ML9

May 23, 2022

[1]:
```
# Consider the following training data set. Write a program to␣
↪construct a decision
# tree using ID3 algorithm.
# Display Accuracy measures for the same and predict a class of␣
↪suitable query.
```

[2]:
```
import numpy as np
import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.preprocessing import LabelEncoder
from sklearn.tree import plot_tree
```

[3]:
```
data = pd.read_csv("ML9.csv")
data
```

[3]:

	Outlook	Temperature	Humidity	Wind	Play Tennis
0	Sunny	Hot	High	Weak	No
1	Sunny	Hot	High	Strong	No
2	Overcast	Hot	High	Weak	Yes
3	Rain	Mild	High	Weak	Yes
4	Rain	Cool	Normal	Weak	Yes
5	Rain	Cool	Normal	Strong	No
6	Overcast	Cool	Normal	Strong	Yes
7	Sunny	Mild	High	Weak	No
8	Sunny	Cool	Normal	Weak	Yes
9	Rain	Mild	Normal	Weak	Yes
10	Sunny	Mild	Normal	Strong	Yes
11	Overcast	Mild	High	Strong	Yes
12	Overcast	Hot	Normal	Weak	Yes
13	Rain	Mild	High	Strong	No

[4]:
```
x = data.iloc[:,:-1]
x
y = data.iloc[:,-1]
y
```

[4]:
```
0      No
1      No
```

```
2     Yes
3     Yes
4     Yes
5      No
6     Yes
7      No
8     Yes
9     Yes
10    Yes
11    Yes
12    Yes
13     No
Name: Play Tennis, dtype: object
```

[5]:
```
le = LabelEncoder()
x = x.apply(le.fit_transform)
x
```

[5]:

	Outlook	Temperature	Humidity	Wind
0	2	1	0	1
1	2	1	0	0
2	0	1	0	1
3	1	2	0	1
4	1	0	1	1
5	1	0	1	0
6	0	0	1	0
7	2	2	0	1
8	2	0	1	1
9	1	2	1	1
10	2	2	1	0
11	0	2	0	0
12	0	1	1	1
13	1	2	0	0

[6]:
```
print("Outlook: ",list(zip(data.iloc[:,0],x.iloc[:,0])))
print("Temperature: ",list(zip(data.iloc[:,1],x.iloc[:,1])))
print("Humidity: ",list(zip(data.iloc[:,2],x.iloc[:,2])))
print("Wind: ",list(zip(data.iloc[:,3],x.iloc[:,3])))
```

```
Outlook:  [('Sunny', 2), ('Sunny', 2), ('Overcast', 0), ('Rain', 1), ('Rain',
1), ('Rain', 1), ('Overcast', 0), ('Sunny', 2), ('Sunny', 2), ('Rain', 1),
('Sunny', 2), ('Overcast', 0), ('Overcast', 0), ('Rain', 1)]
Temperature:  [('Hot', 1), ('Hot', 1), ('Hot', 1), ('Mild', 2), ('Cool', 0),
('Cool', 0), ('Cool', 0), ('Mild', 2), ('Cool', 0), ('Mild', 2), ('Mild', 2),
('Mild', 2), ('Hot', 1), ('Mild', 2)]
Humidity:  [('High', 0), ('High', 0), ('High', 0), ('High', 0), ('Normal', 1),
('Normal', 1), ('Normal', 1), ('High', 0), ('Normal', 1), ('Normal', 1),
('Normal', 1), ('High', 0), ('Normal', 1), ('High', 0)]
```

```
Wind:  [('Weak', 1), ('Strong', 0), ('Weak', 1), ('Weak', 1), ('Weak', 1),
('Strong', 0), ('Strong', 0), ('Weak', 1), ('Weak', 1), ('Weak', 1), ('Strong',
0), ('Strong', 0), ('Weak', 1), ('Strong', 0)]
```

[7]:
```
dt = DecisionTreeClassifier(criterion="entropy")
dt.fit(x,y)
```

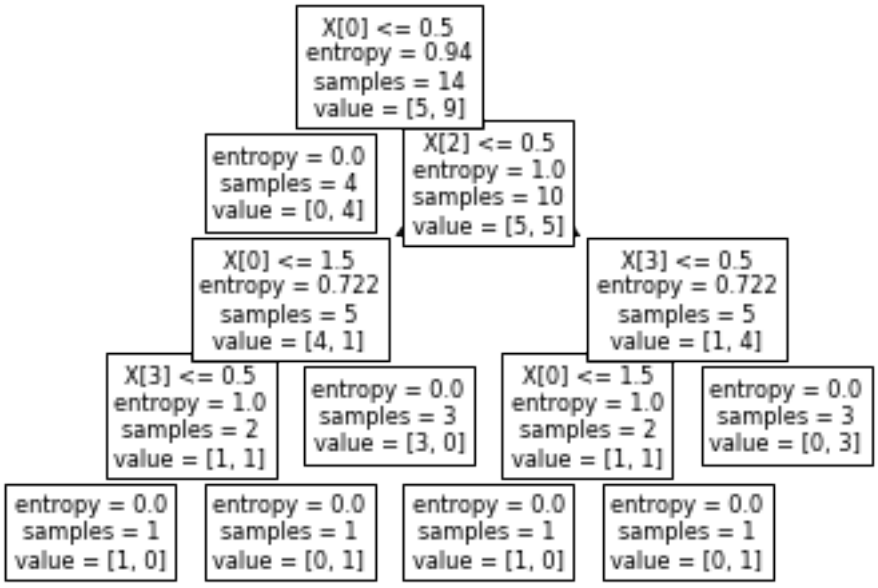
[7]:
```
DecisionTreeClassifier(criterion='entropy')
```

[8]:
```
query = np.array([2,1,0,0])
pred = dt.predict([query])
pred
```

[8]:
```
array(['No'], dtype=object)
```

[9]:
```
plot_tree(dt)
```

[9]:
```
[Text(148.8, 195.696, 'X[0] <= 0.5\nentropy = 0.94\nsamples = 14\nvalue = [5,
9]'),
 Text(111.60000000000001, 152.208, 'entropy = 0.0\nsamples = 4\nvalue = [0,
4]'),
 Text(186.0, 152.208, 'X[2] <= 0.5\nentropy = 1.0\nsamples = 10\nvalue = [5,
5]'),
 Text(111.60000000000001, 108.72, 'X[0] <= 1.5\nentropy = 0.722\nsamples =
5\nvalue = [4, 1]'),
 Text(74.4, 65.232, 'X[3] <= 0.5\nentropy = 1.0\nsamples = 2\nvalue = [1, 1]'),
 Text(37.2, 21.744, 'entropy = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(111.60000000000001, 21.744, 'entropy = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(148.8, 65.232, 'entropy = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(260.40000000000003, 108.72, 'X[3] <= 0.5\nentropy = 0.722\nsamples =
5\nvalue = [1, 4]'),
 Text(223.20000000000002, 65.232, 'X[0] <= 1.5\nentropy = 1.0\nsamples =
2\nvalue = [1, 1]'),
 Text(186.0, 21.744, 'entropy = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(260.40000000000003, 21.744, 'entropy = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(297.6, 65.232, 'entropy = 0.0\nsamples = 3\nvalue = [0, 3]')]
```


X[0] <= 0.5
entropy = 0.94
samples = 14
value = [5, 9]
entropy = 0.0
samples = 4
value = [0, 4]
X[2] <= 0.5
entropy = 1.0
samples = 10
value = [5, 5]
X[0] <= 1.5
entropy = 0.722
samples = 5
value = [4, 1]
X[3] <= 0.5
entropy = 0.722
samples = 5
value = [1, 4]
X[3] <= 0.5
entropy = 1.0
samples = 2
value = [1, 1]
entropy = 0.0
samples = 3
value = [3, 0]
X[0] <= 1.5
entropy = 1.0
samples = 2
value = [1, 1]
entropy = 0.0
samples = 3
value = [0, 3]
entropy = 0.0
samples = 1
value = [1, 0]
entropy = 0.0
samples = 1
value = [0, 1]
entropy = 0.0
samples = 1
value = [1, 0]
entropy = 0.0
samples = 1
value = [0, 1]

[ ]: