Lab8. Animal Classification using Decision Trees

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STEP 1

In [1]:
```
import pandas as pd
```

In [3]:
```
data=pd.read_csv('animals.csv')
data.head()
```

Out[3]:

	toothed	hair	breathes	legs	species
0	True	True	True	True	Mammal
1	True	True	True	True	Mammal
2	True	False	True	False	Reptile
3	False	True	True	True	Mammal
4	True	True	True	True	Mammal

In [4]:
```
data.shape
```

Out[4]:
```
(10, 5)
```

In [5]:
```
data.columns
```

Out[5]:
```
Index(['toothed', 'hair', 'breathes', 'legs', 'species'], dtype='object')
```

In [6]:
```
data.size
```

Out[6]:
```
50
```

step 2

In [7]:
```
from sklearn.tree import DecisionTreeClassifier
```

In [8]:
```
dc=DecisionTreeClassifier(criterion='entropy')
```

In [9]:
```
from sklearn.model_selection import train_test_split
```

In [10]:
```
X=data.drop("species",axis=1)
y=data['species']
```

In [11]:
```
x_train,x_test,y_train,y_test=train_test_split(X,y,test_size=0.33)
```

In [12]:
```
dc.fit(x_train,y_train)
```

Out[12]:
```
DecisionTreeClassifier(criterion='entropy')
```

In [13]:
```
y_pred=dc.predict(x_test)
```

In [14]:
```
from sklearn.metrics import accuracy_score
```

In [15]:
```
a_score=accuracy_score(y_test,y_pred)
a_score
```

Out[15]:
```
1.0
```

In [16]:
```
from sklearn.metrics import classification_report
cr=classification_report(y_pred,y_test)
print(cr)
```

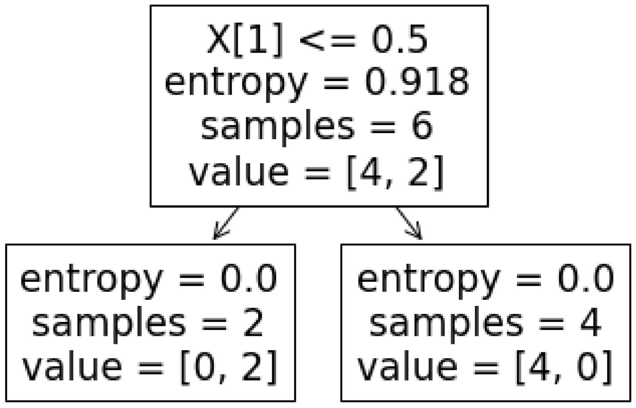
```
              precision    recall  f1-score   support

      Mammal       1.00      1.00      1.00         2
     Reptile       1.00      1.00      1.00         2

    accuracy                           1.00         4
   macro avg       1.00      1.00      1.00         4
weighted avg       1.00      1.00      1.00         4
```

In [17]:
```
from sklearn.tree import export_graphviz
from sklearn import tree
```

In [18]:
```
with open ("tree1.dot",'w') as f:
    f = tree.export_graphviz(dc,
                             out_file=f,
                             max_depth=4,
                             impurity=False,
                             feature_names=X.columns.values,
                             class_names=['Reptile','Mammal'],
                             filled=True)
```

In [20]:
```
tree.plot_tree(dc)
```

Out[20]:
```
[Text(0.5, 0.75, 'X[1] <= 0.5\nentropy = 0.918\nsamples = 6\nvalue = [4,
2]'),
 Text(0.25, 0.25, 'entropy = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.75, 0.25, 'entropy = 0.0\nsamples = 4\nvalue = [4, 0]')]
```



STEP 3

In [21]:
```
x_test1=pd.read_csv("animals_test.csv")
x_test1
```

Out[21]:

	toothed	hair	breathes	legs	species
0	False	False	True	False	Reptile
1	False	True	True	True	Mammal
2	True	False	True	True	Reptile

In [22]:
```
dc
```

Out[22]:
```
DecisionTreeClassifier(criterion='entropy')
```

STEP 4

In [23]:
```
tx=x_test1.drop("species",axis=1)
```

In [24]:
```
y_pred=dc.predict(tx)
```

In [25]:
```
y_pred
```

Out[25]:
```
array(['Reptile', 'Mammal', 'Reptile'], dtype=object)
```

STEP 5

In [26]:
```
DTC=DecisionTreeClassifier(criterion='gini')
```

In [27]:
```
DTC.fit(X,y)
y_pred1=DTC.predict(tx)
```

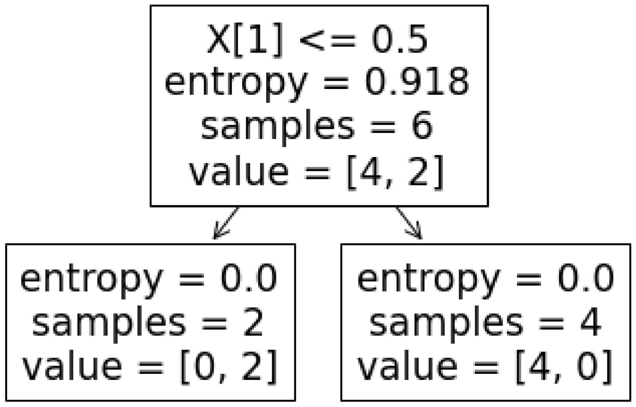
In [28]:
```
y_pred1
```

Out[28]:
```
array(['Reptile', 'Mammal', 'Reptile'], dtype=object)
```

In [29]:
```
with open ("tree1.dot2",'w') as f:
    f = tree.export_graphviz(dc,
                            out_file=f,
                            max_depth=4,
                            impurity=False,
                            feature_names=X.columns.values,
                            class_names=['Reptile','Mammal'],
                            filled=True)
```

In [38]:
```
tree.plot_tree(dc)
```

Out[38]:
```
[Text(0.5, 0.75, 'X[1] <= 0.5\nentropy = 0.918\nsamples = 6\nvalue = [4,
2]'),
 Text(0.25, 0.25, 'entropy = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.75, 0.25, 'entropy = 0.0\nsamples = 4\nvalue = [4, 0]')]
```



STEP 6

In [39]:
```
z_data=pd.read_csv('zoo.csv')
z_data
```

Out[39]:

	animal_name	hair	feathers	eggs	milk	airborne	aquatic	predator	toothed	backbone	b
0	aardvark	1	0	0	1	0	0	1	1	1	
1	antelope	1	0	0	1	0	0	0	1	1	
2	bass	0	0	1	0	0	1	1	1	1	
3	bear	1	0	0	1	0	0	1	1	1	
4	boar	1	0	0	1	0	0	1	1	1	
...	...	...	...	...	...	...	...	...	...	...	
96	wallaby	1	0	0	1	0	0	0	1	1	
97	wasp	1	0	1	0	1	0	0	0	0	
98	wolf	1	0	0	1	0	0	1	1	1	
99	worm	0	0	1	0	0	0	0	0	0	
100	wren	0	1	1	0	1	0	0	0	1	

101 rows × 18 columns

In [40]:
```
x=z_data.drop(['animal_name','class_type'],axis=1)
y=z_data.class_type
```

In [41]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33,random_state
```

In [42]:
```
ID3=DecisionTreeClassifier(criterion='entropy',max_depth=3)
```

In [43]:
```
ID3.fit(x_train,y_train)
y_pred2=ID3.predict(x_test)
y_pred2
```

Out[43]:
```
array([1, 1, 1, 1, 1, 7, 1, 1, 1, 1, 4, 7, 7, 2, 7, 1, 1, 2, 4, 1, 7, 7,
       7, 7, 1, 7, 7, 7, 1, 1, 2, 7, 1, 1], dtype=int64)
```

In [44]:
```
print("model accuracy:",accuracy_score(y_test,y_pred2))
print("Train accuracy:",ID3.score(x_train,y_train))
print("Test accuracy:",ID3.score(x_test,y_test))
```

```
model accuracy: 0.7352941176470589
Train accuracy: 0.8805970149253731
Test accuracy: 0.7352941176470589
```

In [45]:
```
cr=classification_report(y_pred2,y_test)
print(cr)
```

```
              precision    recall  f1-score   support

           1       1.00      1.00      1.00        17
           2       1.00      1.00      1.00         3
           3       0.00      0.00      0.00         0
           4       1.00      1.00      1.00         2
           5       0.00      0.00      0.00         0
           6       0.00      0.00      0.00         0
           7       1.00      0.25      0.40        12

    accuracy                           0.74        34
   macro avg       0.57      0.46      0.49        34
weighted avg       1.00      0.74      0.79        34


C:\Users\joshua\anaconda3\lib\site-packages\sklearn\metrics\_classification.p
y:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being
set to 0.0 in labels with no true samples. Use `zero_division` parameter to c
ontrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\joshua\anaconda3\lib\site-packages\sklearn\metrics\_classification.p
y:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being
set to 0.0 in labels with no true samples. Use `zero_division` parameter to c
ontrol this behavior.
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C:\Users\joshua\anaconda3\lib\site-packages\sklearn\metrics\_classification.p
y:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being
set to 0.0 in labels with no true samples. Use `zero_division` parameter to c
ontrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```
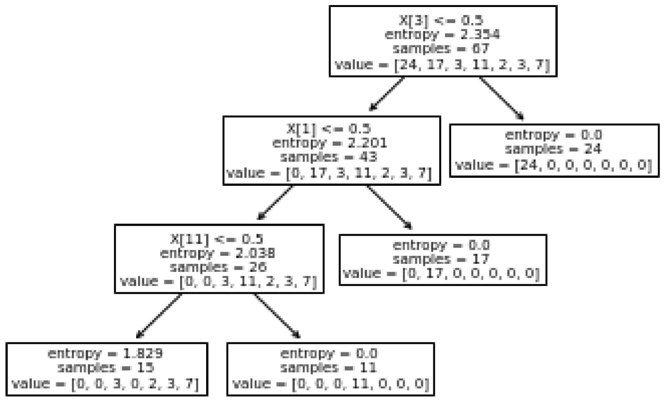

In [46]:
```
from sklearn import tree
tree.plot_tree(ID3)
```

Out[46]:
```
[Text(0.6666666666666666, 0.875, 'X[3] <= 0.5\nentropy = 2.354\nsamples = 67
\nvalue = [24, 17, 3, 11, 2, 3, 7]'),
 Text(0.5, 0.625, 'X[1] <= 0.5\nentropy = 2.201\nsamples = 43\nvalue = [0, 1
7, 3, 11, 2, 3, 7]'),
 Text(0.3333333333333333, 0.375, 'X[11] <= 0.5\nentropy = 2.038\nsamples = 26
\nvalue = [0, 0, 3, 11, 2, 3, 7]'),
 Text(0.16666666666666666, 0.125, 'entropy = 1.829\nsamples = 15\nvalue = [0,
0, 3, 0, 2, 3, 7]'),
 Text(0.5, 0.125, 'entropy = 0.0\nsamples = 11\nvalue = [0, 0, 0, 11, 0, 0,
0]'),
 Text(0.6666666666666666, 0.375, 'entropy = 0.0\nsamples = 17\nvalue = [0, 1
7, 0, 0, 0, 0, 0]'),
 Text(0.8333333333333334, 0.625, 'entropy = 0.0\nsamples = 24\nvalue = [24,
0, 0, 0, 0, 0, 0]')]
```



In [ ]: