* Confusion Matrix ⇉

Predicted (ŷ) \ Actual (y)	M (C_1)	F (C_2)	I (C_3)
M (C_1)	① 64	② 46	③ 139
F (C_2)	④ 12	⑤ 237	⑥ 42
I (C_3)	⑦ 52	⑧ 79	⑨ 165

Support

M (C_1)	F (C_2)	I (C_3)
128	362	346

Class	M (C_1)	F (C_2)	I (C_3)
TP	① 64	⑤ 237	⑨ 165
FP	②+③ = 46 +139 = 185	④+⑥ = 12+42 = 54	⑦+⑧ = 52+79 = 131
TN	⑤+⑥+⑧+⑨ = 523	①+③+⑦+⑨ = 420	①+②+④+⑤ = 353
FN	④+⑦ ⇉ 64	②+⑧ = 46+79 = 125	③+⑥ = 139+42 = 181

$$\text{Precision} \Rightarrow \frac{TP}{(TP+FP)} \Rightarrow \frac{TP1+TP2+TP3}{(TP1+TP2+TP3)+(FP1+FP2+FP3)}$$

$$= \frac{466}{(466)+(376)} = \frac{466}{842} = 0.55$$

~~Precision in % ⇉ 0.26~~

$$\text{Recall (Sensitivity)} = \frac{TP}{(TP+FN)} = \frac{466}{(466+370)} = \frac{466}{836} = 0.5$$

$$F1\text{-score} = 2 \times (prc \times rec) / (prc + rec) \;/\; \frac{2}{\frac{1}{recall} + \frac{1}{precision}}$$

$$= 2 \times (0.55 \times 0.55) / (0.55 + 0.55)$$

$$= 2 \times 0.3025 / 1.10$$

$$F1\text{-score} = 0.55$$

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

$$= \frac{466 + 1302}{466 + 370 + 376 + 1302} = \frac{1768}{2514}$$

$$= 0.70$$

For Class C_1:

$$\text{Precision} = \frac{TP_1}{TP_1 + FP_1} = \frac{64}{(64+185)} = \frac{64}{249} = 0.22$$

$$\text{Recall} = \frac{TP_1}{TP_1 + FN_1} = \frac{64}{64+64} = \frac{64}{128} = 0.5$$

$$F1\text{-score} = 2 \times (prc \times rec) / (prc + rec) \;/\; \frac{2}{\frac{1}{recall} + \frac{1}{precision}}$$

$$= 2 \times (0.22 \times 0.5) / (0.22 \times 0.5)$$

$$= 2 \times (0.11) / 0.11 = 0.34$$

$$\text{Accuracy} = \frac{(TP_1 + TN_1)}{(TP_1 + FN_1 + FP_1 + TN_1)} = \frac{587}{836} = 0.70$$

For class C_2,

$$\text{Precision} = \frac{TP_2}{TP_2 + FP_2} = \frac{237}{237 + 54} = \frac{237}{291} = \underline{0.81}$$

$$\text{Recall} = \frac{TP_2}{TP_2 + FN_2} = \frac{237}{237 + 125} = \underline{0.65}$$

$$F_1\text{-score} = \frac{2}{\frac{1}{\text{recall}} + \frac{1}{\text{precision}}} = \frac{2}{\frac{1}{0.81} + \frac{1}{0.65}} = \frac{2}{2.77}$$

$$= 0.72.$$

$$\text{Accuracy} = \frac{(TP_2 + FN_2)}{(TP_2 + FN_2 + FP_2 + FN_2)} = \frac{657}{836} = \underline{0.78}$$

Similary, for class C_3,

Precision = 0.56, Recall = 0.48

F1-score = 0.51, Accuracy = 0.62