

# CPSC 330 Lecture 9: Classification Metrics

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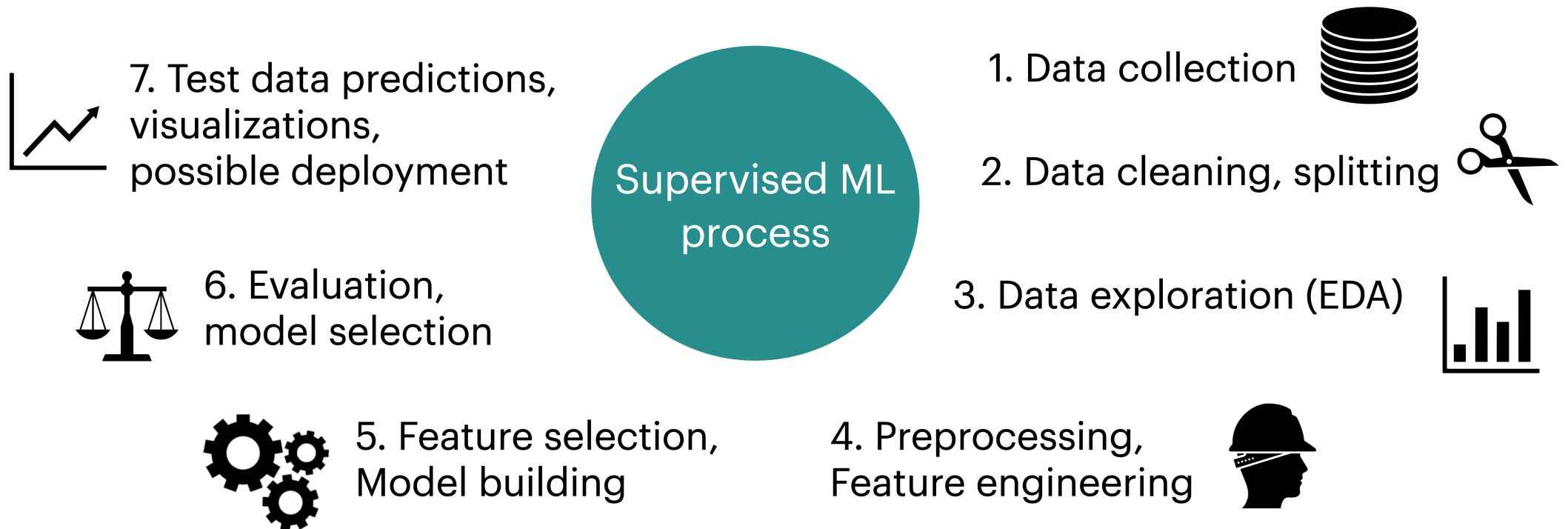
# Announcements

# ML workflow

What question do I want to answer?



