Iris Flower Classification

Objective

The aim is to classify iris flowers among three species from measurements of sepals and petals' length and width.The iris data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant.The central goal here is to design a model that makes useful classifications for new flowers or, in other words, one which exhibits good generalization.

```
#Importing libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as  plt
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report
```

```
#Importing Data from .csv file
columns=["SepalLengthCm","SepalWidthCm","PetalLengthCm","PetalWidthCm","Species"]
dataset = pd.read_csv('iris_data.csv',names=columns)
dataset.head()
```

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

Next steps: Generate code with dataset   View recommended plots

```
dataset.tail()
```

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
145	6.7	3.0	5.2	2.3	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
149	5.9	3.0	5.1	1.8	Iris-virginica

```
dataset.shape
```

```
(150, 5)
```

Exploratory Data Analysis (EDA)

```
#Histogram of petal length
sns.FacetGrid(dataset, hue="Species", height=5) \
    .map(sns.distplot, "PetalLengthCm") \
    .add_legend()
plt.show()
```

```
/usr/local/lib/python3.10/dist-packages/seaborn/axisgrid.py:854: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  func(*plot_args, **plot_kwargs)
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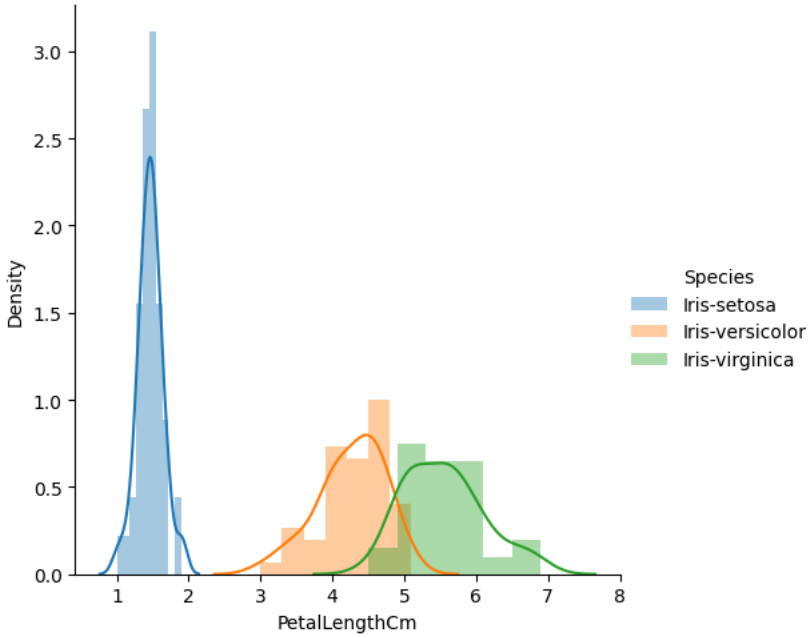


```
#Histogram of petal width
sns.FacetGrid(dataset,hue="Species",height=5) \
    .map(sns.distplot,"PetalWidthCm") \
    .add_legend()
plt.show()
```

