2), int64(2), object(16)
memory usage: 1.1+ MB


In [28]: # datatypes[0]

In [61]: keys = list(data.keys())

In [62]: encodingcols = []

In [63]: for i in keys:
             if (type(data[i][0]) == str):
                 encodingcols.append(i)
```

```
In [64]: keys

Out[64]: ['gender',
          'SeniorCitizen',
          'Partner',
          'Dependents',
          'tenure',
          'PhoneService',
          'MultipleLines',
          'InternetService',
          'OnlineSecurity',
          'OnlineBackup',
          'DeviceProtection',
          'TechSupport',
          'StreamingTV',
          'StreamingMovies',
          'Contract',
          'PaperlessBilling',
          'PaymentMethod',
          'MonthlyCharges',
          'TotalCharges']

In [65]: encodingcols

Out[65]: ['gender',
          'Partner',
          'Dependents',
          'PhoneService',
          'MultipleLines',
          'InternetService',
          'OnlineSecurity',
          'OnlineBackup',
          'DeviceProtection',
          'TechSupport',
          'StreamingTV',
          'StreamingMovies',
          'Contract',
          'PaperlessBilling',
          'PaymentMethod']

In [66]: from sklearn.preprocessing import LabelEncoder
         labelencoder_X = LabelEncoder()
         for i in encodingcols:
             data[i]     = labelencoder_X.fit_transform(data[i])

In [67]: data.head(15)

Out[67]:     gender  SeniorCitizen  Partner  Dependents  tenure  PhoneService  \
         0        0              0        1           0       1             0
```

1	1	0	0	0	34	1
2	1	0	0	0	2	1
3	1	0	0	0	45	0
4	0	0	0	0	2	1
5	0	0	0	0	8	1
6	1	0	0	1	22	1
7	0	0	0	0	10	0
8	0	0	1	0	28	1
9	1	0	0	1	62	1
10	1	0	1	1	13	1
11	1	0	0	0	16	1
12	1	0	1	0	58	1
13	1	0	0	0	49	1
14	1	0	0	0	25	1

	MultipleLines	InternetService	OnlineSecurity	OnlineBackup	\
0	1	0	0	2	
1	0	0	2	0	
2	0	0	2	2	
3	1	0	2	0	
4	0	1	0	0	
5	2	1	0	0	
6	2	1	0	2	
7	1	0	2	0	
8	2	1	0	0	
9	0	0	2	2	
10	0	0	2	0	
11	0	2	1	1	
12	2	1	0	0	
13	2	1	0	2	
14	0	1	2	0	

	DeviceProtection	TechSupport	StreamingTV	StreamingMovies	Contract	\
0	0	0	0	0	0	
1	2	0	0	0	1	
2	0	0	0	0	0	
3	2	2	0	0	1	
4	0	0	0	0	0	
5	2	0	2	2	0	
6	0	0	2	0	0	
7	0	0	0	0	0	
8	2	2	2	2	0	
9	0	0	0	0	1	
10	0	0	0	0	0	
11	1	1	1	1	2	
12	2	0	2	2	1	
13	2	0	2	2	0	
14	2	2	2	2	0	

	PaperlessBilling	PaymentMethod	MonthlyCharges	TotalCharges
0	1	2	29.85	29.85
1	0	3	56.95	1889.50
2	1	3	53.85	108.15
3	0	0	42.30	1840.75
4	1	2	70.70	151.65
5	1	2	99.65	820.50
6	1	1	89.10	1949.40
7	0	3	29.75	301.90
8	1	2	104.80	3046.05
9	0	0	56.15	3487.95
10	1	3	49.95	587.45
11	0	1	18.95	326.80
12	0	1	100.35	5681.10
13	1	0	103.70	5036.30
14	1	2	105.50	2686.05

In [72]:
```
from sklearn.metrics import classification_report
def reports(truelab,predlabels):
    print(confusion_matrix(truelab, predlabels))
    print("Accuracy ",round(accuracy_score(truelab, predlabels),2)*100)

    print (classification_report(y_pred=predlabels,y_true=truelab))
    return ( round(accuracy_score(truelab, predlabels),2)*100)
```

In [102]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(data, label, test_size = 0.3, ra
```

In [103]:
```
from sklearn.preprocessing import StandardScaler
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)
X_test = sc_X.transform(X_test)
```

