

PROFESSIONAL & CONTINUING EDUCATION

UNIVERSITY *of* WASHINGTON

EVALUATE MODELS



EVALUATE MODEL

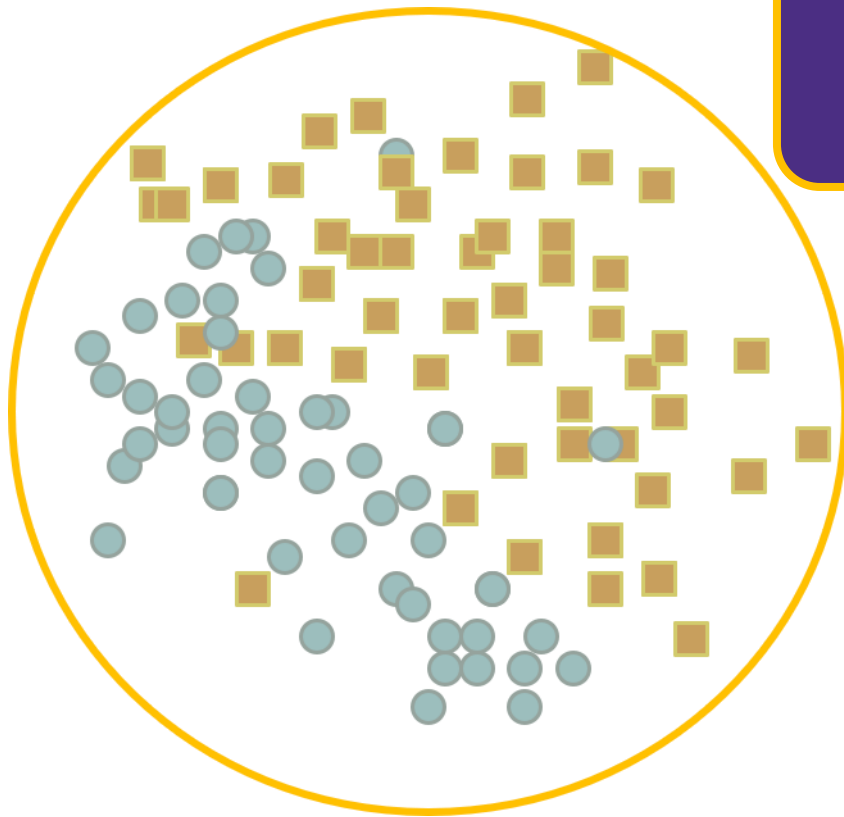
The following segment will use an over-fitting example to explain the following concepts:

- Modeling Data
 - > Training Data
 - > Test Data
- Model (Hypothesis)
- Over-fitting
- Model Accuracy
- Confusion Matrix (Classification Matrix)
 - > True Positive
 - > False Positive
 - > True Negative
 - > False Negative



W

EVALUATE MODEL: ALL DATA



All Data



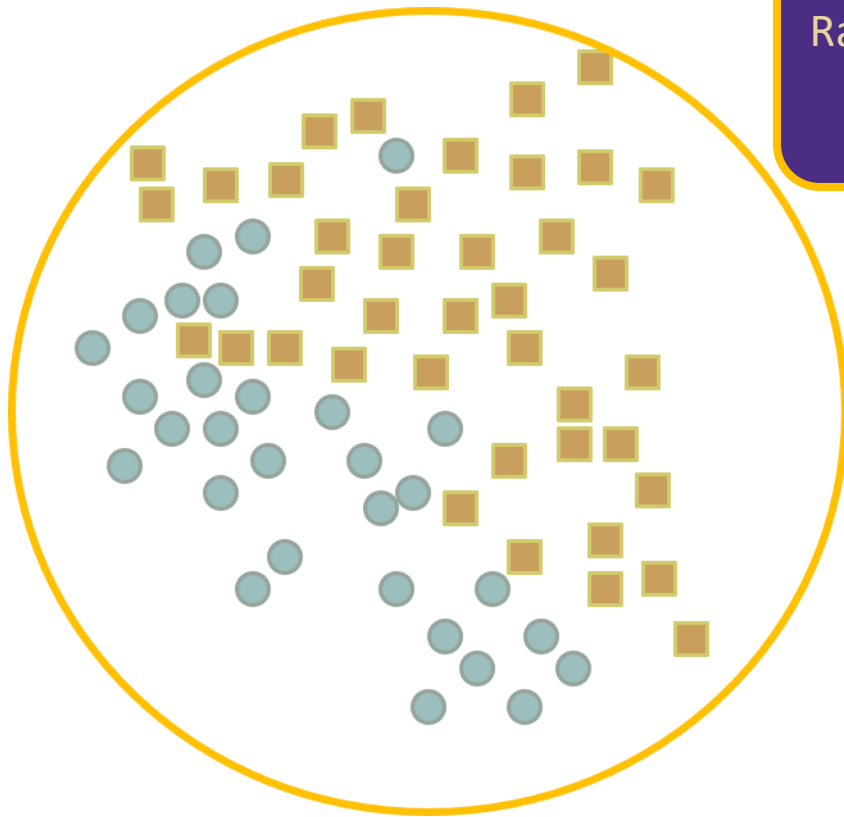
EVALUATE MODEL: TEST DATA



Randomly assign Holdout (Hidden)
Test Data



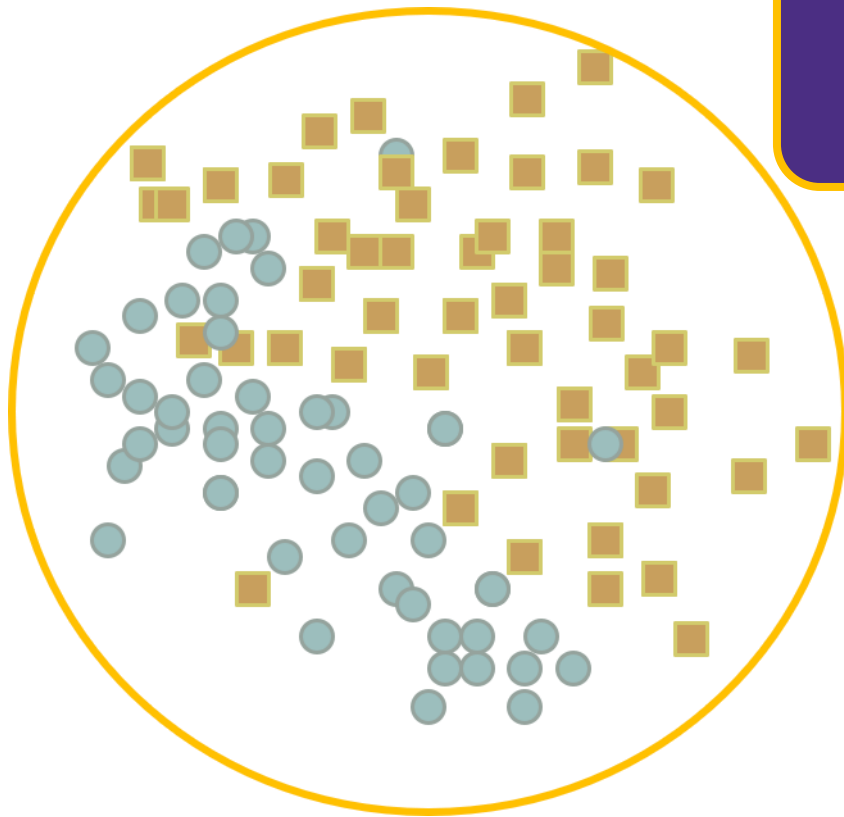
EVALUATE MODEL: TEST DATA



Randomly assign Holdout (Hidden)
Test Data



EVALUATE MODEL: ALL DATA



All Data



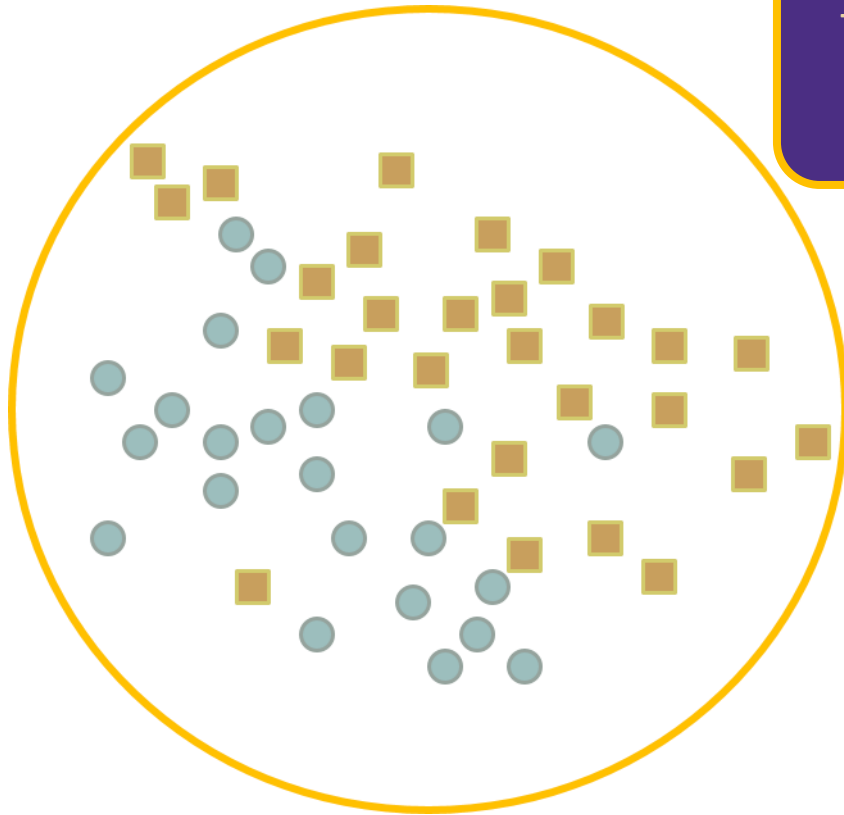
EVALUATE MODEL: TRAINING DATA



The Data that is not Test Data is
used for Training



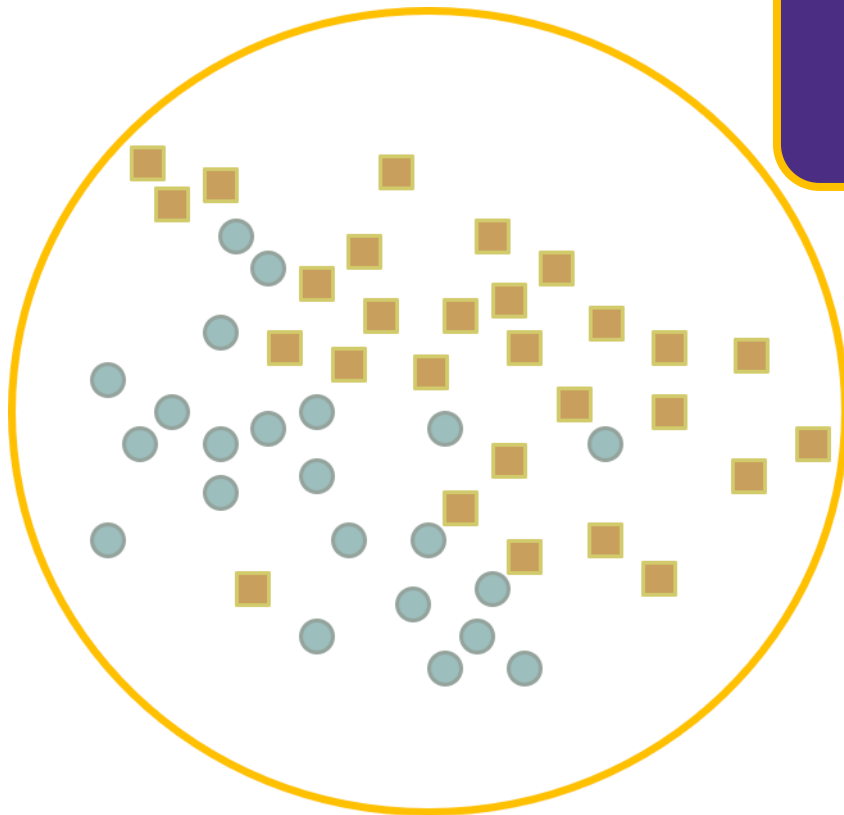
EVALUATE MODEL: TRAINING DATA



The Data that is not Test Data is
used for Training



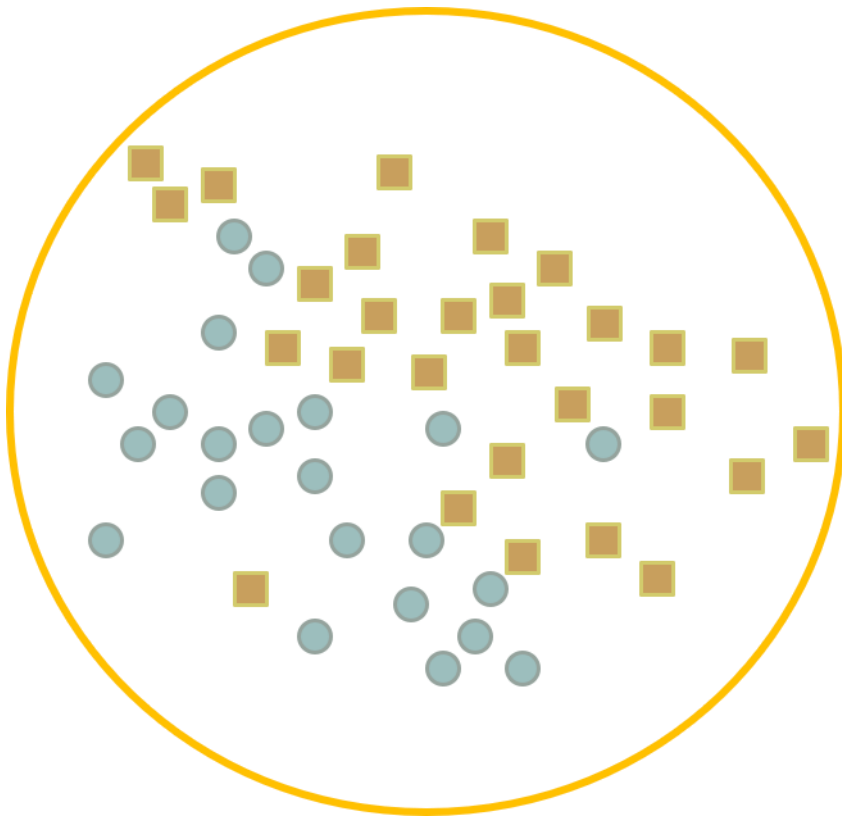
EVALUATE MODEL: TRAINING



I want to predict if a point is a square (positive) or a circle (negative). The prediction is based on the point's location



EVALUATE MODEL: TRAINING

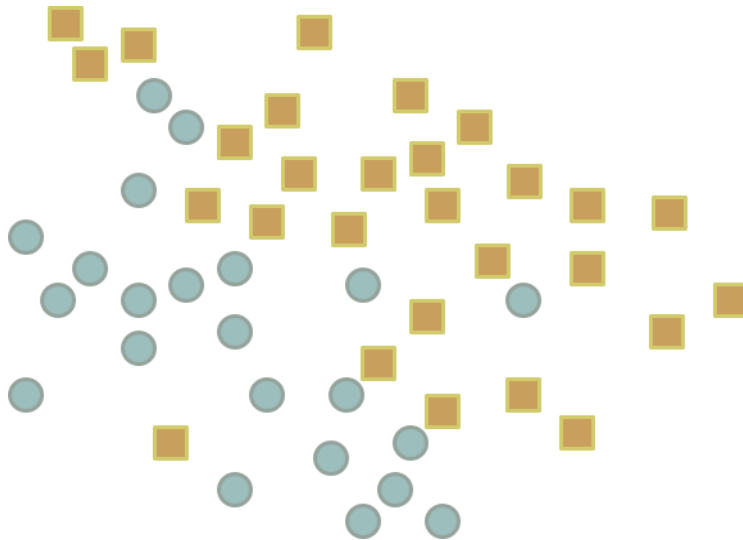
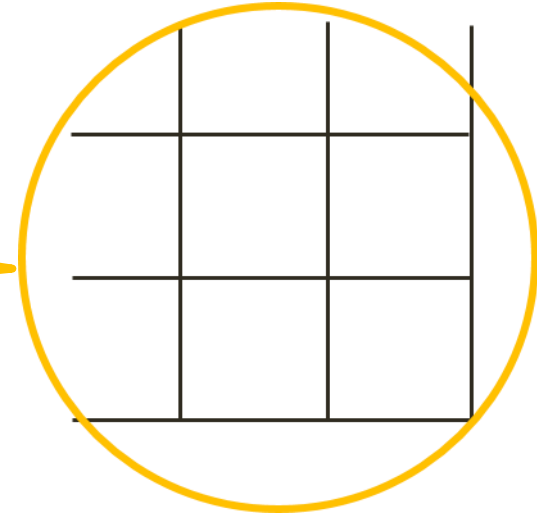


W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX

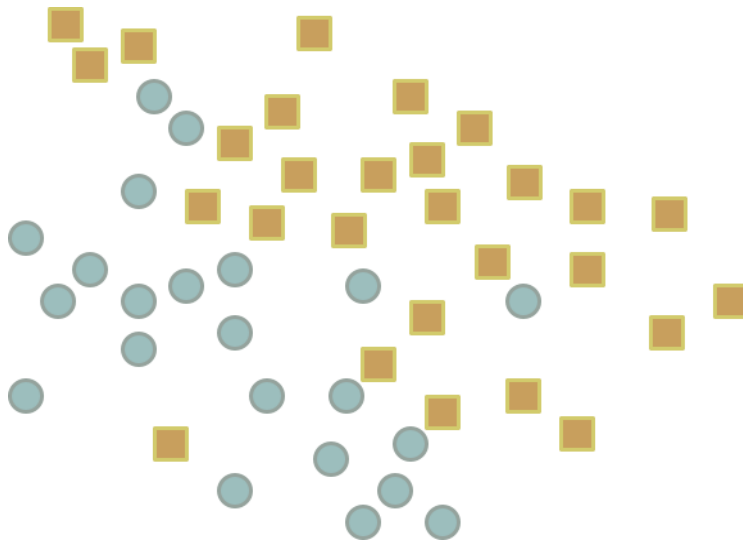
Confusion Matrix (Classification Matrix):
Compare Squares and Circles with
Predicted Squares and Circles



W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX





Actual Squares

W

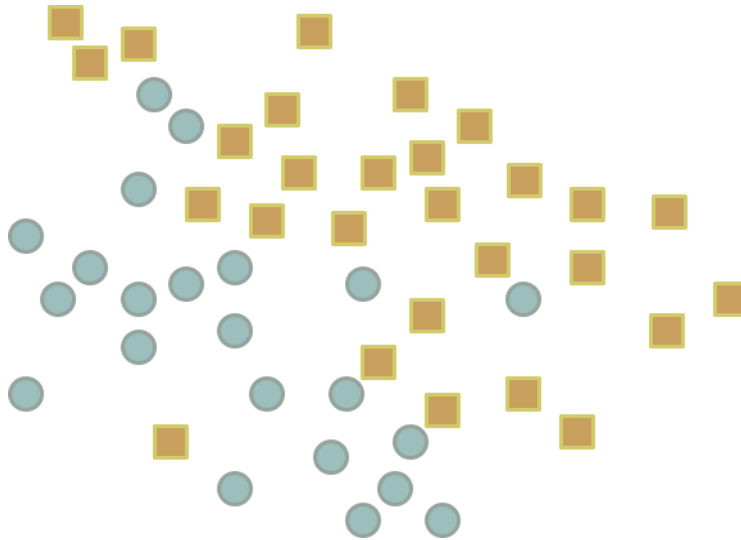
isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX

Squares are defined as positive

	Sq	
		
		

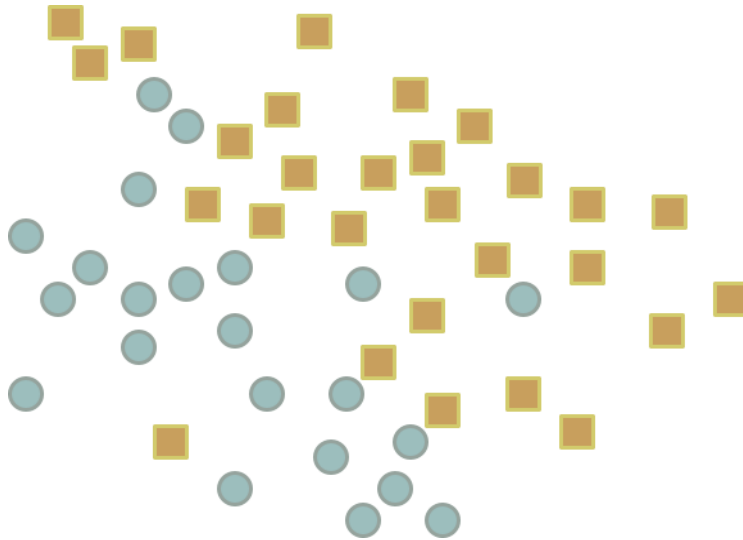
Actual Squares







W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX



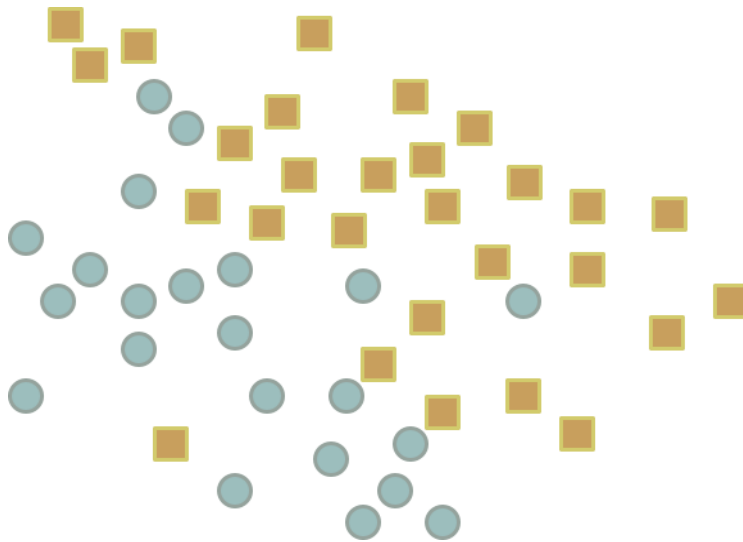
	Sq	
		
		

Actual
Circles





W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX



Circles are defined as negative

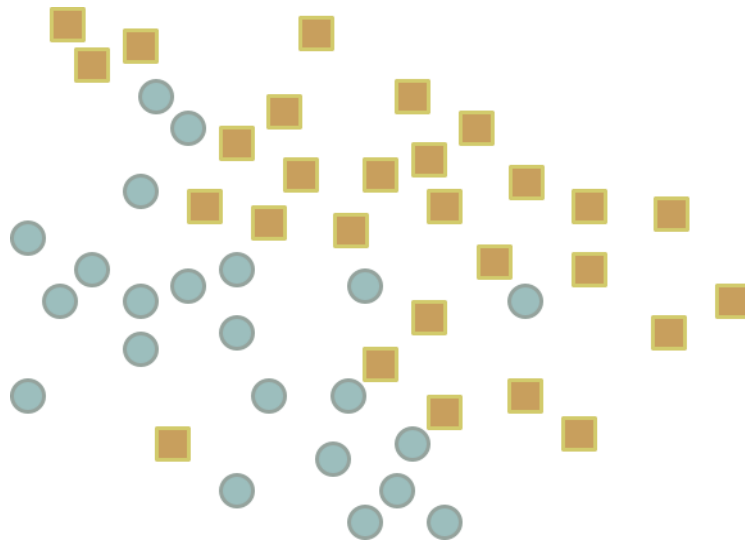
	Sq	Ci
		
		

Actual
Circles





W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX



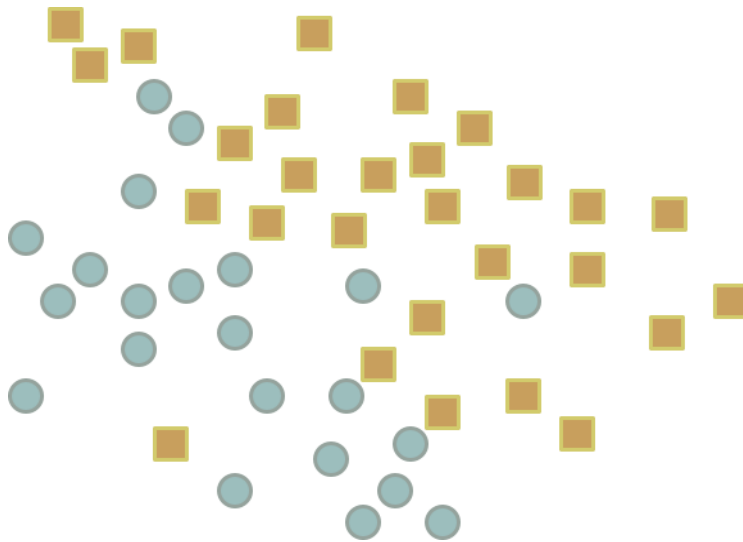
Predictions define
Positive and Negative



	Sq	Ci
P		
N		

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX



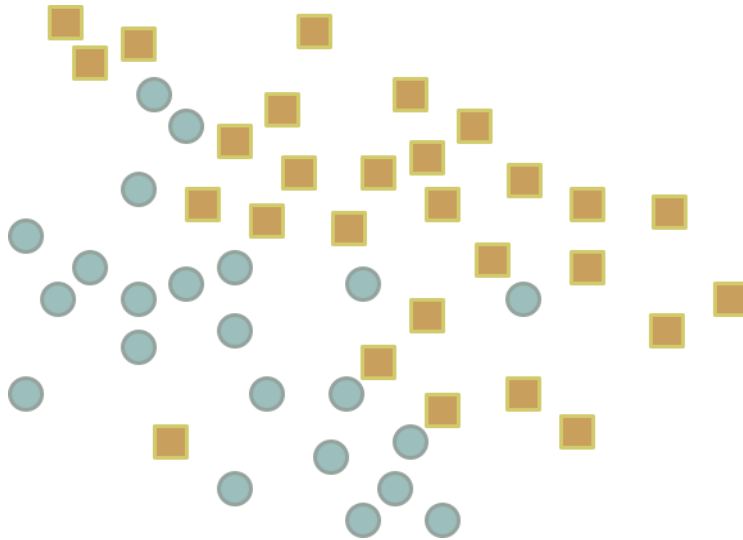
	Sq	Ci
P		
N		



Correct Predictions are True
Positives and True Negatives

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX



	Sq	Ci
P		
N		





Incorrect Predictions are False
Positives and False Negatives

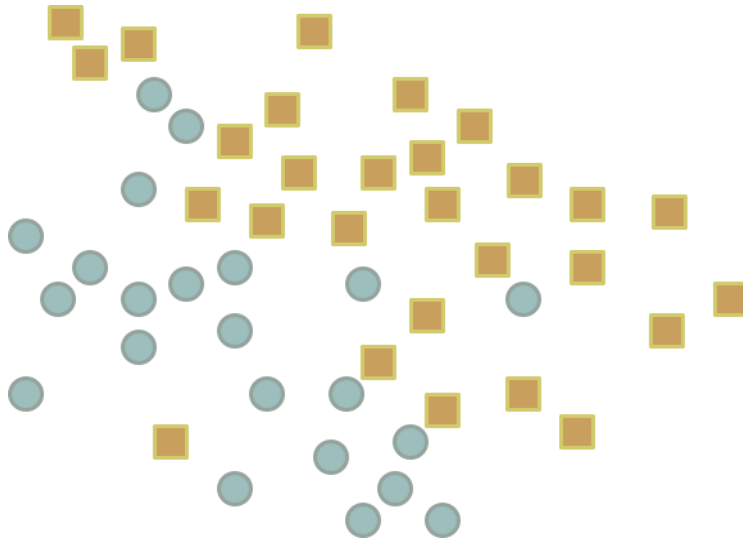
W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX

Confusion Matrix (Classification Matrix):
Vertical are actual classes
Horizontal are predicted classes

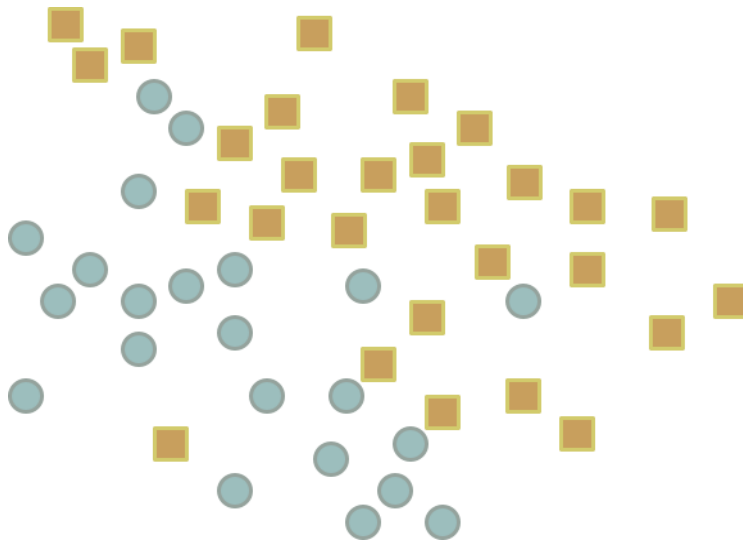
	Sq	Ci
P		
N		




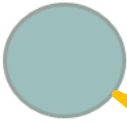


W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: CONFUSION MATRIX

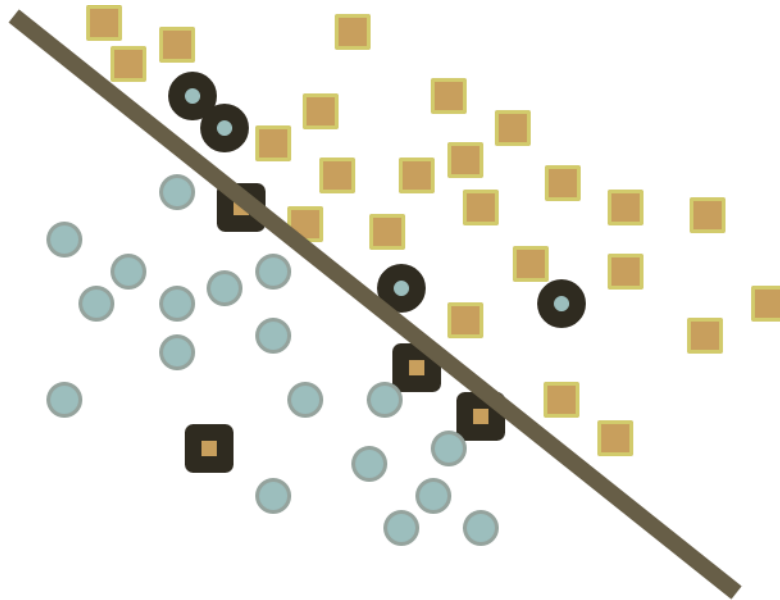


	Sq	Ci	
P			False Positive
N			True Negative
	True Positive	False Negative	

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TRAIN MODEL 1

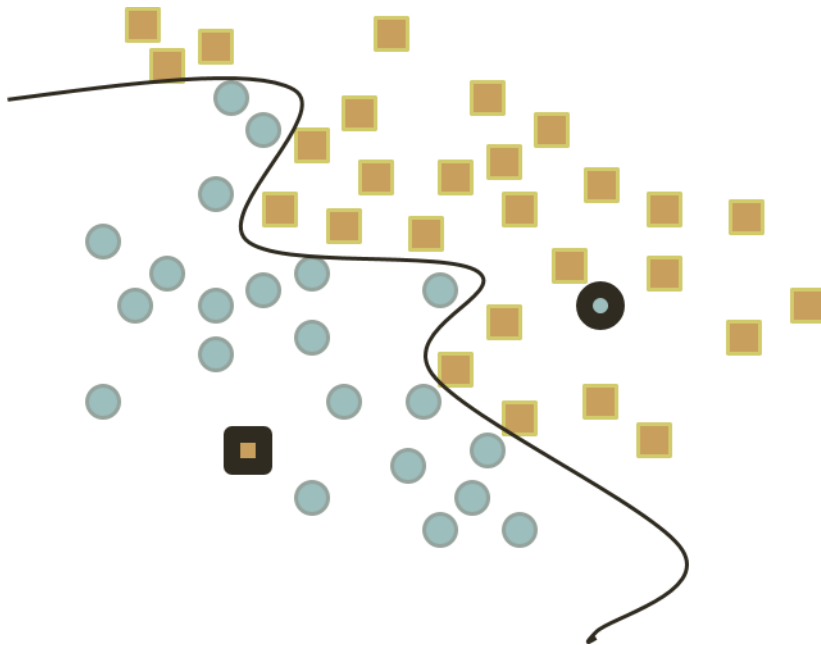


	Sq	Ci
P	36	4
N	4	26

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TRAIN MODEL 2

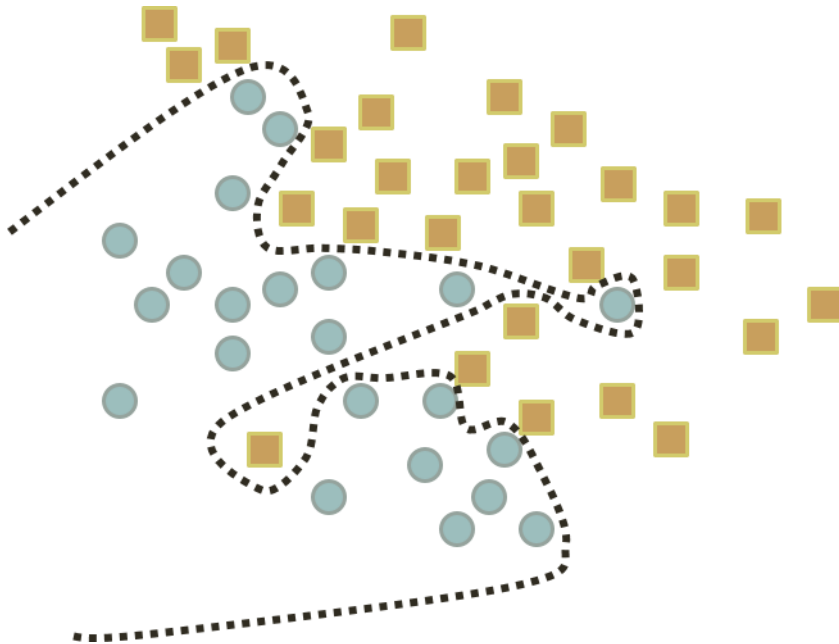


	Sq	Ci
P	39	1
N	1	29

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TRAIN MODEL 3



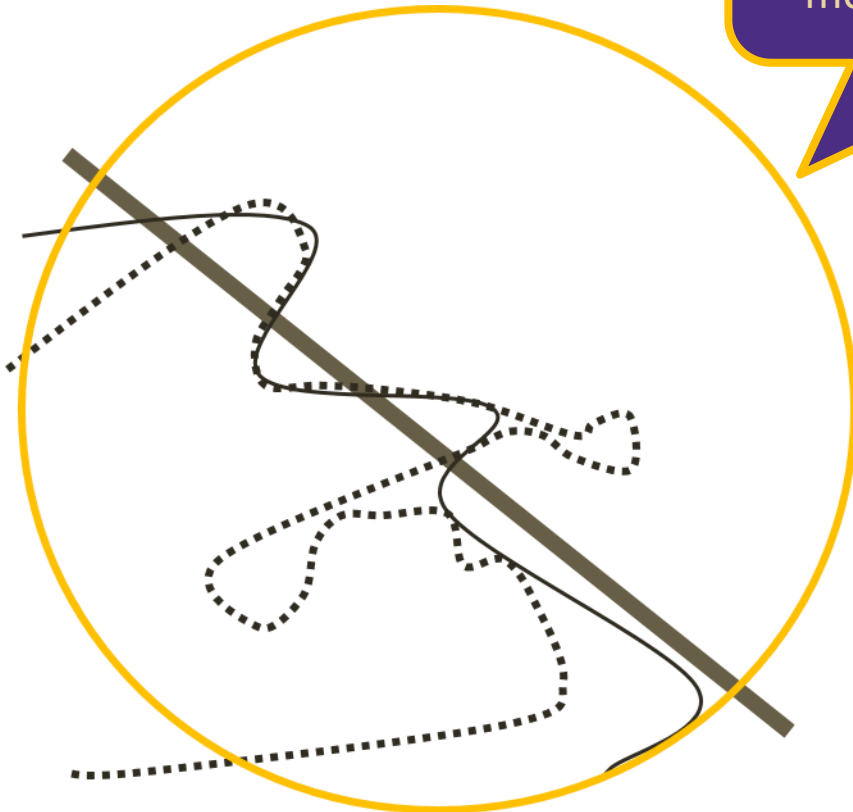
	Sq	Ci
P	40	0
N	0	30

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: 3 MODELS

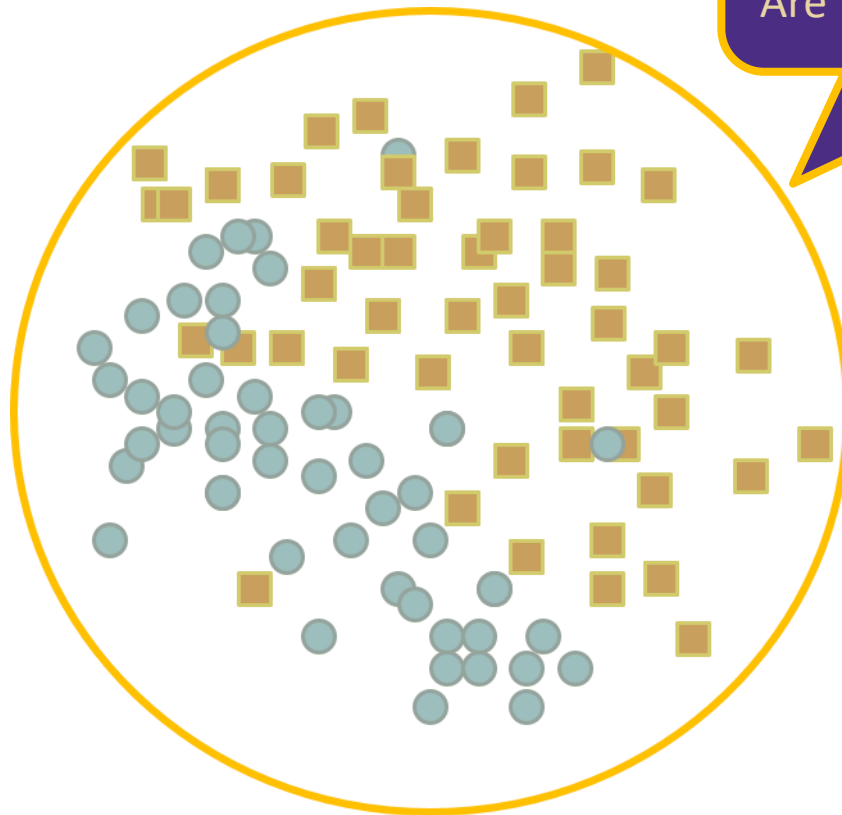
These models are based on training data. In these cases, models are called hypotheses.