```
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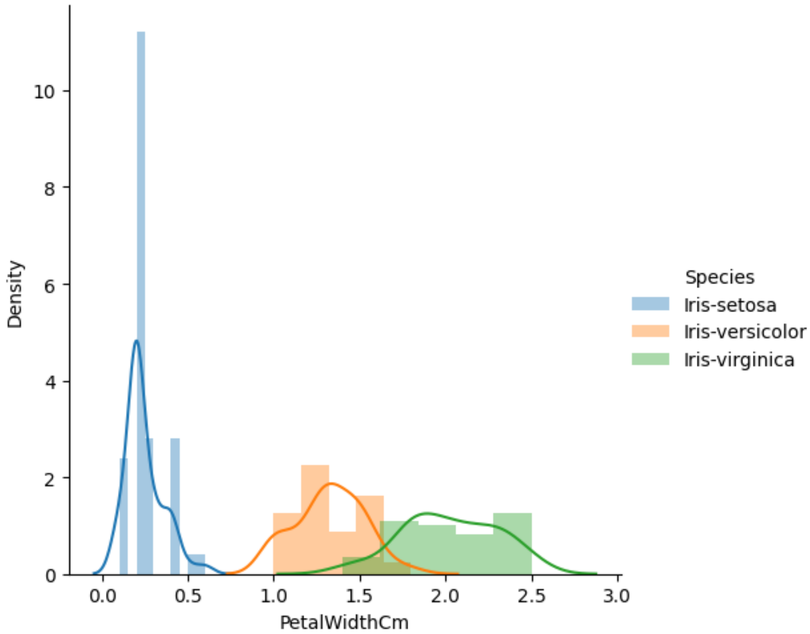


```
#Histogram of sepal length
sns.FacetGrid(dataset,hue="Species",height=5) \
    .map(sns.distplot,"SepalLengthCm") \
    .add_legend()
plt.show()
```

```
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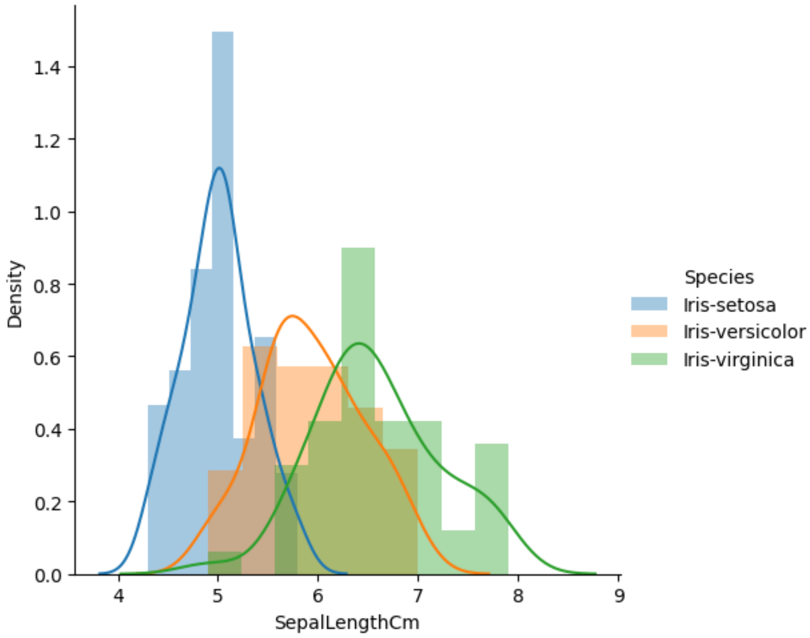


```
#Histogram of sepal width
sns.FacetGrid(dataset,hue="Species",height=5) \
    .map(sns.distplot,"SepalWidthCm") \
    .add_legend()
plt.show()
```

```
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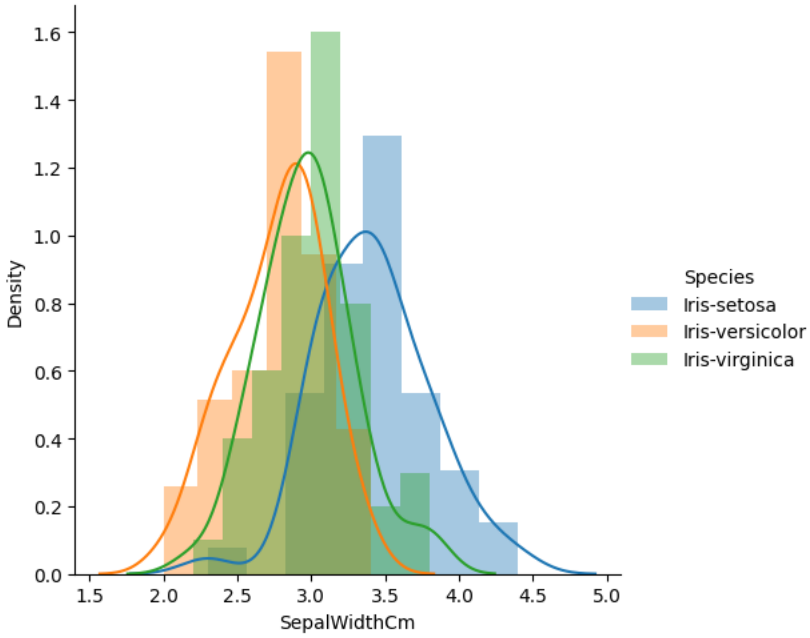
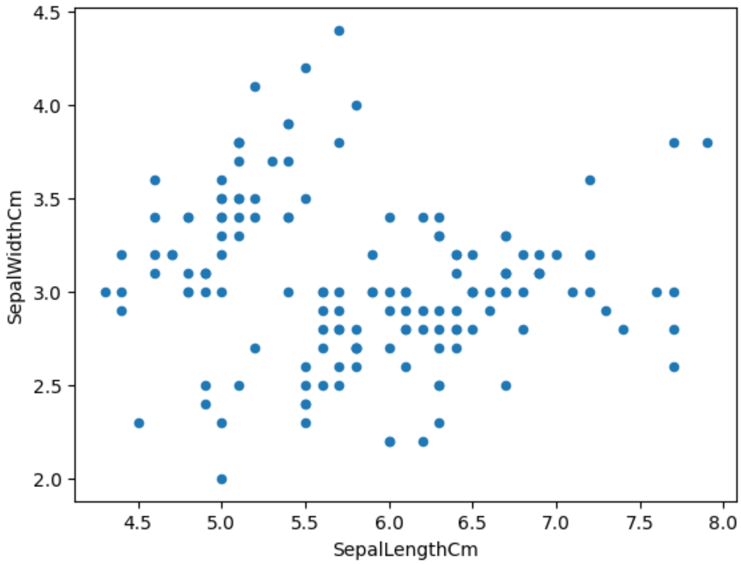
```



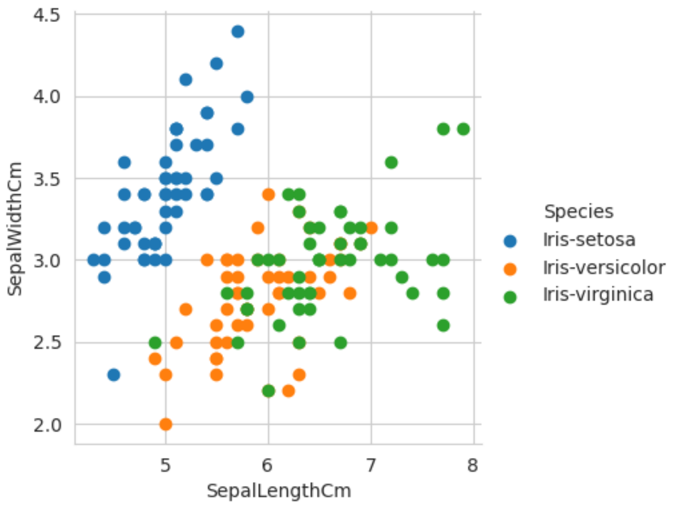
2D scatter plot

