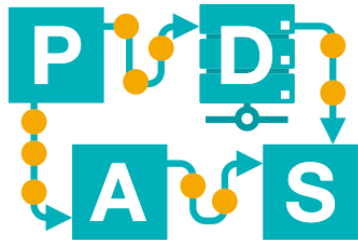


Evaluation of Supervised Learning Problems

Lecture 8

IDS-L8-I



Chair of Process
and Data Science

RWTHAACHEN
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:

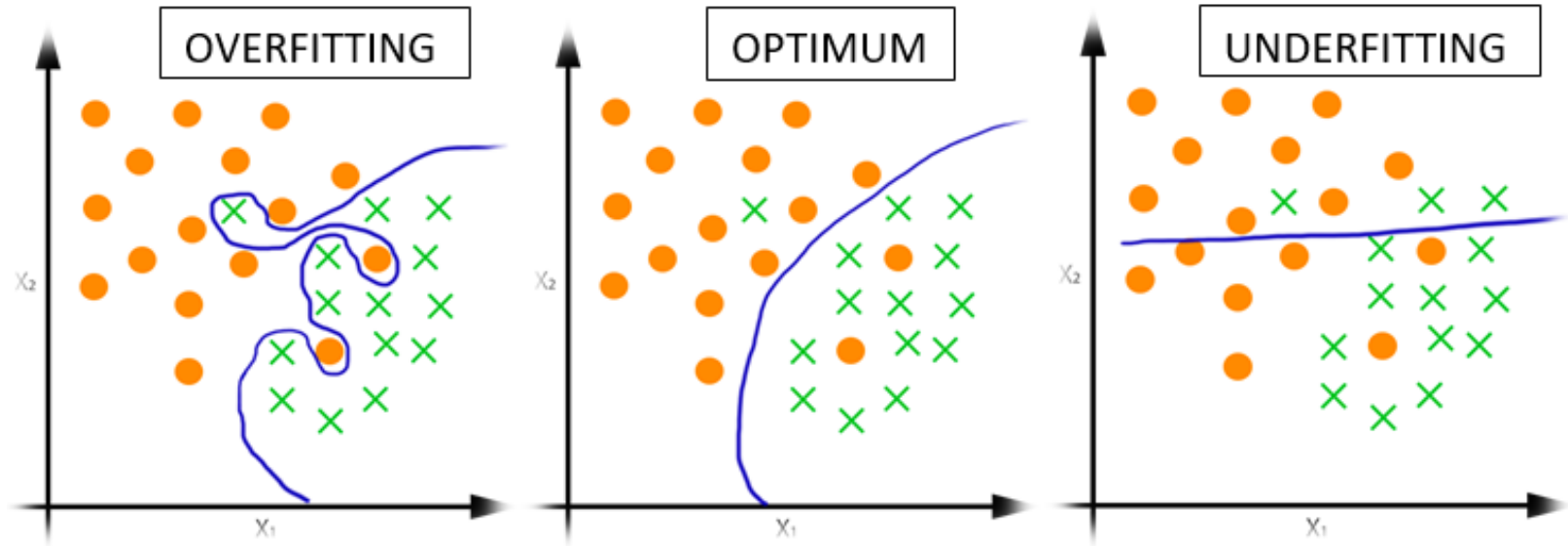


Diagram by Sachin Joglekar (Google).

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: $\frac{TP+TN}{TP+TN+FP+FN}$
- F₁-score: $2 \times \frac{\text{precision} \times \text{recall}}{\text{precision} + \text{recall}}$

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: $\frac{57+346}{57+346+7+16} = 0.94$
- F₁-score: $2 \times \frac{0.89 \times 0.78}{0.89+0.78} = 0.83$