decision-tree-1-1-1

October 17, 2024

[52]:
```
import pandas as pd
import matplotlib.pyplot as plt
```

1 Implement Decision Tree

[53]:
```
data=pd.read_excel(r'C:\Users\lenovo\Downloads\dt (1).xlsx')
```

[54]:
```
print(data)
```

```
    RID          age  income student credit_rating buys_computer
0     1        youth    high      no          fair            no
1     2        youth    high      no     excellent            no
2     3  middle_aged    high      no          fair           yes
3     4       senior  medium      no          fair           yes
4     5       senior     low     yes          fair           yes
5     6       senior     low     yes     excellent            no
6     7  middle_aged     low     yes     excellent           yes
7     8        youth  medium      no          fair            no
8     9        youth     low     yes          fair           yes
9    10       senior  medium     yes          fair           yes
10   11        youth  medium     yes     excellent           yes
11   12  middle_aged  medium      no     excellent           yes
12   13  middle_aged    high     yes          fair           yes
13   14       senior  medium      no     excellent            no
```

1.1 Data Encoding

[55]:
```
#Encode the text or non numerical data into numerical value
```

[56]:
```
from sklearn.preprocessing import LabelEncoder
```

[57]:
```
# create instances for class LableEncoder
le_age = LabelEncoder()
le_income = LabelEncoder()
le_student = LabelEncoder()
le_credit_rating = LabelEncoder()
```

```
le_buys_computer = LabelEncoder()
```

[58]:

```
# fit_tranform
data['age_n']=le_age.fit_transform(data['age'])
data['income_n']=le_income.fit_transform(data['income'])
data['student_n']=le_student.fit_transform(data['student'])
data['credit_rating_n']=le_credit_rating.fit_transform(data['credit_rating'])
data['buys_computer_n']=le_buys_computer.fit_transform(data['buys_computer'])
```

[59]:

```
data.head()
```

[59]:

```
   RID          age  income student credit_rating buys_computer  age_n  \
0    1        youth    high      no          fair            no      2
1    2        youth    high      no     excellent            no      2
2    3  middle_aged    high      no          fair           yes      0
3    4       senior  medium      no          fair           yes      1
4    5       senior     low     yes          fair           yes      1

   income_n  student_n  credit_rating_n  buys_computer_n
0         0          0                1                0
1         0          0                0                0
2         0          0                1                1
3         2          0                1                1
4         1          1                1                1
```

[60]:

```
data_new=data.
  ↪drop(['age','income','student','credit_rating','buys_computer'],axis=1)
data_new
```

[60]:

```
    RID  age_n  income_n  student_n  credit_rating_n  buys_computer_n
0     1      2         0          0                1                0
1     2      2         0          0                0                0
2     3      0         0          0                1                1
3     4      1         2          0                1                1
4     5      1         1          1                1                1
5     6      1         1          1                0                0
6     7      0         1          1                0                1
7     8      2         2          0                1                0
8     9      2         1          1                1                1
9    10      1         2          1                1                1
10   11      2         2          1                0                1
11   12      0         2          0                0                1
12   13      0         0          1                1                1
13   14      1         2          0                0                0
```

[61]:

```
feature_cols=['age_n', 'income_n', 'student_n', 'credit_rating_n']
x = data_new.drop(['buys_computer_n', 'RID'],axis = 'columns')
```

```
y = data_new['buys_computer_n']
```

[62]:

```
x
```

[62]:

```
    age_n  income_n  student_n  credit_rating_n
0       2         0          0                1
1       2         0          0                0
2       0         0          0                1
3       1         2          0                1
4       1         1          1                1
5       1         1          1                0
6       0         1          1                0
7       2         2          0                1
8       2         1          1                1
9       1         2          1                1
10      2         2          1                0
11      0         2          0                0
12      0         0          1                1
13      1         2          0                0
```

[63]:

```
y
```

[63]:

```
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
Name: buys_computer_n, dtype: int32
```

1.2 Devide the data into train and test

[64]:

```
# for splitting
from sklearn.model_selection import train_test_split
```

[65]:

```
x_train, x_test, y_train, y_test=train_test_split(x,y,test_size = 0.
 ↪25,random_state=42)
```

[66]:

```
x_train
```

[66]:

```
    age_n  income_n  student_n  credit_rating_n
5       1         1          1                0
8       2         1          1                1
2       0         0          0                1
1       2         0          0                0
13      1         2          0                0
4       1         1          1                1
7       2         2          0                1
10      2         2          1                0
3       1         2          0                1
6       0         1          1                0
```

[67]:

```
y_train
```

[67]:

```
5     0
8     1
2     1
1     0
13    0
4     1
7     0
10    1
3     1
6     1
Name: buys_computer_n, dtype: int32
```

[68]:

```
x_test
```

[68]:

```
    age_n  income_n  student_n  credit_rating_n
9       1         2          1                1
11      0         2          0                0
0       2         0          0                1
12      0         0          1                1
```

[69]:

```
y_test
```

[69]:

```
9     1
11    1
0     0
12    1
Name: buys_computer_n, dtype: int32
```

pd.concat() is a function from the Pandas library in Python used to concatenate (or combine) two or more DataFrames or Series along a particular axis (either rows or columns).

[70]:

```
# concatenating the training dataset
pd.concat([x_train, y_train], axis = 1)
```

```
[70]:     age_n  income_n  student_n  credit_rating_n  buys_computer_n
      5       1         1          1                0                0
      8       2         1          1                1                1
      2       0         0          0                1                1
      1       2         0          0                0                0
      13      1         2          0                0                0
      4       1         1          1                1                1
      7       2         2          0                1                0
      10      2         2          1                0                1
      3       1         2          0                1                1
      6       0         1          1                0                1
```

```
[71]: pd.concat([x_test, y_test], axis = 1)
```

```
[71]:     age_n  income_n  student_n  credit_rating_n  buys_computer_n
      9       1         2          1                1                1
      11      0         2          0                0                1
      0       2         0          0                1                0
      12      0         0          1                1                1
```

1.3 Train the model using Decision tree algorithm

```
[72]: # towards building our Decision Tree model
      from sklearn.tree import DecisionTreeClassifier
      clf = DecisionTreeClassifier(criterion = 'entropy')
      dt = clf.fit(x_train, y_train)
      dt
```

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

```
[73]: y_pred = dt.predict(x_test)
      y_pred
```

```
[73]: array([1, 1, 0, 1])
```

```
[74]: y_test
```

```
[74]: 9     1
      11    1
      0     0
      12    1
      Name: buys_computer_n, dtype: int32
```

1.4 Perfromance Metrics

```
[75]: # metric
      from sklearn.metrics import accuracy_score
      accuracy_score(y_test, y_pred)
```

```
[75]: 1.0
```

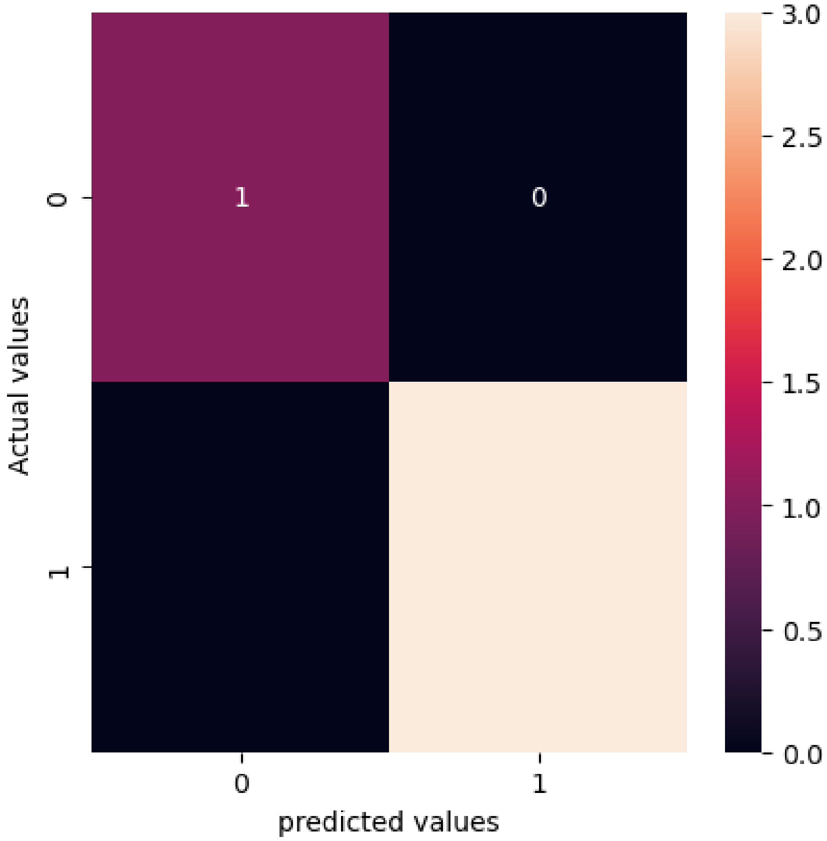
1.5 Plot Confusion Matrix

```
[76]: from sklearn.metrics import confusion_matrix
```

```
[77]: #Create a confusion matrix by importing the function confusion_matrix
      from sklearn.metrics import confusion_matrix,accuracy_score
      confusion= confusion_matrix(y_test, y_pred)
      confusion
```