Formulation to supervised machine learning problem



# Classification Metrics

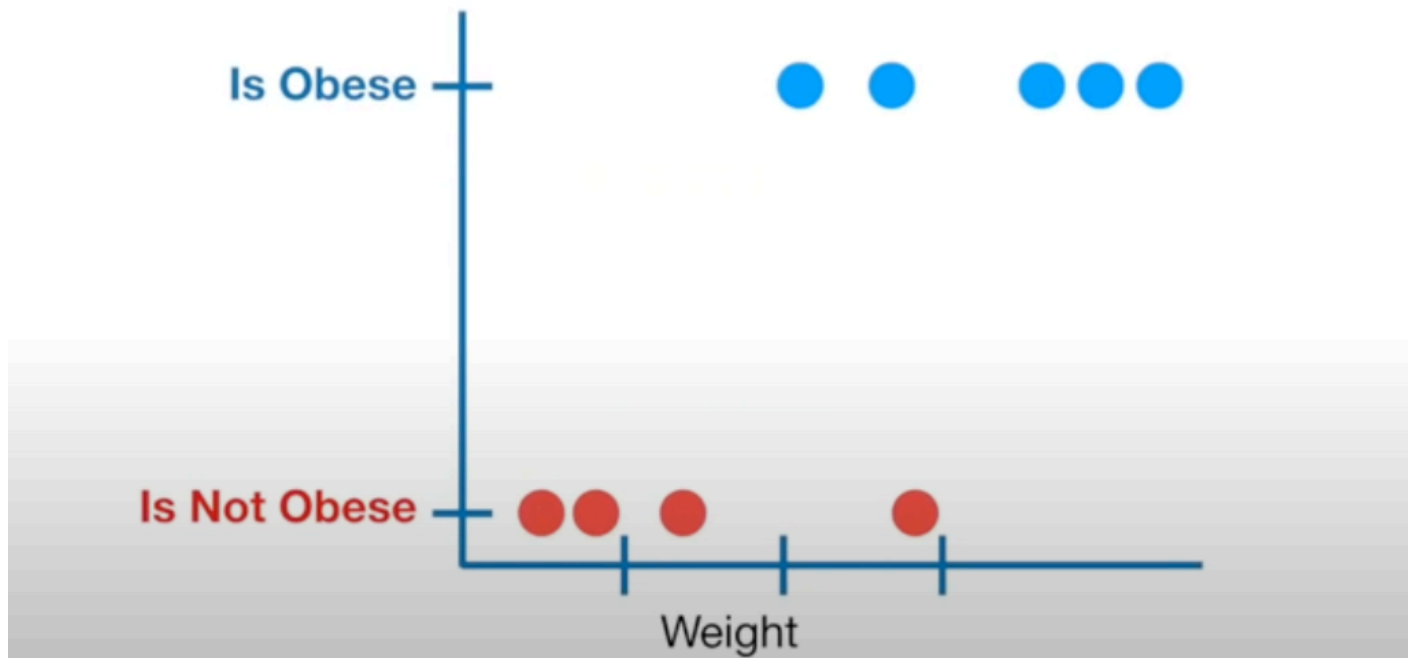
At the end of last class we talked about some of the problems with “accuracy”, and we brainstormed some possible alternatives, and [saw that there are tonnes of options](#).

Today, let’s sift through the noise and develop some intuition about **why** we need classification metrics, and **how** some of them are used.

# Example from StatQuest!

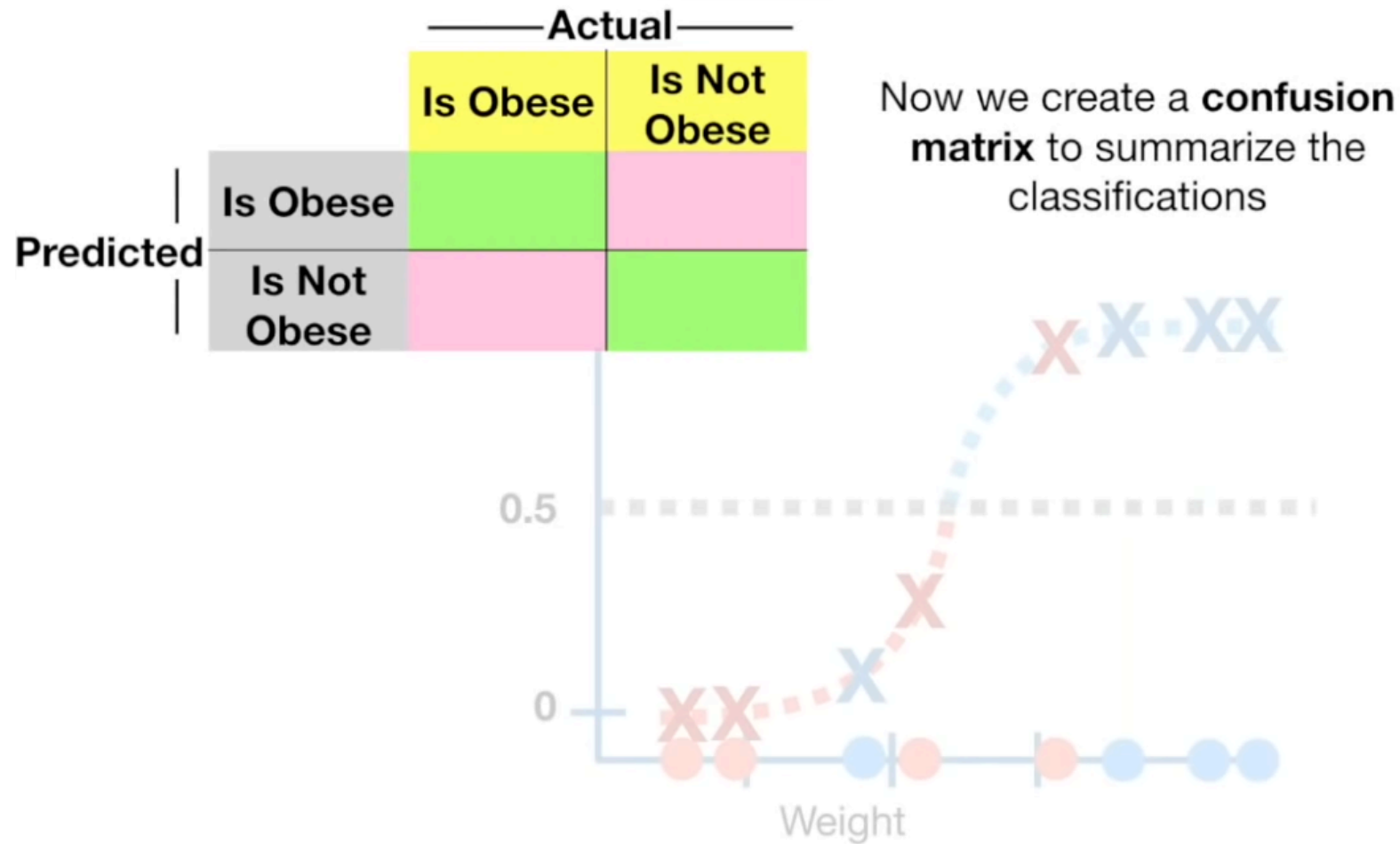
Let's first walk through this [example through StatQuest](#) with obese mice and classifying them using Logistic Regression:

Let's start with some data...



Source: StatQuest

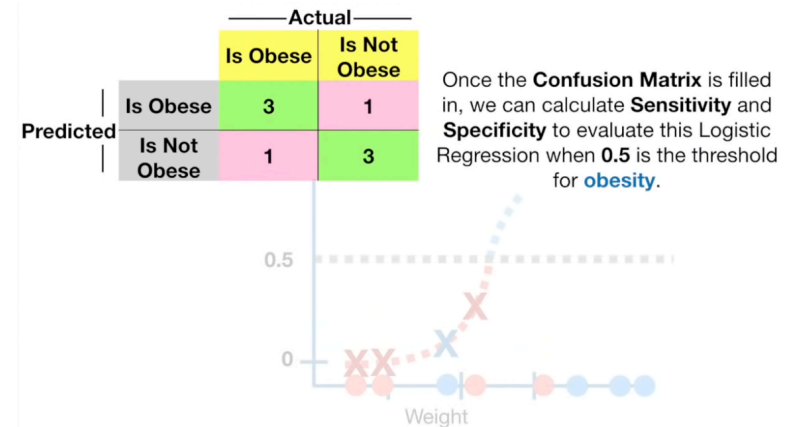
# Activity 1: Create Confusion Matrix



Source: StatQuest

# Activity 2: Calculate Precision, Recall, Specificity

- Recall (aka Sensitivity in biomedical literature)
  - $TP/(TP+FN)$
- Precision
  - $TP/(TP+FP)$
- Specificity
  - $TN/(TN+FP)$



# Break!

Let's take a 10 minute break.



