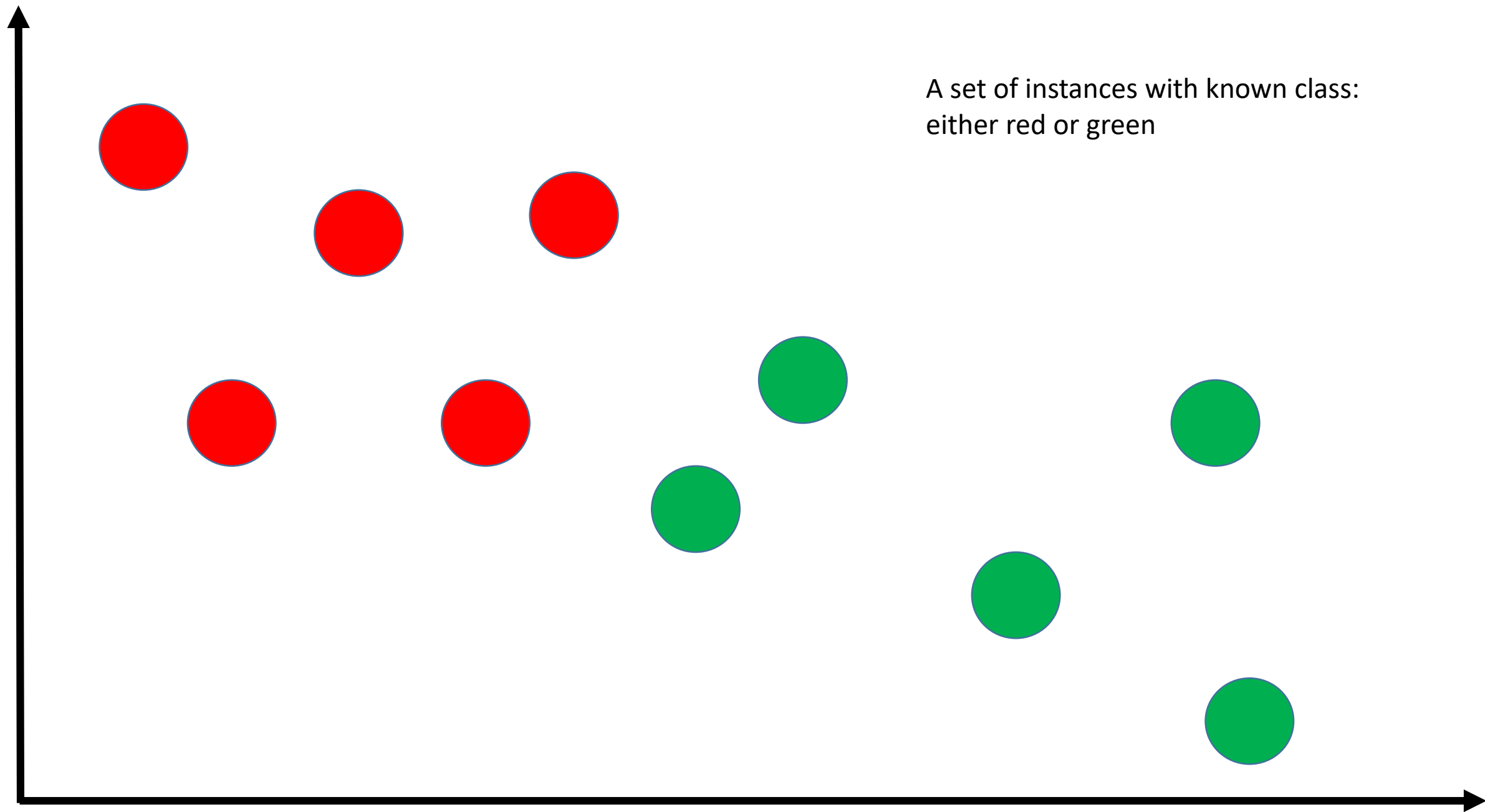


# KNN Demo

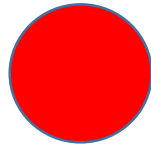
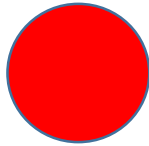
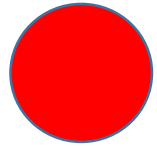
- KNN: majority class
- KNN: distance-weighted nearest neighbor
- Confusion Matrix



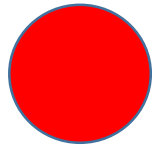
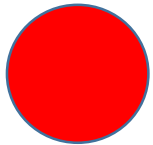
A set of instances with known class:  
either red or green

# KNN classification (majority)

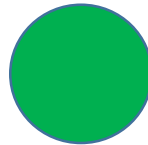
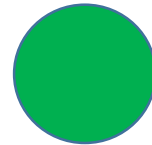
Given new instances (stars 1-5), with unknown class, use k nearest neighbors to predict the class.



Likely red



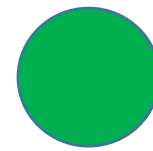
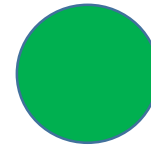
Could be green or red...