```
dataset.plot(kind='scatter', x='SepalLengthCm',y='SepalWidthCm')
plt.show()
```



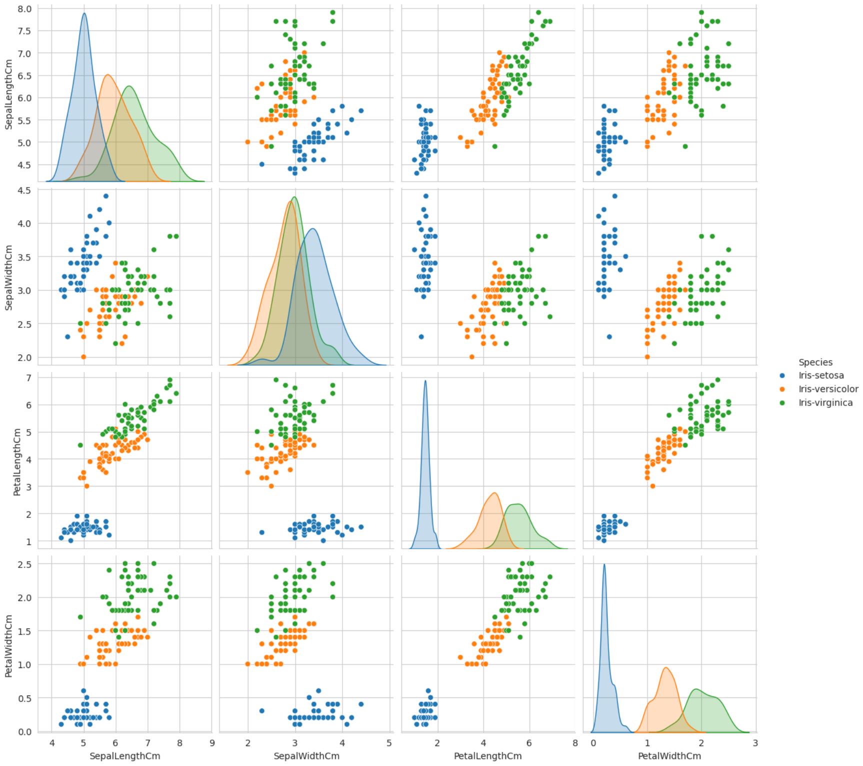
2D scatter plot with color-coding for each flower type/class.

