Lab 04

Comparing Decision tree and SVM

Decision Tree

In [ ]:
```
import pandas as pd
df = pd.read_csv("cancerAllv3.csv")
df.head()
```

```
C:\Users\jyosn\AppData\Local\Temp\ipykernel_16144\3637813710.py:1: DeprecationWar
ning:
Pyarrow will become a required dependency of pandas in the next major release of
pandas (pandas 3.0),
(to allow more performant data types, such as the Arrow string type, and better i
nteroperability with other libraries)
but was not found to be installed on your system.
If this would cause problems for you,
please provide us feedback at https://github.com/pandas-dev/pandas/issues/54466

  import pandas as pd
```

Out[ ]:

	radius	texture	perimeter	area	s	c	concavity	cp	sym	
0	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	0.2419	0.07
1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	0.1812	0.05
2	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	0.2069	0.05
3	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	0.2597	0.09
4	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	0.1809	0.05

5 rows × 31 columns

> This dataset has 31 columns.

In [ ]:
```
features=['radius','texture','perimeter','area','s','c','concavity','cp','sym']
import numpy as np
X = np.array(df)
y = X[:,30]
X = X[:,0:9]
```

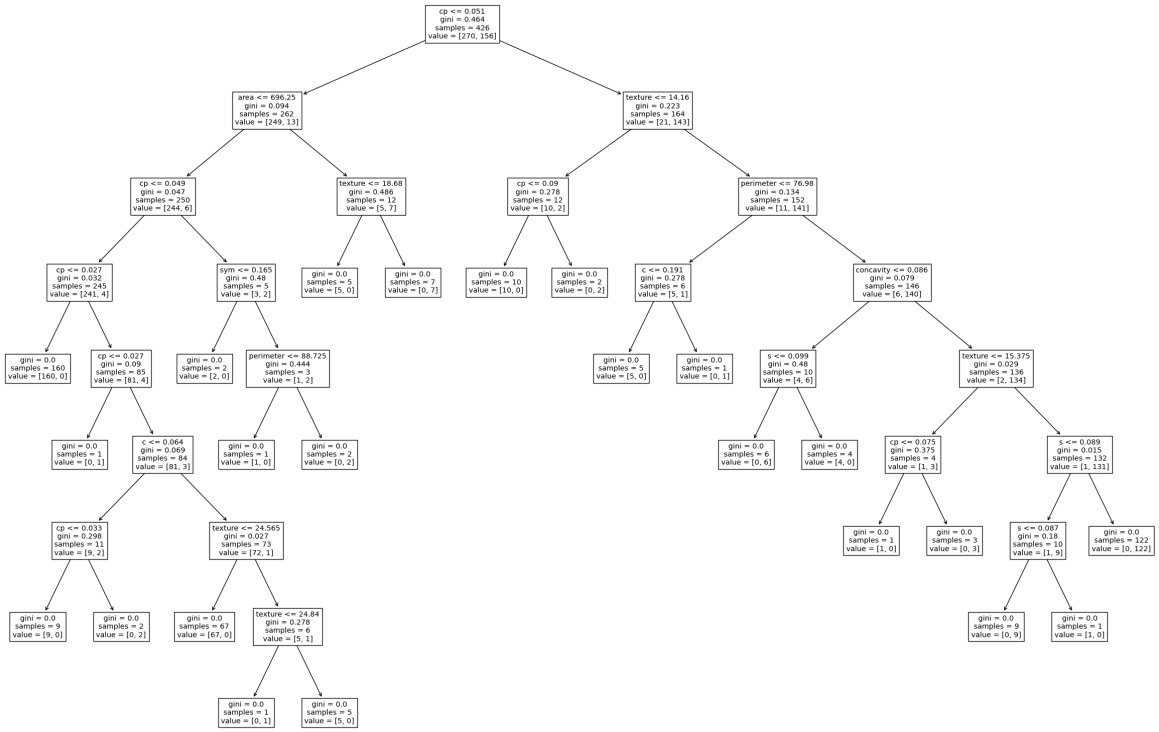
- We now split the dataset.
- The parameter `random_state` is used for reproducibility of code. It ensures that the split is same each time we run this code. If we set it to None then the split will change every time.
- `shuffle` prevents bias due to order. It shuffles the rows randomly before splitting.

- `test_size` : The fraction of data that goes into test set.