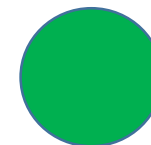
Probably red



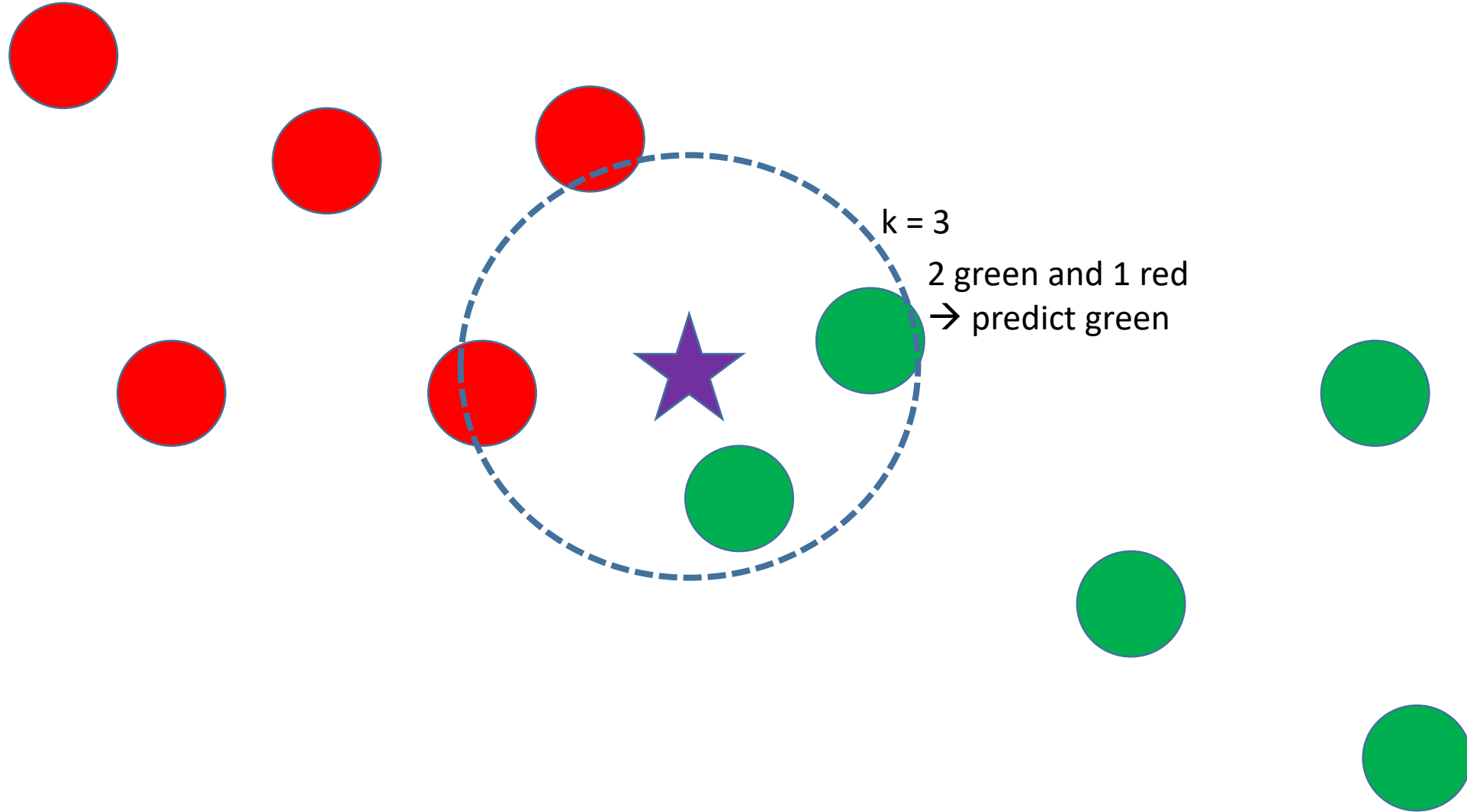
Probably green



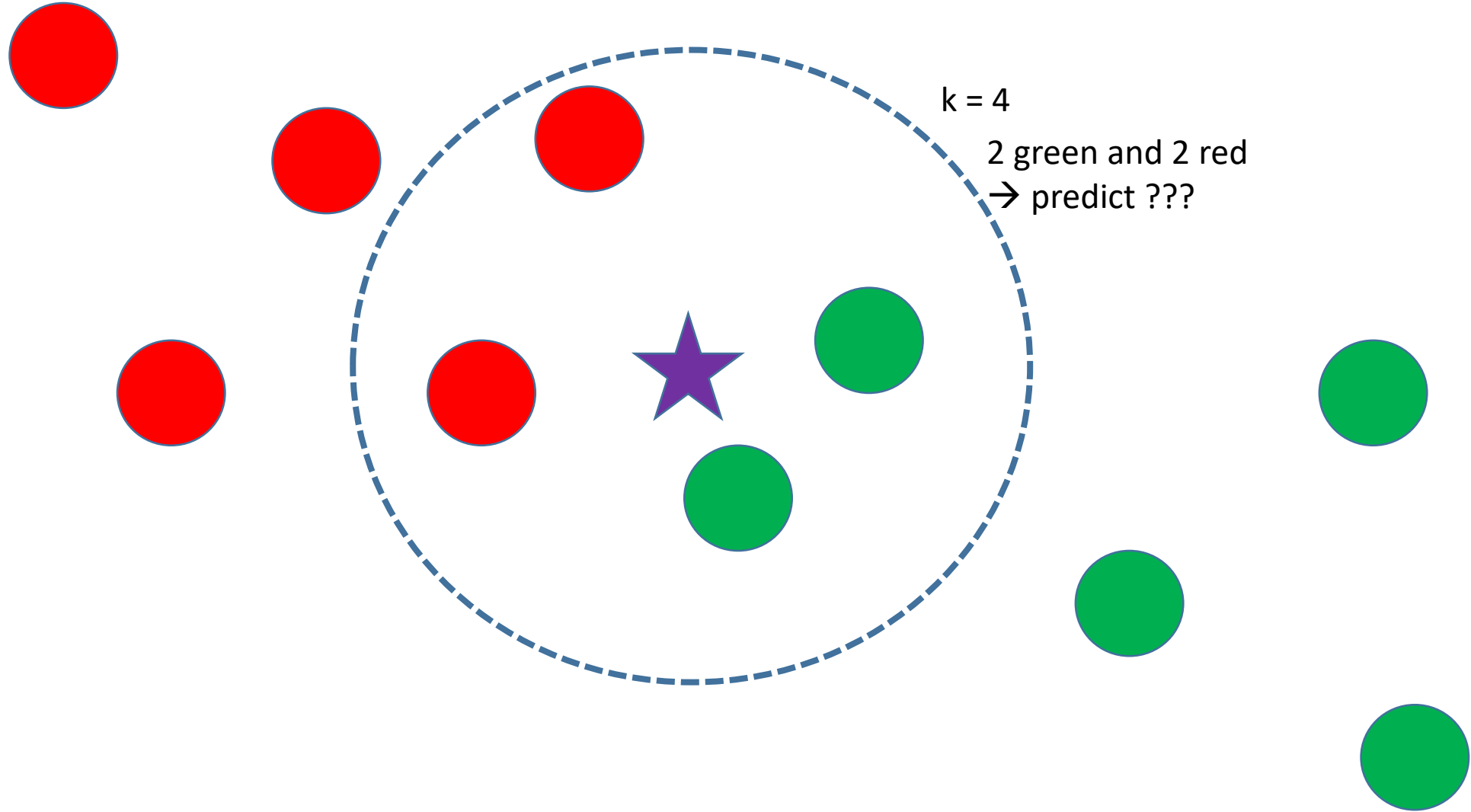
Likely green



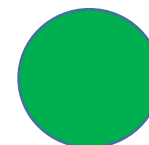
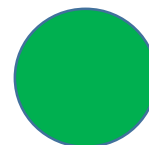
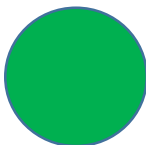
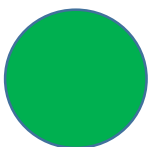
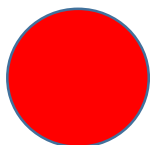
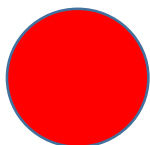
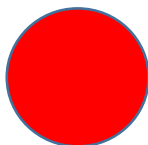
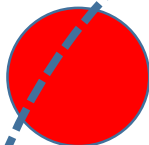
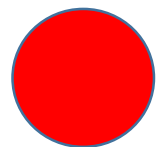
# KNN classification (majority)



# KNN classification (majority)



# KNN classification (majority)



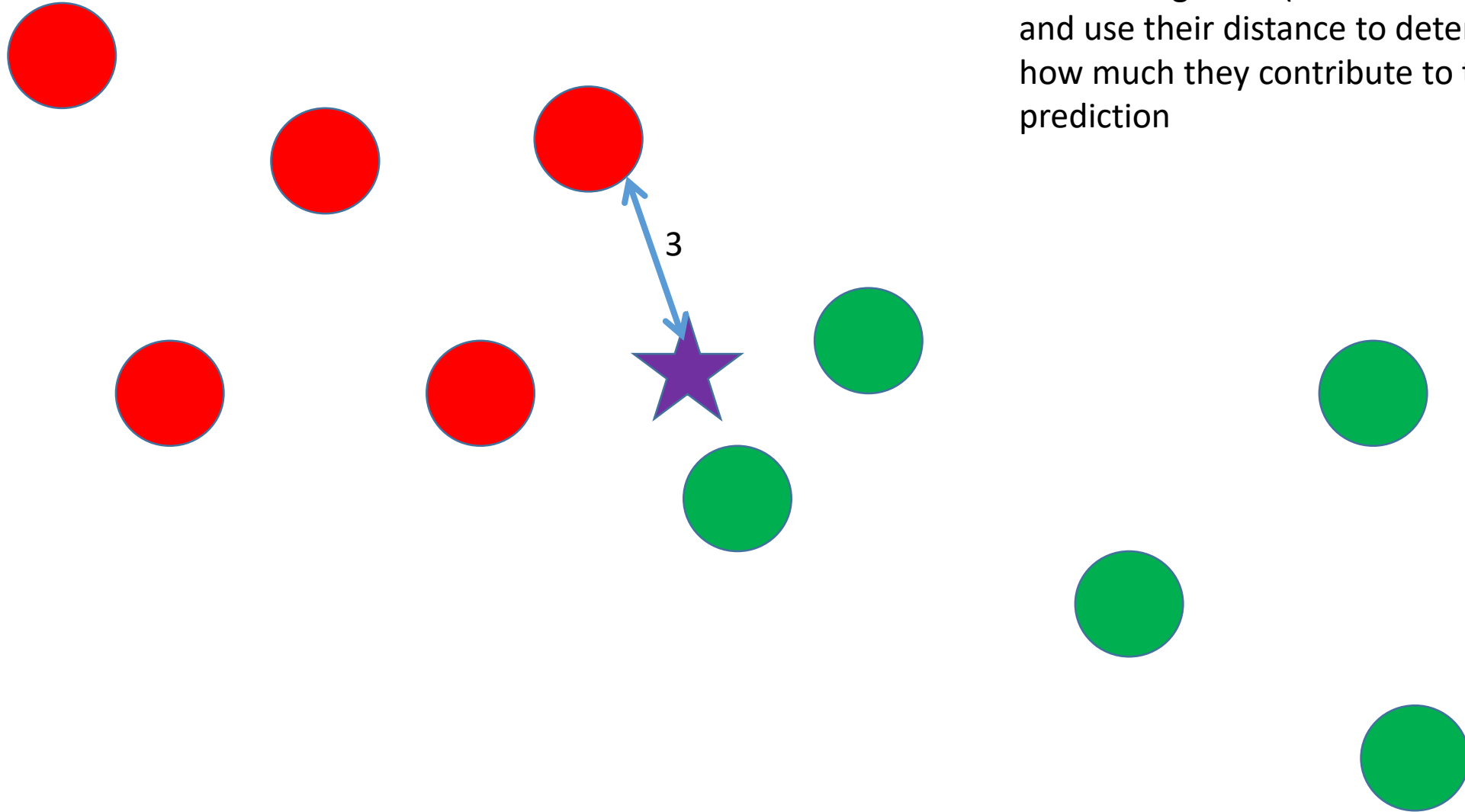
$k = 5$

2 green and 3 red

→ predict red

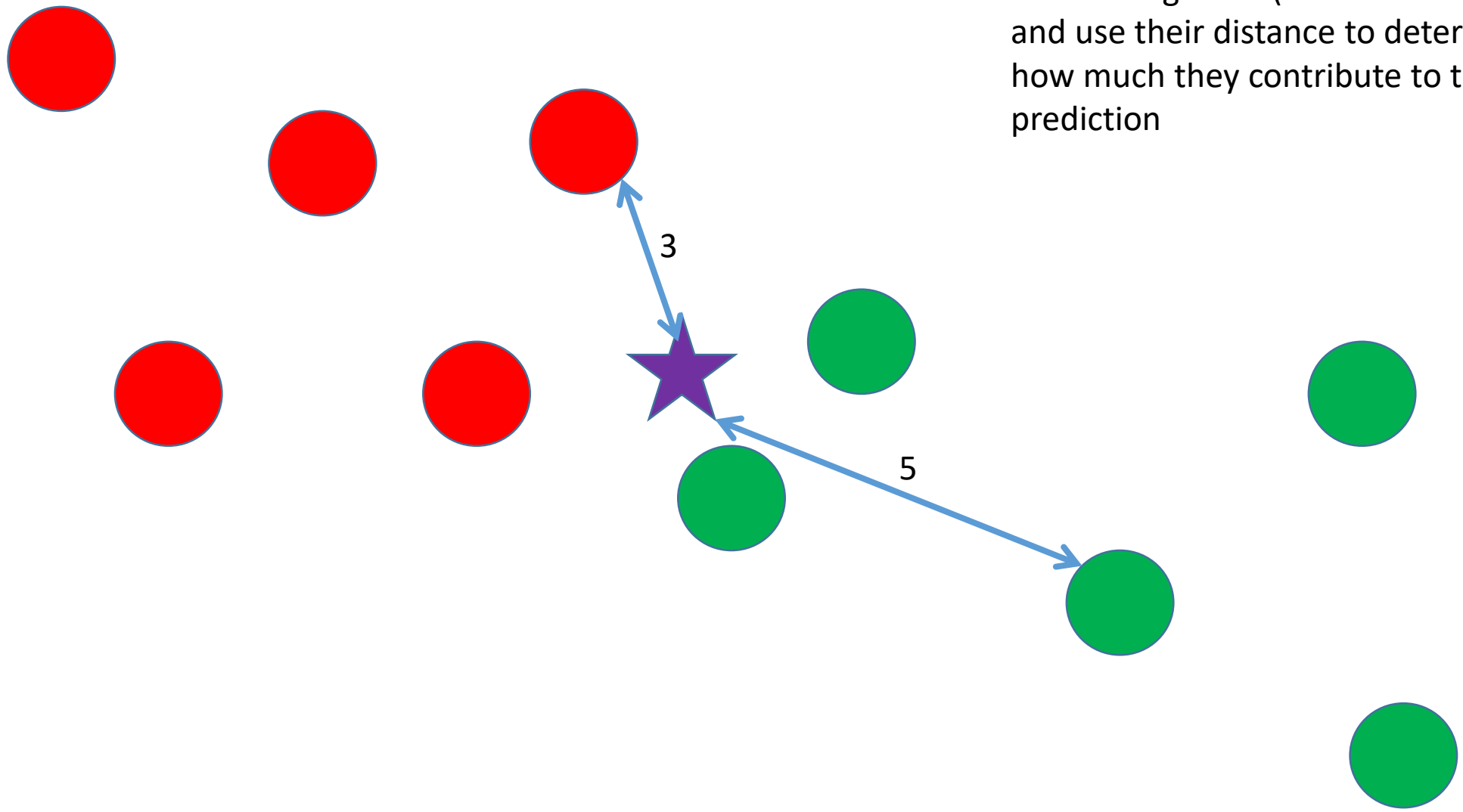
# KNN classification (distance-weighted)

Use all neighbors (all data instances) and use their distance to determine how much they contribute to the prediction



