Setting up

- **No zoom chat**
  - Questions will be answered at specific times
- **Suppress distractions**
  - Clear notifications
    - Turn off your phone, mails, Facebook…
- Get ready: Open a clean browser with only:
  - Your personal report
  - The course instructions: https://tinyurl.com/instructions-fund-of-ai

ARTIFICIAL NEURAL NETWORKS

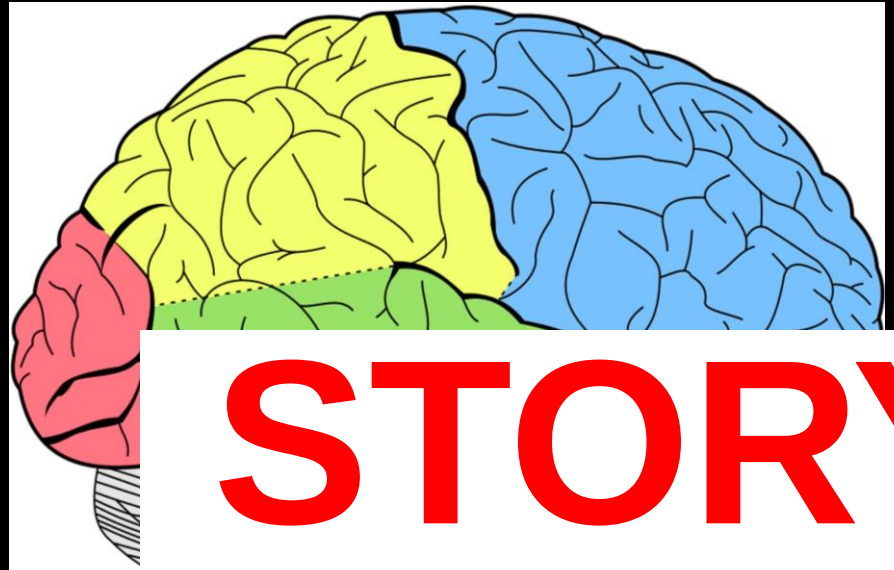
Loïs Vanhée
Associate professor
Responsible and Ethical Artificial Intelligence
loisv@cs.umu.se

5DV124,5DV201
Fundamentals of Artificial Intelligence

Department of Computing Science

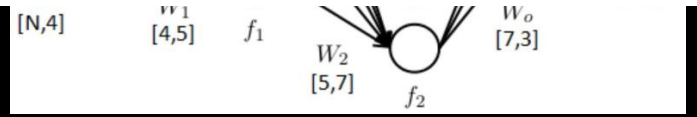
UMEÅ UNIVERSITY

What is generally said about neural networks?