W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: ALL DATA



Training data overlaid on test data.
Visual comparison of data sets.
Are the distributions comparable?



isSquare is predicted from xLocation and yLocation

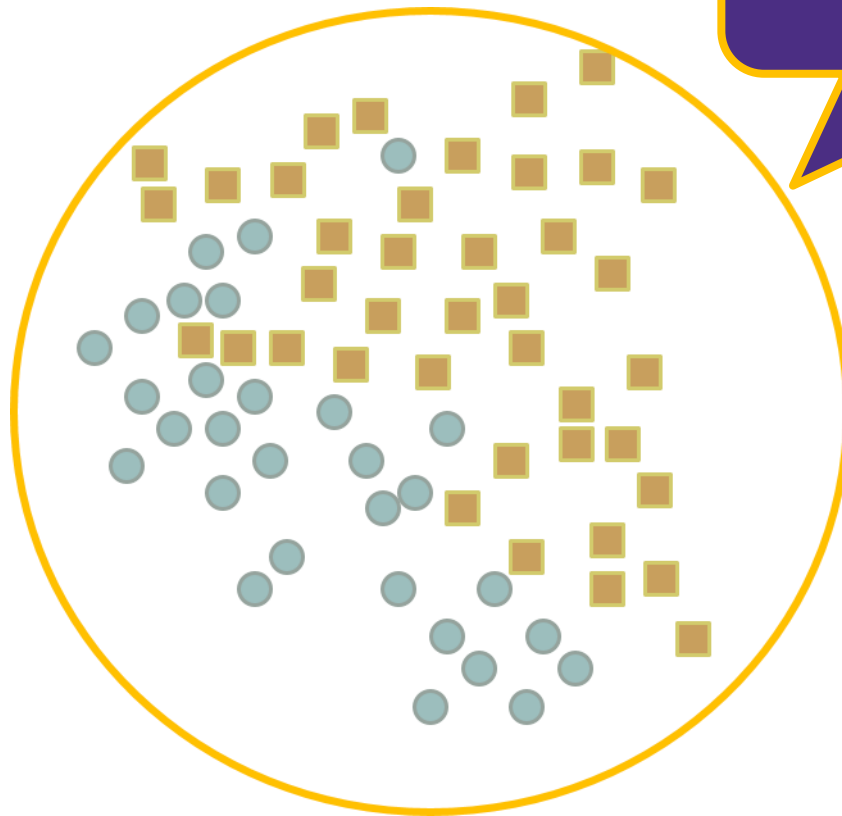
EVALUATE MODEL: TRAINING DATA



W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST DATA

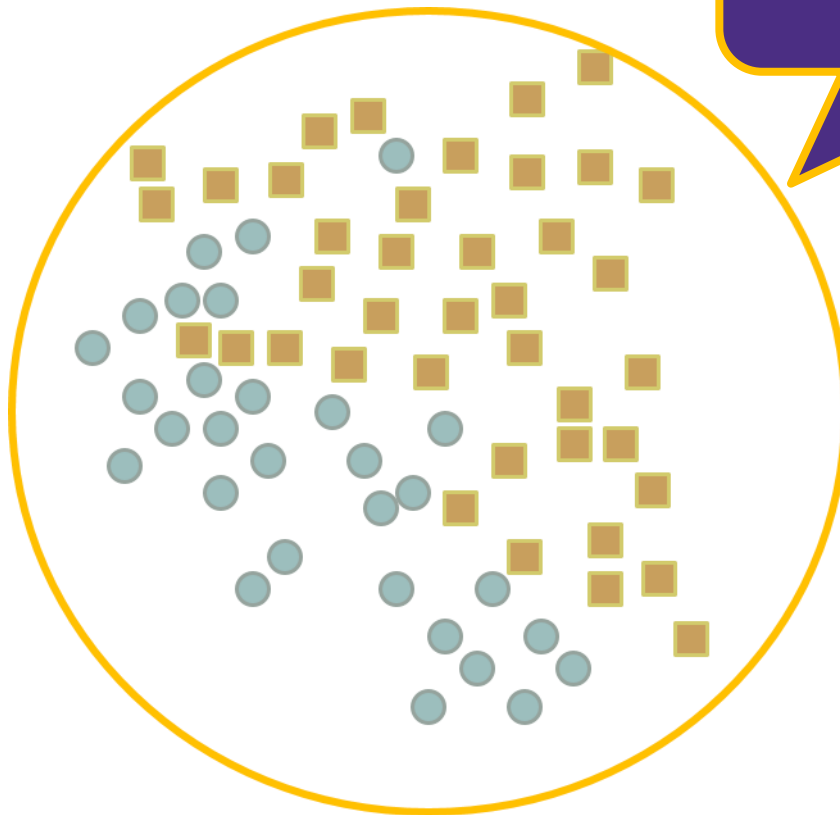


Holdout (Hidden) Test Data

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST DATA

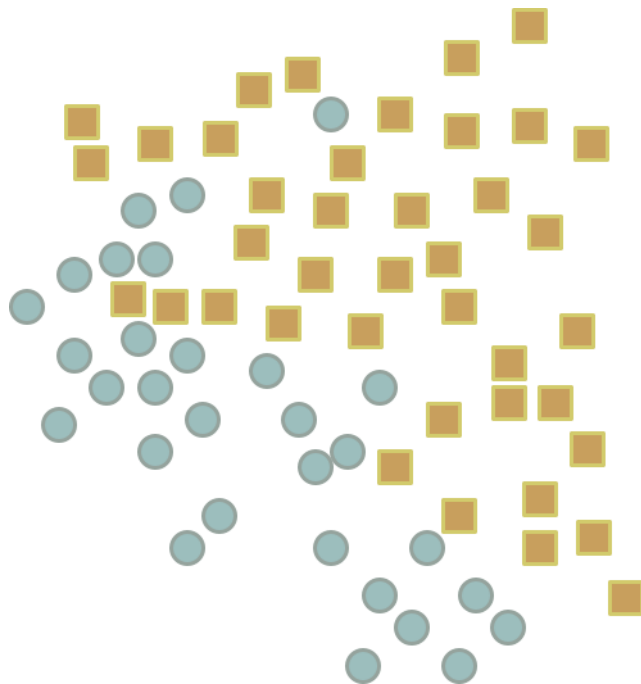






In the test data set:
I want to test if a square is
predicted as positive and if a circle
is predicted as negative

