Evaluation Metrics using Confusion Matrix

1. **KNN Classification:**

Array = [77, 8]
[14, 35]

True Purchased **77**	False Not Purchased **8**
False Purchased **14**	True Not Purchased **35**

True Purchased = TP = 77
True Not Purchased = TN = 35
False Purchased = FP = 14
False Not Purchased = FN = 8
Total Purchased = TP + FN = 85
Total Not Purchased = TN + FP = 49
Sum of Purchased and Not Purchased = TP+ TN +FP +FN = 134

- **Accuracy:**

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

$= \frac{77 + 35}{77+14+35+8}$

$= \frac{112}{134}$ **= 0.84**

- **Recall:**

Formula: Purchased = TP/ Total Purchased

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

$= \frac{77}{77+8}$

$= \frac{77}{85}$ **= 0.91**

Formula: Not Purchased = TN/ Total Not Purchased

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

$= \frac{35}{14+35}$

$$= \frac{35}{49} = \mathbf{0.71}$$

- **Precision:**

  Formula: Purchased

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

$$= \frac{77}{77+14}$$

$$= \frac{77}{91} = \mathbf{0.85}$$

  Formula: Not Purchased

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

$$= \frac{35}{35+8}$$

$$= \frac{35}{43} = \mathbf{0.81}$$

- **F1 measure:**

  Formula: Purchased

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

$$= 2* \frac{0.91*0.85}{0.91+0.85}$$

$$= 2* \frac{0.7735}{1.76} = \mathbf{0.87}$$

  Formula: Not Purchased

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

$$= 2* \frac{0.71*0.81}{0.71+0.81}$$

$$= 2* \frac{0.5751}{1.52} = \mathbf{0.76}$$

- **Macro Average:**

  Formula: Precision

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

$$= \frac{0.85+0.81}{2} = \mathbf{0.83}$$

Formula: Recall

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

$$= \frac{0.91+0.71}{2} = \mathbf{0.81}$$

Formula: F1 measure

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

$$= \frac{0.87+0.76}{2} = \mathbf{0.82}$$

- **Weighted Average:**

Formula: Precision

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

$$= 0.85 * \frac{85}{134} + 0.81 * \frac{49}{134}$$

$$= 0.85 * 0.63 + 0.81 * 0.37 = \mathbf{0.83}$$

Formula: Recall

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

$$= 0.91 * \frac{85}{134} + 0.71 * \frac{49}{134}$$

$$= 0.91 * 0.63 + 0.71 * 0.37 = \mathbf{0.84}$$

Formula: F1 measure

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

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

$$= 0.87 * \frac{85}{134} + 0.76 * \frac{49}{134}$$

$$= 0.87 * 0.63 + 0.76 * 0.37 \quad \mathbf{= 0.83}$$