METRICS : CLASSIFICATION MODELS

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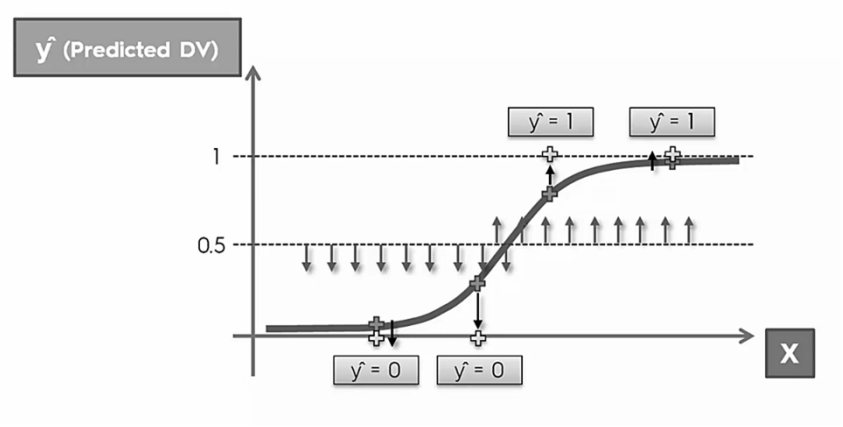
CONFUSION MATRIX

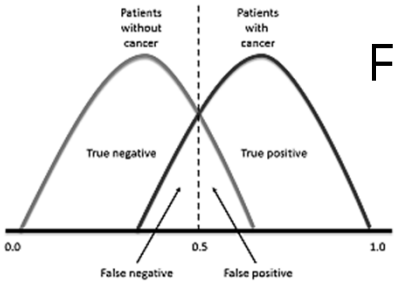
- The confusion matrix is a handy presentation of the accuracy of a model with two or more classes.
- The table presents predictions on the x-axis and accuracy outcomes on the y-axis.
- The cells of the table are the number of predictions made by a machine learning algorithm.

		Actual class		
		Cat	**Dog**	**Rabbit**
Predicted class	**Cat**	**5**	2	0
	Dog	3	**3**	2
	Rabbit	0	1	**11**

FALSE POSITIVES AND NEGATIVES

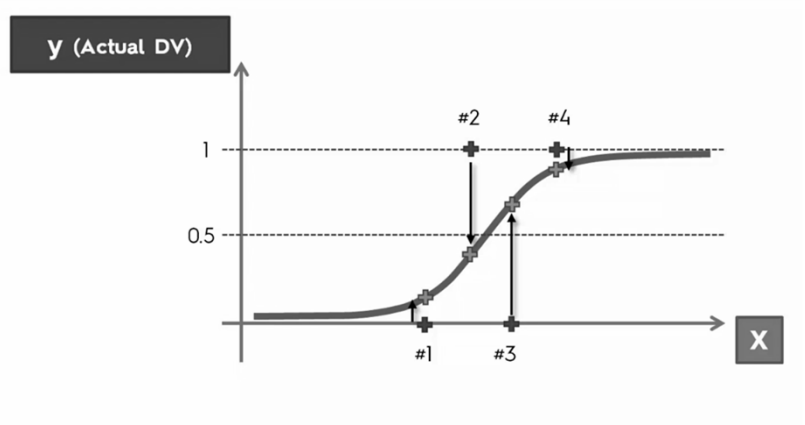


FP & FN CONTD..

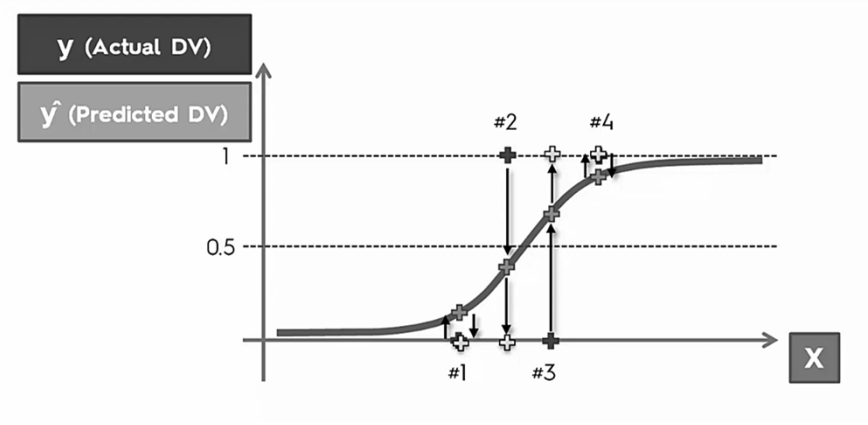


- Most classifiers produce a score, which is then thresholded to decide the classification
- If a classifier produces a score between 0.0 (definitely negative) and 1.0 (definitely positive), it is common to consider anything over 0.5 as positive
- Any threshold applied to a dataset (in which PP is the positive population and NP is the negative population) is going to produce true positives (TP), false positives (FP), true negatives (TN) and false negatives (FN)

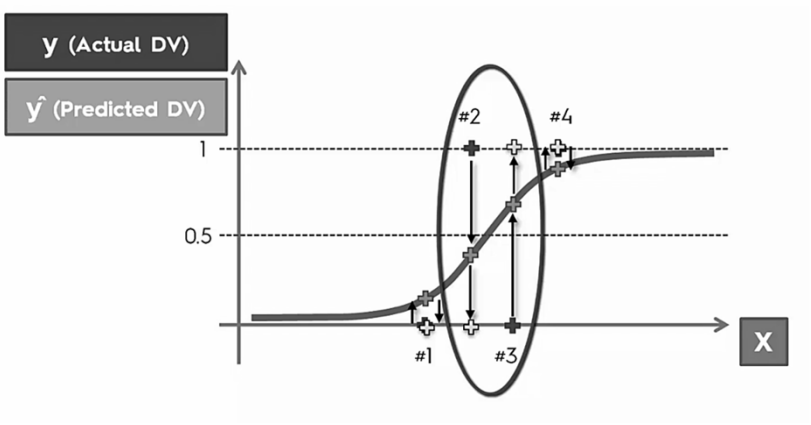
FP & FN CONTD..



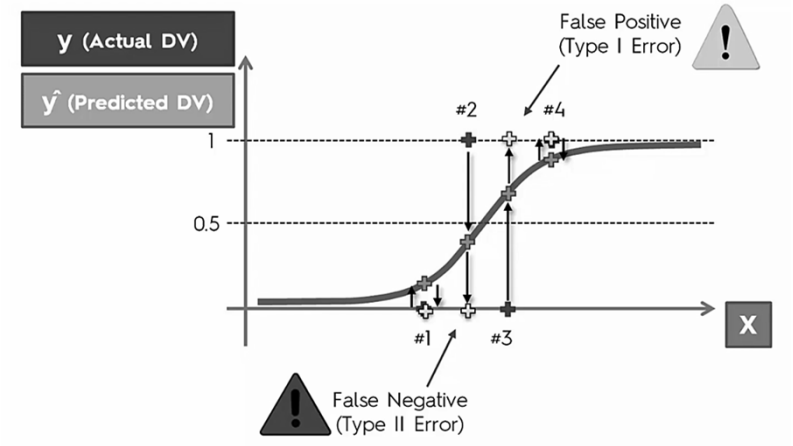
FP & FN CONTD..



FP & FN CONTD..



FP & FN CONTD..



CONFUSION MATRIX

$$\text{Accuracy (ACC)} = \frac{\Sigma \text{ True positive} + \Sigma \text{ True negative}}{\Sigma \text{ Total population}}$$

$$\text{Positive predictive value (PPV), Precision} = \frac{\Sigma \text{ True positive}}{\Sigma \text{ Predicted condition positive}}$$

$$\text{True positive rate (TPR), Recall, Sensitivity, probability of detection} = \frac{\Sigma \text{ True positive}}{\Sigma \text{ Condition positive}}$$

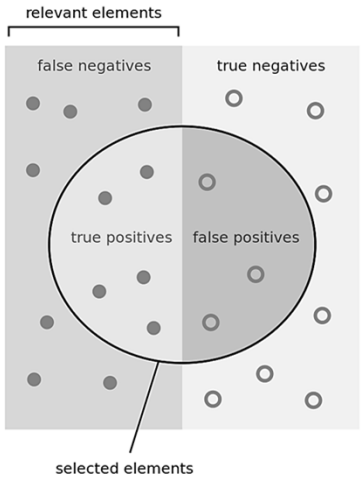
		True condition	
	Total population	Condition positive	Condition negative
Predicted condition	Predicted condition positive	**True positive**, Power	**False positive**, Type I error
	Predicted condition negative	**False negative**, Type II error	**True negative**

CLASSIFICATION ACCURACY

- Classification accuracy is the number of correct predictions made as a ratio of all predictions made.
- This is the most common evaluation metric for classification problems
- Also the most misused!!
- It is really only suitable when there are an equal number of observations in each class (which is rarely the case) and that all predictions and prediction errors are equally important, which is often not the case.

$$\text{Accuracy (ACC)} = \frac{\Sigma \text{ True positive} + \Sigma \text{ True negative}}{\Sigma \text{ Total population}}$$

PRECISION AND RECALL



How many selected items are relevant?

$$\text{Precision} = \frac{\text{true positives}}{\text{selected elements}}$$

How many relevant items are selected?

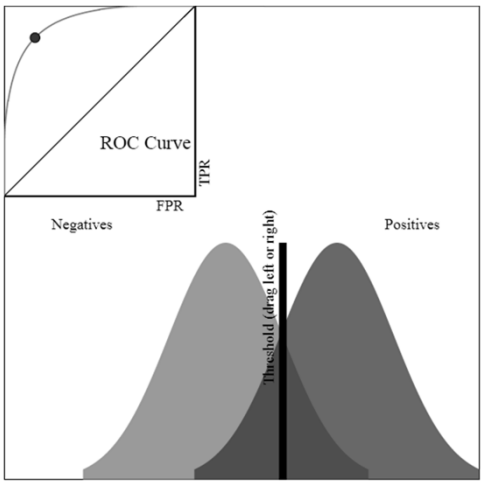
$$\text{Recall} = \frac{\text{true positives}}{\text{relevant elements}}$$

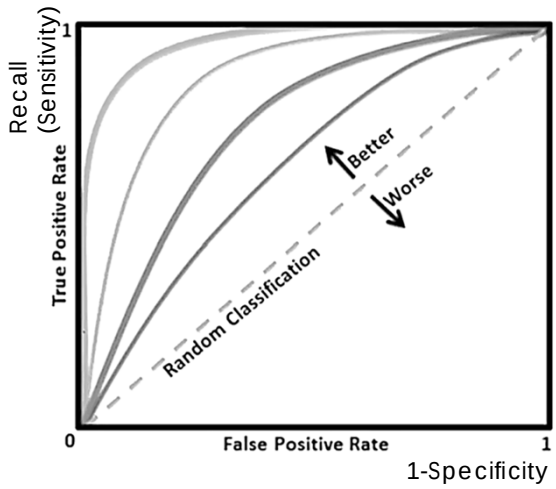
F1 SCORE

- The F_1 score is the harmonic average of the precision and recall
- F_1 score reaches its best value at 1 (perfect precision and recall) and worst at 0.

$$F_1 \text{ score} = \frac{2}{\frac{1}{\text{Recall}} + \frac{1}{\text{Precision}}}$$

ROC CURVE





THANK YOU