# KNN classification (distance-weighted)

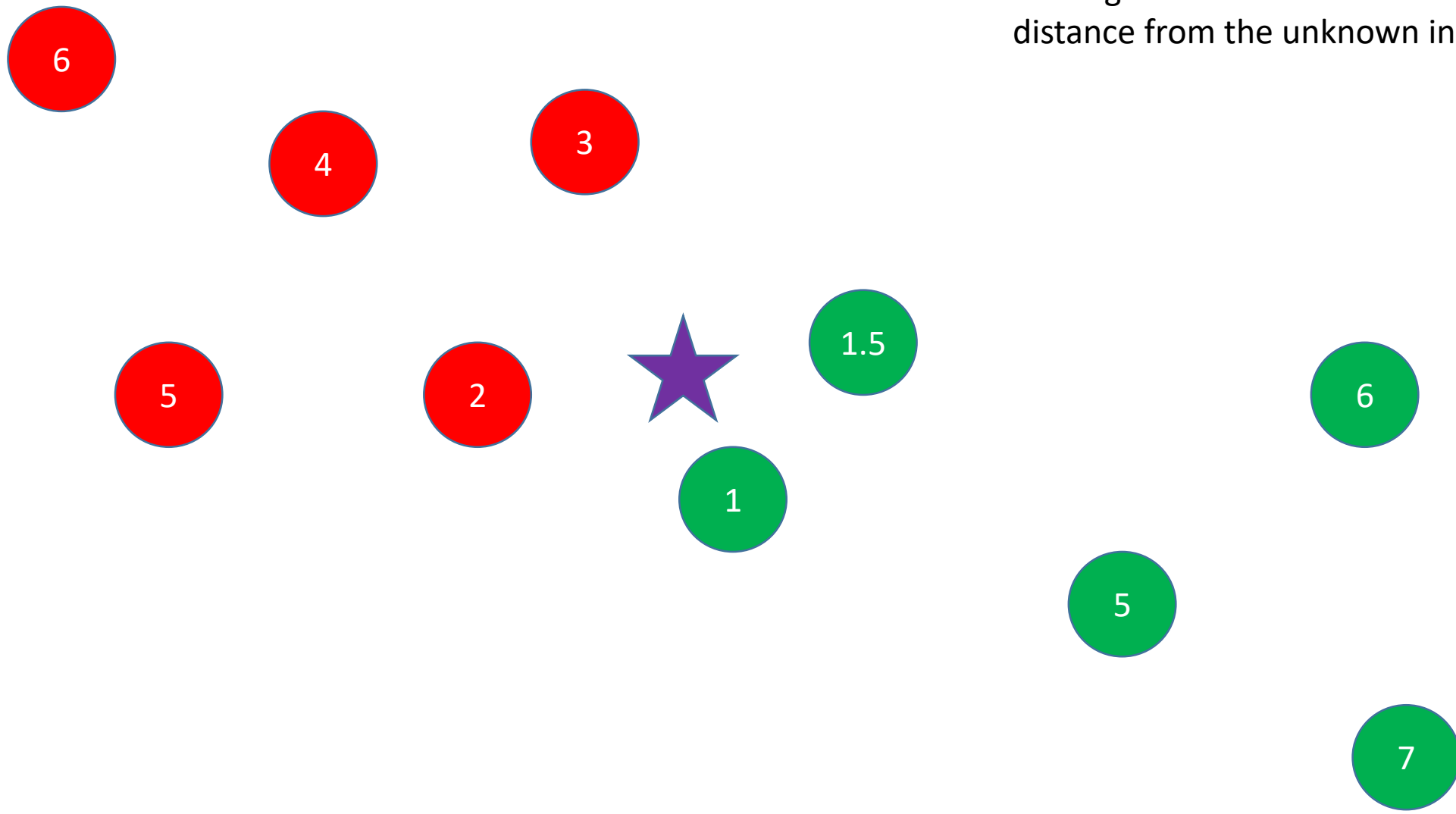
Use all neighbors (all data instances) and use their distance to determine how much they contribute to the prediction



