In [ ]:
```
#Urmila Jagdhane
#LGM VIP Datascience TASK 2
```

In [40]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
```

In [20]:
```
iris=pd.read_csv(r"C:\Users\urmil\Downloads\Iris csv.csv")
```

In [21]:
```
iris
```

Out[21]:

	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
...	...	...	...	...	...	...
145	146	6.7	3.0	5.2	2.3	Iris-virginica
146	147	6.3	2.5	5.0	1.9	Iris-virginica
147	148	6.5	3.0	5.2	2.0	Iris-virginica
148	149	6.2	3.4	5.4	2.3	Iris-virginica
149	150	5.9	3.0	5.1	1.8	Iris-virginica

150 rows × 6 columns

In [22]:
```
iris.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   Id             150 non-null    int64  
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object 
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

In [32]:
```
iris.head()
```

Out[32]:

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

In [33]:
```
iris.tail()
```

Out[33]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species	Species_class
145	146	6.7	3.0	5.2	2.3	Iris-virginica	1
146	147	6.3	2.5	5.0	1.9	Iris-virginica	1
147	148	6.5	3.0	5.2	2.0	Iris-virginica	1
148	149	6.2	3.4	5.4	2.3	Iris-virginica	1

Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species	Species_class

In [37]:
```
iris.columns
```

Out[37]:
```
Index(['Id', 'SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm', 'PetalWidthCm',
       'Species', 'Species_class'],
      dtype='object')
```

In [25]:
```
iris.Species.value_counts()
```

Out[25]:
```
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: Species, dtype: int64
```

In [26]:
```
iris['Species_class']=np.where(iris.Species=='Iris-virginica',1,np.where(iris.Species=='Iris-versicolor',2,3
```

In [28]:
```
iris.Species_class.value_counts()
```

Out[28]:
```
3    50
2    50
1    50
Name: Species_class, dtype: int64
```

In [45]:
```
cols=['SepalLengthCm','SepalWidthCm','PetalLengthCm','PetalWidthCm']
```

In [46]:
```
from sklearn.model_selection import train_test_split

train_X, test_X, train_y, test_y = train_test_split( iris[cols],
                                                     iris['Species_class'],
                                                     test_size = 0.2,
                                                     random_state = 123 )
```

In [50]:
```
#Model Building
param_grid = {'max_depth': np.arange(2,8),
              'max_features': np.arange(2,5)}
```

In [51]:
```
from sklearn.model_selection import GridSearchCV
from sklearn.tree import DecisionTreeClassifier, export_graphviz
tree = GridSearchCV(DecisionTreeClassifier(), param_grid, cv = 10,verbose=1,n_jobs=-1)
tree.fit( train_X, train_y )
```

Out[51]:
```
Fitting 10 folds for each of 18 candidates, totalling 180 fits
GridSearchCV(cv=10, estimator=DecisionTreeClassifier(), n_jobs=-1,
             param_grid={'max_depth': array([2, 3, 4, 5, 6, 7]),
                         'max_features': array([2, 3, 4])},
             verbose=1)
```

In [52]:
```
tree.best_score_
```

Out[52]:
```
0.9583333333333334
```

In [54]:
```
tree.best_estimator_
```

Out[54]:
```
DecisionTreeClassifier(max_depth=5, max_features=3)
```

In [55]:
```
tree.best_params_
```

Out[55]:
```
{'max_depth': 5, 'max_features': 3}
```

In [56]:
```
train_pred = tree.predict(train_X)
```

In [57]:
```
test_pred = tree.predict(test_X)
```

In [59]:
```
import sklearn.metrics as metrics
print(metrics.classification_report(test_y, test_pred))
```

```
              precision    recall  f1-score   support

           1       1.00      0.82      0.90        11
           2       0.75      1.00      0.86         6
           3       1.00      1.00      1.00        13
```

```
    accuracy                           0.93        30
   macro avg       0.92      0.94      0.92        30
weighted avg       0.95      0.93      0.93        30
```

In [62]:
```
#Building Final Decision Tree
clf_tree  =DecisionTreeClassifier( max_depth =4, max_features=2)
clf_tree.fit( train_X, train_y)
```

Out[62]:
```
DecisionTreeClassifier(max_depth=4, max_features=2)
```

In [63]:
```
tree_test_pred = pd.DataFrame({'actual': test_y, 'pedicted':clf_tree.predict(test_X)})
```

In [64]:
```
tree_test_pred.sample(n=10)
```

Out[64]:

	actual	pedicted
133	1	2
4	3	3
90	2	2
24	3	3
37	3	3
8	3	3
88	2	2
13	3	3
104	1	1
138	1	1

In [70]:
```
metrics.accuracy_score( tree_test_pred.actual, tree_test_pred.pedicted )
```

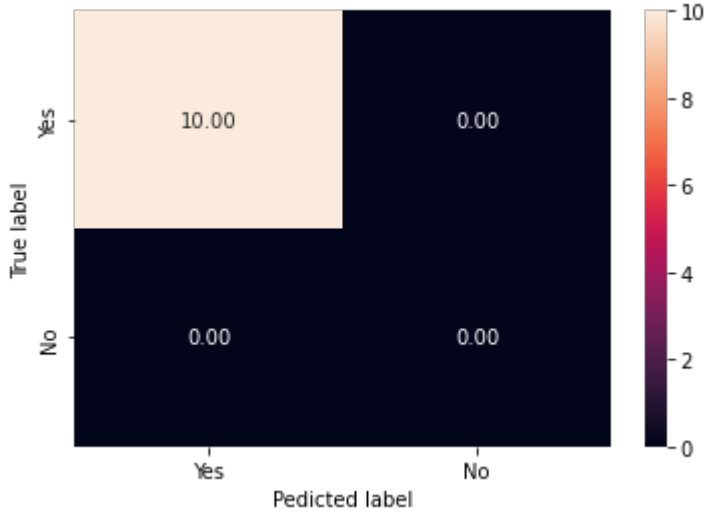
Out[70]:
```
0.9666666666666667
```

In [76]:
```
tree_cm = metrics.confusion_matrix( tree_test_pred.pedicted,
                                    tree_test_pred.actual,
                                    [1,0] )
sns.heatmap(tree_cm, annot=True,
            fmt='.2f',
            xticklabels = ["Yes", "No"] , yticklabels = ["Yes", "No"] )

plt.ylabel('True label')
plt.xlabel('Pedicted label')
```

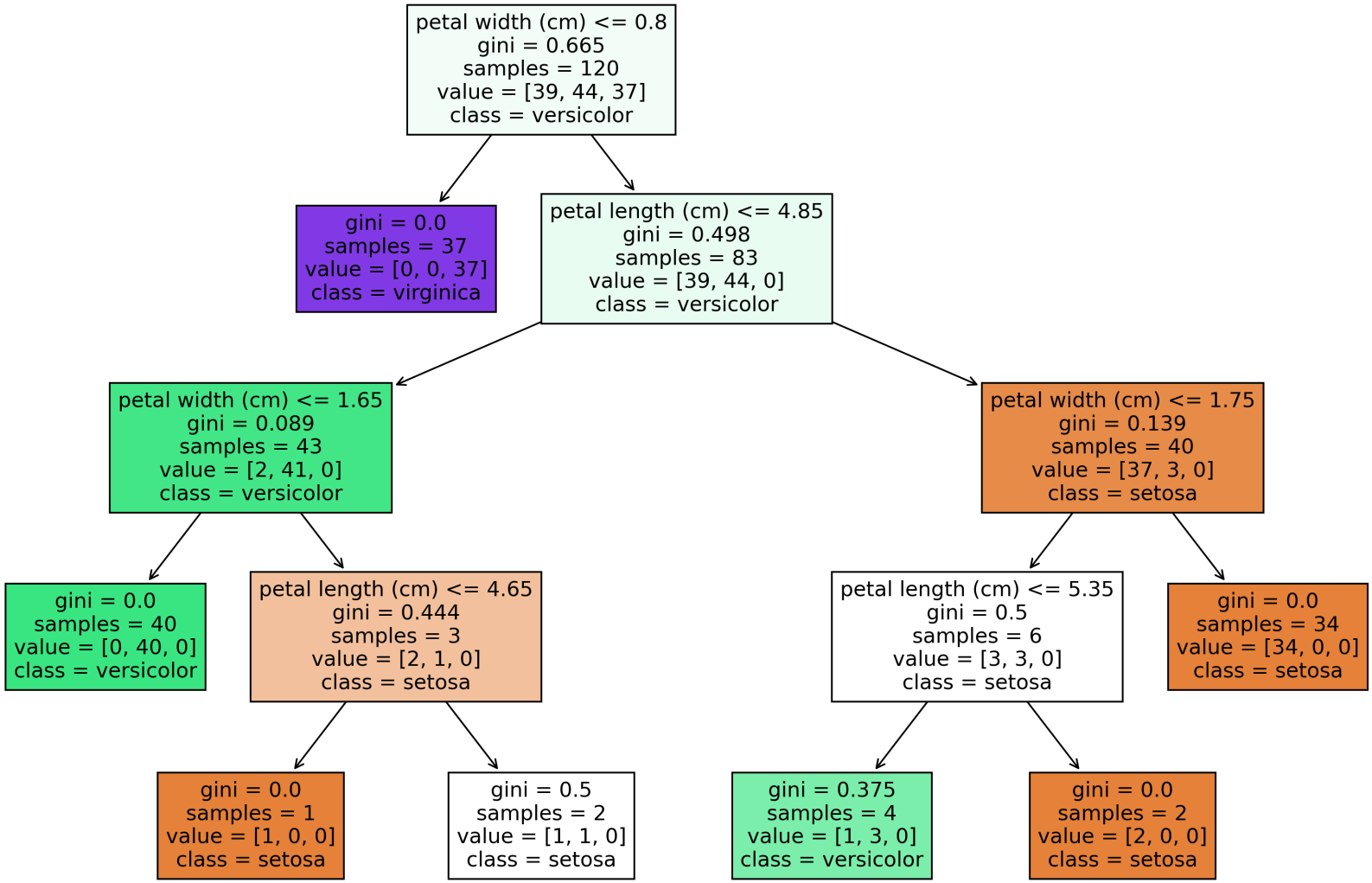
```
C:\Users\urmil\anaconda3\lib\site-packages\sklearn\utils\validation.py:70: FutureWarning: Pass labels=[1, 0]
as keyword args. From version 1.0 (renaming of 0.25) passing these as positional arguments will result in an
error
  warnings.warn(f"Pass {args_msg} as keyword args. From version "
```

Out[76]:
```
Text(0.5, 15.0, 'Pedicted label')
```



In [77]:

```
#Graphical Representation of Decision Tree
from sklearn import tree
fn=['sepal length (cm)','sepal width (cm)','petal length (cm)','petal width (cm)']
cn=['setosa', 'versicolor', 'virginica']
fig, axes = plt.subplots(nrows = 1,ncols = 1,figsize = (15,10), dpi=300)
tree.plot_tree(clf_tree,
               feature_names = fn,
               class_names=cn,
               filled = True);
fig.savefig('imagename.png')
```


petal width (cm) <= 0.8
gini = 0.665
samples = 120
value = [39, 44, 37]
class = versicolor
gini = 0.0
samples = 37
value = [0, 0, 37]
class = virginica
petal length (cm) <= 4.85
gini = 0.498
samples = 83
value = [39, 44, 0]
class = versicolor
petal width (cm) <= 1.65
gini = 0.089
samples = 43
value = [2, 41, 0]
class = versicolor
petal width (cm) <= 1.75
gini = 0.139
samples = 40
value = [37, 3, 0]
class = setosa
gini = 0.0
samples = 40
value = [0, 40, 0]
class = versicolor
petal length (cm) <= 4.65
gini = 0.444
samples = 3
value = [2, 1, 0]
class = setosa
petal length (cm) <= 5.35
gini = 0.5
samples = 6
value = [3, 3, 0]
class = setosa
gini = 0.0
samples = 34
value = [34, 0, 0]
class = setosa
gini = 0.0
samples = 1
value = [1, 0, 0]
class = setosa
gini = 0.5
samples = 2
value = [1, 1, 0]
class = setosa
gini = 0.375
samples = 4
value = [1, 3, 0]
class = versicolor
gini = 0.0
samples = 2
value = [2, 0, 0]
class = setosa

In [ ]: