Machine Learning

Iman Mossavat

Your ML Teacher

iman.mossavat@fontys.nl

- @Imossavat (X/Twitter)
- Mossavat (LinkedIn)

Fontys ICT since August 2022

Teaching (including prior semesters):

- Academic Preparation
- S7 AI–Advanced
- smart industry (DA&ML)
- S1 Coach & teacher (SW)
- S3 SW Agile Coach
- Internship Coach (AI)

Research:

- Always looking for competent Interns!

Math and Science club

Science and Math Club

Timeline

Mashhad

(1979-2002)

- Ferdowsi University of Mashhad
- Control Systems
- Fuzzy logic & Genetic Algorithms

Tehran

(2002-2005)

- Sharif University
- Cryptography
- Provable Security

Singapore

(Jul. 2005- Feb. 2007)

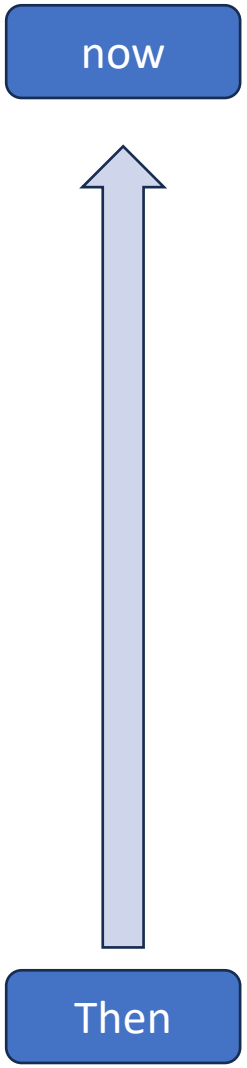
- National University of Singapore
- Signal Processing
- Holographic Data Storage

Eindhoven

(Feb 2007- …)

- Technical University of Eindhoven / ASML/Fontys
- (Bayesian) Machine Learning
- TUE (2007-2011)
  ASML (2011-2022)
  Fontys (2022-…)

What I have been busy with during my career



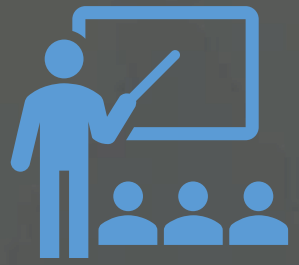
Learning by humans

Learning by computers

Mathematical foundations of Information

Modeling the Physical World

Code



We strive to be professional

Treat all classmates and instructors with respect and consideration.

