Evaluation Metrics using Confusion Matrix

1. **Random Forest Classification:**

Array = [78, 7]
[6, 43]

True Purchased **78**	False Not Purchased **7**
False Purchased **6**	True Not Purchased **43**

True Purchased = TP = 78
True Not Purchased = TN = 43
False Purchased = FP = 6
False Not Purchased = FN = 7
Total Purchased = TP + FN = 85
Total Not Purchased = TN + FP = 49
Sum of Purchased and Not Purchased = TP+ TN +FP +FN = 134

- **Accuracy:**

Formula: $\frac{TP + TN}{TP + FP + TN + FN}$

$= \frac{78 + 43}{78+6+43+7}$

$= \frac{121}{134}$ **= 0.90**

- **Recall:**

Formula: Purchased = TP/ Total Purchased

$= \frac{TP}{TP + FN}$

$= \frac{78}{78+7}$

$= \frac{78}{85}$ **= 0.92**

Formula: Not Purchased = TN/ Total Not Purchased

$= \frac{TN}{TN + FP}$

$= \frac{43}{43+6}$

$$= \frac{43}{49} = \mathbf{0.88}$$

- **Precision:**

  Formula: Purchased

$$= \frac{TP}{TP + FP}$$

$$= \frac{78}{78+6}$$

$$= \frac{78}{84} = \mathbf{0.93}$$

  Formula: Not Purchased

$$= \frac{TN}{TN + FN}$$

$$= \frac{43}{43+7}$$

$$= \frac{43}{50} = \mathbf{0.86}$$

- **F1 measure:**

  Formula: Purchased

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

$$= 2* \frac{0.92*0.93}{0.92+0.93}$$

$$= 2* \frac{0.8556}{1.85} = \mathbf{0.92}$$

  Formula: Not Purchased

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

$$= 2* \frac{0.88*0.86}{0.88+0.86}$$

$$= 2* \frac{0.7568}{1.74} = \mathbf{0.87}$$

- **Macro Average:**

  Formula: Precision

$$= \frac{\text{Precision Purchased + Precision Not Purchased}}{2}$$

$$= \frac{0.93+0.86}{2} = \mathbf{0.89}$$

Formula: Recall

$$= \frac{\text{Recall Purchased + Recall Not Purchased}}{2}$$

$$= \frac{0.92+0.88}{2} = \mathbf{0.90}$$

Formula: F1 measure

$$= \frac{\text{F1 measure Purchased + F1 measure Not Purchased}}{2}$$

$$= \frac{0.92+0.87}{2} = \mathbf{0.90}$$

- **Weighted Average:**

Formula: Precision

$$= \text{Precision Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}} + \text{Precision Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 0.93 * \frac{85}{134} + 0.86 * \frac{49}{134}$$

$$= 0.93 * 0.63 + 0.86 * 0.37 = \mathbf{0.90}$$

Formula: Recall

$$= \text{Recall Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}} + \text{Recall Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 0.92 * \frac{85}{134} + 0.88 * \frac{49}{134}$$

$$= 0.92 * 0.63 + 0.88 * 0.37 = \mathbf{0.90}$$

Formula: F1 measure

$$= \text{F1 measure Purchased} * \frac{\text{Total Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$+ \text{F1 measure Not Purchased} * \frac{\text{Total Not Purchased}}{\text{Sum of Purchased \& Not Purchased}}$$

$$= 0.92 * \frac{85}{134} + 0.87 * \frac{49}{134}$$

$$= 0.92 * 0.63 + 0.88 * 0.37 \quad \mathbf{= 0.90}$$