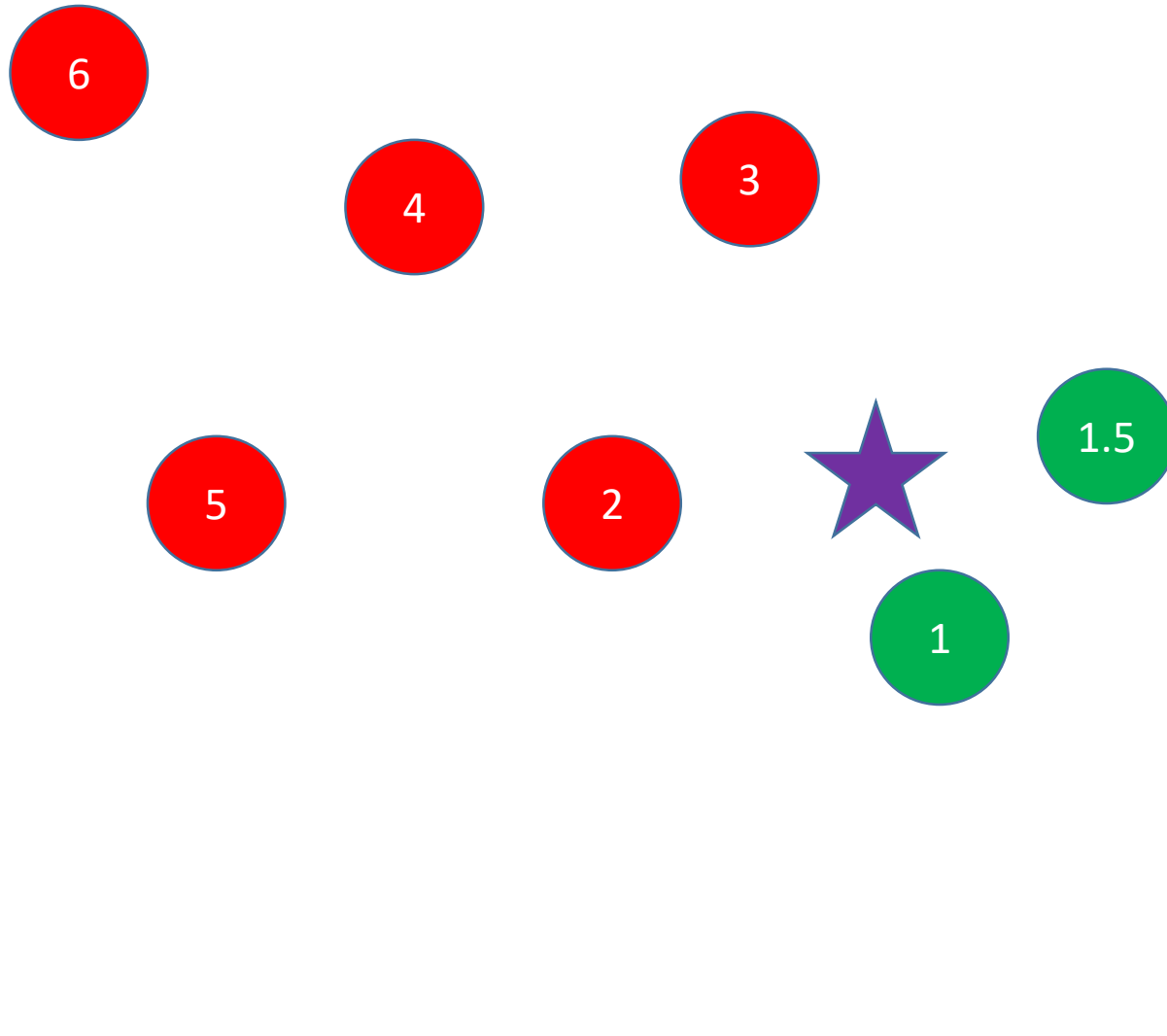


# KNN classification (distance-weighted)

All neighbors are labelled with their distance from the unknown instance



# KNN classification (distance-weighted)



