DSC 540 - Topic 5- Assignment

September 8, 2021

[7]:
```
import pandas as pd
import numpy as np
from sklearn.tree import DecisionTreeClassifier, export_graphviz
from sklearn import tree
import statsmodels.tools.tools as stattools
```

[20]:
```
car_d = pd.read_excel('H:/Krishna/GCU/DSC 540/Topic 5/Topic5_Assignment.
↪xlsx',header=0)
```

[21]:
```
car_d.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14 entries, 0 to 13
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Day         14 non-null     object
 1   Temp x1     14 non-null     object
 2   Wind x2     14 non-null     object
 3   Traffic x3  14 non-null     object
 4   Car y       14 non-null     object
dtypes: object(5)
memory usage: 688.0+ bytes
```

[22]:
```
car_d.head(5)
```

[22]:

	Day	Temp x1	Wind x2	Traffic x3	Car y
0	s1	hot	weak	long	no
1	s2	hot	strong	long	no
2	s3	hot	weak	long	yes
3	s4	mild	weak	long	yes
4	s5	cool	weak	short	yes

[36]:
```
# Let's convert all our input variables into categorical data and then use them␣
↪for the decision tree
# The factorize function in pandas will help in getting the factors for the␣
↪categorical input variables
# These factors will be used as input for the decision tree
```

```
Temp_labels,Temp_uniques=pd.factorize(car_d['Temp x1'])
Wind_labels,Wind_uniques=pd.factorize(car_d['Wind x2'])
Traffic_labels,Traffic_uniques=pd.factorize(car_d['Traffic x3'])
decision_labels,decision_uniques=pd.factorize(car_d['Car y'])
```

[37]:
```
# The categorical factor variables are appended to the dataframe
car_d['Temp_cat']=Temp_labels
car_d['Wind_cat']=Wind_labels
car_d['Traffic_cat']=Traffic_labels
car_d['Decision_cat']=decision_labels
```

[38]:
```
# We can see the summary of the input datframe now has the factors for the␣
 ↪categorical variables
car_d.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14 entries, 0 to 13
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Day           14 non-null     object
 1   Temp x1       14 non-null     object
 2   Wind x2       14 non-null     object
 3   Traffic x3    14 non-null     object
 4   Car y         14 non-null     object
 5   Temp_cat      14 non-null     int64
 6   Wind_cat      14 non-null     int64
 7   Traffic_cat   14 non-null     int64
 8   Decision_cat  14 non-null     int64
dtypes: int64(4), object(5)
memory usage: 1.1+ KB
```

[39]:
```
# Below is the dataset with both the input and their corresponding factors
car_d
```

[39]:

	Day	Temp x1	Wind x2	Traffic x3	Car y	Temp_cat	Wind_cat	Traffic_cat	\
0	s1	hot	weak	long	no	0	0	0	
1	s2	hot	strong	long	no	0	1	0	
2	s3	hot	weak	long	yes	0	0	0	
3	s4	mild	weak	long	yes	1	0	0	
4	s5	cool	weak	short	yes	2	0	1	
5	s6	cool	strong	short	no	2	1	1	
6	s7	cool	strong	short	yes	2	1	1	
7	s8	mild	weak	long	no	1	0	0	
8	s9	cool	weak	short	yes	2	0	1	
9	s10	mild	weak	short	yes	1	0	1	
10	s11	mild	strong	short	yes	1	1	1	

```
11  s12    mild  strong       long   yes          1          1            0
12  s13     hot    weak      short   yes          0          0            1
13  s14    mild  strong       long    no          1          1            0
```

```
    Decision_cat
0              0
1              0
2              1
3              1
4              1
5              0
6              1
7              0
8              1
9              1
10             1
11             1
12             1
13             0
```

[28]:
```
# Select the input variables for the Decision Tree algorithm and label them␣
↪accordingly
car_in = car_d[['Temp_cat','Wind_cat','Traffic_cat']]
car_in_name=['Temp','Wind','Traffic']
```

[29]:
```
car_in
```

[29]:
```
    Temp_cat  Wind_cat  Traffic_cat
0          0         0            0
1          0         1            0
2          0         0            0
3          1         0            0
4          2         0            1
5          2         1            1
6          2         1            1
7          1         0            0
8          2         0            1
9          1         0            1
10         1         1            1
11         1         1            0
12         0         0            1
13         1         1            0
```

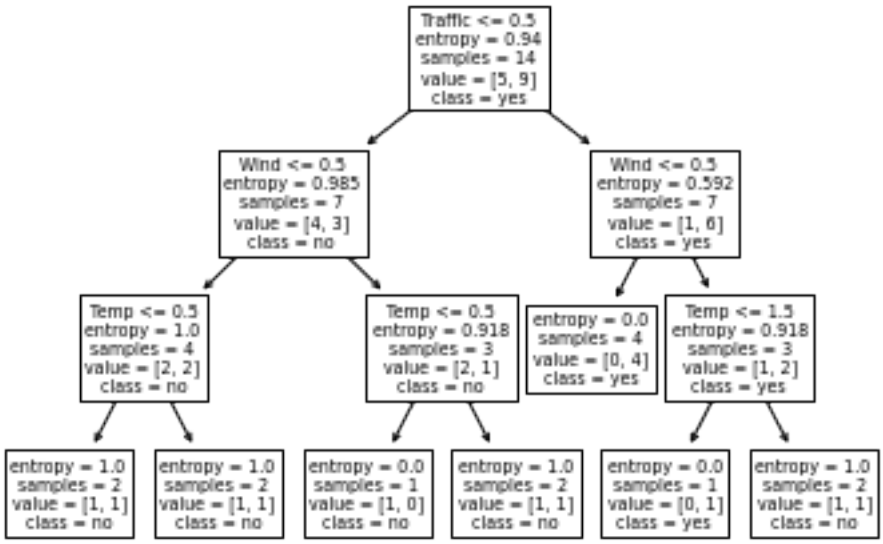
[50]:
```
# Select the output variables for the Decision Tree algorithm and label them␣
↪accordingly
car_out = car_d[['Decision_cat']]
car_out_name = ['no','yes']
```

[119]:
```
# We will be using the DecisionTreeClassifier method with criterion set to␣
↪entropy (c5.0) to build our decision tree
clf=DecisionTreeClassifier(criterion='entropy')
cart_app = clf.fit(car_in,car_out)
```

Plotting The Complete Decision Tree

[120]:
```
tree.plot_tree(cart_app,feature_names=car_in_name,␣
↪class_names=car_out_name,impurity=True)
```

[120]:
```
[Text(181.35000000000002, 190.26, 'Traffic <= 0.5\nentropy = 0.94\nsamples =
14\nvalue = [5, 9]\nclass = yes'),
 Text(111.60000000000001, 135.9, 'Wind <= 0.5\nentropy = 0.985\nsamples =
7\nvalue = [4, 3]\nclass = no'),
 Text(55.800000000000004, 81.53999999999999, 'Temp <= 0.5\nentropy =
1.0\nsamples = 4\nvalue = [2, 2]\nclass = no'),
 Text(27.900000000000002, 27.180000000000007, 'entropy = 1.0\nsamples = 2\nvalue
= [1, 1]\nclass = no'),
 Text(83.7, 27.180000000000007, 'entropy = 1.0\nsamples = 2\nvalue = [1,
1]\nclass = no'),
 Text(167.4, 81.53999999999999, 'Temp <= 0.5\nentropy = 0.918\nsamples =
3\nvalue = [2, 1]\nclass = no'),
 Text(139.5, 27.180000000000007, 'entropy = 0.0\nsamples = 1\nvalue = [1,
0]\nclass = no'),
 Text(195.3, 27.180000000000007, 'entropy = 1.0\nsamples = 2\nvalue = [1,
1]\nclass = no'),
 Text(251.10000000000002, 135.9, 'Wind <= 0.5\nentropy = 0.592\nsamples =
7\nvalue = [1, 6]\nclass = yes'),
 Text(223.20000000000002, 81.53999999999999, 'entropy = 0.0\nsamples = 4\nvalue
= [0, 4]\nclass = yes'),
 Text(279.0, 81.53999999999999, 'Temp <= 1.5\nentropy = 0.918\nsamples =
3\nvalue = [1, 2]\nclass = yes'),
 Text(251.10000000000002, 27.180000000000007, 'entropy = 0.0\nsamples = 1\nvalue
= [0, 1]\nclass = yes'),
 Text(306.90000000000003, 27.180000000000007, 'entropy = 1.0\nsamples = 2\nvalue
= [1, 1]\nclass = no')]
```

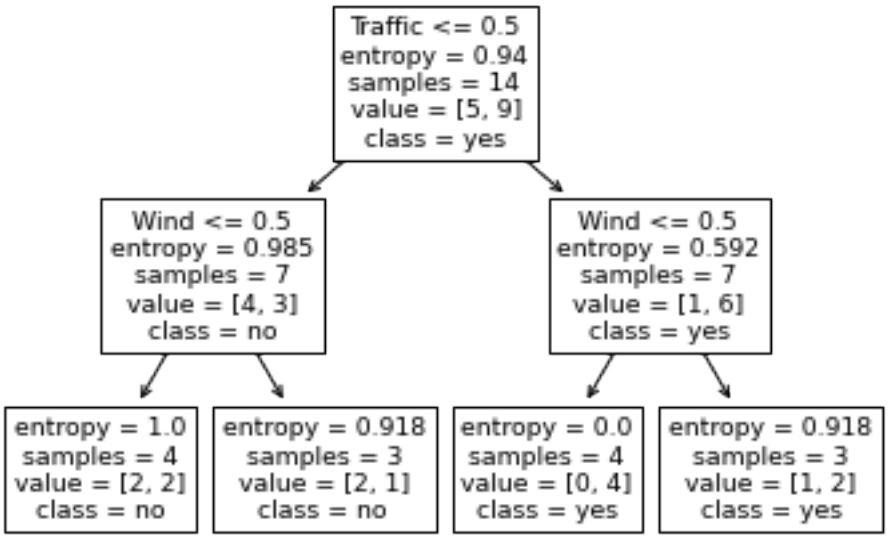


Plotting a Partial Decision Tree

[129]:
```
# We will be using the DecisionTreeClassifier method with criterion set to␣
 ↪entropy (c5.0) to build our decision tree.
# The max_depth helps to pre-prune the tree and make sure it doesn't exceed the␣
 ↪given depth
clf_part=DecisionTreeClassifier(criterion='entropy', max_depth = 2)
cart_app_part = clf_part.fit(car_in,car_out)
```

[130]:
```
tree.plot_tree(cart_app_part,feature_names=car_in_name,␣
 ↪class_names=car_out_name,impurity=True)
```

[130]:
```
[Text(167.4, 181.2, 'Traffic <= 0.5\nentropy = 0.94\nsamples = 14\nvalue = [5,
9]\nclass = yes'),
 Text(83.7, 108.72, 'Wind <= 0.5\nentropy = 0.985\nsamples = 7\nvalue = [4,
3]\nclass = no'),
 Text(41.85, 36.23999999999998, 'entropy = 1.0\nsamples = 4\nvalue = [2,
2]\nclass = no'),
 Text(125.55000000000001, 36.23999999999998, 'entropy = 0.918\nsamples =
3\nvalue = [2, 1]\nclass = no'),
 Text(251.10000000000002, 108.72, 'Wind <= 0.5\nentropy = 0.592\nsamples =
7\nvalue = [1, 6]\nclass = yes'),
 Text(209.25, 36.23999999999998, 'entropy = 0.0\nsamples = 4\nvalue = [0,
4]\nclass = yes'),
 Text(292.95, 36.23999999999998, 'entropy = 0.918\nsamples = 3\nvalue = [1,
2]\nclass = yes')]
```


Traffic <= 0.5
entropy = 0.94
samples = 14
value = [5, 9]
class = yes
Wind <= 0.5
entropy = 0.985
samples = 7
value = [4, 3]
class = no
Wind <= 0.5
entropy = 0.592
samples = 7
value = [1, 6]
class = yes
entropy = 1.0
samples = 4
value = [2, 2]
class = no
entropy = 0.918
samples = 3
value = [2, 1]
class = no
entropy = 0.0
samples = 4
value = [0, 4]
class = yes
entropy = 0.918
samples = 3
value = [1, 2]
class = yes

[1]:

[ ]:

[ ]:

[ ]: