# Evaluation Matrices in Classification

Why evaluation matrix?

- Evaluation matrix explains the performances of the model

Classification accuracy

	region	tenure	age	marital	address	income	ed	employ	retire	gender	reside	custcat
0	2	13	44	1	9	64.0	4	5	0.0	0	2	1
1	3	11	33	1	7	1			0		6	4
2	3	68	52	1	24	1			1		2	3
3	2	33	33	0	12						1	1
4	2	23	30	1	9				0		4	3
5	2	41	39	0	17	78.0				1	1	3
6	3	45	22	1	2	19.0	2	4	0.0	1	5	2
7	2	38	35	0	5	76.0	2	10	0.0	0	3	4
8	3	45	59	1	7	166.0	4	31	0.0	0	5	3

Training set

Model

Test set
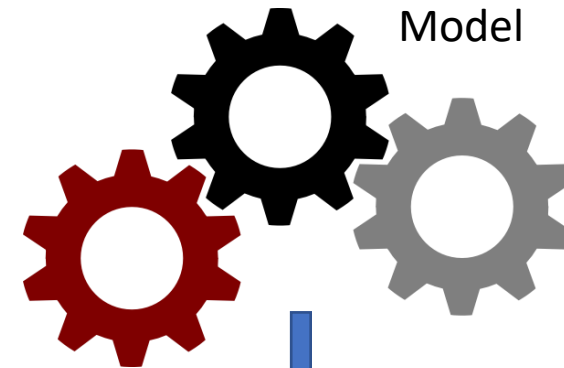
Predicted value
1
1
3
4
...
2

Actual label y $\neq$ Predicted label $\hat{y}$

Three Popular Evaluation Matrices

Evaluation matrices provide a key role in the development of a model, as they provide insight to area that might require improvement .

- Jaccard index
- F1-score
- Log loss

Jaccord Index

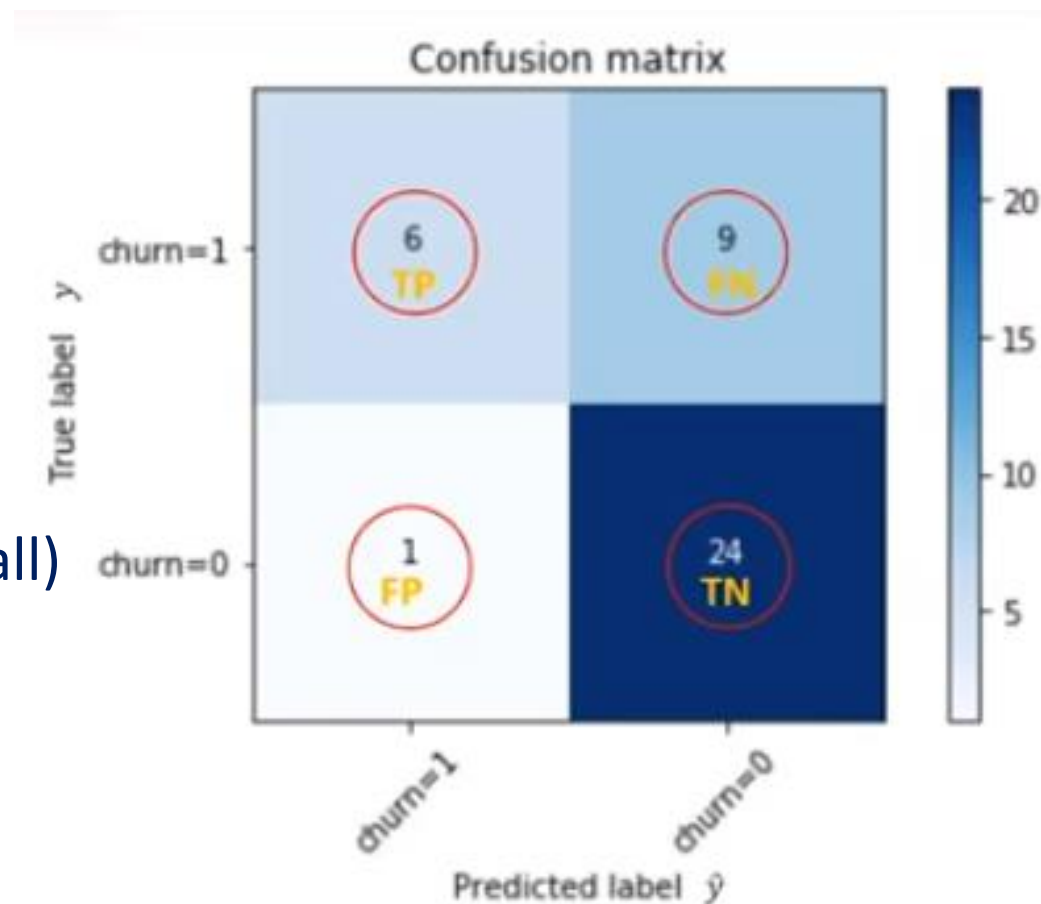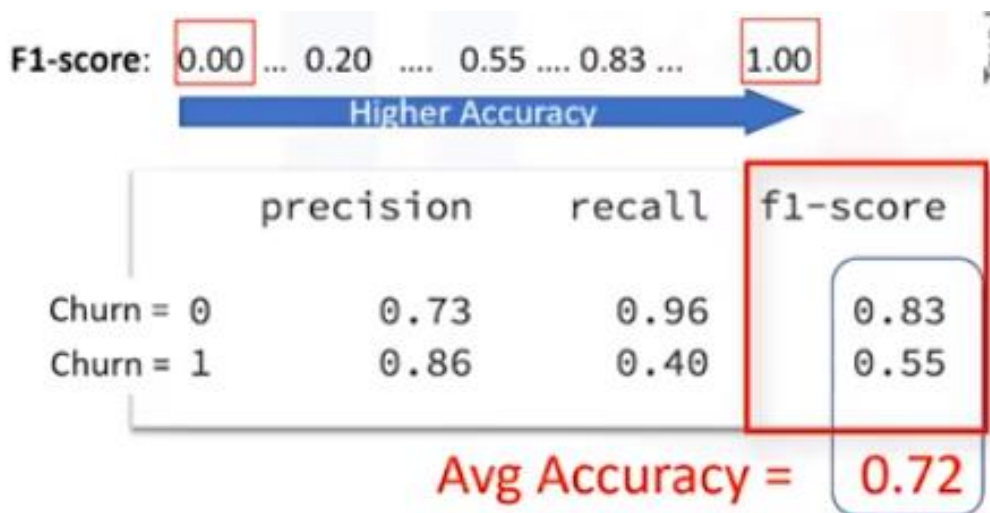- y actual labels
- $\hat{y}$ predicted labels

$$J(y, \hat{y}) = \frac{|y \cap \hat{y}|}{|y \cup \hat{y}|} = \frac{|y \cap \hat{y}|}{|y| + |\hat{y}| - |y \cap \hat{y}|}$$

- y=[0,0,0,0,0,1,1,1,1,1]
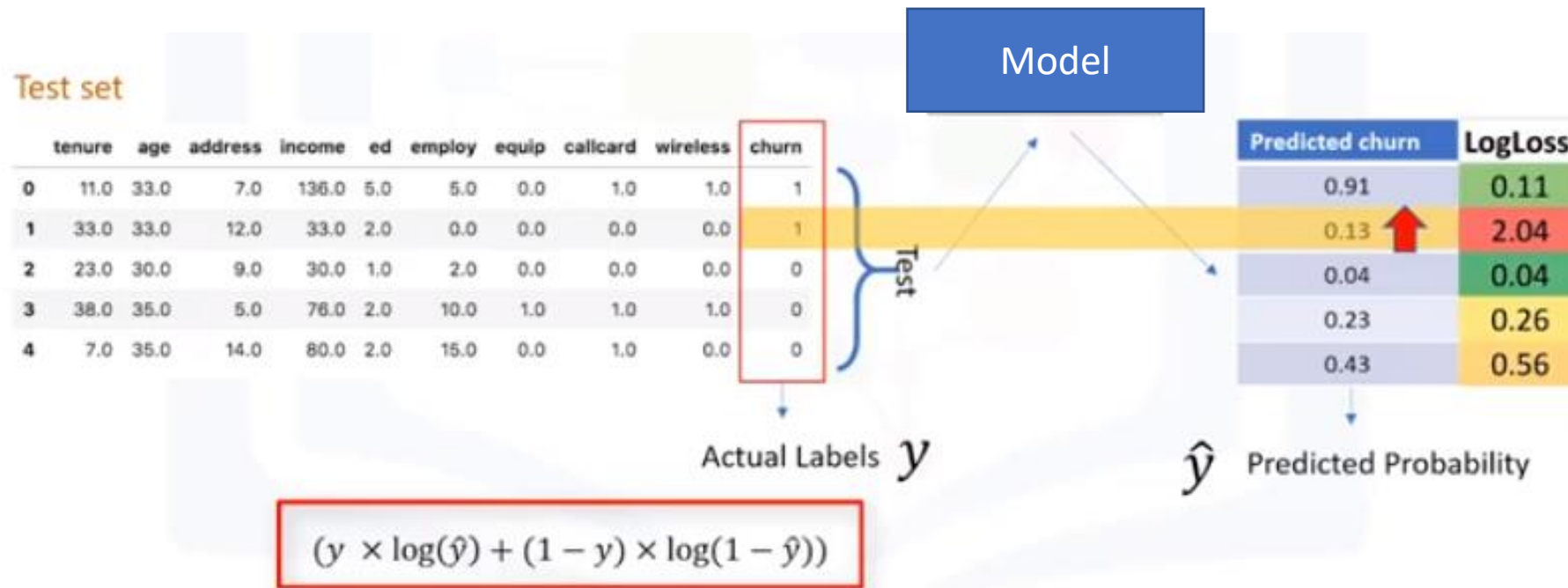- $\hat{y}$= [1,1,0,0,0,1,1,1,1,1]

$$J(y, \hat{y}) = \frac{8}{10 + 10 - 8} = 0.66$$

F1-Score

- Precision = TP / (TP + FP)
  (measure of accuracy)
- Recall = TP / (TP + FN)
  (true positive rate)
- F1-Score = 2 x (prc x rec) / (prc + rec)
  (harmonic average of the precision and recall)

F1-score: 0.00 ... 0.20 .... 0.55 .... 0.83 ... 1.00
Higher Accuracy

	precision	recall	f1-score
Churn = 0	0.73	0.96	0.83
Churn = 1	0.86	0.40	0.55

Avg Accuracy = 0.72

Confusion matrix

	churn=1	churn=0
churn=1	6 TP	9 FN
churn=0	1 FP	24 TN

True label y

Predicted label ŷ

Log Loss

- Measure the performance of a classifier where the predicted output is a probability value between 0 and 1 (Ex. logistic regression)

$$(y \times \log(\hat{y}) + (1 - y) \times \log(1 - \hat{y}))$$

Log Loss

$$LogLoss = -\frac{1}{n}\sum (y \times \log(\hat{y}) + (1 - y) \times \log(1 - \hat{y}))$$