Telecommunications Provider based on KNN algorithm

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A communication service provider can divide a customer's membership into four categories based on multiple independent variables such asage, region, material, income, etc.

Independed Variables

- region
- tenure
- age
- marital
- addree
- income
- ed
- employ
- retire
- gender
- reside #### Target (depended varibale)
- custcat

Tools To work with this project, multiple libraries and frameworks need to be installed. The following is a list of them.

- Pandas
- NumPy
- Matplotlib
- Sciki-learn

Import the required packets.

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn import preprocessing
```

Load the data

[2]:
```
df = pd.read_csv('teleCust1000t.csv')
df.head(3)
```

[2]:

	region	tenure	age	marital	address	income	ed	employ	retire	gender	\
0	2	13	44	1	9	64.0	4	5	0.0	0	
1	3	11	33	1	7	136.0	5	5	0.0	0	

```
2       3      68   52        1        24    116.0   1       29      0.0        1

   reside  custcat
0       2        1
1       6        4
2       2        3
```

Count the number of classes in the 'custcat'

[3]:
```
df['custcat'].value_counts()
# len(df['custcat'].value_counts())
```

[3]:
```
3    281
1    266
4    236
2    217
Name: custcat, dtype: int64
```

[4]:
```
df.columns
```

[4]:
```
Index(['region', 'tenure', 'age', 'marital', 'address', 'income', 'ed',
       'employ', 'retire', 'gender', 'reside', 'custcat'],
      dtype='object')
```

Independent data

[5]:
```
X = df[['region', 'tenure','age', 'marital', 'address', 'income', 'ed',␣
↪'employ','retire', 'gender', 'reside']] .values
```

Dependent data

[6]:
```
y = df['custcat'].values
```

Normalize data

[7]:
```
stander = preprocessing.StandardScaler()
stander.fit(X)
X = stander.transform(X)
X[:1]
```

[7]:
```
array([[-0.02696767, -1.055125  ,  0.18450456,  1.0100505 , -0.25303431,
        -0.12650641,  1.0877526 , -0.5941226 , -0.22207644, -1.03459817,
        -0.23065004]])
```

Split the data into 80% for training and 20% for testing.

[8]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split( X, y, test_size=0.2,␣
↪random_state=4)
print ('Train set:', X_train.shape,  y_train.shape)
print ('Test set:', X_test.shape,  y_test.shape)
```

```
Train set: (800, 11) (800,)
Test set: (200, 11) (200,)
```

0.0.1 K nearest neighbor (KNN)

[9]:
```
from sklearn.neighbors import KNeighborsClassifier
k = 2
#Train Model and Predict
model = KNeighborsClassifier(n_neighbors = k).fit(X_train,y_train)
model
```

[9]:
```
KNeighborsClassifier(n_neighbors=2)
```

[10]:
```
yhat = model.predict(X_test)
yhat[:3]
```

[10]:
```
array([3, 1, 1], dtype=int64)
```

0.0.2 Accuracy evaluation

[11]:
```
from sklearn import metrics
print("Train set Accuracy: ", metrics.accuracy_score(y_train, model.
 ↪predict(X_train)))
print("Test set Accuracy: ", metrics.accuracy_score(y_test, yhat))
# result = metrics.classification_report(y_test, yhat)
# result
```

