H(N) = sum(-p\*log\_2(p))

IG = H(N) - w1\*H(N1) - w2\*H(N2)

H( N )= -11/25\*log\_2(11/25) –14/25\*log\_2(14/25) Traffic

Y=11

N=14

E=0.989

=0.989 🡺 E=0.989

Weekday Weekend

IG =0.097

Y=1 N=0

E=0.0

Y= 1 N=0

E=0.0

Y=0 N=1

E=0.0

Y=2 N=0

E=0.0

Y=2 N=0

E=0.0

Y=2 N=5

E=0.811

Y= 3 N=0

E=0.0

Y=0 N=7

E=0.0

Y=7

N=13

E=0.934

Y=4

N=1

E=0.721

IG=0.0079 IG= 0.322

Y=3 N= 7

E=0.881

Y=1 N=1  
 E= 1.0

Y=4 N= 6

E=0.97

Y=3 N= 0  
E=0.0

1pm 8am Time 1pm 8am  
   
  
  
 IG=0.8812 IG=0.321 IG=0.0 IG=1.0

sunny rainy sunny rainy sunny rainy sunny rainy  
  
 Weather

confusion\_matrix (train) = [[ 9. 0.]

[ 2. 14.]]

sensitivity = 0.81

specificity = 1.0

misclassification\_rate = 1- 0.92 =0.08

confusion\_matrix(test)= [[3. 1.]

[4. 7.]]

**Root**

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 8am no

weekend sunny 8am yes

weekend sunny 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 1pm no

weekend rainy 1pm yes

weekday rainy 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekend sunny 1pm yes

weekday rainy 8am yes

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am yes

weekend rainy 8am no

weekday sunny 1pm no

weekday rainy 8am yes

weekday sunny 8am yes

Y=11 N=14

**Weekdays**

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekday rainy 8am yes

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am yes

weekday sunny 1pm no

weekday rainy 8am yes

weekday sunny 8am yes

Y=7 N=13

**Weekend**

weekend sunny 8am yes

weekend sunny 1pm yes

weekend rainy 1pm yes

weekend sunny 1pm yes

weekend rainy 8am no

Y=4 N=1

**Weekday, 1pm**

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 1pm no

weekday sunny 1pm no

weekday rainy 1pm yes

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

Y=3 N=7

**Weekday, 8am**

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday rainy 8am yes

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am yes

weekday rainy 8am yes

weekday sunny 8am yes

Y=4 N=6

**Weekend 1pm**

weekend sunny 1pm yes

weekend rainy 1pm yes

weekend sunny 1pm yes

Y=3 N=0

**Weekend 8am**

weekend sunny 8am yes

weekend rainy 8am no

Y=1 N=1

**Weekday 1pm sunny**

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

Y=0 N=7

**Weekday 1pm rainy**

weekday rainy 1pm yes

weekday rainy 1pm yes

weekday rainy 1pm yes

Y=3 N=0

**Weekday 8am sunny**

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am yes

weekday sunny 8am yes

Y=2 N=6

**Weekday 8am rainy**

weekday rainy 8am yes

weekday rainy 8am yes

Y=2 N=0

**Weekend 1pm sunny**

weekend sunny 1pm yes

weekend sunny 1pm yes

Y=2 N=0

**Weekend 1pm rainy**

weekend rainy 1pm yes

Y=1 N=0

**Weekend 8am sunny**

weekend sunny 8am yes

Y=1 N=0

**Weekend 8am rainy**

weekend rainy 8am no

Y=0 N=1

confusion\_matrix

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Actual value | |
|  | positive | negative |
| Predicted value | positive | TP=9 | FP=0 |
| negative | FN=2 | TN=14 |

confusion\_matrix (train) = [[ 9. 0.]

[ 2. 14.]]

weekday sunny 1pm no no TN

weekday rainy 1pm yes yes TP

weekday sunny 8am no no TN

weekday sunny 1pm no no TN

weekday rainy 1pm yes yes TP

weekday sunny 8am no no TN

weekend sunny 8am yes yes TP

weekend sunny 1pm yes yes TP

weekday sunny 8am no no TN

weekday sunny 1pm no no TN

weekday sunny 1pm no no TN

weekend rainy 1pm yes yes TP

weekday rainy 1pm yes yes TP

weekday sunny 8am no no TN

weekday sunny 1pm no no TN

weekend sunny 1pm yes yes TP

weekday rainy 8am yes yes TP

weekday sunny 8am no no TN

weekday sunny 8am no no TN

weekday sunny 1pm no no TN

weekday sunny 8am yes no FN

weekend rainy 8am no no TN

weekday sunny 1pm no no TN

weekday rainy 8am yes yes TP

weekday sunny 8am yes no FN

Sensitivity = TP/(TP+FN) = 9/(9+2) = 0.81

**Sensitivity = 0.81**

Specificity = TN / (FP + TN ) = 14/(0 + 14) = 1

**Specificity = 1.0**

Accuracy= (TP+ TN)/( TP + TN+ FP +FN) = (9 + 14)/(9 + 14 + 0 + 2) = 23/25 =0.92

**Misclassification\_rate** = 1 - Accuracy = 1 - 0.92 =0.08

**Confusion\_matrix(test)**

weekend rainy 8am no no TN

weekday sunny 8am yes no FN

weekend sunny 1pm yes yes TP

weekday sunny 8am no no TN

weekend sunny 1pm yes yes TP

weekday rainy 8am no yes FP

weekday sunny 8am yes no FN

weekday sunny 1pm no no TN

weekday sunny 1pm no no TN

weekday sunny 1pm no no TN

weekend rainy 8am yes no FN

weekday sunny 8am yes no FN

weekday sunny 1pm no no TN

weekday rainy 1pm yes yes TP

weekday sunny 1pm no no TN

confusion\_matrix(test)= [[3. 1.]

[4. 7.]]

**Moving to create tree (using IG):**

Comparison ( IG("weather") = 0.21 ) > ( IG("day") = 0.0979 ) > ( IG("time") = 0.0014 )

node\_root 🡺 node\_weather

**For “weather” =”sunny”**

Comparison ( IG("day") = 0.38 ) > ( IG("time") = 0.01 )

node\_root 🡺 node\_weather 🡺 node\_day 🡺 node\_time

**For “weather” =”rainny”**

Comparison ( IG("day") = 0.30 ) > ( IG("time") = 0.19 )

node\_root 🡺 node\_weather 🡺 node\_day 🡺 node\_time

H(N) = sum(-p\*log\_2(p))

IG = H(N) - w1\*H(N1) - w2\*H(N2)

H( N )= -11/25\*log\_2(11/25) –14/25\*log\_2(14/25) Traffic

Y=11

N=14

E=0.989

=0.989 🡺 E=0.989

Weather= ‘sunny’ Weather= ‘rainny’

Y= 2 N=0

Y=1 N=0

Y=0 N=1

Y=3 N=0

Y=1 N=0

Y=2 N=0

Y=2 N=6

Y= 0 N=7

Y=5

N=13

E=0.85

Y=6

N=1

E=0.59

weekday,sunny

weekend, sunny weekday,rainy weekend,rainy

Y=2 N= 13

E=0.56

Y= 1 N= 1  
 E= 1

Y=3 N= 0

E=0

Y=5 N= 0  
E=0

**1 pm 8am 1pm 8am 1pm 8am 1pm 8am**

**Mode weather : sunny**

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am no

weekend sunny 8am yes

weekend sunny 1pm yes

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 1pm no

weekend sunny 1pm yes

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am yes

weekday sunny 1pm no

weekday sunny 8am yes

Y=5 N= 13

**Mode weather : rainy**

weekday rainy 1pm yes

weekday rainy 1pm yes

weekend rainy 1pm yes

weekday rainy 1pm yes

weekday rainy 8am yes

weekend rainy 8am no

weekday rainy 8am yes

Y=6 N=1

**Mode weather : sunny : weekday**

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 1pm no

weekday sunny 8am yes

weekday sunny 1pm no

weekday sunny 8am yes

Y=2 N= 13

**Mode weather : sunny : weekend**

weekend sunny 8am yes

weekend sunny 1pm yes

weekend sunny 1pm yes

Y=3 N=0

**Mode weather : rainy : weekday**

weekday rainy 1pm yes

weekday rainy 1pm yes

weekday rainy 1pm yes

weekday rainy 8am yes

weekday rainy 8am yes

Y= 5 N=0

**Mode weather : rainy : weekend**

weekend rainy 1pm yes

weekend rainy 8am no

Y= 1 N=1

**Mode time : sunny : weekday : 1 pm**

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

weekday sunny 1pm no

Y =0 N=7

**Mode time : sunny : weekday : 8 am**

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am no

weekday sunny 8am yes

weekday sunny 8am yes

Y=2 N=6

**Mode time : sunny : weekend : 1 pm**

weekend sunny 1pm yes

weekend sunny 1pm yes

Y=2 N=0

**Mode time : sunny : weekend : 8 am**

weekend sunny 8am yes

Y=1 N=0

**Mode time : rainy : weekday : 1 pm**

weekday rainy 1pm yes

weekday rainy 1pm yes

weekday rainy 1pm yes

Y=3 N=0

**Mode time : rainy : weekday : 8 am**

weekday rainy 8am yes

weekday rainy 8am yes

Y=2 N=0

**Mode time : rainy : weekday : 1 pm**

weekend rainy 1pm yes

Y=1 N=0

**Mode time : rainy : weekend : 8 am**

weekend rainy 8am no

Y=0 N=1

**Confusion\_matrix** = [[ 9. 0.]

[ 2. 14.]]

Train dataset

sunny weekday 1pm no no

rainy weekday 1pm yes yes

sunny weekday 8am no no

sunny weekday 1pm no no

rainy weekday 1pm yes yes

sunny weekday 8am no no

sunny weekend 8am yes yes

sunny weekend 1pm yes yes

sunny weekday 8am no no

sunny weekday 1pm no no

sunny weekday 1pm no no

rainy weekend 1pm yes yes

rainy weekday 1pm yes yes

sunny weekday 8am no no

sunny weekday 1pm no no

sunny weekend 1pm yes yes

rainy weekday 8am yes yes

sunny weekday 8am no no

sunny weekday 8am no no

sunny weekday 1pm no no

sunny weekday 8am yes no

rainy weekend 8am no no

sunny weekday 1pm no no

rainy weekday 8am yes yes

sunny weekday 8am yes no

Sensitivity = TP/(TP+FN) = 9/(9+2) = 0.81

**Sensitivity = 0.81**

Specificity = TN / (FP + TN ) = 14/(0 + 14) = 1

**Specificity = 1.0**

Accuracy= (TP+ TN)/( TP + TN+ FP +FN) = (9 + 14)/(9 + 14 + 0 + 2) = 23/25 =0.92

**Misclassification\_rate** = 1 - Accuracy = 1 - 0.92 =0.08

Test dataset

weekend rainy 8am no no

weekday sunny 8am yes no

weekend sunny 1pm yes yes

weekday sunny 8am no no

weekend sunny 1pm yes yes

weekday rainy 8am no yes

weekday sunny 8am yes no

weekday sunny 1pm no no

weekday sunny 1pm no no

weekday sunny 1pm no no

weekend rainy 8am yes no

weekday sunny 8am yes no

weekday sunny 1pm no no

weekday rainy 1pm yes yes

weekday sunny 1pm no no

**confusion\_matrix(test)**= [[3. 1.]

[4. 7.]]