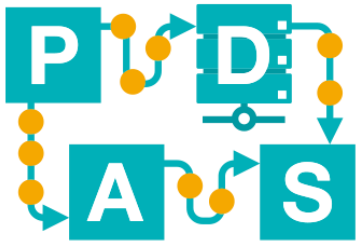
Evaluation of Supervised Learning Problems

Lecture 9

IDS-L9-I



Chair of Process and Data Science

RWTH AACHEN UNIVERSITY

Let’s play a game!

I will give you a set of numbers (in no specific order), one by one.

Your task is to individuate a “rule” that all numbers follow. Examples of rules:

- **“Prime numbers”**
- **“Odd numbers”**

Let’s play a game!

8

Let’s play a game!

8, 64

Let’s play a game!

8, 64, 256

Let’s play a game!

8, 64, 256, 128

Let’s play a game!

8, 64, 256, 128, 32

Let’s play a game!

8, 64, 256, 128, 32, 24

Let’s play a game!

8, 64, 256, 128, 32, 24, 72

Let’s play a game!

Solution: the rule is “multiples of 8”.

Let’s play a game!

Did some of you, at a certain point, guessed “powers of 2”?

Your hypothesis was *overfitting* the data. The rule was too specific for the set of numbers, and so unable to generalize to unseen values.

Let’s play a game!

Did some of you, at a certain point, guessed “even numbers” or “multiples of 4”?

Your hypothesis was *underfitting* the data. The rule was not specific enough, and thus it included too much data. It was imprecise.

Let’s play a game!

Recall this image:

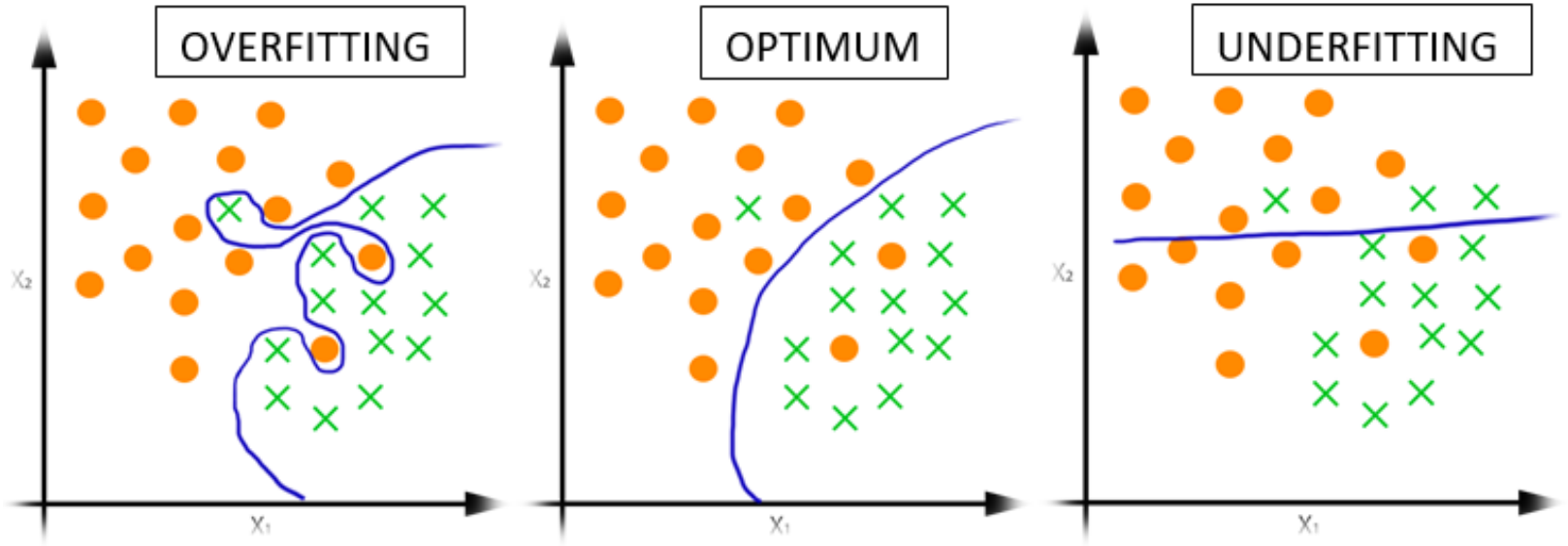


Diagram by Sachin Joglekar (Google).

Let’s play a game!

Of course, this game was tailored to be mean. But that is what happens in reality.

Keep in mind: not only you see just a fraction of the possible data, but often the data you have contains some bias.

Basic metrics

		predicted	
		spam	ham
target	spam	57	16
	ham	7	346

Can you calculate precision, recall, accuracy and F1-score based on this confusion matrix?

(spam is “positive”, ham is “negative”)

Basic metrics

		predicted	
		spam	ham
target	spam	57	16
	ham	7	346

Can you calculate precision, recall, accuracy and F1-score based on this confusion matrix?

- **Precision:** $\frac{TP}{TP+FP}$
- **Recall:** $\frac{TP}{TP+FN}$
- **Accuracy:** $\frac{TP+TN}{TP+TN+FP+FN}$
- **F_1-score:** $2 \times \frac{precision \times recall}{precision+recall}$

Basic metrics: solutions

		predicted	
		spam	ham
target	spam	57	16
	ham	7	346

Can you calculate precision, recall, accuracy and F1-score based on this confusion matrix?

- **Precision:** $\frac{57}{57+7} = 0.89$
- **Recall:** $\frac{57}{57+16} = 0.78$
- **Accuracy:** $\frac{57+346}{57+346+7+16} = 0.94$
- **F_1-score:** $2 \times \frac{0.89 \times 0.78}{0.89+0.78} = 0.83$