KNN + Confusion Matrix + IRIS Data set + Colab
CS550 Homework

Shoumya Singh
ID-19566

30. KNN + Confusion Matrix + IRIS Data set + Colab

- Process of adding notebooks to your portfolio

1. Execute IRIS_KNN.ipynb on Colab to understand how to apply Confusion matrix on KNN-Classifier using Iris Data set
   - Add more comments to the IRIS_KNN.ipynb
     - Pick an Evaluation Metric: Confusion Matrix
     - KNN + Confusion Matrix
     - Classification
       - Precision and Recall
       - Precision/Recall Trade-off
2. Follow this procedure to create a PDF file for IRIS_KNN.ipynb
3. Add the PDF file to GitHub to improve your portfolio

```
Machine Learning
     Supervised Learning
            KNN + Confusion Matrix + IRIS Data set + Colab
```

4. Submit the PDF as the answer for the homework.

Solution:

```
import pandas as pd
import numpy as np
import sklearn
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn import metrics
from sklearn.metrics import *
from sklearn.model_selection import *
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

```
iris = pd.read_csv('iris.csv')
col_list = iris.columns
print(type(col_list))
print(col_list[:])
iris['species'].value_counts()
iris_data = iris.iloc[:,0:4] # select all the rows and col indices 0 to 3
iris_lables = iris.iloc[:,4:] # select all trhe rows and 4th cloumn
iris_data.shape
iris_data.head(2)
```

Output

```
<class 'pandas.core.indexes.base.Index'>
Index(['sepal_length', 'sepal_width', 'petal_length', 'petal_width',
       'species'],
      dtype='object')
```

	sepal_length	sepal_width	petal_length	petal_width
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2

```
iris_lables.shape
iris_lables.head(2)
```

Output

	species
0	Setosa
1	Setosa

```
#standardizing using sklearn pre-processing
iris_standard = StandardScaler().fit_transform(iris_data)  # this has
transformed dataframe to numpy N-dimensional array,
#each row in df is a list we will have n inner lists in a outer list,thats
why length of iris_standard is 150 and
#length of each inner list is 4.
print('length of iris_standard is ',len(iris_standard))
print('length of inner list is',len(iris_standard[0]))
print('sample elements are')
print((iris_standard[0:3]))
```

Output

```
length of iris_standard is  150
length of inner list is 4
sample elements are
[[-0.90068117  1.01900435 -1.34022653 -1.3154443 ]
 [-1.14301691 -0.13197948 -1.34022653 -1.3154443 ]
 [-1.38535265  0.32841405 -1.39706395 -1.3154443 ]]
```

```
#splitting dataset into train and test
iris_lables_np = iris_lables.values.reshape(1,150)
x_train, x_test, y_train, y_test = train_test_split(iris_standard,
iris_lables_np[0], test_size=0.33, random_state=42)
print(x_test[0:2],y_test[0:2])
print(len(x_test),len(y_test))
print(len(x_train),len(y_train))
```

Output

```
[[ 3.10997534e-01 -5.92373012e-01  5.35408562e-01  8.77547895e-04]
 [-1.73673948e-01  1.70959465e+00 -1.16971425e+00 -1.18381211e+00]]
['Versicolor' 'Setosa']
50 50
100 100
```

```
#Training using K_NN

neigh = KNeighborsClassifier(n_neighbors=5)
neigh.fit(x_train, y_train)
```

Output

```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                     metric_params=None, n_jobs=None, n_neighbors=5, p=2,
                     weights='uniform')
```

```
#predicting

predict_array = neigh.predict(x_test)
print(metrics.accuracy_score(y_test, predict_array))
#print(predict_array[0])
#print(y_test[0])

for i in range(len(predict_array)):
   if (predict_array[i] != y_test[i]):
       print('actual is {} but predicted is
{}'.format(y_test[i],predict_array[i]))
       print('Wrong')
```

Output

