```
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('/content/Iris_data.csv')
iris.shape
col_list = iris.columns
print(type(col_list))
print(col_list[:])
iris['Species'].value_counts()
iris_data = iris.iloc[:,1:5] # select all the rows and col indices 0 to 3
iris_lables = iris.iloc[:,5:] # select all the rows and 4th cloumn
iris_data.shape
iris_data.head(2)
```

```
<class 'pandas.core.indexes.base.Index'>
Index(['row', '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)
```

	Species
0	I. setosa
1	I. setosa

```
#standardizing using sklearn pre-processing
iris_standard = StandardScaler().fit_transform(iris_data)  # this has transformed dataframe to numpy N-dimensional
#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]))
```

```
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
print(x_test[0:2],y_test[0:2])
print(len(x_test),len(y_test))
print(len(x_train),len(y_train))
```

```
[[ 3.10997534e-01 -5.92373012e-01  5.35408562e-01  8.77547895e-04]
 [-1.73673948e-01  1.70959465e+00 -1.16971425e+00 -1.18381211e+00]] ['I.\xa0versicolor' 'I.\xa0setosa']
50 50
100 100
```

```
#Training using K_NN
```

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

```
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')
```

```
0.98
actual is I. virginica but predicted is I. versicolor
Wrong
```

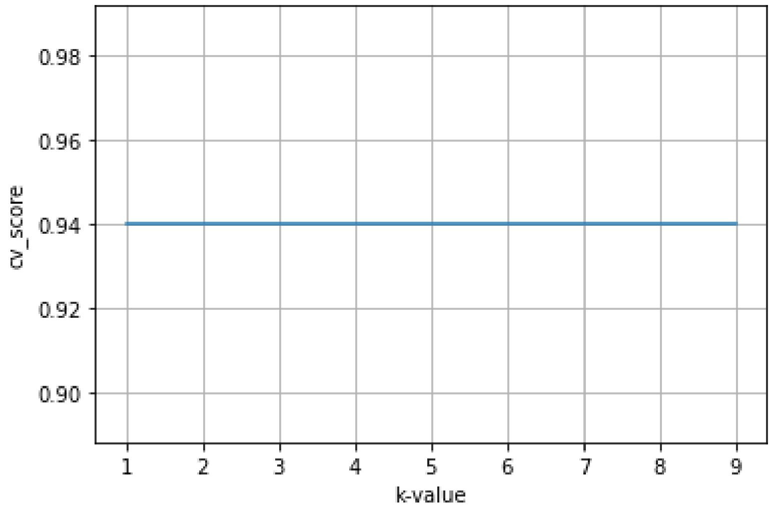
```
#prediction on non standardized data
x_train, x_test, y_train, y_test = train_test_split(iris_data, iris_lables_np[0], test_size=0.33, random_state=42)
neigh2 = KNeighborsClassifier(n_neighbors=5)
neigh2.fit(x_train, y_train)
predict_array = neigh2.predict(x_test)
print(metrics.accuracy_score(y_test,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

```
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))
```

```
5
[0.9400000000000001, 0.9400000000000001, 0.9400000000000001, 0.940000000000
(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))
```

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

    I. setosa       1.00      1.00      1.00        19
I. versicolor       0.88      1.00      0.94        15
 I. 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
```