Practical – 6

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Aim: Solving classification problems using Scikit-learn

Theory:

Classification:

Classification in machine learning and statistics is a supervised learning approach in which the computer program learns from the data given to it and make new observations or classifications. In Classification, a program learns from the given dataset or observations and then classifies new observation into a number of classes or groups. Such as, Yes or No, 0 or 1, Spam or Not Spam, cat or dog, etc. Classes can be called as targets/labels or categories.

There are two types of Classifications:

Binary Classifier: If the classification problem has only two possible outcomes, then it is called as Binary Classifier.

Examples: YES or NO, MALE or FEMALE, SPAM or NOT SPAM, CAT or DOG, etc.

Multi-class Classifier: If a classification problem has more than two outcomes, then it is called as Multi-class Classifier.

Example: Classifications of types of crops, Classification of types of music.

Classification Algorithms can be further divided into the Mainly two category:

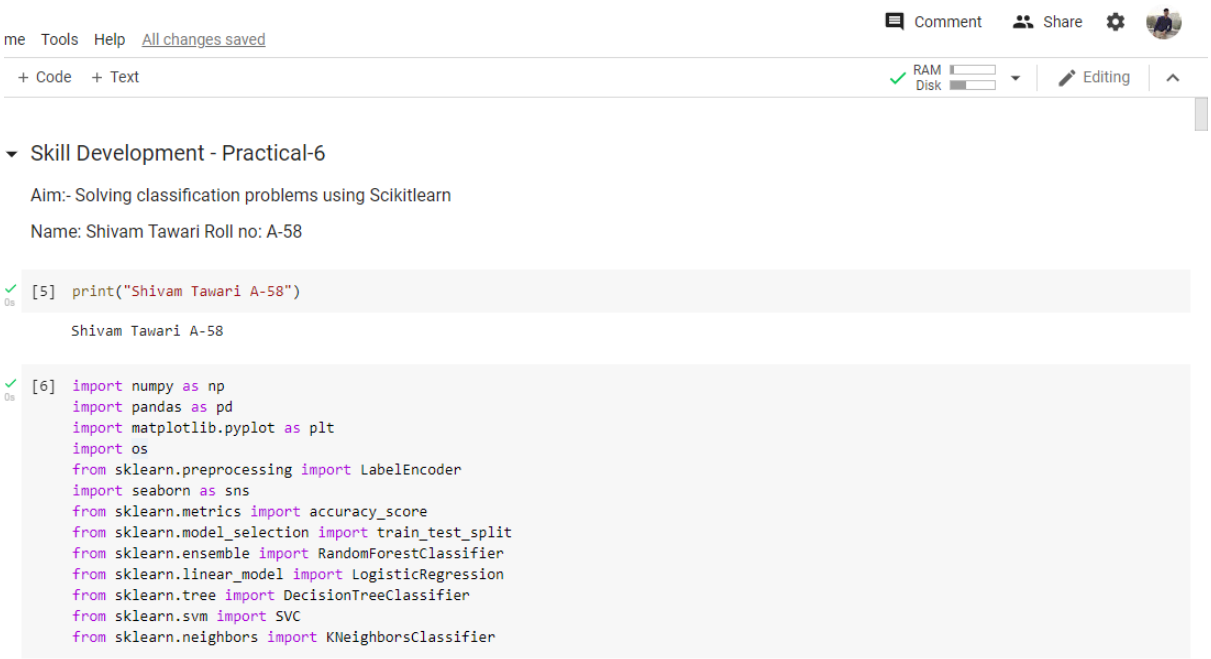
- **Linear Models:**

1. Logistic Regression
2. Support Vector Machines

- **Non-linear Models**

1. K-Nearest Neighbours
2. Kernel SVM
3. Naïve Bayes
4. Decision Tree Classification
5. Random Forest Classification

Code & Output:



```
input_path='/content/iris.csv'
df=pd.read_csv(input_path)
df.head()
```

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

```
[8] df.drop('Id',axis=1,inplace=True)
    df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   SepalLengthCm  150 non-null    float64
 1   SepalWidthCm   150 non-null    float64
 2   PetalLengthCm  150 non-null    float64
 3   PetalWidthCm   150 non-null    float64
```