1 GNB

In [104]:
```
from sklearn.naive_bayes import GaussianNB
gaussiannb= GaussianNB()
gaussiannb.fit(X_train, y_train)
gaussiannbpred = gaussiannb.predict(X_test)
probs = gaussiannb.predict(X_test)

GAUSIAN = reports(y_test,gaussiannbpred)
```

```
[[1190  356]
 [ 160  407]]
Accuracy  76.0
              precision    recall  f1-score   support
```

```
          No       0.88      0.77      0.82      1546
         Yes       0.53      0.72      0.61       567

    accuracy                           0.76      2113
   macro avg       0.71      0.74      0.72      2113
weighted avg       0.79      0.76      0.77      2113
```

```
In [111]: from sklearn.metrics import cohen_kappa_score
          from sklearn.utils import resample
          from scipy.sparse import coo_matrix
          import copy
          import random
```

```
In [ ]:
```

2 Boot Strap

```
In [179]: from imblearn.over_sampling import SMOTE
          sm = SMOTE(random_state=42)
          X_train,y_train = sm.fit_sample(X_train,y_train)
```

```
In [180]: X = copy.deepcopy(X_train)
          Y = copy.deepcopy(y_train)
```

```
In [181]: X_sparse = coo_matrix(X_train)
```

```
In [182]: epoch = 50
```

```
In [183]: # X_train
```

```
In [184]: kappascores = []
          index = np.arange(len(X_train))
          for i in range(epoch):
              temp = np.random.choice(index,size=100,replace=True)
              gaussiannb= GaussianNB()
          #     print (temp)
              train_2 = []
              y_train_2 = y_train[temp]
              for col in range(len(X_train.T)):
                  train_2.append(X_train.T[col][temp])

              train_2 = np.array(train_2).T

              gaussiannb.fit(train_2, y_train_2)
              gaussiannbpred = gaussiannb.predict(X_test)
```

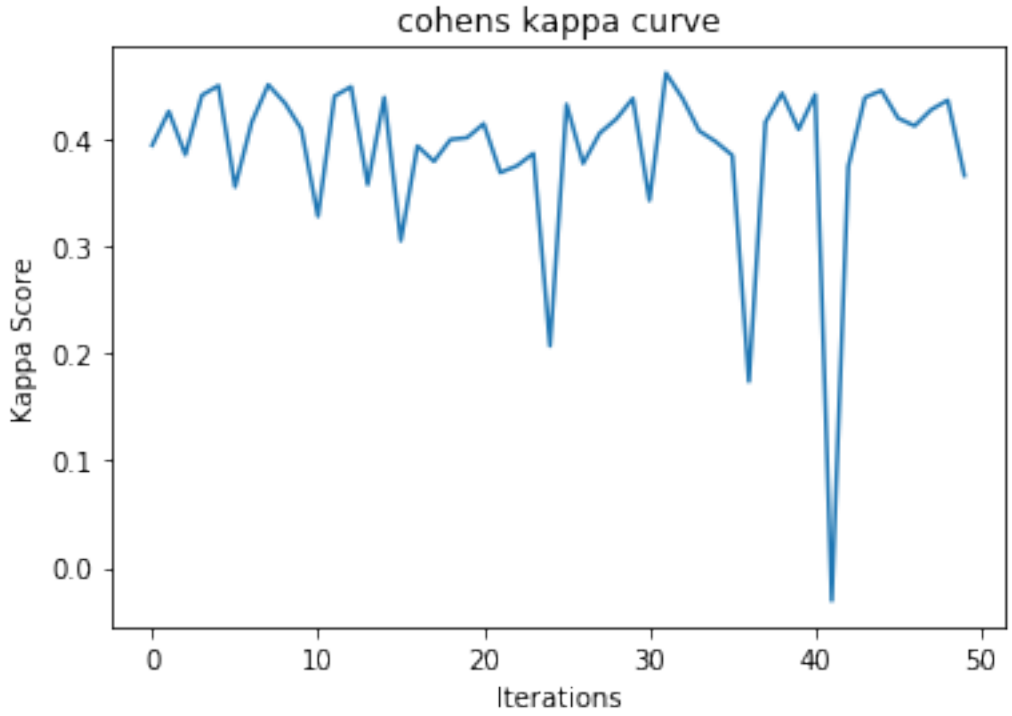
```
            probs = gaussiannb.predict(X_test)

        #     GAUSIAN = reports(y_test,gaussiannbpred)
            kappascores.append(cohen_kappa_score(y_test,gaussiannbpred))
```

In [185]:
```
# len(X_train.T[0][temp])
```

In [186]:
```
ZZ = np.arange(len(kappascores))
```

In [187]:
```
plt.plot(ZZ,kappascores)
plt.xlabel("Iterations")
plt.ylabel("Kappa Score")
plt.title("cohens kappa curve")
```

Out[187]: Text(0.5, 1.0, 'cohens kappa curve')



In [ ]: