

## Manual calculation of classification report values for SVM model

Below is the confusion matrix derived through classification Algorithm using SVM.

```
print(cm)
[[77  2]
 [23 18]]
```

Below is the classification report derived through classification Algorithm using SVM.

```
print(clf_report)
```

	precision	recall	f1-score	support
0	0.77	0.97	0.86	79
1	0.90	0.44	0.59	41
accuracy			0.79	120
macro avg	0.83	0.71	0.73	120
weighted avg	0.81	0.79	0.77	120

### Accuracy

Formula:

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN}$$

For the above case:

$$Accuracy = (77+18) / (77+18+23+2) = 95/120 = 0.7916$$

### Precision

Formula:

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

For the above case Precision value for unpurchased:

$$Precision = 77 / (77+23) = 77/100 = 0.77$$

For the above case Precision value for purchased:

$$Precision = 18 / (18+2) = 18/20 = 0.90$$

## Recall

Formula:

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

For the above case Recall value for non-purchased:

$$\text{Recall} = 77 / (77+2) = 77/79 = 0.974$$

For the above case Recall value for purchased:

$$\text{Recall} = 18 / (18+23) = 18/41 = 0.439$$

## F1 Score

Formula:

$$\text{F1-Score} = \frac{2 \cdot \text{Precision} \cdot \text{Recall}}{\text{Precision} + \text{Recall}}$$

For the above case for unpurchased:

$$\text{F1-Score} = (2 * 0.77 * 0.97) / (0.77 + 0.97) = 0.8585$$

For the above case for purchased:

$$\text{F1-Score} = (2 * 0.90 * 0.44) / (0.90 + 0.44) = 0.5910$$

## Macro-Average

Formula:

$$\text{Macro-Average of Precision} = \text{Precision (Unpurchased)} + \text{precision(purchased)} / 2$$

For the above case macro-average of precision:

$$\text{Macro-Average} = (0.77 + 0.90) / 2 = 0.835$$

For the above case macro-average of Recall:

$$\text{Macro-Average of Recall} = \text{Recall (Unpurchased)} + \text{Recall(purchased)} / 2$$

$$\text{Macro-Average} = (0.97 + 0.439) / 2 = 0.7045$$

## Weighted-Average

Formula:

$$\begin{aligned} \text{Weighted-Average of Precision} = & \text{Precision (Unpurchased)} \times (\text{Total Unpurchased} / \text{Total dataset}) \\ & + \text{precision (purchased)} \times (\text{Total purchased} / \text{Total dataset}) \end{aligned}$$

For the above case Weighted-average of precision:

$$\text{Weighted-Average} = ((0.77) * (80/120) + (0.90) * (41/120)) = (0.513 + 0.3075) = 0.820$$

$$\begin{aligned} \text{Weighted-Average of Recall} &= \text{Recall (Unpurchased)} \times (\text{Total Unpurchased} / \text{Total dataset}) \\ &\quad + \text{Recall (purchased)} \times (\text{Total purchased} / \text{Total dataset}) \end{aligned}$$

For the above case Weighted-average of recall:

$$\text{Weighted-Average} = ((0.97) * (80/120) + (0.439) * (41/120)) = 0.646 + 0.1499 = 0.795$$