Decision Tree

In [34]:

```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn import datasets
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn import tree
from sklearn.metrics import classification_report
from sklearn import preprocessing
```

In [35]:

```
#import some data to play with
Iris = pd.read_csv(r"C:\Users\HOME\Desktop\DSA\Lab11\iris.csv",index_col=0)
```

In [36]:

```
Iris.head()
```

Out[36]:

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa

In [37]:

```
Iris.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 150 entries, 1 to 150
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Sepal.Length  150 non-null    float64
 1   Sepal.Width   150 non-null    float64
 2   Petal.Length  150 non-null    float64
 3   Petal.Width   150 non-null    float64
 4   Species       150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 7.0+ KB
```

In [38]:

```
Iris.describe()
```

Out[38]:

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.057333	3.758000	1.199333
std	0.828066	0.435866	1.765298	0.762238
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

In [39]:

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

In [40]:

```
x = Iris.iloc[:,0:4]
y=Iris['Species']
```

In [41]:
```
Iris
```
Out[41]:

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	0
2	4.9	3.0	1.4	0.2	0
3	4.7	3.2	1.3	0.2	0
4	4.6	3.1	1.5	0.2	0
5	5.0	3.6	1.4	0.2	0
...	...	...	...	...	...
146	6.7	3.0	5.2	2.3	2
147	6.3	2.5	5.0	1.9	2
148	6.5	3.0	5.2	2.0	2
149	6.2	3.4	5.4	2.3	2
150	5.9	3.0	5.1	1.8	2

150 rows × 5 columns

In [42]:
```
x
```
Out[42]:

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width
1	5.1	3.5	1.4	0.2
2	4.9	3.0	1.4	0.2
3	4.7	3.2	1.3	0.2
4	4.6	3.1	1.5	0.2
5	5.0	3.6	1.4	0.2
...	...	...	...	...
146	6.7	3.0	5.2	2.3
147	6.3	2.5	5.0	1.9
148	6.5	3.0	5.2	2.0
149	6.2	3.4	5.4	2.3
150	5.9	3.0	5.1	1.8

150 rows × 4 columns

In [43]:
```
y
```
Out[43]:
```
1      0
2      0
3      0
4      0
5      0
      ..
146    2
147    2
148    2
149    2
150    2
Name: Species, Length: 150, dtype: int32
```

In [44]:
```
Iris['Species'].unique()
```
Out[44]:
```
array([0, 1, 2])
```

In [45]:
```
Iris.Species.value_counts()
```
Out[45]:
```
Species
0    50
1    50
2    50
Name: count, dtype: int64
```

In [46]:
```
colnames=list(Iris.columns)
```

In [47]:
```
colnames
```
Out[47]:
```
['Sepal.Length', 'Sepal.Width', 'Petal.Length', 'Petal.Width', 'Species']
```

In [48]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=40)
```

Decision Tree Classifier

```
In [49]: model=DecisionTreeClassifier(criterion='entropy',max_depth=3)
         model.fit(x_train,y_train)
```