Now, sum the inverse of the distance for each class:

**RED:**

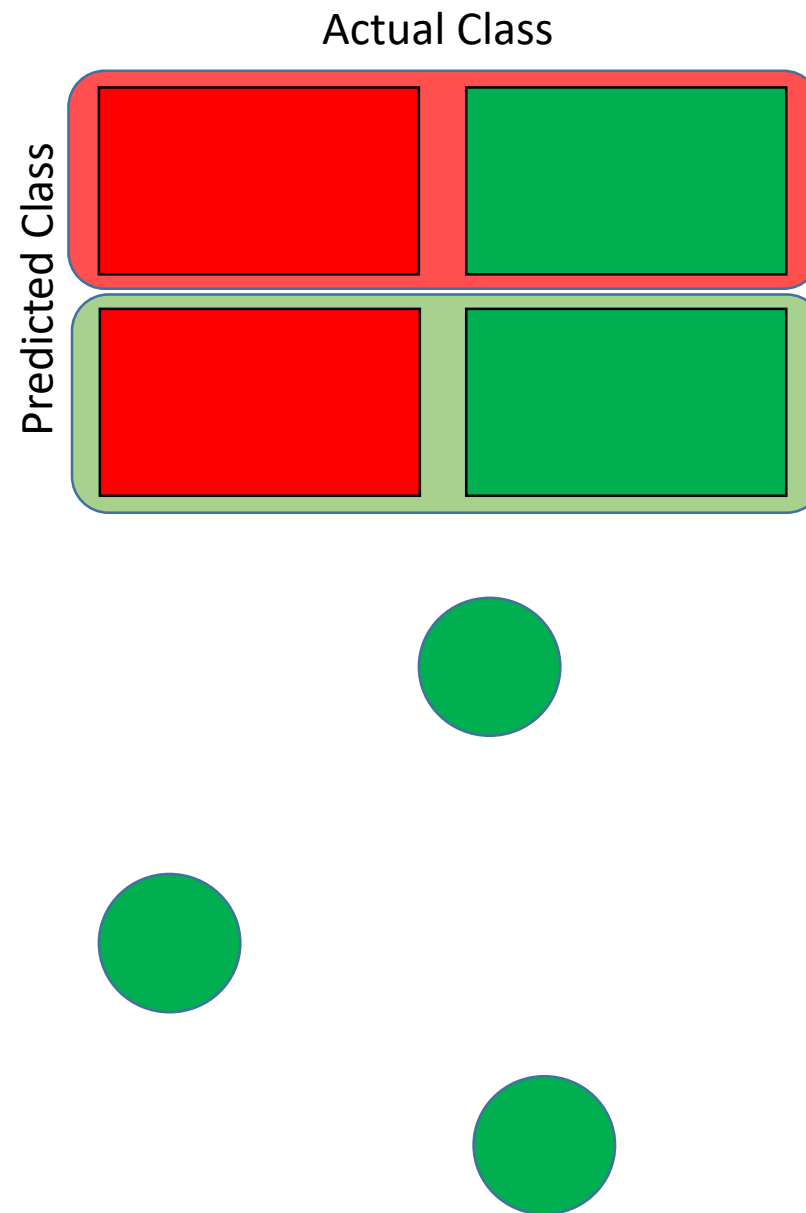
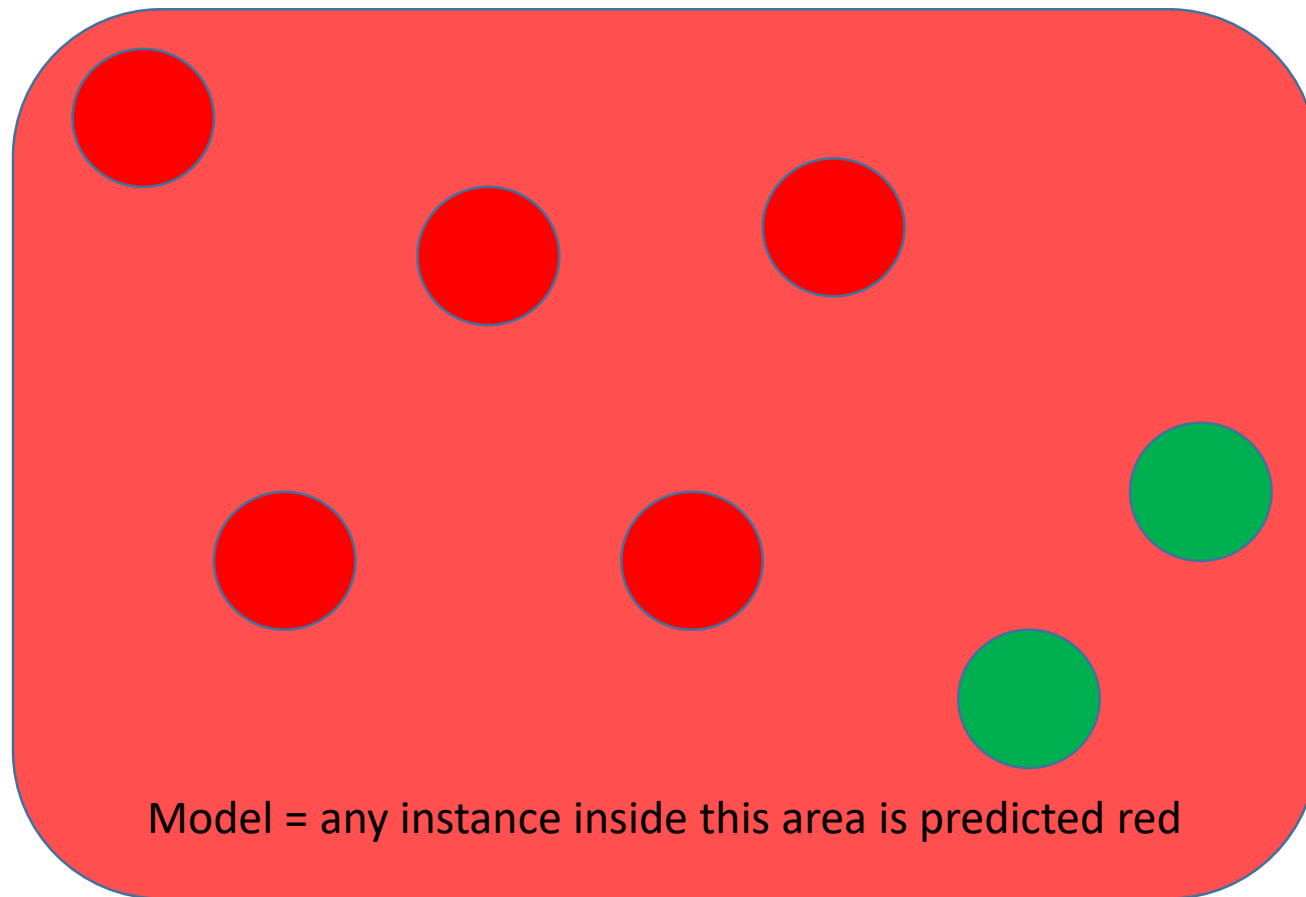
$$1/2 + 1/3 + 1/4 + 1/5 + 1/6 = 1.45$$

