Decision Tree

It is a tree-based supervised learning algorithms.It is mostly used for classification problem. It works for both

categorical or continous input.

Reading the data

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

In [2]:
```
df=pd.read_csv("daily_weather.csv")
df.head()
```

Out[2]:

	number	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am	max_v
0	0	918.060000	74.822000	271.100000	2.080354	
1	1	917.347688	71.403843	101.935179	2.443009	
2	2	923.040000	60.638000	51.000000	17.067852	
3	3	920.502751	70.138895	198.832133	4.337363	
4	4	921.160000	44.294000	277.800000	1.856660	

In [3]:
```
df.shape
```

Out[3]:
```
(1095, 11)
```

In [4]:
```
df.describe()
```

Out[4]:

	number	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am
count	1095.000000	1092.000000	1090.000000	1091.000000	1092.000000
mean	547.000000	918.882551	64.933001	142.235511	5.508284
std	316.243577	3.184161	11.175514	69.137859	4.552813
min	0.000000	907.990000	36.752000	15.500000	0.693451
25%	273.500000	916.550000	57.281000	65.972506	2.248768
50%	547.000000	918.921045	65.715479	166.000000	3.871333
75%	820.500000	921.160073	73.450974	191.000000	7.337163
max	1094.000000	929.320000	98.906000	343.400000	23.554978

In [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1095 entries, 0 to 1094
Data columns (total 11 columns):
number                      1095 non-null int64
air_pressure_9am            1092 non-null float64
air_temp_9am                1090 non-null float64
avg_wind_direction_9am      1091 non-null float64
avg_wind_speed_9am          1092 non-null float64
max_wind_direction_9am      1092 non-null float64
max_wind_speed_9am          1091 non-null float64
rain_accumulation_9am       1089 non-null float64
rain_duration_9am           1092 non-null float64
relative_humidity_9am       1095 non-null float64
relative_humidity_3pm       1095 non-null int64
dtypes: float64(9), int64(2)
memory usage: 94.2 KB
```

In [6]:
```
df[df.isnull().any(axis=1)].head()
```

Out[6]:

	number	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am	max
16	16	917.890000	NaN	169.200000	2.192201	
111	111	915.290000	58.820000	182.600000	15.613841	
177	177	915.900000	NaN	183.300000	4.719943	
262	262	923.596607	58.380598	47.737753	10.636273	
277	277	920.480000	62.600000	194.400000	2.751436	

In [7]:
```
#Data Cleaning
del df['number']
df.head()
```

Out[7]:

	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am	max_wind_direc
0	918.060000	74.822000	271.100000	2.080354	29
1	917.347688	71.403843	101.935179	2.443009	14
2	923.040000	60.638000	51.000000	17.067852	6
3	920.502751	70.138895	198.832133	4.337363	2
4	921.160000	44.294000	277.800000	1.856660	13

In [8]:
```
df=df.dropna()              #All row with NaN will be dropped out of df
df.head()
```

Out[8]:

	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am	max_wind_direc
0	918.060000	74.822000	271.100000	2.080354	29
1	917.347688	71.403843	101.935179	2.443009	14
2	923.040000	60.638000	51.000000	17.067852	6
3	920.502751	70.138895	198.832133	4.337363	2
4	921.160000	44.294000	277.800000	1.856660	13

In [9]:
```
df.shape
```

Out[9]:
```
(1064, 10)
```

Loading the library

In [10]:
```
from sklearn.metrics import accuracy_score,auc
from sklearn.model_selection import train_test_split

from sklearn.tree import DecisionTreeClassifier
```

Building the Model

In [11]:
```
dep="relative_humidity_3pm"
ind=df.columns.tolist()
ind.remove(dep)
```

In [12]:
```
x=df[ind]
y=df[dep]
```

In [13]:
```
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.33,random_state=324)
```

In [14]:
```
model=DecisionTreeClassifier(max_leaf_nodes=10,random_state=0)
model.fit(xtrain,ytrain)
```

Out[14]:
```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, max_leaf_nodes=10,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, presort=False, random_state=0,
            splitter='best')
```

Predicting the Value

In [15]:
```
pred=model.predict(xtest)
```

In [16]:
```
accuracy_score(pred,ytest)
```

Out[16]:
```
0.9005681818181818
```

Decision Tree HyperParameter

In [17]:
```
from sklearn.tree import DecisionTreeClassifier,export_graphviz
from sklearn import tree
from IPython.display import SVG
from graphviz import Source
from IPython.display import display
```

In [18]:
```
xtrain.describe()
```

Out[18]:

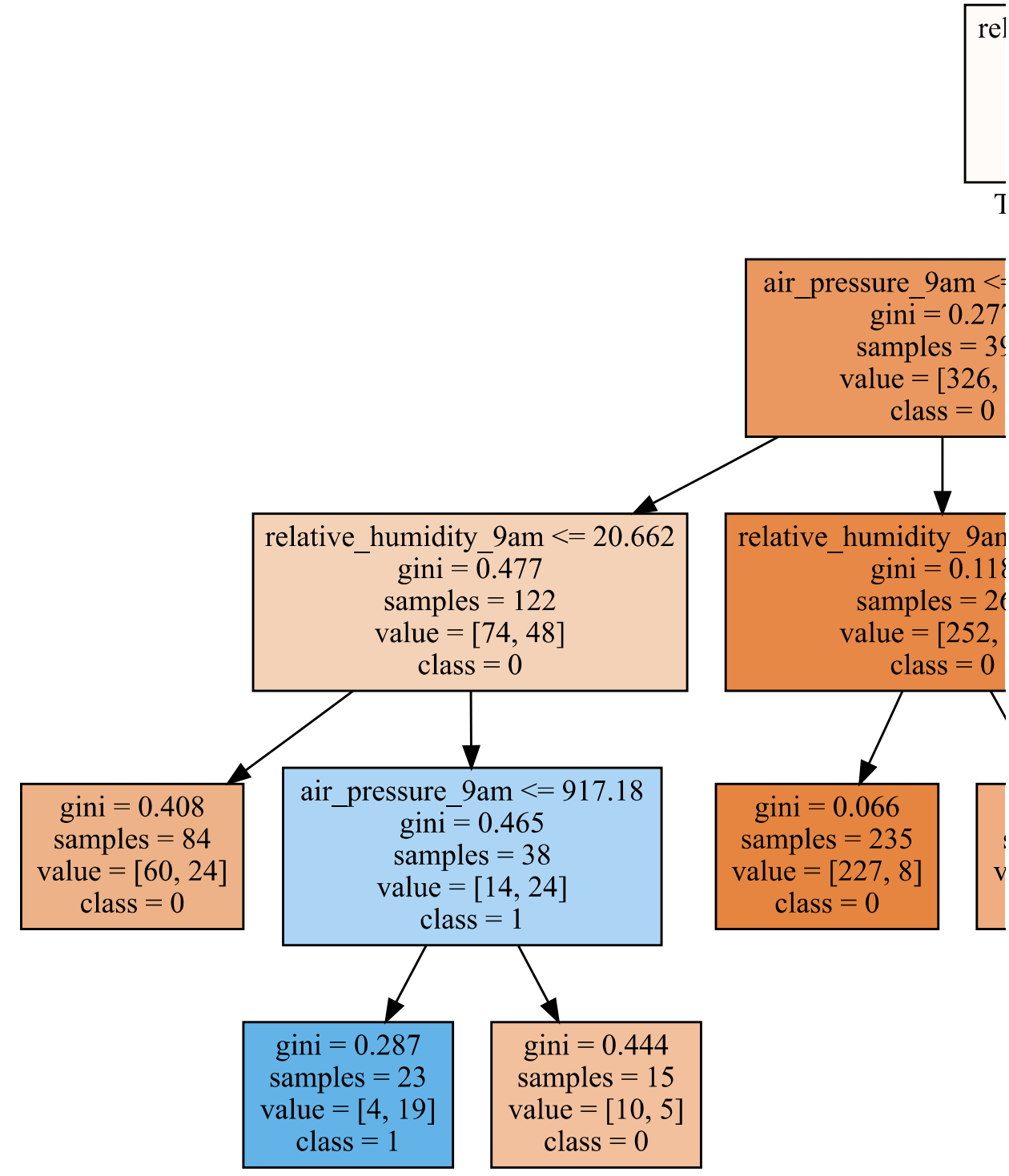
	air_pressure_9am	air_temp_9am	avg_wind_direction_9am	avg_wind_speed_9am	max_wind_
count	712.000000	712.000000	712.000000	712.000000	
mean	918.913897	65.194366	142.123330	5.568288	
std	3.147923	11.210412	68.773699	4.467828	
min	907.990000	36.752000	15.500000	0.782929	
25%	916.727792	57.375500	65.282862	2.304048	
50%	919.000000	65.967556	166.225018	3.958486	
75%	921.134993	73.908500	190.500000	7.504934	
max	929.320000	91.112000	343.400000	21.541732	

max_depth : depth of the tree,tells how deep tree is max_features : how many feature will it take to calculate GINI max_leaf_nodes : number of terminal nodes min_samples_leaf: minimum number of sample in leaf node

In [19]:
```
model=DecisionTreeClassifier(max_leaf_nodes=10,min_impurity_decrease=0.0004,rand
                             max_depth=5,min_samples_leaf=10)
model.fit(xtrain,ytrain)
```

Out[19]:
```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=5,
            max_features=None, max_leaf_nodes=10,
            min_impurity_decrease=0.0004, min_impurity_split=None,
            min_samples_leaf=10, min_samples_split=2,
            min_weight_fraction_leaf=0.0, presort=False, random_state=0,
            splitter='best')
```

In [20]:
```
graph=Source(tree.export_graphviz(model,out_file=None,
                                  feature_names=xtrain.columns,class_names=['0','
                                  filled=True))
display(SVG(graph.pipe(format="svg")))
```



In [21]:
```
pred=model.predict(xtest)
accuracy_score(pred,ytest)
```

Out[21]: 0.9005681818181818

Disadvantage of Decision Tree

1.Overfitting problem

Advantage

1. Easy to Understand
2. Useful for DataExploration
3. Non Parametric Method