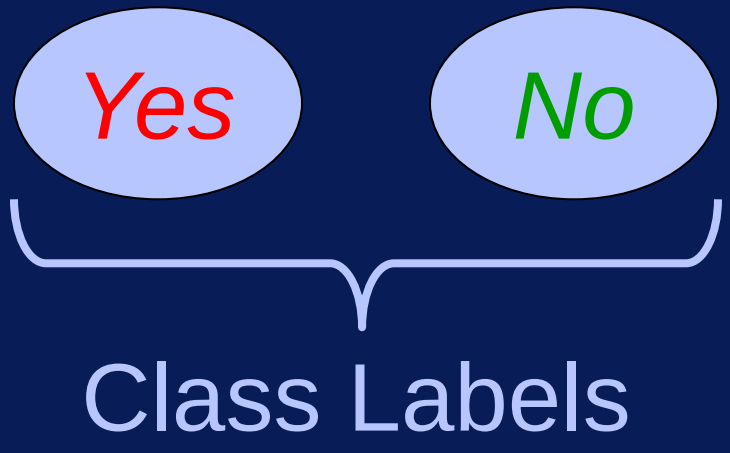
Confusion Matrix

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

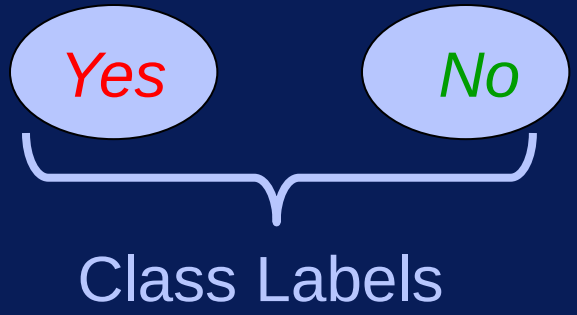
Classification

Is this animal a mammal?



Types of Classification Errors

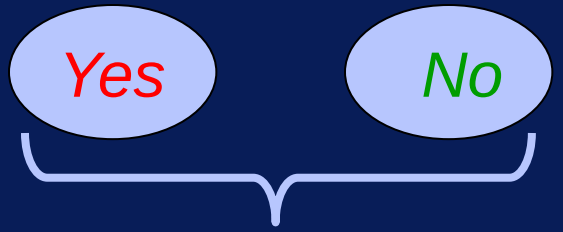
Is this animal a mammal?



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?



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

Confusion Matrix

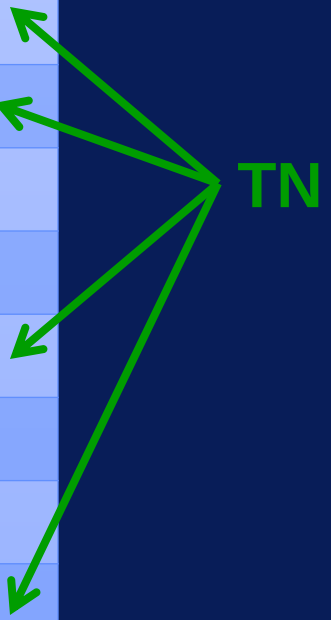
True Label	Predicted Label
Yes	No
No	No
No	No
Yes	Yes
Yes	Yes
No	No
Yes	No
Yes	Yes
No	No
No	Yes

TP

	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

FP

Confusion Matrix

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

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

Incorrect Predictions :
3 out of 10 = 0.3

Confusion Matrix & Accuracy Rate

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

$$\text{Accuracy Rate} = \frac{\text{\# correct predictions}}{\text{\# total predictions}}$$

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

$$= (3 + 4) / 10 = 7 / 10 = 0.7$$

Confusion Matrix & Error Rate

		Predicted Class Label	
		Yes	No
True Class Label	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

		Predicted Class Label	
		Yes	No
True Class Label	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