**GREEN:**

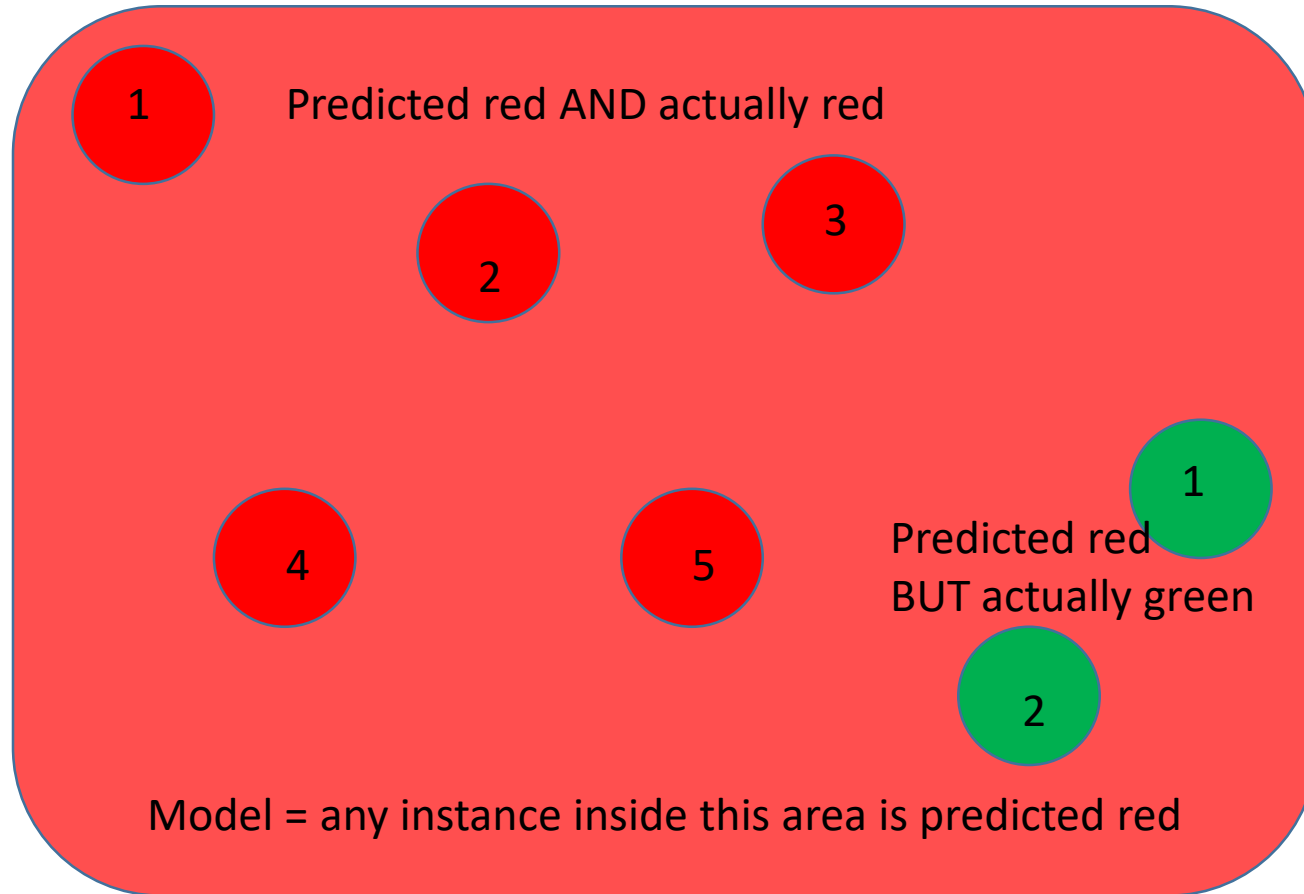
$$1/1 + 1/1.5 + 1/5 + 1/6 + 1/7 = 2.18$$

