K Nearest Neighbors Project

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1 K Nearest Neighbors Project

Welcome to the KNN Project! This will be a simple project very similar to the lecture, except you'll be given another data set. Go ahead and just follow the directions below. ## Import Libraries **Import pandas,seaborn, and the usual libraries.**

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

1.1 Get the Data

** Read the 'KNN_Project_Data csv file into a dataframe **

```
In [2]: df = pd.read_csv('KNN_Project_Data')
```

Check the head of the dataframe.

```
In [23]: df.head()

Out[23]:           XVPM         GWYH         TRAT        TLLZ         IGGA  \
         0  1636.670614   817.988525  2565.995189  358.347163   550.417491
         1  1013.402760   577.587332  2644.141273  280.428203  1161.873391
         2  1300.035501   820.518697  2025.854469  525.562292   922.206261
         3  1059.347542  1066.866418   612.000041  480.827789   419.467495
         4  1018.340526  1313.679056   950.622661  724.742174   843.065903

                   HYKR         EDFS        GUUB         MGJM         JHZC  \
         0  1618.870897  2147.641254  330.727893  1494.878631   845.136088
         1  2084.107872   853.404981  447.157619  1193.032521   861.081809
         2  2552.355407   818.676686  845.491492  1968.367513  1647.186291
         3   685.666983   852.867810  341.664784  1154.391368  1450.935357
         4  1370.554164   905.469453  658.118202   539.459350  1899.850792

            TARGET CLASS
         0             0
```

