K Nearest Neighbors with Python

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1 K Nearest Neighbors with Python

You've been given a classified data set from a company! They've hidden the feature column names but have given you the data and the target classes.

We'll try to use KNN to create a model that directly predicts a class for a new data point based off of the features.

Let's grab it and use it!

1.1 Import Libraries

```
In [1]: import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        import numpy as np
        %matplotlib inline
```

1.2 Get the Data

Set index_col=0 to use the first column as the index.

```
In [2]: df = pd.read_csv("Classified Data",index_col=0)
```

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

Out[3]:

	WTT	PTI	EQW	SBI	LQE	QWG	FDJ	PJF	HQE	NXJ	TARGET CLASS
0	0.913917	1.162073	0.567946	0.755464	0.780862	0.352608	0.759697	0.643798	0.879422	1.231409	1
1	0.635632	1.003722	0.535342	0.825645	0.924109	0.648450	0.675334	1.013546	0.621552	1.492702	0
2	0.721360	1.201493	0.921990	0.855595	1.526629	0.720781	1.626351	1.154483	0.957877	1.285597	0
3	1.234204	1.386726	0.653046	0.825624	1.142504	0.875128	1.409708	1.380003	1.522692	1.153093	1
4	1.279491	0.949750	0.627280	0.668976	1.232537	0.703727	1.115596	0.646691	1.463812	1.419167	1

1.3 Standardize the Variables

```
In [4]: from sklearn.preprocessing import StandardScaler
```

```
In [5]: scaler = StandardScaler()
```

```
In [6]: scaler.fit(df.drop('TARGET CLASS',axis=1))
```

```
Out[6]: StandardScaler(copy=True, with_mean=True, with_std=True)

In [7]: scaled_features = scaler.transform(df.drop('TARGET CLASS',axis=1))

In [8]: df_feat = pd.DataFrame(scaled_features,columns=df.columns[:-1])
        df_feat.head()

Out[8]:         WTT       PTI       EQW       SBI       LQE       QWG       FDJ  \
        0 -0.123542  0.185907 -0.913431  0.319629 -1.033637 -2.308375 -0.798951
        1 -1.084836 -0.430348 -1.025313  0.625388 -0.444847 -1.152706 -1.129797
        2 -0.788702  0.339318  0.301511  0.755873  2.031693 -0.870156  2.599818
        3  0.982841  1.060193 -0.621399  0.625299  0.452820 -0.267220  1.750208
        4  1.139275 -0.640392 -0.709819 -0.057175  0.822886 -0.936773  0.596782

                PJF       HQE       NXJ
        0 -1.482368 -0.949719 -0.643314
        1 -0.202240 -1.828051  0.636759
        2  0.285707 -0.682494 -0.377850
        3  1.066491  1.241325 -1.026987
        4 -1.472352  1.040772  0.276510
```

1.4 Train Test Split

```
In [9]: from sklearn.cross_validation import train_test_split

In [21]: X=df_feat

         y=df['TARGET CLASS']

         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.30, random_state =101)
```

1.5 Other Alternitive

```
In [10]: X_train, X_test, y_train, y_test = train_test_split(scaled_features,df['TARGET CLASS'],
                                                             test_size=0.30)
```

1.6 Using KNN

Remember that we are trying to come up with a model to predict whether someone will TARGET CLASS or not. We'll start with k=1.

```
In [11]: from sklearn.neighbors import KNeighborsClassifier

In [12]: knn = KNeighborsClassifier(n_neighbors=1)

In [13]: knn.fit(X_train,y_train)

Out[13]: KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                    metric_params=None, n_jobs=1, n_neighbors=1, p=2,
                    weights='uniform')

In [14]: pred = knn.predict(X_test)
```

1.7 Predictions and Evaluations

Let's evaluate our KNN model!

```
In [15]: from sklearn.metrics import classification_report,confusion_matrix

In [16]: print(confusion_matrix(y_test,pred))

[[127  12]
 [ 12 149]]

In [17]: print(classification_report(y_test,pred))

precision    recall  f1-score   support

          0       0.91      0.91      0.91       139
          1       0.93      0.93      0.93       161

avg / total       0.92      0.92      0.92       300
```

1.8 Choosing a K Value

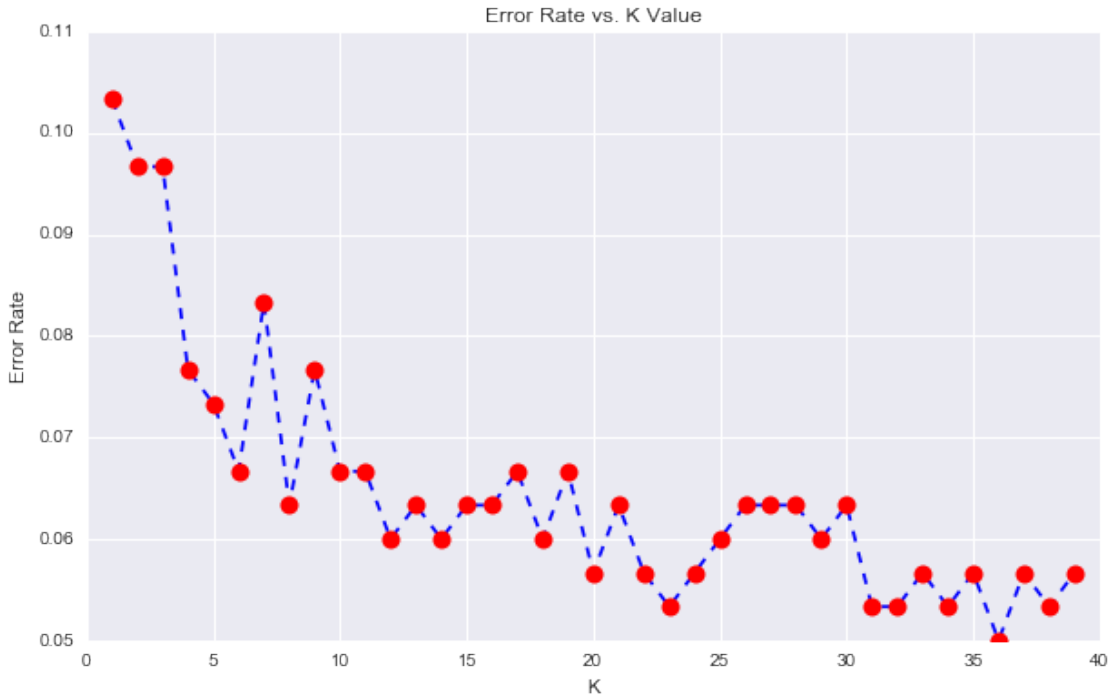
```
In [98]: error_rate = []

         for i in range(1,40):

             knn = KNeighborsClassifier(n_neighbors=i)
             knn.fit(X_train,y_train)
             pred_i = knn.predict(X_test)
             error_rate.append(np.mean(pred_i != y_test))

In [99]: plt.figure(figsize=(10,6))
         plt.plot(range(1,40),error_rate,color='blue', linestyle='dashed', marker='o',
                  markerfacecolor='red', markersize=10)
         plt.title('Error Rate vs. K Value')
         plt.xlabel('K')
         plt.ylabel('Error Rate')

Out[99]: <matplotlib.text.Text at 0x11ca82ba8>
```



At K value of 23 we notice a lower error rate. Rerun KNN with k = 23

```
In [100]: knn = KNeighborsClassifier(n_neighbors=1)

          knn.fit(X_train,y_train)
          pred = knn.predict(X_test)

          print('WITH K=1')
          print('\n')
          print(confusion_matrix(y_test,pred))
          print('\n')
          print(classification_report(y_test,pred))
```

```
WITH K=1


[[125  18]
 [ 13 144]]


             precision    recall  f1-score   support

          0       0.91      0.87      0.89       143
          1       0.89      0.92      0.90       157

avg / total       0.90      0.90      0.90       300
```

```
In [22]: knn = KNeighborsClassifier(n_neighbors=17)

         knn.fit(X_train,y_train)
```

```
pred = knn.predict(X_test)

print('WITH K=1')
print('\n')
print(confusion_matrix(y_test,pred))
print('\n')
print(classification_report(y_test,pred))
```

```
WITH K=1


[[153   6]
 [  9 132]]


             precision    recall  f1-score   support

          0       0.94      0.96      0.95       159
          1       0.96      0.94      0.95       141

avg / total       0.95      0.95      0.95       300
```

In [23]:
```
# NOW WITH K=23
knn = KNeighborsClassifier(n_neighbors=23)

knn.fit(X_train,y_train)
pred = knn.predict(X_test)

print('WITH K=23')
print('\n')
print(confusion_matrix(y_test,pred))
print('\n')
print(classification_report(y_test,pred))
```

```
WITH K=23


[[150   9]
 [ 10 131]]


             precision    recall  f1-score   support

          0       0.94      0.94      0.94       159
          1       0.94      0.93      0.93       141

avg / total       0.94      0.94      0.94       300
```