```
sns.set_style("whitegrid")
sns.FacetGrid(dataset, hue="Species", height=4) \
    .map(plt.scatter,"SepalLengthCm","SepalWidthCm") \
    .add_legend()
plt.show()
```



Pairwise Scatter Plot

```
sns.set_style("whitegrid")
sns.pairplot(dataset,hue="Species",height=3,aspect=1)
plt.show()
```



Data Preprocessing

```
dataset["Species"].value_counts()
```

```
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: Species, dtype: int64
```

```
dataset.tail()
```

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
145	6.7	3.0	5.2	2.3	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
149	5.9	3.0	5.1	1.8	Iris-virginica

Descriptive statistics of data set

```
dataset.describe()
```

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

Checking for Null Values

```
dataset.isnull().sum()
```

```
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

```
dataset['Species'].unique()
```

```
array(['Iris-setosa', 'Iris-versicolor', 'Iris-virginica'], dtype=object)
```

Label Encoding

```
label_encoder = preprocessing.LabelEncoder()
dataset['Species']= label_encoder.fit_transform(dataset['Species'])

dataset['Species'].unique()
```

```
array([0, 1, 2])
```

```
#X = dataset.drop(["Species"], axis=1)
#y = dataset["Species"]
```

Splitting the dataSet

```
X = dataset.iloc[:, [2,3]].values

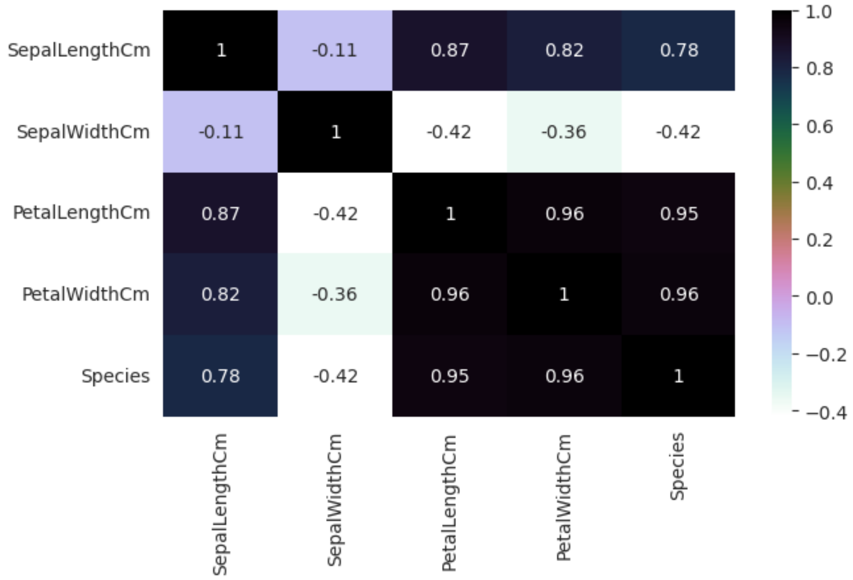
y = dataset.iloc[:, 4].values
```

```
len(X)
len(y)
```

```
150
```

Heatmap is to identify the highly correlated features

```
plt.figure(figsize=(7,4))
sns.heatmap(dataset.corr(),annot=True,cmap='cubehelix_r')
plt.show()
```



Model Development

```
#splitting the dataset into train set and test set
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = .3, random_state = 2)
```

Feature Scaling

```
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)
X_test = sc_X.fit_transform(X_test)
```

DecisionTree Classifier

```
from sklearn.tree import DecisionTreeClassifier
classifier = DecisionTreeClassifier(criterion = 'entropy', random_state = 0)
classifier.fit(X_train, y_train)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier(criterion='entropy', random_state=0)
```