1	1
2	1
3	0
4	0

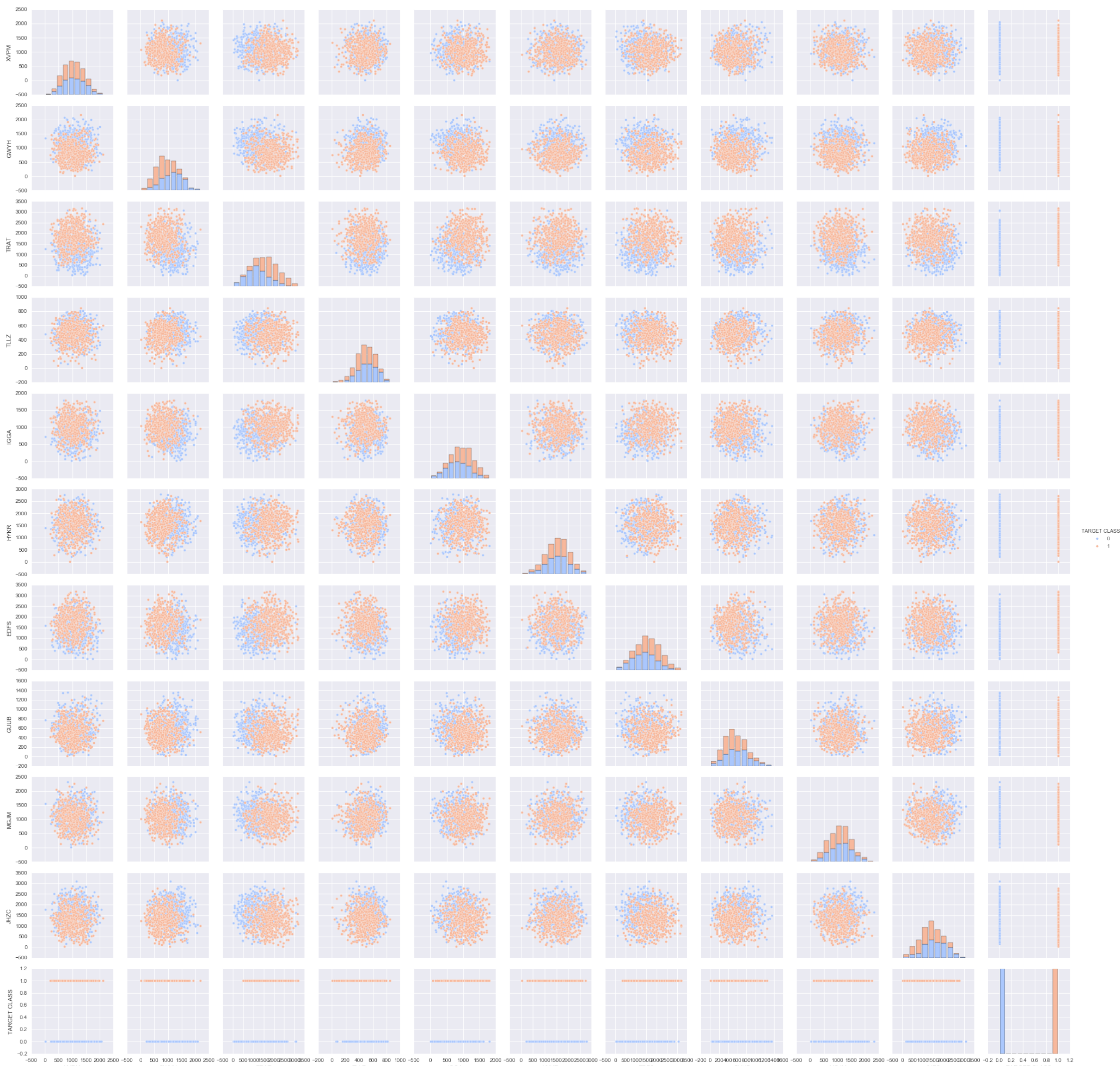
2 EDA

Since this data is artificial, we'll just do a large pairplot with seaborn.

Use seaborn on the dataframe to create a pairplot with the hue indicated by the TARGET CLASS column.

In [4]:
```
# THIS IS GOING TO BE A VERY LARGE PLOT
sns.pairplot(df,hue='TARGET CLASS',palette='coolwarm')
```

Out[4]: <seaborn.axisgrid.PairGrid at 0x1197505f8>



3 Standardize the Variables

Time to standardize the variables.

** Import StandardScaler from Scikit learn.**

In [5]:
```python
from sklearn.preprocessing import StandardScaler
```

** Create a StandardScaler() object called scaler.**

In [6]:
```python
scaler = StandardScaler()
```

** Fit scaler to the features.**

In [7]:
```python
scaler.fit(df.drop('TARGET CLASS',axis=1))
```

Out[7]:
```
StandardScaler(copy=True, with_mean=True, with_std=True)
```

Use the .transform() method to transform the features to a scaled version.

In [8]:
```python
scaled_features = scaler.transform(df.drop('TARGET CLASS',axis=1))
```

Convert the scaled features to a dataframe and check the head of this dataframe to make sure the scaling worked.

In [9]:
```python
df_feat = pd.DataFrame(scaled_features,columns=df.columns[:-1])
df_feat.head()
```

Out[9]:
```
       XVPM      GWYH      TRAT      TLLZ      IGGA      HYKR      EDFS  \
0  1.568522 -0.443435  1.619808 -0.958255 -1.128481  0.138336  0.980493
1 -0.112376 -1.056574  1.741918 -1.504220  0.640009  1.081552 -1.182663
2  0.660647 -0.436981  0.775793  0.213394 -0.053171  2.030872 -1.240707
3  0.011533  0.191324 -1.433473 -0.100053 -1.507223 -1.753632 -1.183561
4 -0.099059  0.820815 -0.904346  1.609015 -0.282065 -0.365099 -1.095644

       GUUB      MGJM      JHZC
0 -0.932794  1.008313 -1.069627
1 -0.461864  0.258321 -1.041546
2  1.149298  2.184784  0.342811
3 -0.888557  0.162310 -0.002793
4  0.391419 -1.365603  0.787762
```

4 Train Test Split

Use train_test_split to split your data into a training set and a testing set.

In [10]:
```python
from sklearn.model_selection import train_test_split
```

In [11]:
```python
X_train, X_test, y_train, y_test = train_test_split(scaled_features,df['TARGET CLASS'
                                                    test_size=0.30)
```

5 Using KNN

Import KNeighborsClassifier from scikit learn.

```
In [12]: from sklearn.neighbors import KNeighborsClassifier
```

Create a KNN model instance with n_neighbors=1

```
In [13]: knn = KNeighborsClassifier(n_neighbors=1)
```

Fit this KNN model to the training data.

```
In [14]: knn.fit(X_train,y_train)

Out[14]: KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                    metric_params=None, n_jobs=1, n_neighbors=1, p=2,
                    weights='uniform')
```

6 Predictions and Evaluations

Let's evaluate our KNN model!
Use the predict method to predict values using your KNN model and X_test.

```
In [24]: pred = knn.predict(X_test)
```

** Create a confusion matrix and classification report.**

```
In [16]: from sklearn.metrics import classification_report,confusion_matrix

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

[[112  40]
 [ 34 114]]


In [18]: print(classification_report(y_test,pred))

             precision    recall  f1-score   support

          0       0.77      0.74      0.75       152
          1       0.74      0.77      0.75       148

avg / total       0.75      0.75      0.75       300
```

7 Choosing a K Value

Let's go ahead and use the elbow method to pick a good K Value!

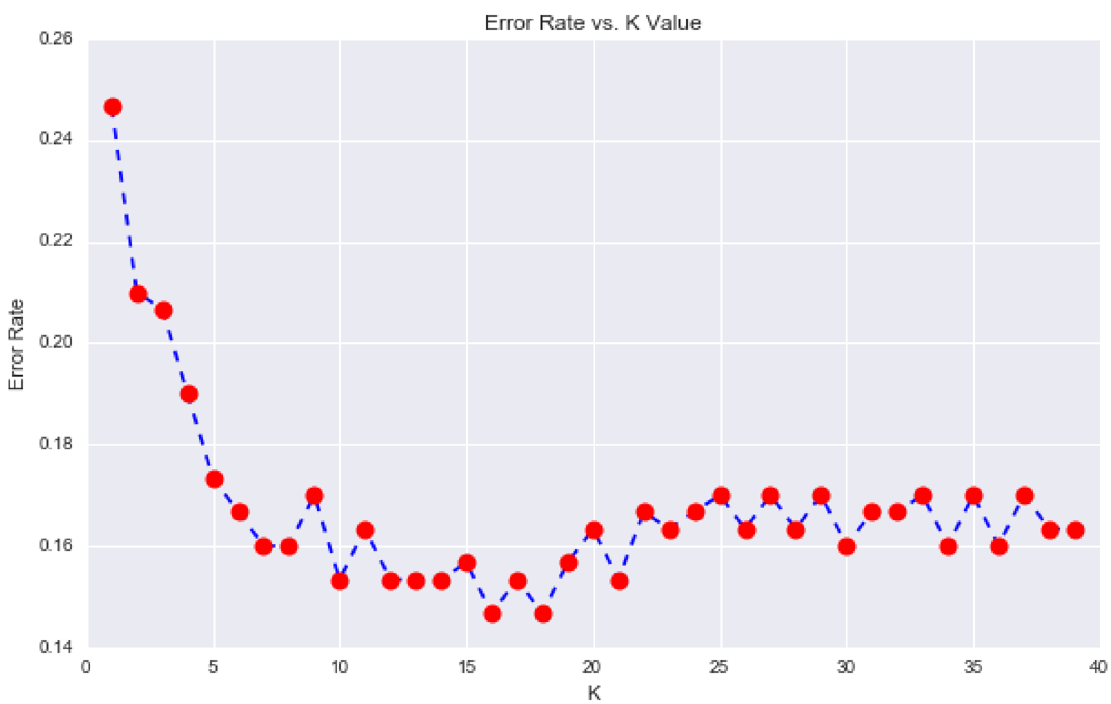
** Create a for loop that trains various KNN models with different k values, then keep track of the error_rate for each of these models with a list. Refer to the lecture if you are confused on this step.**

In [25]:
```
error_rate = []

# Will take some time
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))
```

Now create the following plot using the information from your for loop.

In [20]:
```
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[20]:
```
<matplotlib.text.Text at 0x11cbdb710>
```



7.1 Retrain with new K Value

Retrain your model with the best K value (up to you to decide what you want) and re-do the classification report and the confusion matrix.

```
In [21]: # NOW WITH K=30
         knn = KNeighborsClassifier(n_neighbors=30)

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

         print('WITH K=30')
         print('\n')
         print(confusion_matrix(y_test,pred))
         print('\n')
         print(classification_report(y_test,pred))
```

```
WITH K=30


[[127  25]
 [ 23 125]]


             precision    recall  f1-score   support

          0       0.85      0.84      0.84       152
          1       0.83      0.84      0.84       148

avg / total       0.84      0.84      0.84       300
```

8 Great Job!