# Confusion matrix questions

Imagine a spam filter model where emails classified as spam are labeled 1 and non-spam emails are labeled 0. If a spam email is incorrectly classified as non-spam, what is this error called?

- a. A false positive
- b. A true positive
- c. A false negative
- d. A true negative

# Confusion matrix questions

In an intrusion detection system, intrusions are identified as 1 and non-intrusive activities as 0. If the system fails to identify an actual intrusion, wrongly categorizing it as non-intrusive, what is this type of error called?

- a. A false positive
- b. A true positive
- c. A false negative
- d. A true negative

# Confusion matrix questions

In a medical test for a disease, diseased states are labeled as 1 and healthy states as 0. If a healthy patient is incorrectly diagnosed with the disease, what is this error known as?

- a. A false positive
- b. A true positive
- c. A false negative
- d. A true negative

# iClicker Exercise 9.1

iClicker cloud join link: <https://join.iclicker.com/VYFJ>

Select all of the following statements which are TRUE.

- a. In medical diagnosis, false positives are more damaging than false negatives (assume “positive” means the person has a disease, “negative” means they don’t).
- b. In spam classification, false positives are more damaging than false negatives (assume “positive” means the email is spam, “negative” means they it’s not).
- c. If method A gets a higher accuracy than method B, that means its precision is also higher.
- d. If method A gets a higher accuracy than method B, that means its recall is also higher.

# Counter examples

Method A - higher accuracy but lower precision

Negative	Positive
90	5
5	0

Method B - lower accuracy but higher precision

Negative	Positive
80	15
0	5

# Thresholding Exercise 9.2

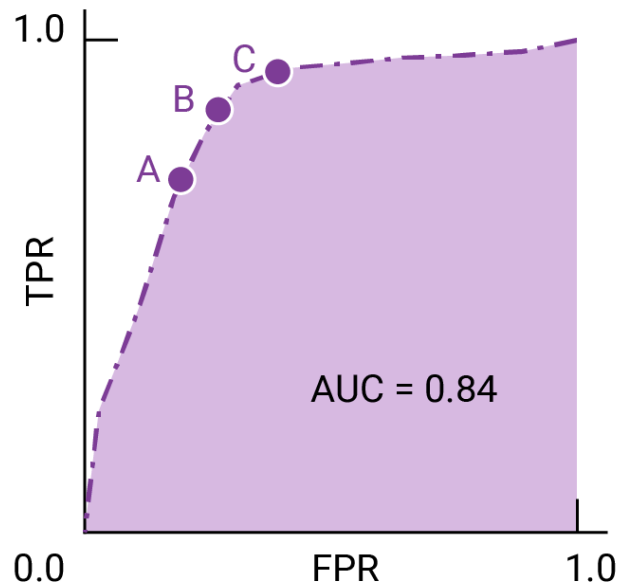
iClicker cloud join link: <https://join.iclicker.com/VYFJ>

Select all of the following statements which are TRUE.

- a. If we increase the classification threshold, both true and false positives are likely to decrease.
- b. If we increase the classification threshold, both true and false negatives are likely to decrease.
- c. Lowering the classification threshold generally increases the model's recall.
- d. Raising the classification threshold can improve the precision of the model if it effectively reduces the number of false positives without significantly affecting true positives.

# ROC AUC questions

Consider the points A, B, and C in the following diagram, each representing a threshold. Which threshold would you pick in each scenario?



- a. If false positives (false alarms) are highly costly
- b. If false positives are cheap and false negatives (missed true positives) highly costly
- c. If the costs are roughly equivalent

Source

# Next Class: Dr. Giulia Toti !

I'll be covering CPSC 430 for that prof, so Dr. Toti will be covering my section.

Have fun!