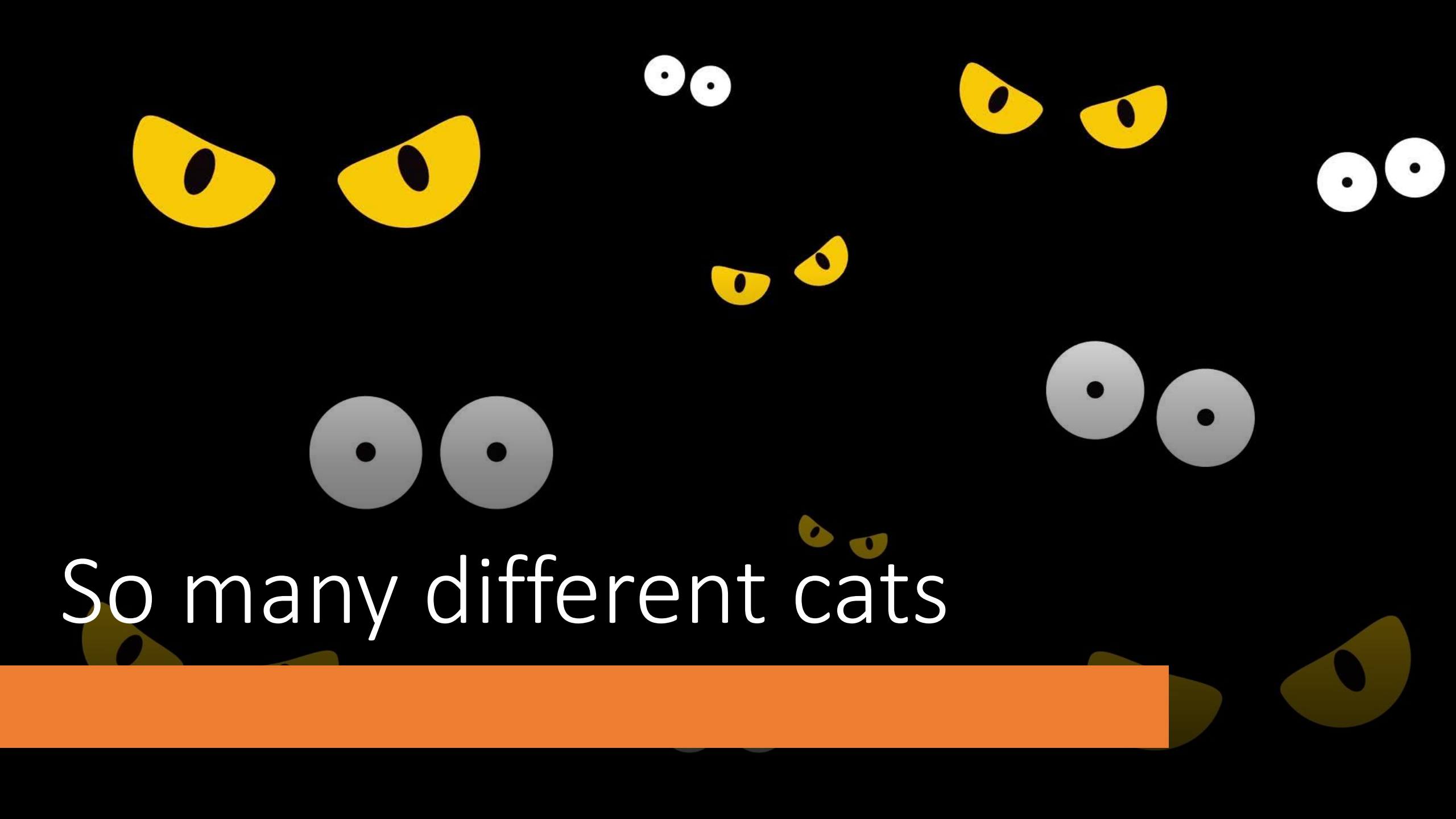
We are original and investigative

Research

Do not settle down until you understand

Test your stuff, know your stuff

Please program how does a cat look like


So many different cats

Machine Learning: Focusing on WHAT vs. HOW

Task: recognising dogs (huskies) from wolves

It is very hard to program how an image of a husky and wolf should look like at pixel-level.

Instead of defining what a husky and a wolf are, provide **labeled data** of huskies and wolves and provide a means to recognize **patterns** in the image:

( , husky) , ( , wolf) , ...

Slide is taken from “Probabilistic Generative Models” course, Iman Mossavat and Jan Jitse Venselaar, 05-08-2022, AI Innovation Center, High-Tech Campus, Eindhoven

Car Track Example

Training Data (Practice Races)

At first, you practice on **a simple track**: a simple loop with clear roads.

You play the same track over and over, learning how to **steer, accelerate, and drift**. This is like training data: you get better by practicing on specific examples.

Test Data (A New Track)

Now, imagine you unlock a **brand-new race track** with curves, hills, and even dirt roads.

You have never played this track before.
Your skills from training will be tested here.
This is like test data: it checks if you **learned the game** or just memorized the old track.

Generalization (Being a Pro Anywhere)

If you're really good at the game, you won’t just win on the first track, you’ll be able to race on **any track** and still do well!

That means you have **generalized** your racing skills.

But if you **only memorized** the turns of the first track and struggle everywhere else, that means you **overfitted:** you didn’t truly learn how to race, you just memorized one track.

In reality we have an in between situation, where we partly memorized, and partly abstracted the skills.

Efficient generalization is the name of the game.

You may not have seen many examples of a snake, but you will quickly recognise them and differentiate them from other animals.

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The research assignment

The research assignment

- Tell (a) what you found, (b) what surprised you, and (c) what you are still unsure about.
  - How would this affect society positively and negatively?
  - Do you trust this ML system? Why or why not?
  - What's a big misconception you noticed?

Capture & compare

What are the 3 key takeaways?

What are the patterns you found across topics?

Closure

If you only had another hour, what would you want to find out next?

What was most surprising across all four domains?

Do these examples change how you think about ML in everyday life?

Training Example in Google Colab

You can get free compute on Google Colab.

See an example here (this example contains many important concepts you need to understand when it comes to training models)