Predicting the test results

```
y_pred = classifier.predict(X_test)
```

Making the confusion matrix

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
cm
```

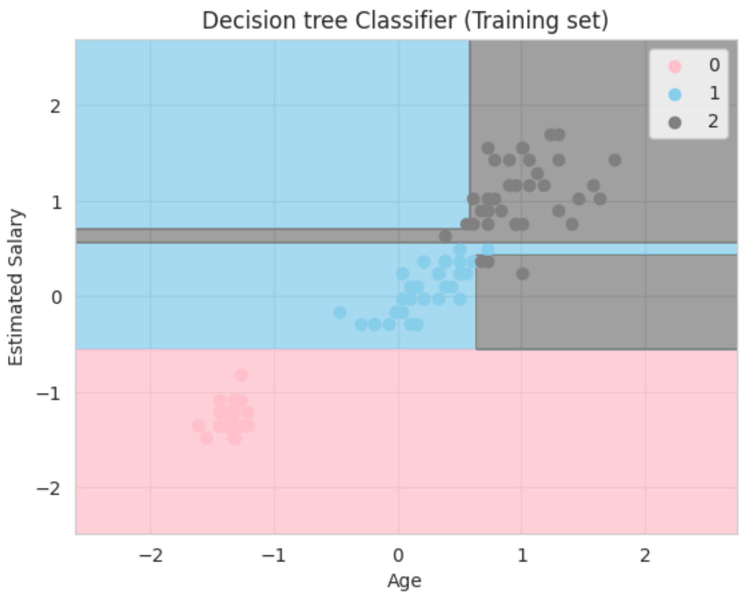
```
array([[17,  0,  0],
       [ 0, 13,  2],
       [ 0,  0, 13]])
```

Visualization

Visualising the Training set results

```
from matplotlib.colors import ListedColormap
X_set, y_set = X_train, y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, classifier.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('pink','skyblue','gray')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('pink', 'skyblue','gray'))(i), label = j)
plt.title('Decision tree Classifier (Training set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

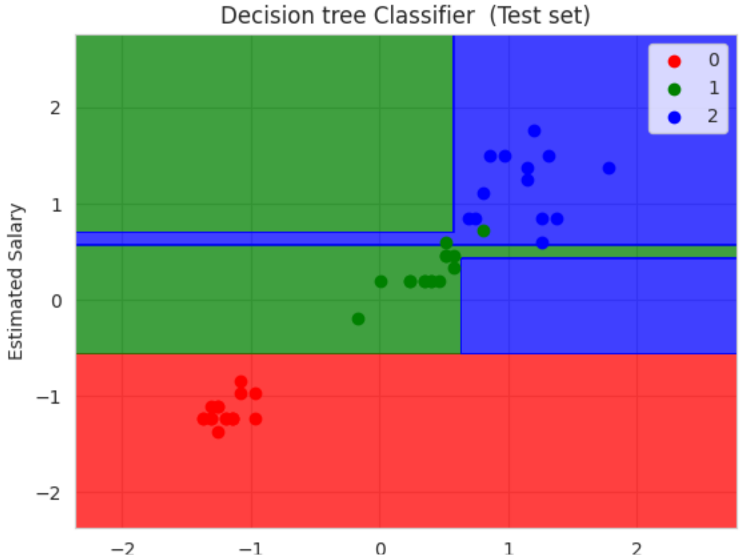
```
<ipython-input-37-47d89a32a8bb>:10: UserWarning: *c* argument looks like a si
  plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
```



Visualising the Test set results

```
from matplotlib.colors import ListedColormap
X_set, y_set = X_test, y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, classifier.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green','blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green','blue'))(i), label = j)
plt.title('Decision tree Classifier  (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

```
<ipython-input-38-5e1e11bcd0e1>:10: UserWarning: *c* argument looks like a si
  plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
```



Accuracy

```
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
from math import sqrt
print('The accuracy of the Decision Tree Classifier is : %.2f'%accuracy_score(y_pred,y_test))
rmse = sqrt(mean_squared_error(y_test, y_pred))
print("RMSE value = %.2f"%rmse)
print("R2 Score= %.2f"%r2_score(y_test, y_pred))
```

```
The accuracy of the Decision Tree Classifier is : 0.96
RMSE value = 0.21
R2 Score= 0.93
```

```
classification_report(y_test, y_pred)
```

```
'              precision    recall  f1-score   support\n\n           0
1.00      1.00      1.00        17\n           1       1.00      0.87      0.
93        15\n           2       0.87      1.00      0.93        13\n\n    ac
curacy                           0.96        45\n   macro avg       0.96
```

KNN Algorithm

```
from sklearn import neighbors
model = neighbors.KNeighborsClassifier(n_neighbors=3)
```

```
model.fit(X_train,y_train)
```

```
▾       KNeighborsClassifier
KNeighborsClassifier(n_neighbors=3)
```

```
predict = model.predict(X_test)
```

Accuracy

```
#for checking the model accuracy
print('The accuracy of the KNN is',accuracy_score(predict,y_test))
rmse = sqrt(mean_squared_error(y_test, predict))
print("RMSE value = %.2f"%rmse)
print("R2 Score= %.2f"%r2_score(y_test, predict))
```

```
The accuracy of the KNN is 0.9555555555555556
RMSE value = 0.21
R2 Score= 0.93
```