In [ ]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,y ,
                                                    random_state=104,
                                                    test_size=0.25,  shuffle=True)
```

In [ ]:
```
from sklearn import tree
from sklearn.tree import DecisionTreeClassifier
import matplotlib.pyplot as plt

dtree = DecisionTreeClassifier(criterion='gini')
dtree = dtree.fit(X_train, y_train)
plt.figure(figsize=(30,20))
tree.plot_tree(dtree,feature_names=features)

print(X_train.shape)
```

```
(426, 9)
```



In [ ]:
```
from sklearn.metrics import accuracy_score,classification_report,confusion_matri
predicted = dtree.predict(X_train)
print (accuracy_score(y_train, predicted))
```

```
1.0
```

In [ ]:
```
predicted = dtree.predict(X_test)
print (accuracy_score(y_test, predicted))
```

```
0.916083916083916
```

Thus, the test accuracy of decision tree is 92%.

Classification report

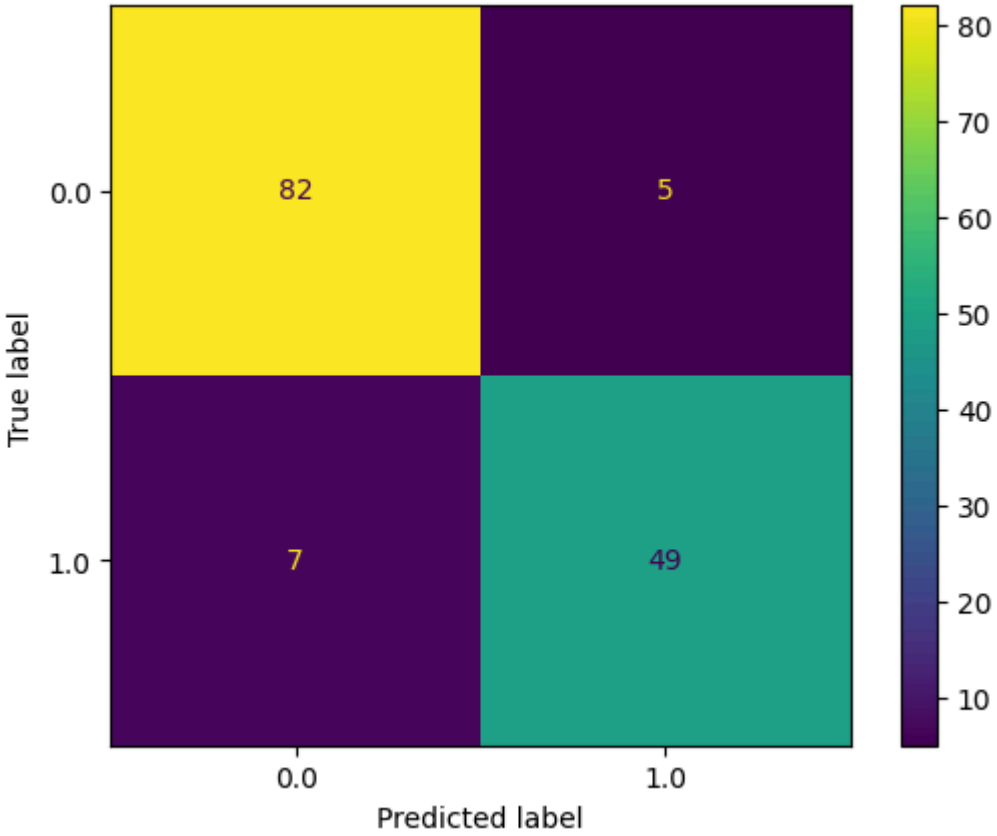
In [ ]:
```
print(classification_report(y_test,predicted,labels=[0.0,1.0]))
# labels should be the exact name of the categories
```

```
              precision    recall  f1-score   support

         0.0       0.92      0.94      0.93        87
         1.0       0.91      0.88      0.89        56

    accuracy                           0.92       143
   macro avg       0.91      0.91      0.91       143
weighted avg       0.92      0.92      0.92       143
```

Confusion Matrix

In [ ]:
```
cm=confusion_matrix(y_test,predicted)
fig=ConfusionMatrixDisplay(confusion_matrix=cm,
                           display_labels=dtree.classes_)
fig.plot()
```

Out[ ]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x14a689303d0
>
```



HYPERPARAMETER TUNING

In [ ]:
```
para={
    'criterion':['gini','entropy'],
    'splitter':['best','random'],
    'min_samples_leaf':[2,4,6,8],
    'max_depth':[2,3,4,5]
}
from sklearn.model_selection import GridSearchCV
dtree_tuned=GridSearchCV(dtree,para,cv=10,scoring='accuracy')
```

```
dtree_tuned.fit(X_train,y_train)
#getting best parameters from gridsearch cv
print(dtree_tuned.best_params_)
```

```
{'criterion': 'gini', 'max_depth': 5, 'min_samples_leaf': 2, 'splitter': 'best'}
```

In [ ]:
```
tuned_predictions=dtree_tuned.predict(X_test)
```

Classification report after Hyperparameter Tuning

In [ ]:
```
print(classification_report(y_test,tuned_predictions,labels=[0.0,1.0]))
```

```
              precision    recall  f1-score   support

         0.0       0.94      0.91      0.92        87
         1.0       0.86      0.91      0.89        56

    accuracy                           0.91       143
   macro avg       0.90      0.91      0.91       143
weighted avg       0.91      0.91      0.91       143
```