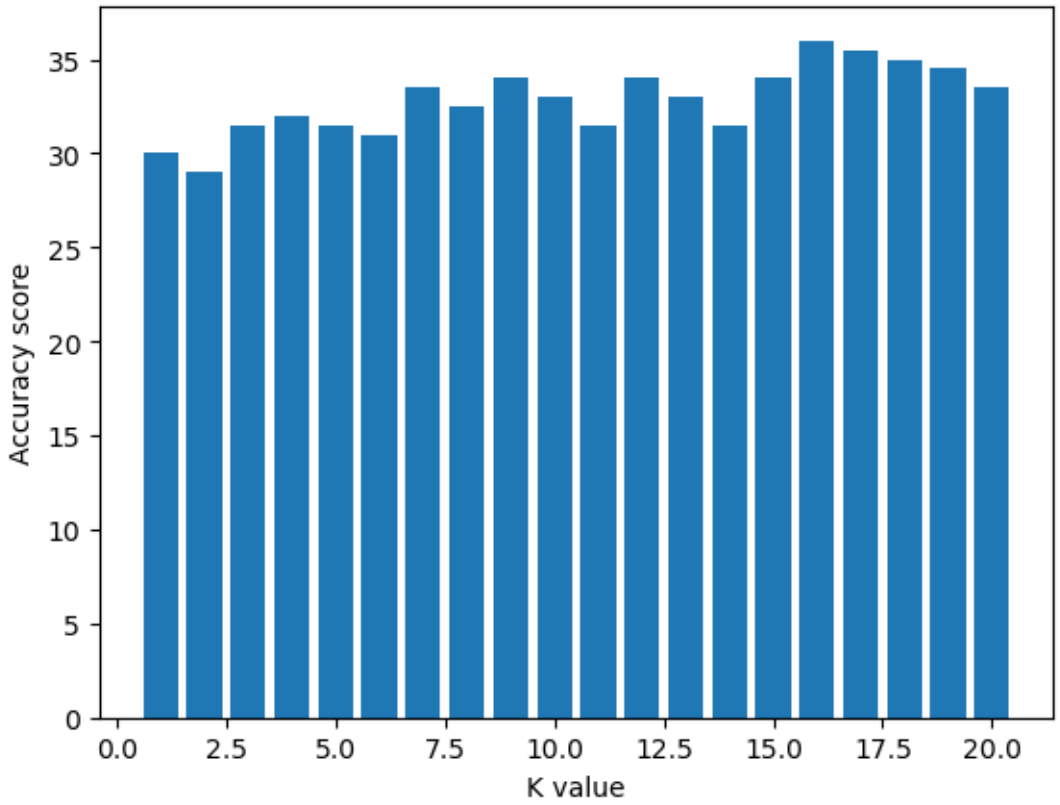
```
Train set Accuracy:  0.6175
Test set Accuracy:  0.29
```

Changing the K value

[12]:
```
k = 20
results = []
for i in range(1,k+1):
    neigh = KNeighborsClassifier(n_neighbors = i).fit(X_train,y_train)
    yhat = neigh.predict(X_test)
    ac = metrics.accuracy_score(y_test, yhat)
    results.append(ac)

plt.bar( np.arange(1,k+1), [i * 100 for i in results])
plt.xlabel('K value')
plt.ylabel('Accuracy score')
```

[12]:
```
Text(0, 0.5, 'Accuracy score')
```



[13]:
```
print('The best accuracy achieved where k is equal to ', str(results.
 ↪index(max(results))), "The accuracy is ",str(results[15]*100)+"%")
```

```
The best accuracy achieved where k is equal to  15 The accuracy is  36.0%
```

Deploying

[14]:
```
import joblib
import os
if not os.path.exists('Model'):
        os.mkdir('Model')
if not os.path.exists('Scaler'):
        os.mkdir('Scaler')

joblib.dump(model, r'Model/model.pickle')
joblib.dump(stander, r'Scaler/scaler.pickle')
```

[14]:
```
['Scaler/scaler.pickle']
```

Add new data and load the model

[15]:

```
new_data = pd.DataFrame([{'region':2, 'tenure':13,'age':45, 'marital':1,␣
↪'address':9, 'income':64.000, 'ed':4, 'employ':5,'retire':0.000, 'gender':0,␣
↪'reside':2}])
new_data = new_data[['region', 'tenure','age', 'marital', 'address', 'income',␣
↪'ed', 'employ','retire', 'gender', 'reside']]
new_data
```

[15]:

	region	tenure	age	marital	address	income	ed	employ	retire	gender	reside
0	2	13	45	1	9	64.0	4	5	0.0	0	2

[19]:
```
import joblib
model = joblib.load(r'Model/model.pickle')
scaler = joblib.load(r'Scaler/scaler.pickle')
new_data = scaler.transform(new_data)
model.predict(new_data)
```

[19]:
```
array([1], dtype=int64)
```