Predicting IBM Employee Attrition Python Jupyter Notebook

Part 3 - Build a k-Nearest Neighbors Model

Import numpy and pandas.

In [1]:
```
import numpy as np
import pandas as pd
```

Import data visualization libraries and set %matplotlib inline.

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

Import churn modeling pickle file into a Pandas dataframe called churn_model2.

In [3]:
```
churn_model2 = pd.read_pickle('../data/churn_modeling_data.pickle')
```

Filter out numeric features of Age, DistanceFromHome, and MonthlyIncome, and scale them.

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

In [5]:
```
scale_feat = ['Age', 'DistanceFromHome', 'MonthlyIncome']
non_scale_feat = ['Churn', 'EnvironmentSatisfaction', 'JobInvolvement', 'StockOpt
                  'BusTravLevel', 'Overtime_Dum']
churn_model2_scale_feat = churn_model2[scale_feat]
churn_model2_non_scale_feat = churn_model2[non_scale_feat]
X_scaled = preprocessing.scale(churn_model2_scale_feat)
```

Generate dataframe out of scaled numeric features.

In [6]:
```
X_scaled_df = pd.DataFrame(X_scaled)
X_scaled_df.columns = ['Age', 'DistanceFromHome', 'MonthlyIncome']
X_scaled_df.head()
```

Out[6]:

	Age	DistanceFromHome	MonthlyIncome
0	0.446350	-1.010909	-0.108350
1	1.322365	-0.147150	-0.291719
2	0.008343	-0.887515	-0.937654
3	-0.429664	-0.764121	-0.763634
4	-1.086676	-0.887515	-0.644858

Append remainder of churn_model2 dataframe with scaled numeric feature columns.

In [7]:
```
churn_model2_scaled = pd.concat([churn_model2_non_scale_feat, X_scaled_df], axis=
churn_model2_scaled.head()
```

Out[7]:

	Churn	EnvironmentSatisfaction	JobInvolvement	StockOptionLevel	Sales_Rep	Single	BusTravL
0	1	1	2	0	0	1	
1	0	2	1	1	0	0	
2	1	3	1	0	0	1	
3	0	3	2	0	0	0	
4	0	0	2	1	0	0	

Define X and y to split data into training and test sets, and construct k-nearest neighbors model.

In [8]:
```
X = churn_model2_scaled.drop(['Churn'], axis=1)
y = churn_model2_scaled['Churn']
```

Split scaled churn / attrition modeling data into training and test sets.

In [9]:
```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn import metrics
```

In [10]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, random_s
```

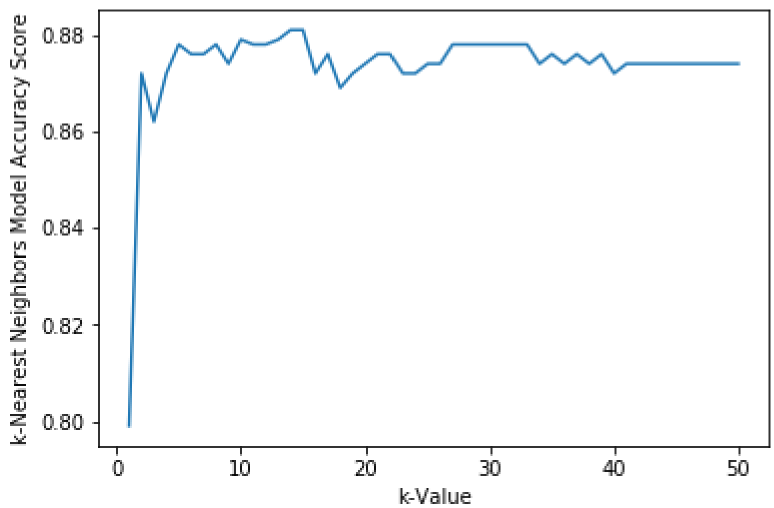
Fit a k-nearest neighbors model on training data set, make predictions on test data set, and calculate accuracy scores for k ranging from 1 to 50.

In [11]:
```
k_range = range(1, 51)

acc_scores1 = []

for k in k_range:
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)
    y_pred = knn.predict(X_test)
    acc_scores1.append(metrics.accuracy_score(y_test, y_pred).round(3))
```

Plot model accuracy scores against k-values.

In [12]:
```
plt.plot(k_range, acc_scores1)
plt.xlabel('k-Value')
plt.ylabel('k-Nearest Neighbors Model Accuracy Score')
```

Out[12]:
```
Text(0,0.5,'k-Nearest Neighbors Model Accuracy Score')
```



Generate dataframe of k-values and their respective accuracy scores, and determine which k-value has the highest accuracy score.

In [13]:
```
knn_acc_scores1 = pd.DataFrame({'k-Value':k_range, 'AccuracyScore':acc_scores1}).
knn_acc_scores1.iloc[7, :]
```

Out[13]:
```
AccuracyScore    0.878
Name: 8, dtype: float64
```

- The optimal k-value of 8 has the highest accuracy score of 0.878.

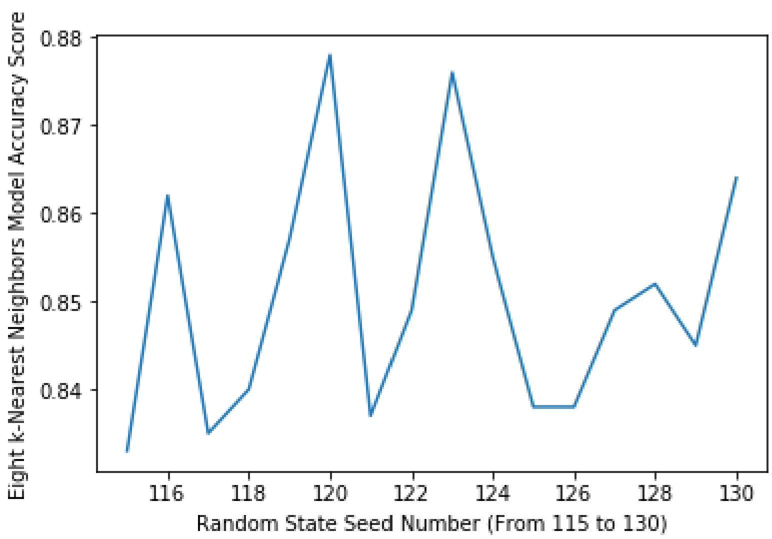
Check for consistency in 8 k-nearest neighbor model accuracy score for random state seed numbers from 115 to 130.

In [14]:
```
seed_range = range(115, 131)

acc_scores2 = []

for seed in seed_range:
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, rand
    knn = KNeighborsClassifier(n_neighbors=8)
    knn.fit(X_train, y_train)
    y_pred = knn.predict(X_test)
    acc_scores2.append(metrics.accuracy_score(y_test, y_pred).round(3))
```

Plot 8 k-nearest neighbor model accuracy scores against random state seed numbers.

In [15]:
```
plt.plot(seed_range, acc_scores2)
plt.xlabel('Random State Seed Number (From 115 to 130)')
plt.ylabel('Eight k-Nearest Neighbors Model Accuracy Score')
```

Out[15]:
```
Text(0,0.5,'Eight k-Nearest Neighbors Model Accuracy Score')
```



- 120 is the random state seed number that will produce the highest accuracy score and best k-nearest neighbors model.