SVM

In [ ]:
```
features=['radius','texture','perimeter','area','s','c','concavity','cp','sym']
```

In [ ]:
```
from sklearn.svm import SVC
```

In [ ]:
```
clf = SVC(kernel='poly')

# fitting x samples and y classes
clf.fit(X_train, y_train)

predicted = clf.predict(X_train)
print (accuracy_score(y_train, predicted))
```

```
0.8896713615023474
```

In [ ]:
```
predicted = clf.predict(X_test)
print (accuracy_score(y_test, predicted))
```

```
0.8881118881118881
```

Classification report

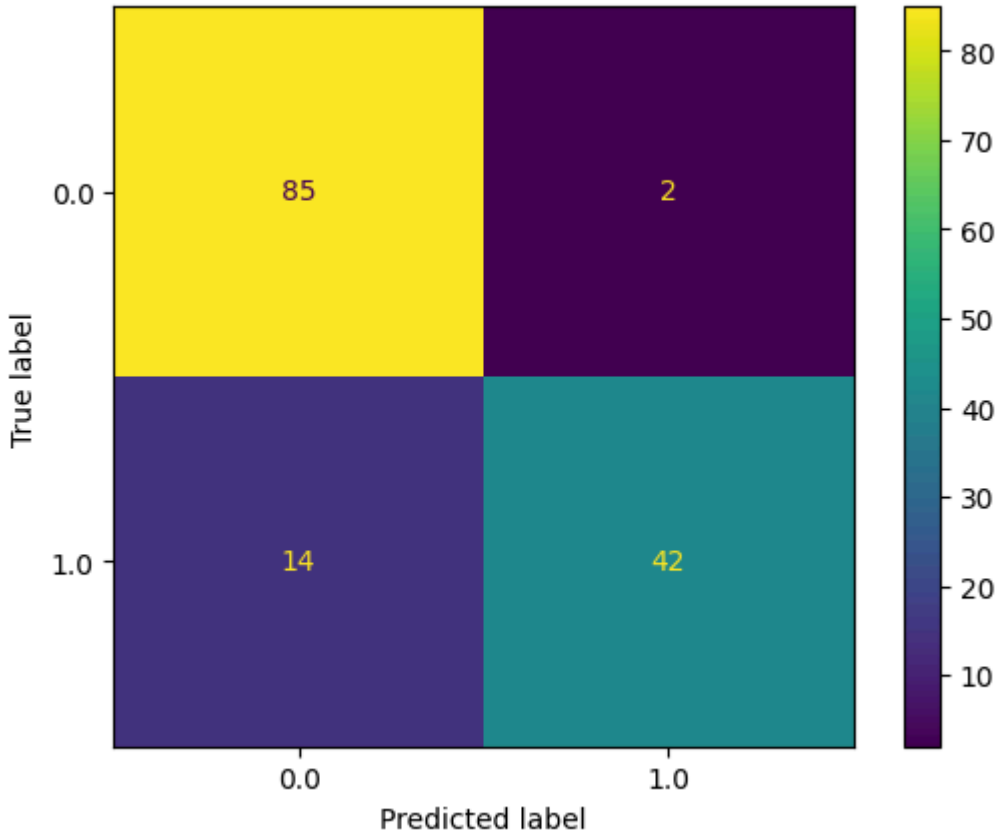
In [ ]:
```
print(classification_report(y_test,predicted,labels=[0.0,1.0]))
# labels should be the exact name of the categories
```

```
              precision    recall  f1-score   support

         0.0       0.86      0.98      0.91        87
         1.0       0.95      0.75      0.84        56

    accuracy                           0.89       143
   macro avg       0.91      0.86      0.88       143
weighted avg       0.90      0.89      0.89       143
```

Confusion Matrix

In [ ]:
```
cm=confusion_matrix(y_test,predicted)
fig=ConfusionMatrixDisplay(confusion_matrix=cm,display_labels=dtree.classes_)
fig.plot()
```

Out[ ]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x14a68593e50
>
```



HYPERPARAMETER TUNING

In [ ]:
```
para={
    'kernel':['linear','rbf','poly'],
}
clf_tuned=GridSearchCV(clf,para,cv=10,scoring='accuracy')
clf_tuned.fit(X_train,y_train)
#getting best parameters from gridsearch cv
print(clf_tuned.best_params_)

clf_tuned_predictions=clf_tuned.predict(X_test)
```

```
{'kernel': 'linear'}
```

Classification report after Hyperparameter Tuning

In [ ]:
```
print(classification_report(y_test,clf_tuned_predictions,
                            labels=[0.0,1.0]))
```

	precision	recall	f1-score	support
0.0	0.91	0.93	0.92	87
1.0	0.89	0.86	0.87	56
accuracy			0.90	143
macro avg	0.90	0.89	0.90	143
weighted avg	0.90	0.90	0.90	143

In [ ]: