Decision Tree - Confusion Matrix

Test Data Count 134	**Predicted (0)** **Not Purchased**	**Predicted (1)** **Purchased**
Actual (0) **Not Purchased**	76 True - Not Purchased	9 False - Not Purchased
Actual (1) **Purchased**	8 False - Purchased	41 True - Purchased

Accuracy: What is the correct Classification of this model ?

$$= \frac{True(Purchased)+True(Not\ Purchased)}{True(Purchased)+True(Not\ Purchased)+False(Purchased)+False(Not\ purchased)}$$

$$= \frac{41+76}{41+76+9+8}$$

Accuracy = 0.87

Recall for Purchased: Out of all actual purchases, how many did we correctly identify ?

$$= \frac{True(Purchased)}{True(Purchased)+False(Not\ Purchased)}$$

$$= \frac{41}{41+8} = \frac{41}{49} = 0.83$$

Recall for Purchased = 0.83

Recall for Not Purchased:

$$= \frac{True(Not\ Purchased)}{True(Not\ Purchased)+False(Purchased)}$$

$$= \frac{76}{76+9} = \frac{76}{85} = 0.89$$

Recall for Not Purchased = 0.89

Precision for Purchased:

Out of all predicted purchases, how many did we correctly identify ?

$$= \frac{True(Purchased)}{True(Purchased)+False(Purchased)}$$

$$= \frac{41}{41+9}$$

Precision for Purchased = 0.82

Precision for Not Purchased:

$$= \frac{True(Not\ Purchased)}{True(Not\ Purchased)+False(Not\ Purchased)}$$

$$= \frac{76}{76+8}$$

Precision for Not Purchased = 0.90

F1 score: Overall performance of Purchased

$$= 2 * \frac{Recall*Precission}{Recall+Precision}$$

$$= 2 * \frac{0.83*0.82}{0.83+0.82} = 2* \frac{0.6806}{1.65} = 2 * 0.4124$$

F1 score for Purchased = 0.82

F1 score: Overall performance of Not Purchased

$$= 2 * \frac{Recall*Precission}{Recall+Precision}$$

$$= 2 * \frac{0.89*0.90}{0.89+0.90} = 2* \frac{0.801}{1.79} = 2 * 0.44$$

F1 score for Not Purchased = 0.89

Macro Average: Average performance of Precision.

Macro Average = $\frac{Precision(Purchased)+Precision(Not\ Purchased)}{2}$

= $\frac{0.82+0.90}{2}$

= $\frac{1.72}{2}$ = 0.86

Macro Average of Precision = 0.86

Macro Average: Average performance of Recall

Macro Average = $\frac{Recall(Purchased)+Recall(Not\ Purchased)}{2}$

= $\frac{0.83+0.89}{2}$

= $\frac{1.72}{2}$

Macro Average of Recall = 0.86

Macro Average: Average performance of F1-Score

Macro Average = $\frac{F1(Purchased)+F1(Not\ Purchased)}{2}$

= $\frac{0.82+0.89}{2}$

= $\frac{1.71}{2}$

Macro Average of F1-Score = 0.85

Weighted Average: What is the sum of the product of each class ?

Weighted Average of Precision = Precision of Purchased* $\frac{Total\ count\ of\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set}$ +

Precision Not Purchased* $\frac{Total\ count\ of\ Not\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set}$

= 0.82 * $\frac{50}{134}$ + 0.90 * $\frac{84}{134}$

= 0.82 * 0.37 + 0.92 * 0.62

Weighted Average of Precision = 0.87

Weighted Average: Recall

$$= \text{Recall of Purchased} * \frac{Total\ count\ of\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set} + \text{Recall Not Purchased} * \frac{Total\ count\ of\ Not\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set}$$

$$= 0.83 * \frac{50}{134} + 0.89 * \frac{84}{134}$$

= 0.83 * 0.37 + 0.89 * 0.62

Weighted Average of Recall = 0.85

Weighted Average: F1 measure

$$= \text{F1 score of Purchased} * \frac{Total\ count\ of\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set} + \text{F1 score of Not Purchased} * \frac{Total\ count\ of\ Not\ Purchased\ in\ Test\ Set}{Total\ count\ of\ Test\ set}$$

$$= 0.82 * \frac{50}{134} + 0.89 * \frac{84}{134}$$

= 0.82 * 0.37 + 0.89 * 0.62

Weighted Average of F1 score = 0.85