```
0.98
actual is Virginica but predicted is Versicolor
Wrong

#prediction on non standardized data
x_train, x_test, y_train, y_test = train_test_split(iris_data,
iris_lables_np[0], test_size=0.33, random_state=42)
neigh2 = KNeighborsClassifier(n_neighbors=5)
neigh2.fit(x_train, y_train)
predict_array = neigh2.predict(x_test)
print(metrics.accuracy_score(y_test, predict_array))
```

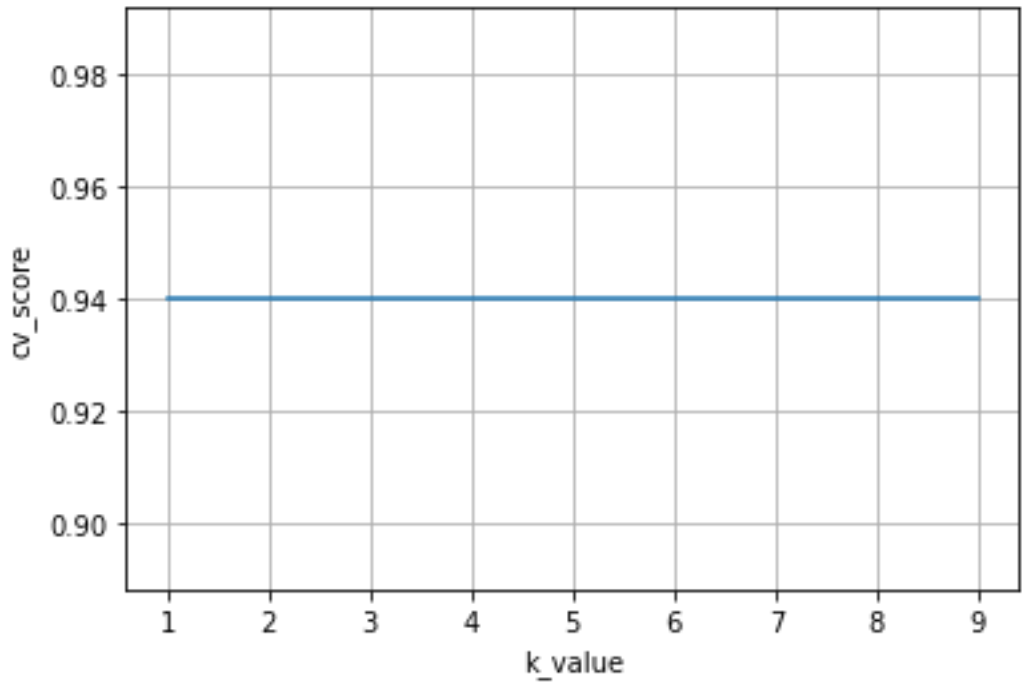
Output

```
0.98

#cross validation using 10 folds,cv=10

k_list= [1,3,5,7,9]
cv_scores=[]

for i in k_list:
    cross_neigh = KNeighborsClassifier(n_neighbors=i)
    scores = cross_val_score(cross_neigh,x_train, y_train,cv=10)
    cv_scores.append(np.mean(scores))

print(len(cv_scores))
print(cv_scores)

cv_score_zip=zip(k_list,cv_scores)

for i in cv_score_zip:
    print(i)


#plot for K-value and accuracy using 10 fold cv.

plt.figure('Iris_KNN')
plt.xlabel('k_value')
plt.ylabel('cv_score')
plt.grid()
plt.plot(k_list,cv_scores)
plt.show()
```

```
# based on above observations we are getting maximum accuracy when k=7,
#So we will use K-value 7 and predict on test datsset and see accuracy.

neigh_K7 = KNeighborsClassifier(n_neighbors=7)
neigh_K7.fit(x_train, y_train)
predict_array_k7 = neigh_K7.predict(x_test)
print(metrics.accuracy_score(y_test, predict_array_k7))
predict_probability = neigh_K7.predict_proba(x_test)

#zipped_pobability = zip(predict_array_k7,predict_probability)
#for i in zipped_pobability:
#    print(i)

cross_predict = cross_val_predict(cross_neigh,x_test,y_test,cv=10)
print(metrics.accuracy_score(y_test, cross_predict))
```

Output

```
5
[0.9400000000000001, 0.9400000000000001, 0.9400000000000001,
0.9400000000000001, 0.9400000000000001]
(1, 0.9400000000000001)
(3, 0.9400000000000001)
(5, 0.9400000000000001)
(7, 0.9400000000000001)
(9, 0.9400000000000001)
```




```
0.98
0.96
```

```
#confusion matrix and classification_report
#precision = TP/TP+FP
#Recall = TP/TP+FN

print(metrics.confusion_matrix(y_test, cross_predict))
print(metrics.classification_report(y_test, cross_predict))
```

Output

```
[[19  0  0]
 [ 0 15  0]
 [ 0  2 14]]
              precision    recall  f1-score   support

      Setosa       1.00      1.00      1.00        19
  Versicolor       0.88      1.00      0.94        15
   Virginica       1.00      0.88      0.93        16

    accuracy                           0.96        50
   macro avg       0.96      0.96      0.96        50
weighted avg       0.96      0.96      0.96        50
```