

Confusion Matrix

After this video you will be able to..

- Describe how a confusion matrix can be used to evaluate a classifier
- Interpret the confusion matrix of a model
- Relate accuracy to values in a confusion matrix

Classification

Is this animal a mammal?

Yes

No



Class Labels

Types of Classification Errors

Is this animal a mammal?

Yes

No

Class Labels

True Label	Predicted Label	Error Type
Yes	Yes	True Positive (TP)
No	No	True Negative (TN)
No	Yes	False Positive (FP)
Yes	No	False Negative (FN)

Confusion Matrix

Is this animal a mammal?

Yes

No

Class Labels

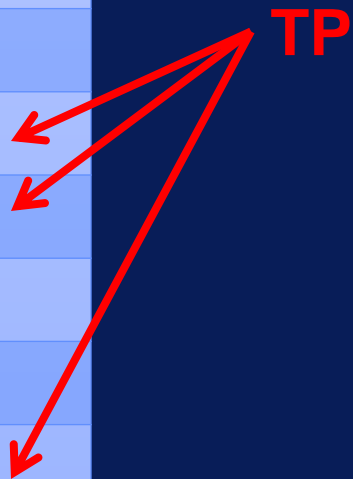
True Class Label	Predicted Class Label		
		Yes	No
	Yes	True Positive (TP)	False Negative (FN)
	No	False Positive (FP)	True Negative (TN)

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP	FN
	No	FP	TN

Confusion Matrix

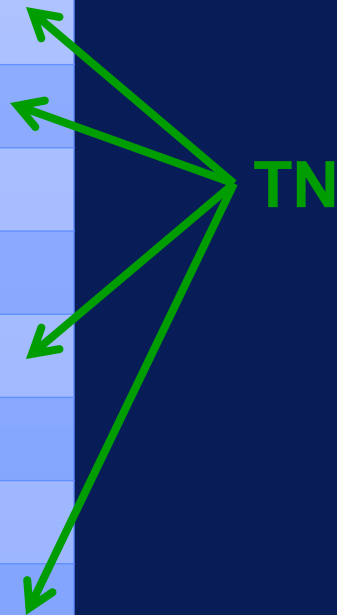
True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes



	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	
	No		

Confusion Matrix

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes



	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	
	No		TN = 4

Confusion Matrix

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes



	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	FN = 2
	No		TN = 4

Confusion Matrix

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	FN = 2
	No	FP = 1	TN = 4

Confusion Matrix

FP



True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	FN = 2
	No	FP = 1	TN = 4

Confusion Matrix

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

	Predicted Class Label	
True Class Label		
	Yes	No
	Yes	No
	TP = 3	FN = 2
	FP = 1	TN = 4

Correct Predictions :
7 out of 10 = 0.7

True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP = 3	FN = 2
	No	FP = 1	TN = 4

Incorrect Predictions :
3 out of 10 = 0.3

Confusion Matrix & Accuracy Rate

True Class Label	Predicted Class Label	
	Yes	No
Yes	TP = 3	FN = 2
No	FP = 1	TN = 4

$$\begin{aligned}\text{Accuracy Rate} &= \frac{\# \text{ correct predictions}}{\# \text{ total predictions}} \\ &= \frac{TP + TN}{TP + TN + FP + FN} \\ &= (3 + 4) / 10 = 7 / 10 = 0.7\end{aligned}$$

Confusion Matrix & Error Rate

True Class Label	Predicted Class Label	
	Yes	No
Yes	TP = 3	FN = 2
No	FP = 1	TN = 4

$$\text{Error Rate} = \frac{\# \text{ incorrect predictions}}{\# \text{ total predictions}}$$


$$= 1 - \text{Accuracy Rate}$$

$$= 1 - 0.7 = 0.3$$


Misclassifications in Confusion Matrix

True Class Label	Predicted Class Label		
		Yes	No
	Yes	TP = 3	FN = 2
	No	FP = 1	TN = 4

High value means
classifying Positive
class is problematic



High value means
classifying Negative
class is problematic



Confusion Matrix

	Predicted Class Label		
True Class Label		Yes	No
	Yes	TP	FN
	No	FP	TN