```
Out[49]: DecisionTreeClassifier(criterion='entropy', max_depth=3)
```

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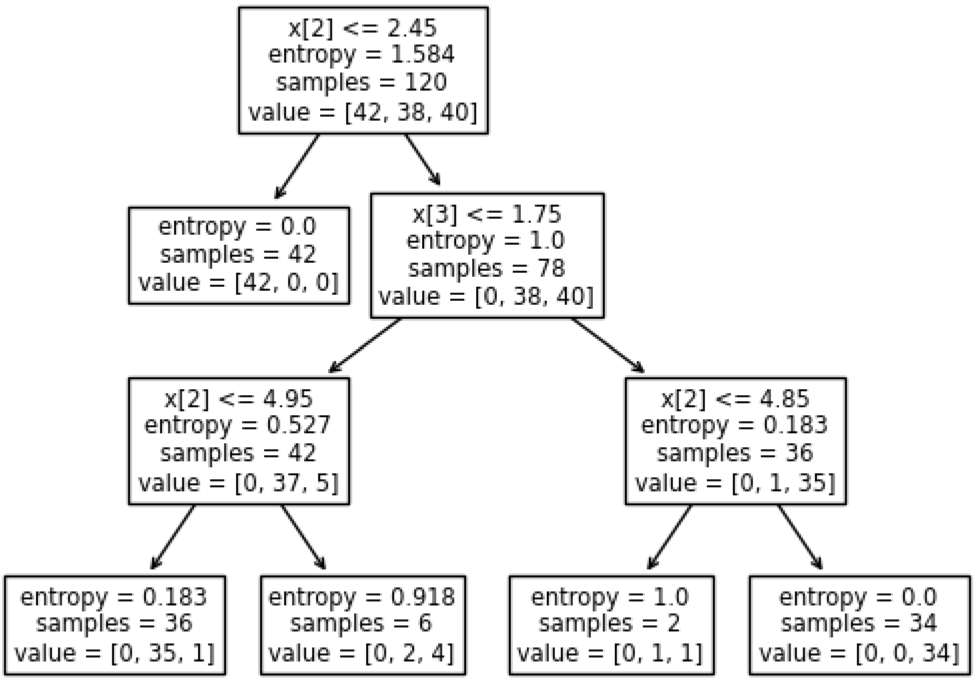
```
In [50]: #plot
```

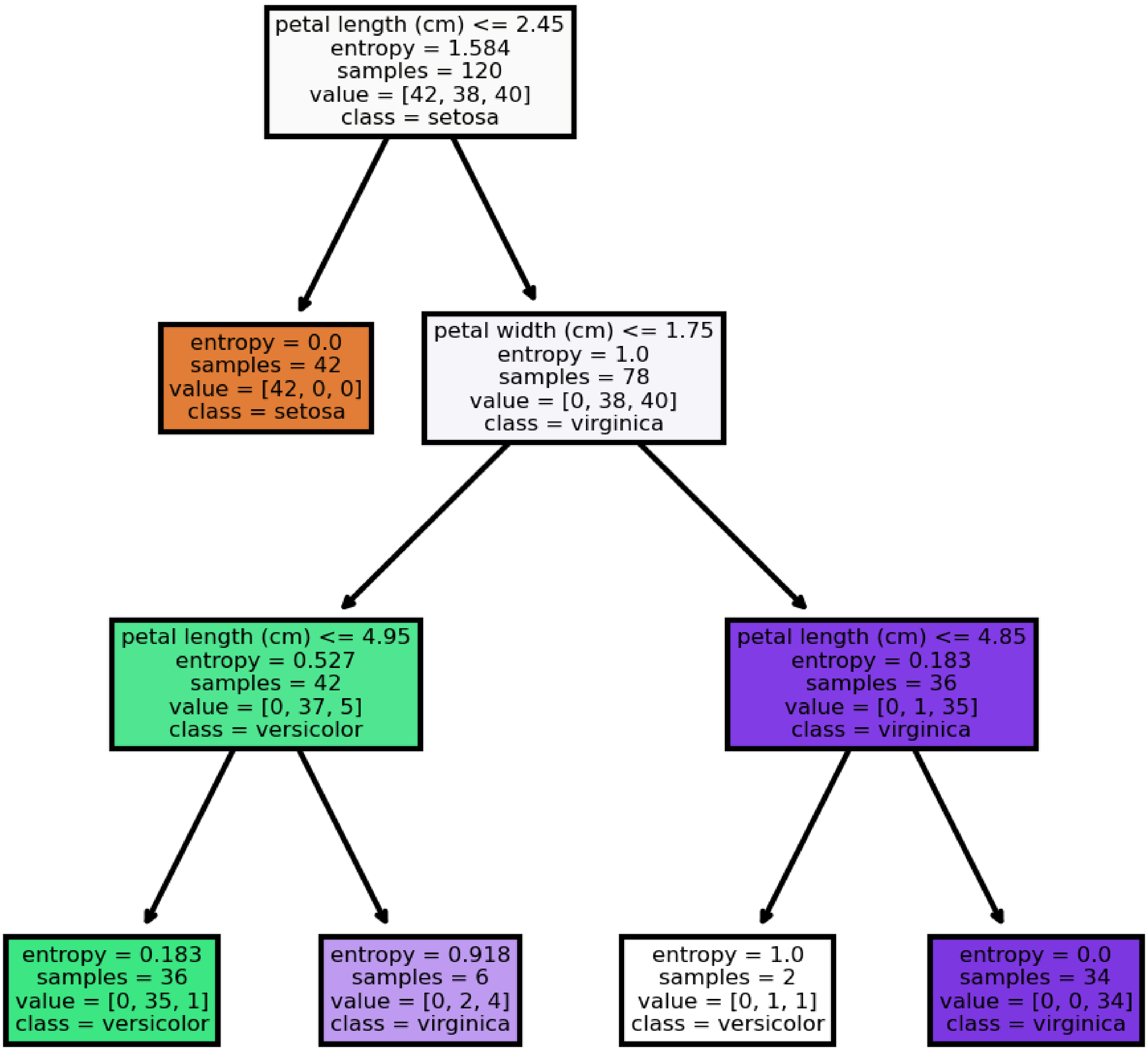
```
In [51]: tree.plot_tree(model)
```

```
Out[51]: [Text(0.375, 0.875, 'x[2] <= 2.45\nentropy = 1.584\nsamples = 120\nvalue = [42, 38, 40]'),
          Text(0.25, 0.625, 'entropy = 0.0\nsamples = 42\nvalue = [42, 0, 0]'),
          Text(0.5, 0.625, 'x[3] <= 1.75\nentropy = 1.0\nsamples = 78\nvalue = [0, 38, 40]'),
          Text(0.25, 0.375, 'x[2] <= 4.95\nentropy = 0.527\nsamples = 42\nvalue = [0, 37, 5]'),
          Text(0.125, 0.125, 'entropy = 0.183\nsamples = 36\nvalue = [0, 35, 1]'),
          Text(0.375, 0.125, 'entropy = 0.918\nsamples = 6\nvalue = [0, 2, 4]'),
          Text(0.75, 0.375, 'x[2] <= 4.85\nentropy = 0.183\nsamples = 36\nvalue = [0, 1, 35]'),
          Text(0.625, 0.125, 'entropy = 1.0\nsamples = 2\nvalue = [0, 1, 1]'),
          Text(0.875, 0.125, 'entropy = 0.0\nsamples = 34\nvalue = [0, 0, 34]')]
```



In [52]:

```
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=(4,4),dpi=300)
tree.plot_tree(model,
               feature_names=fn,
               class_names=cn,
               filled=True);
```



In [53]:

```
#predicting on test data
preds=model.predict(x_test)
pd.Series(preds).value_counts()
```

Out[53]:

```
1    13
2     9
0     8
Name: count, dtype: int64
```

In [54]:

```
preds
```

Out[54]:

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

In [55]:

```
pd.crosstab(y_test,preds)
```

Out[55]:

col_0	0	1	2
Species			
0	8	0	0
1	0	12	0
2	0	1	9

In [56]:

```
np.mean(preds==y_test)
```

Out[56]:

```
0.9666666666666667
```

Decision Tree CART using GINI Criteria

In [57]:

```
from sklearn.tree import DecisionTreeClassifier
model_gini = DecisionTreeClassifier(criterion='gini', max_depth=3)
```

In [58]:

```
model_gini.fit(x_train,y_train)
```

Out[58]:

```
DecisionTreeClassifier(max_depth=3)
```

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In [59]:

```
#Prediction and Computing the accuracy
pred=model.predict(x_test)
np.mean(preds==y_test)
```

Out[59]:

```
0.9666666666666667
```

Decision Tree Regression

In [60]:

```
#Decision Tree Regression
from sklearn.tree import DecisionTreeRegressor
```

In [61]:

```
array = Iris.values
X = array[:,0:3]
y=array[:,3]
```

In [62]:

```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.33,random_state=1)
```

In [63]:

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

Out[63]:

```
DecisionTreeRegressor()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [64]:

```
model.score(X_test,y_test)
```

Out[64]:

```
0.8810631528394766
```