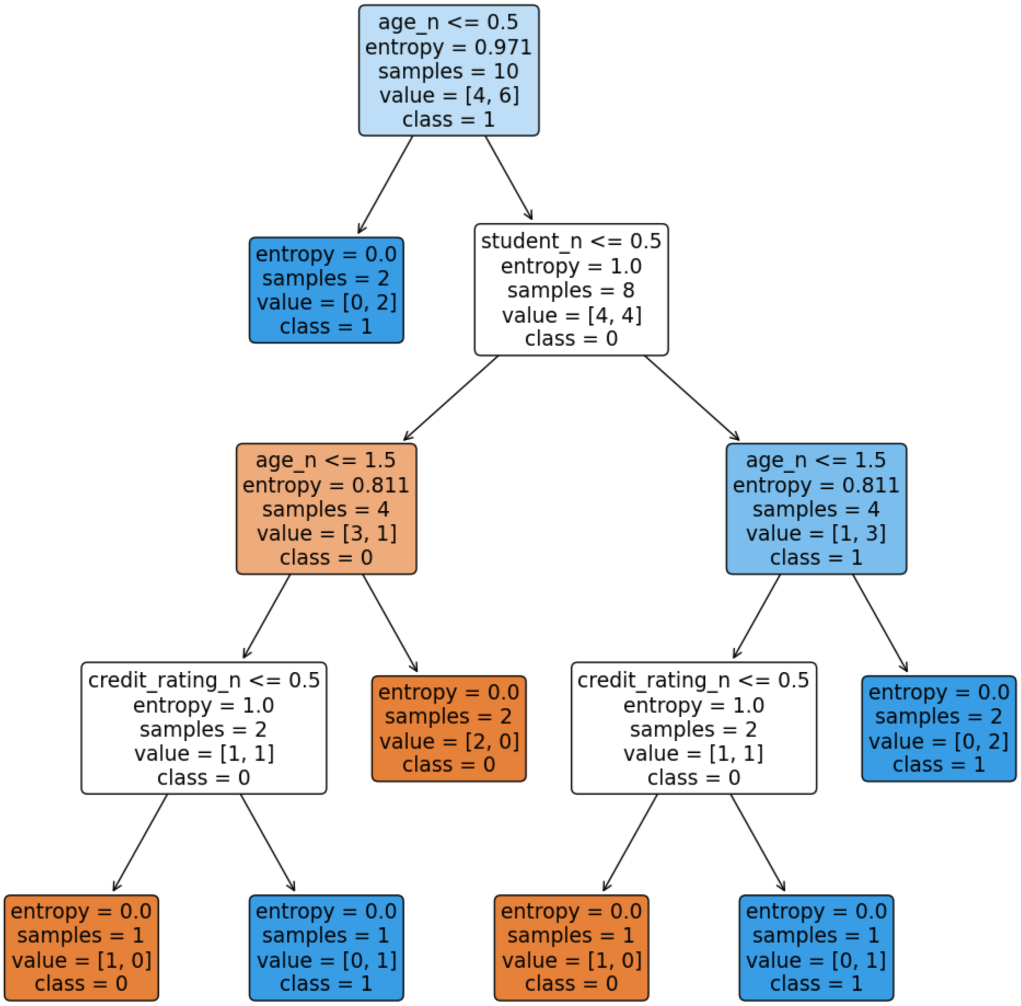
```
[77]: array([[1, 0],
             [0, 3]], dtype=int64)
```

```
[78]: import seaborn as sns
      cm = confusion_matrix(y_test, y_pred)
      plt.figure(figsize=(5,5))
      sns.heatmap(data=cm, annot = True)
      plt.ylabel('Actual values')
      plt.xlabel('predicted values')
      plt.show()
```



1.6 Plot the decision tree

[79]:
```
#graphical visualization of tree
from sklearn.tree import plot_tree
# help you to produce the figure of tree
plt.figure(figsize=(13,13))
dec_tree=plot_tree(decision_tree=dt,feature_names=feature_cols,class_names=["0","1"],\
                    filled=True,rounded=True)
```


age_n <= 0.5
entropy = 0.971
samples = 10
value = [4, 6]
class = 1
entropy = 0.0
samples = 2
value = [0, 2]
class = 1
student_n <= 0.5
entropy = 1.0
samples = 8
value = [4, 4]
class = 0
age_n <= 1.5
entropy = 0.811
samples = 4
value = [3, 1]
class = 0
age_n <= 1.5
entropy = 0.811
samples = 4
value = [1, 3]
class = 1
credit_rating_n <= 0.5
entropy = 1.0
samples = 2
value = [1, 1]
class = 0
entropy = 0.0
samples = 2
value = [2, 0]
class = 0
credit_rating_n <= 0.5
entropy = 1.0
samples = 2
value = [1, 1]
class = 0
entropy = 0.0
samples = 2
value = [0, 2]
class = 1
entropy = 0.0
samples = 1
value = [1, 0]
class = 0
entropy = 0.0
samples = 1
value = [0, 1]
class = 1
entropy = 0.0
samples = 1
value = [1, 0]
class = 0
entropy = 0.0
samples = 1
value = [0, 1]
class = 1

```
[ ]:
```