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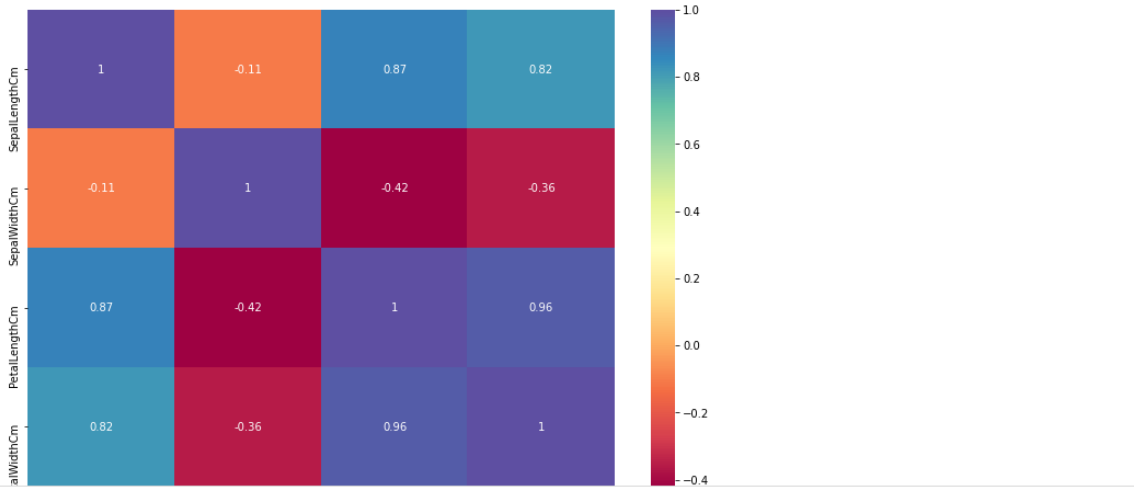
```
plt.figure(figsize=(12,8))
sns.heatmap(df.corr(),annot=True,cmap=plt.cm.Spectral)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f3685708190>
```



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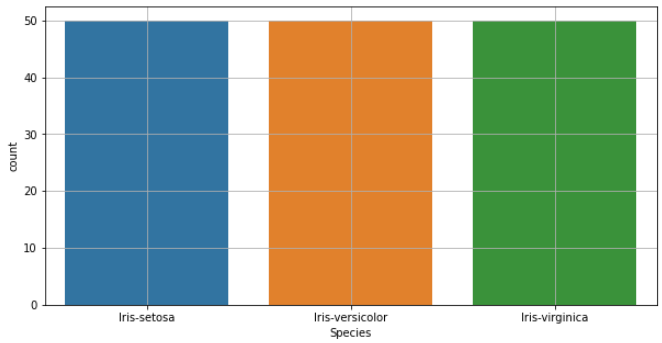
```
[10] plt.figure(figsize=(10,5))
     sns.countplot(x='Species',data=df)
     plt.grid()
```




```
le=LabelEncoder()
df['Species_type']=le.fit_transform(df['Species'])
```

```
[12] def scatterplot(X,Y):
```

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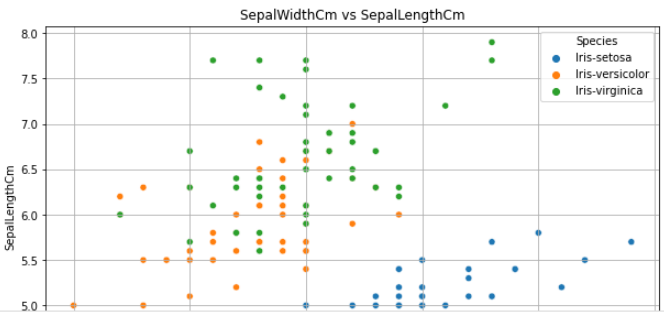
```
[12] def scatterplot(X,Y):
         sns.scatterplot(data=df,x=X,y=Y,hue='Species')
         plt.title(X+" vs "+Y)
         plt.grid()
         plt.show()
```

```
plt.figure(figsize=(10,6))
scatterplot('SepalWidthCm','SepalLengthCm')
plt.figure(figsize=(10,6))
scatterplot('PetalWidthCm','PetalLengthCm')
plt.tight_layout()
```