$2.18 > 1.45 \rightarrow$  predict green

# Confusion Matrix



# Confusion Matrix

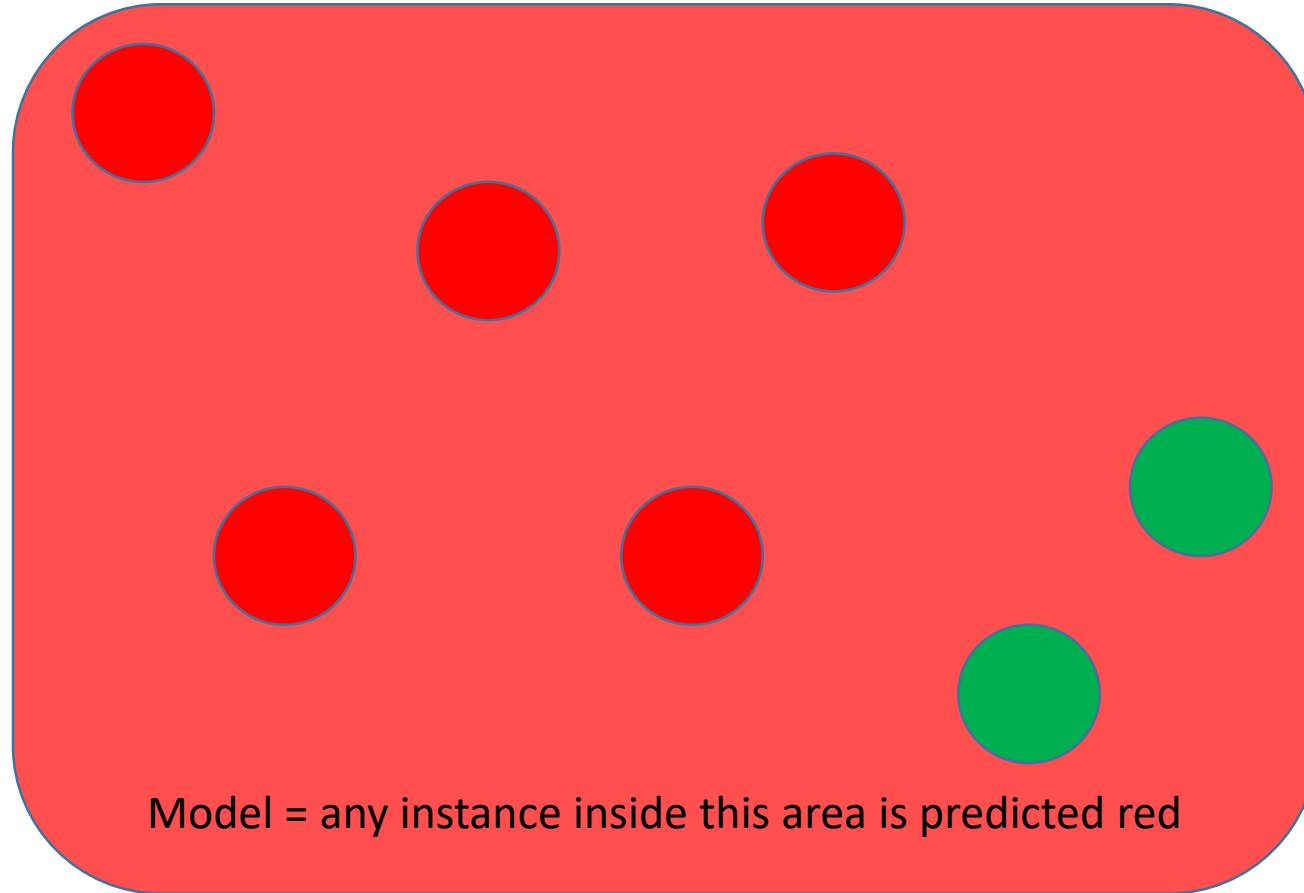


Actual Class		
Predicted Class	5	2
	0	3

Predicted green AND actually green



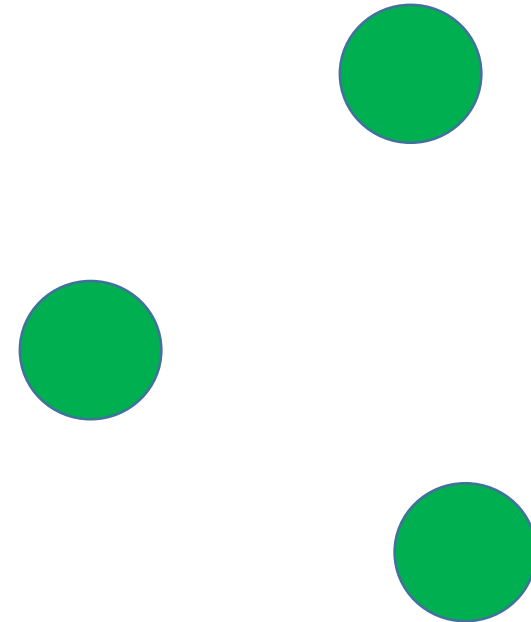
# Confusion Matrix



Precision: Correct Red Predictions / All Red Predictions =  $5/7$

Recall: Correct Red Predictions / All Actual Red =  $5/5$

Actual Class	
Predicted Class	
	Red
Red	5
Green	2
	Green
Red	0
Green	3



# Confusion Matrix