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST DATA



	Sq	Ci	
P			False Positive
N			True Negative

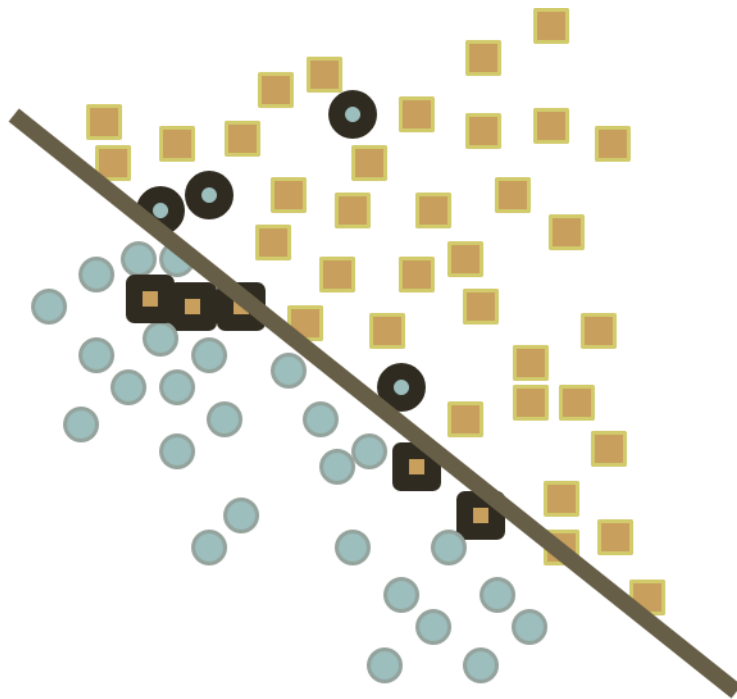
True Positive

False Negative

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST MODEL 1

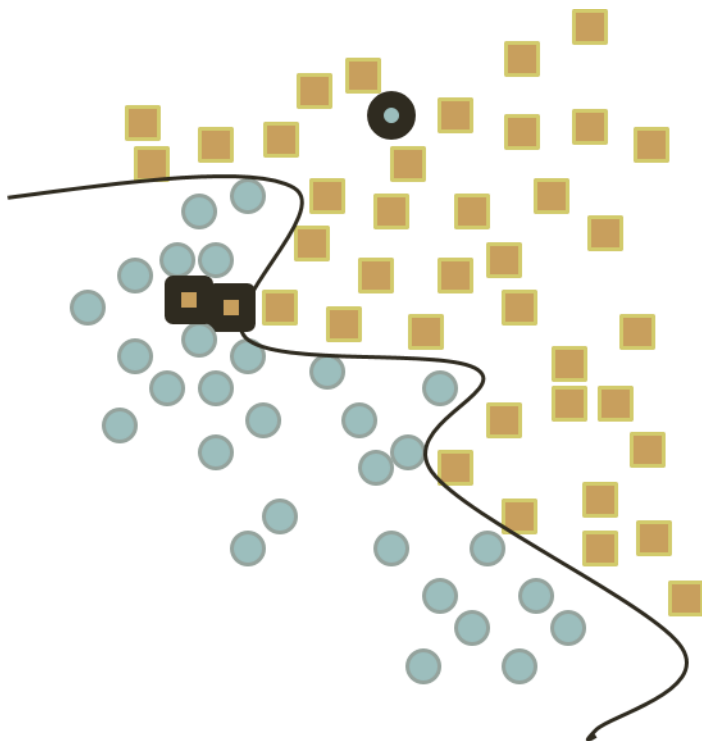


	Sq	Ci
P	35	4
N	5	26

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST MODEL 2



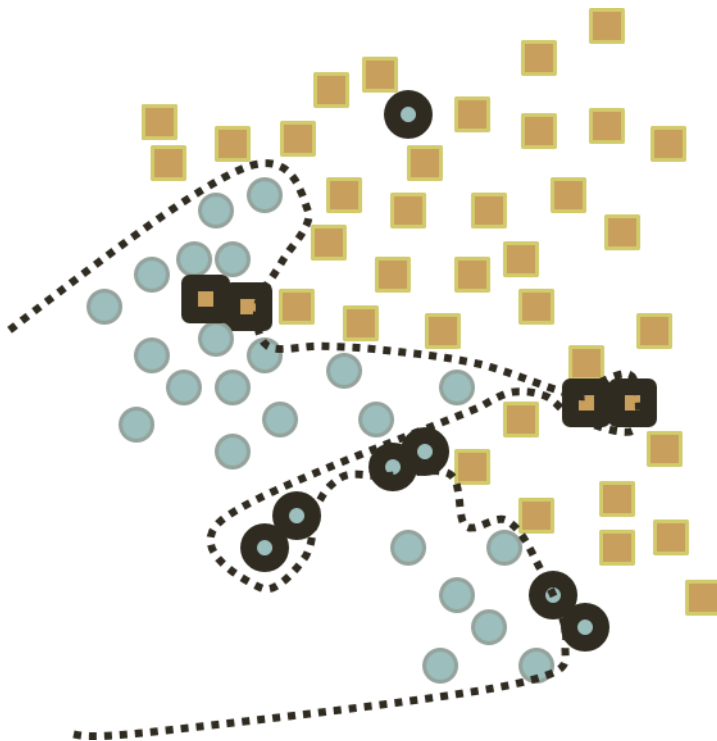
	Sq	Ci
P	38	1
N	2	29

W

isSquare is predicted from xLocation and yLocation

EVALUATE MODEL: TEST MODEL 3

	Sq	Ci
P	36	7
N	4	23



W

isSquare is predicted from xLocation and yLocation