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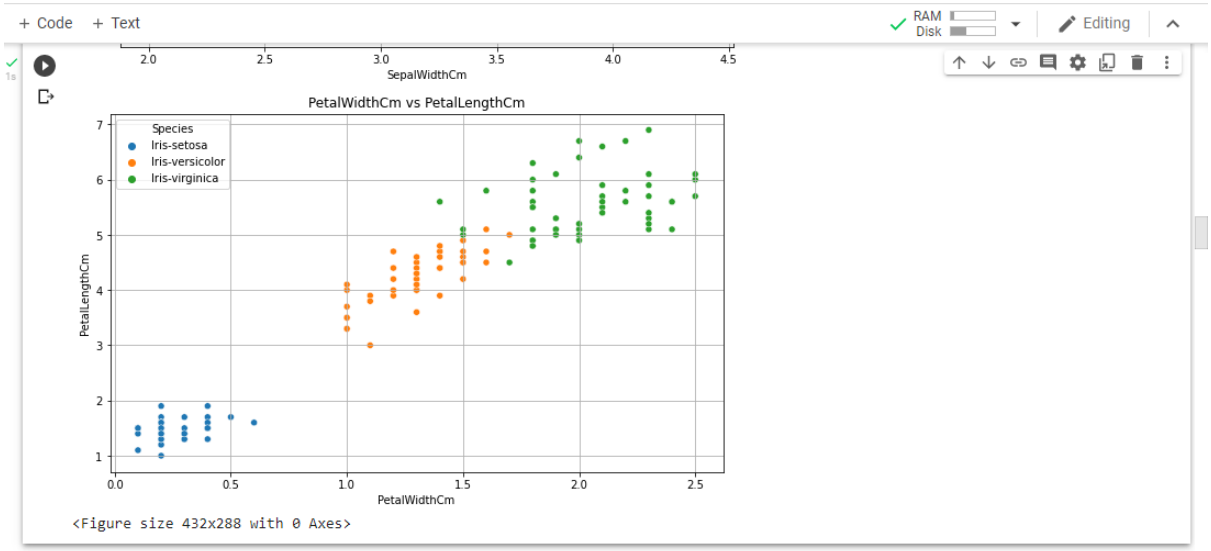


```
[14] sns.pairplot(df,hue='Species',palette='Dark2')
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:306: UserWarning: Dataset has 0 variance; skipping density estimate.
```

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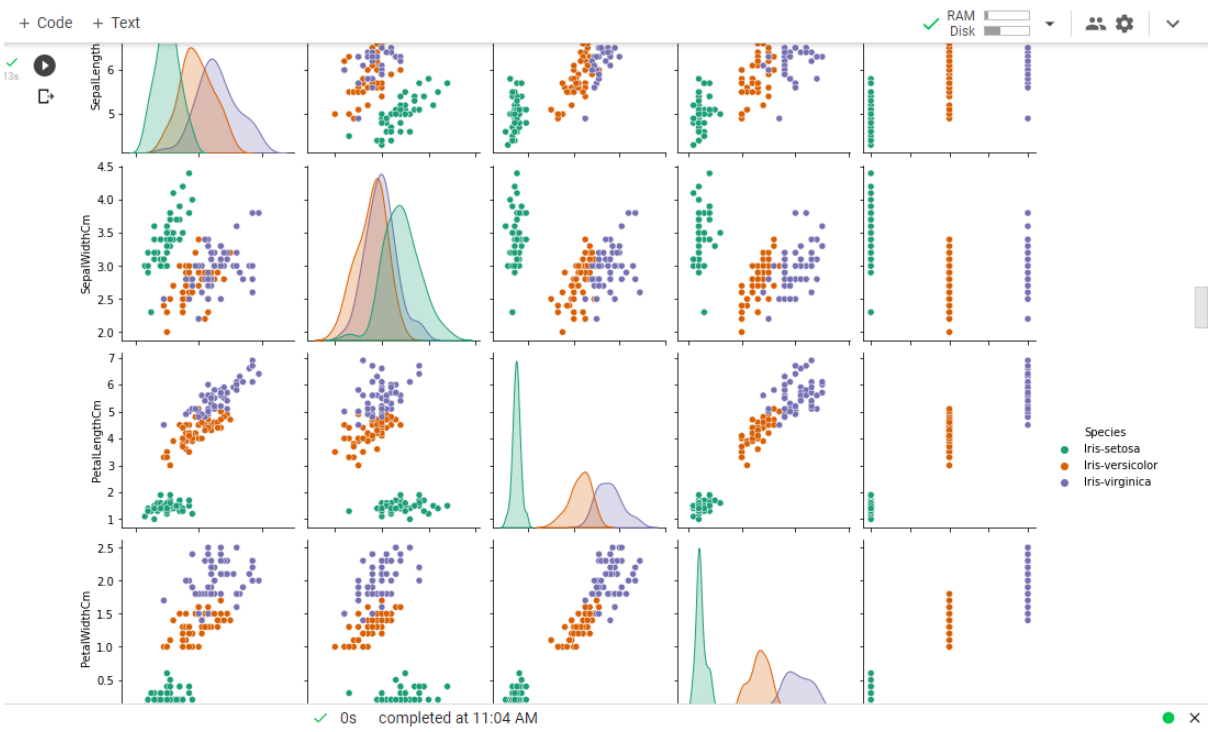

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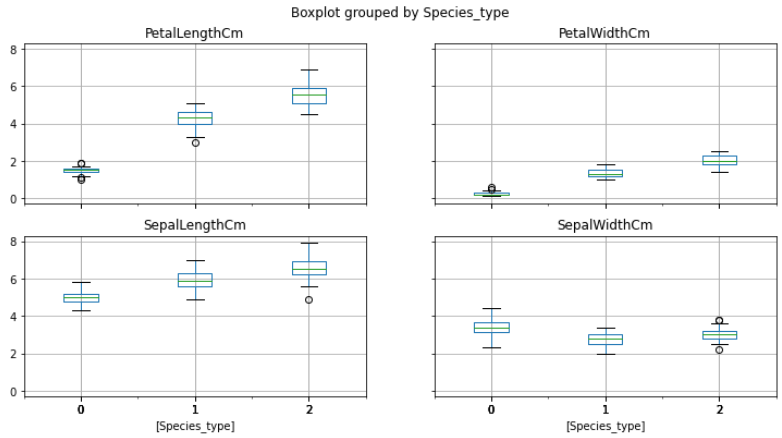
SepalLengthCm SepalWidthCm PetalLengthCm PetalWidthCm Species_type

```
df.boxplot(by="Species_type", figsize=(12, 6))
```

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f365ef099d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f365ef1df10>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f365ef09610>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f365ee8c0d0>]],
      dtype=object)
```



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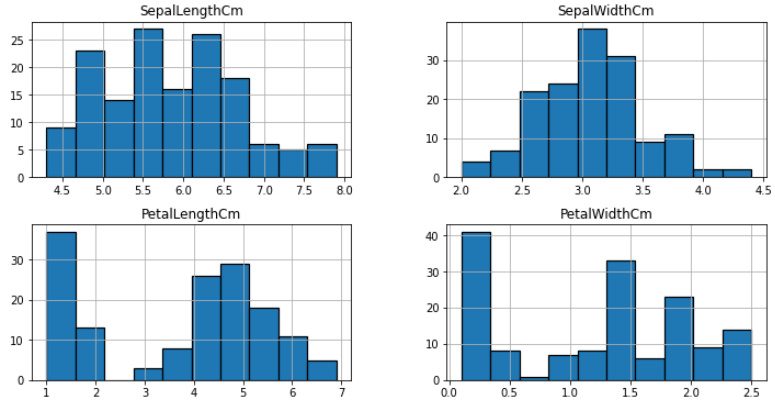
```
[16] df.drop('Species_type',axis=1).hist(edgecolor='black', linewidth=1.2)
     fig=plt.gcf()
     fig.set_size_inches(12,6)
     plt.show()
```




```
[17] X_train,X_test,Y_train,Y_test = train_test_split(df.drop(['Species_type','Species'],axis=1),df['Species_type'],test_size=0.25,rando
```

```
[18] plt.figure(figsize=(8,5))
     sns.countplot(x=Y_test)
```

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```
[19] models = ['random_forest','svm','decision_tree','logistic_regression','knn']
     model_train_acc=[]
     model_test_acc=[]
```

```
[20] svm= SVC()
     svm.fit(X_train,Y_train)
     y_hat_train = svm.predict(X_train)
     y_hat_test = svm.predict(X_test)
     train_acc = np.round(accuracy_score(y_hat_train,Y_train),3)
     test_acc =  np.round(accuracy_score(y_hat_test,Y_test),3)

     model_train_acc.append(train_acc)
     model_test_acc.append(test_acc)

     print("Accuracy Score on train data using SVM: ",train_acc)
     print("Accuracy Score on test data using SVM: ",test_acc)
```

```
Accuracy Score on train data using SVM:  0.955
Accuracy Score on test data using SVM:  0.947
```

```
[21] rfc = RandomForestClassifier()
     rfc.fit(X_train,Y_train)
     y_hat_train = rfc.predict(X_train)
     y_hat_test = rfc.predict(X_test)
     train_acc = np.round(accuracy_score(y_hat_train,Y_train),3)
     test_acc =  np.round(accuracy_score(y_hat_test,Y_test),3)

     model_train_acc.append(train_acc)
     model_test_acc.append(test_acc)
```

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```
[21] print("Accuracy Score on train data using RandomForest: ",train_acc)
     print("Accuracy Score on test data using RandomForest: ",test_acc)
```

```
Accuracy Score on train data using RandomForest:  1.0
Accuracy Score on test data using RandomForest:  0.895
```

```
[22] tree = DecisionTreeClassifier()
     tree.fit(X_train,Y_train)
     y_hat_train = tree.predict(X_train)
     y_hat_test = tree.predict(X_test)
     train_acc = np.round(accuracy_score(y_hat_train,Y_train),3)
     test_acc =  np.round(accuracy_score(y_hat_test,Y_test),3)

     model_train_acc.append(train_acc)
     model_test_acc.append(test_acc)

     print("Accuracy Score on train data using Decision tree: ",train_acc)
     print("Accuracy Score on test data using Decision tree: ",test_acc)
```

```
Accuracy Score on train data using Decision tree:  1.0
Accuracy Score on test data using Decision tree:  0.895
```

```
[23] lr = LogisticRegression(max_iter=200)
     lr.fit(X_train,Y_train)
     y_hat_train = lr.predict(X_train)
     y_hat_test = lr.predict(X_test)
     train_acc = np.round(accuracy_score(y_hat_train,Y_train),3)
     test_acc =  np.round(accuracy_score(y_hat_test,Y_test),3)

     model_train_acc.append(train_acc)
```

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```
print("Accuracy Score on train data using Logistic Regression: ",train_acc)
print("Accuracy Score on test data using Logistic Regression: ",test_acc)
```

```
Accuracy Score on train data using Logistic Regression:  0.973
Accuracy Score on test data using Logistic Regression:  0.921
```

```
def select_neighbors():
    knn_train_acc=[]
    knn_test_acc=[]
    for i in range(1,11):
        knn = KNeighborsClassifier(n_neighbors=i)
        knn.fit(X_train,Y_train)
        y_hat_train = knn.predict(X_train)
        y_hat_test = knn.predict(X_test)
        knn_train_acc.append(accuracy_score(y_hat_train,Y_train))
        knn_test_acc.append(accuracy_score(y_hat_test,Y_test))

    return knn_train_acc,knn_test_acc
```

```
knn_train,knn_test = select_neighbors()
x = np.linspace(1,10,10)

plt.figure(figsize=(10,4))
plt.plot(x,knn_test,color='red')
plt.title("Neighbors vs Accuracy on Test Data using KNN")
plt.xticks(x)
plt.grid()

plt.figure(figsize=(10,4))
plt.plot(x,knn_train,color='red')
plt.title("Neighbors vs Accuracy on Train Data using KNN")
```

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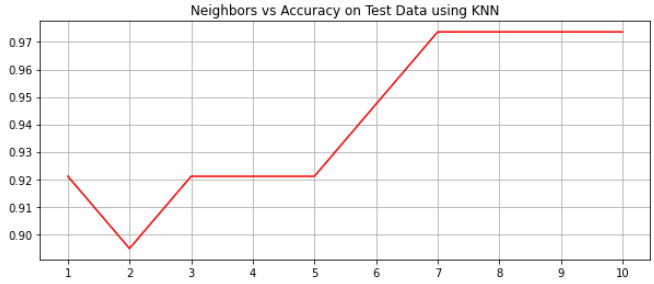

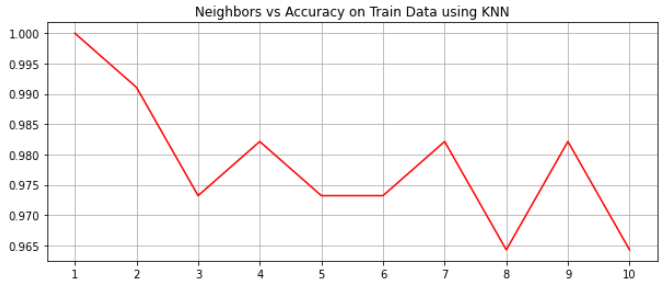


```
train_acc = np.round(knn_train[6],3)
test_acc = np.round(knn_test[6],3)
```

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Conclusion: Hence, successfully performed solving classification problem using Scikit-learn.