STORYTELLING

NONSENSE



All problems can be solved with enough data

Neural networks can solve everything

Intelligence is **solved** ✓

Tool thinking

Tool in the toolbox

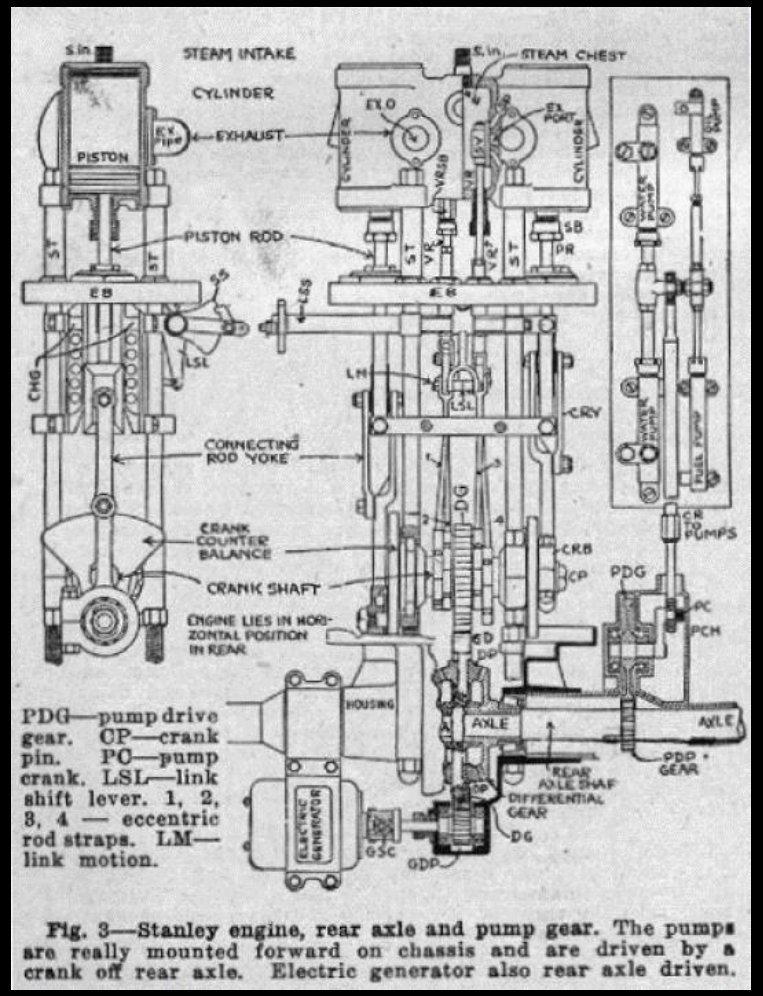
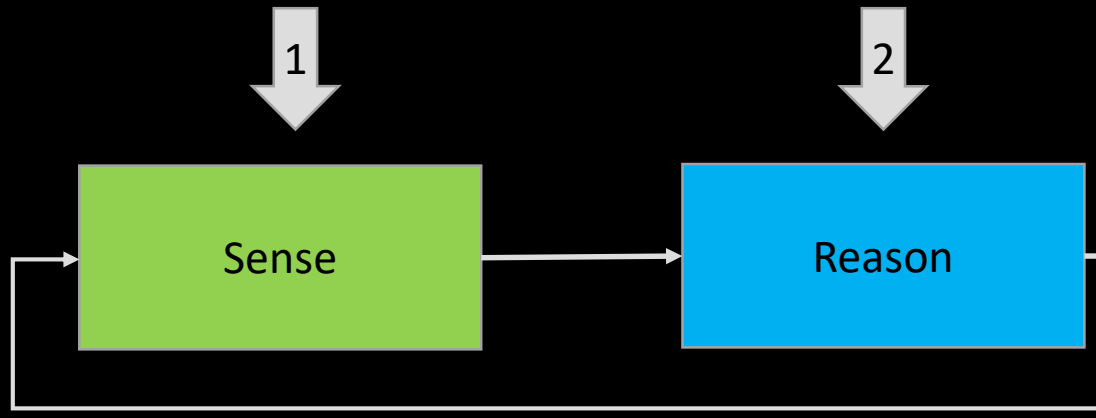


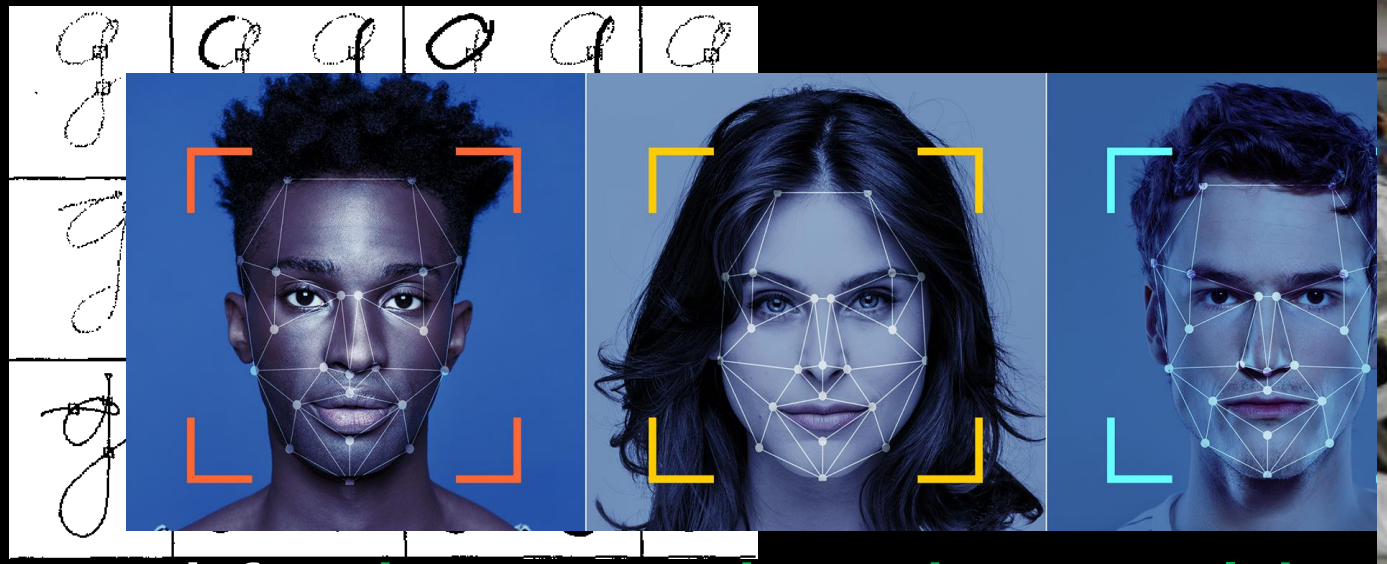
Fig. 3—Stanley engine, rear axle and pump gear. The pumps are really mounted forward on chassis and are driven by a crank off rear axle. Electric generator also rear axle driven.

Inners of the tool

Usage and costs

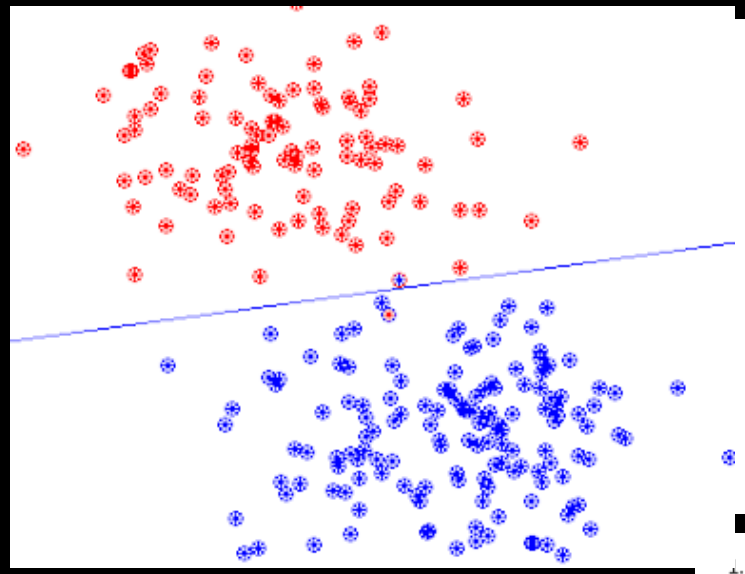
Neural networks within the int

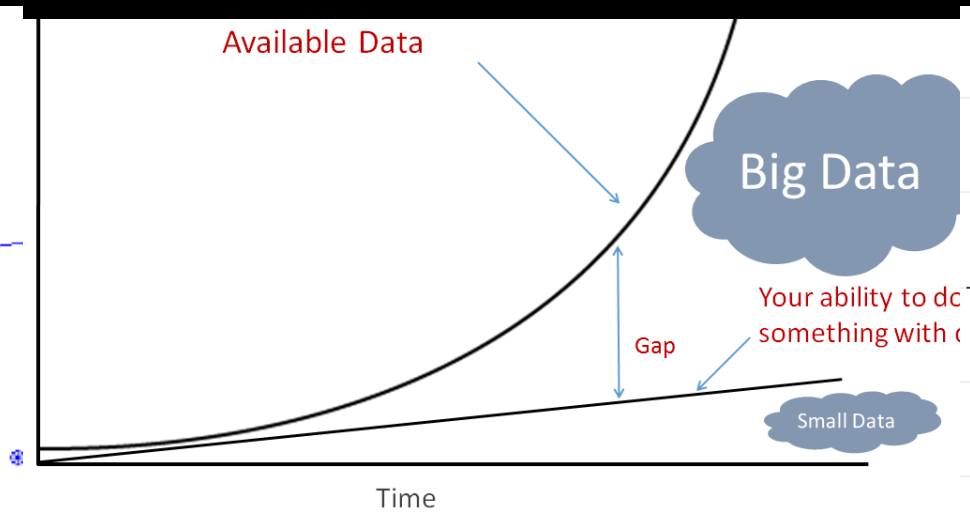


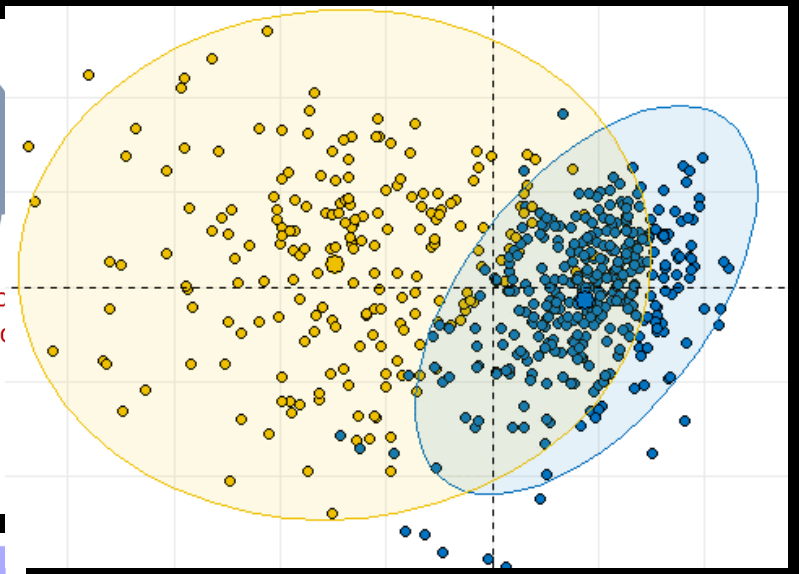


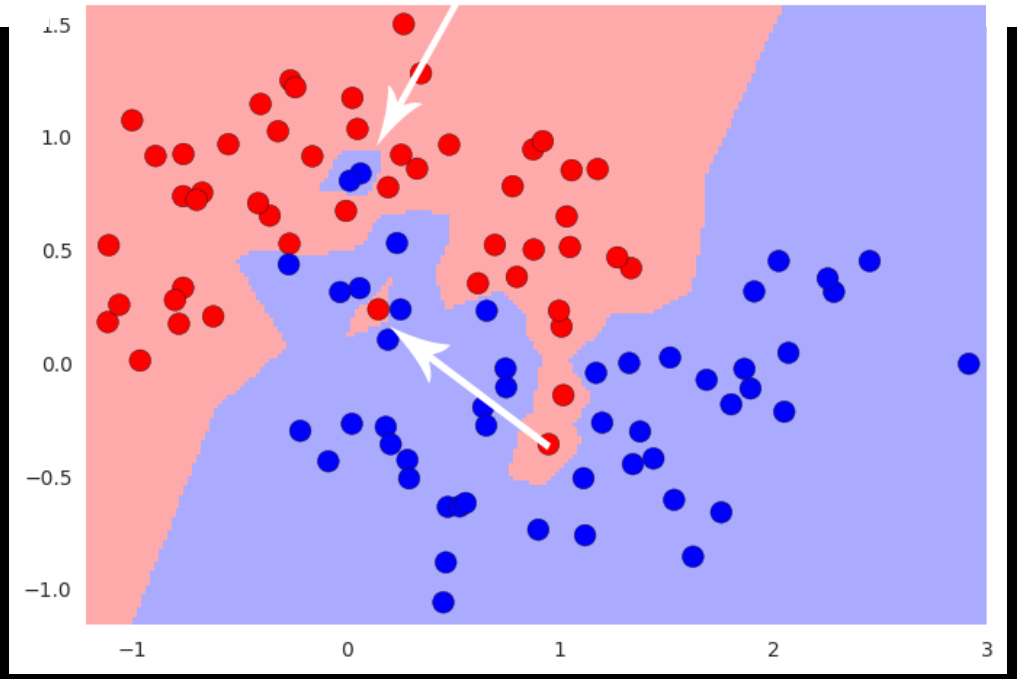
Good for interpreting the world
Bad for elaborated thinking

In the machine learning toolbox

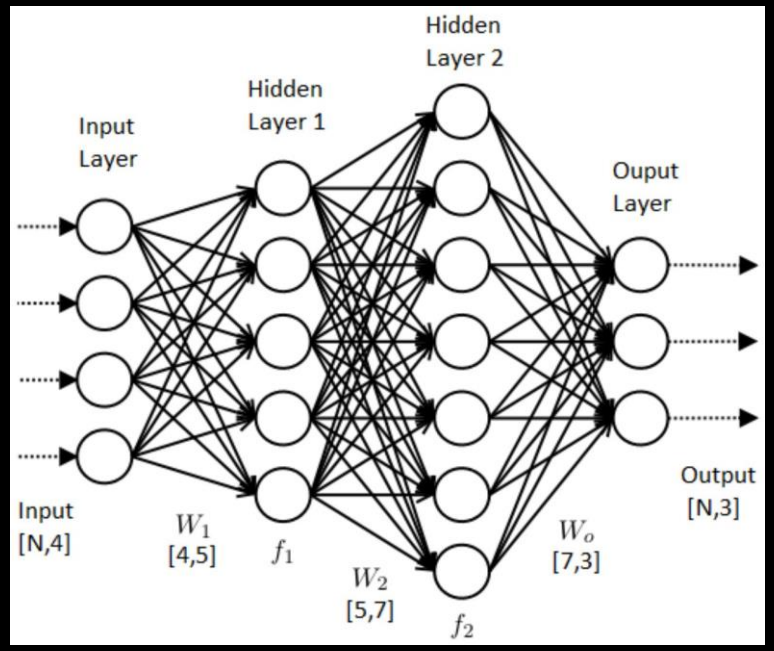


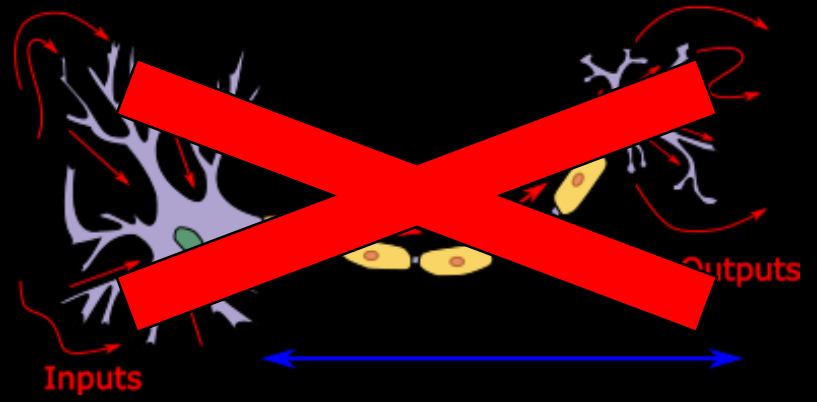


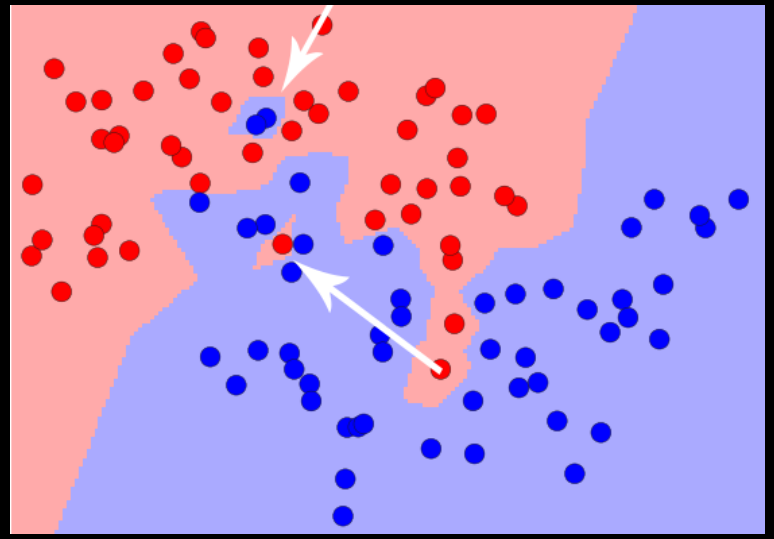




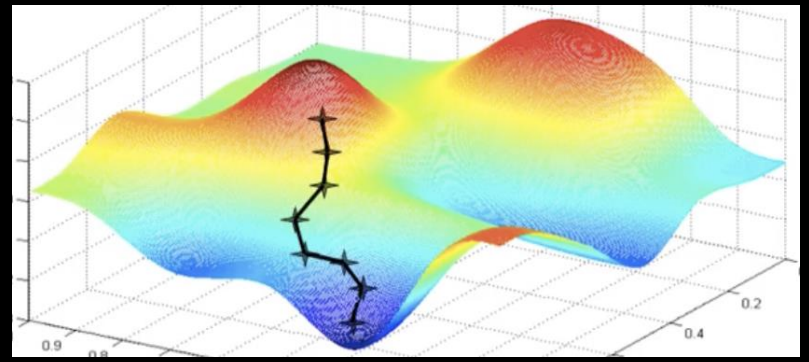
Inner workings





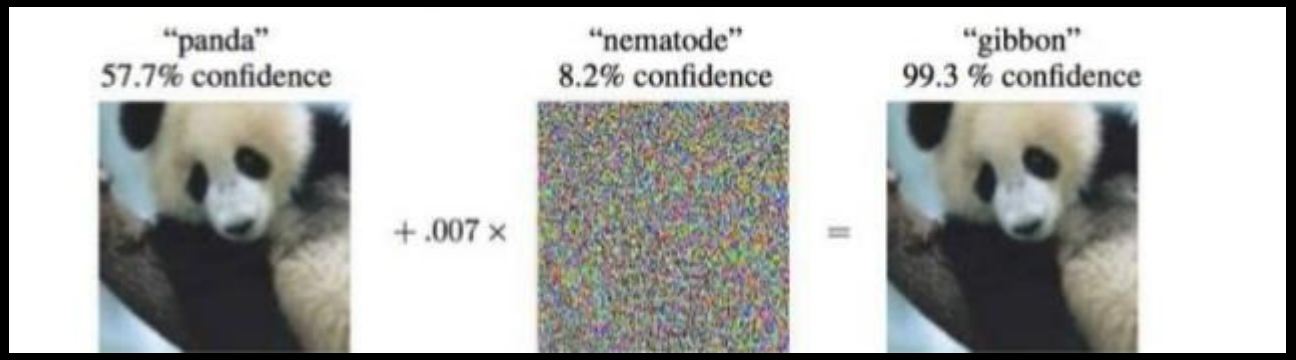


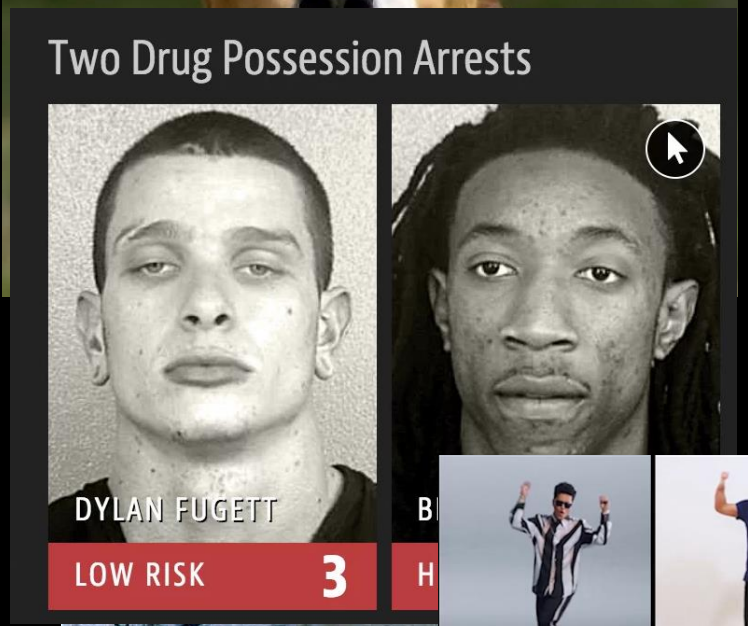
Search
Gradient descent



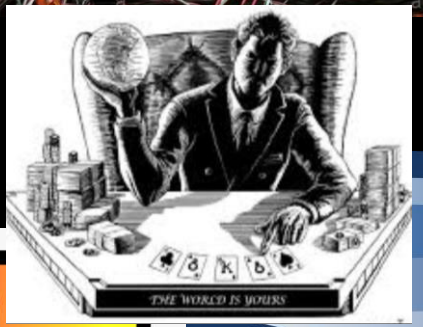
For math, algorithms details, re-check the references

Costs and issues

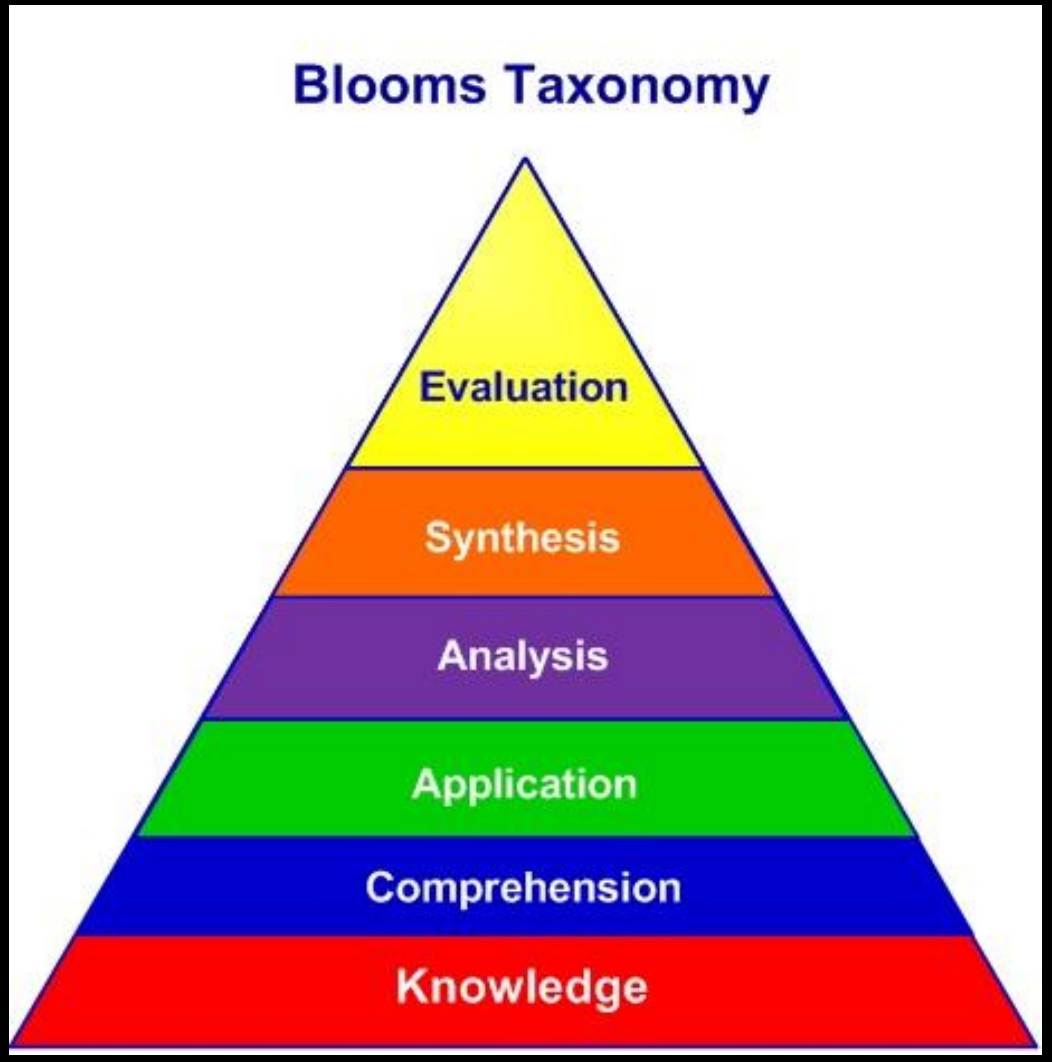




Sensitive to bias
Fragile and hard to fix
Very expensive
Raises serious social issues



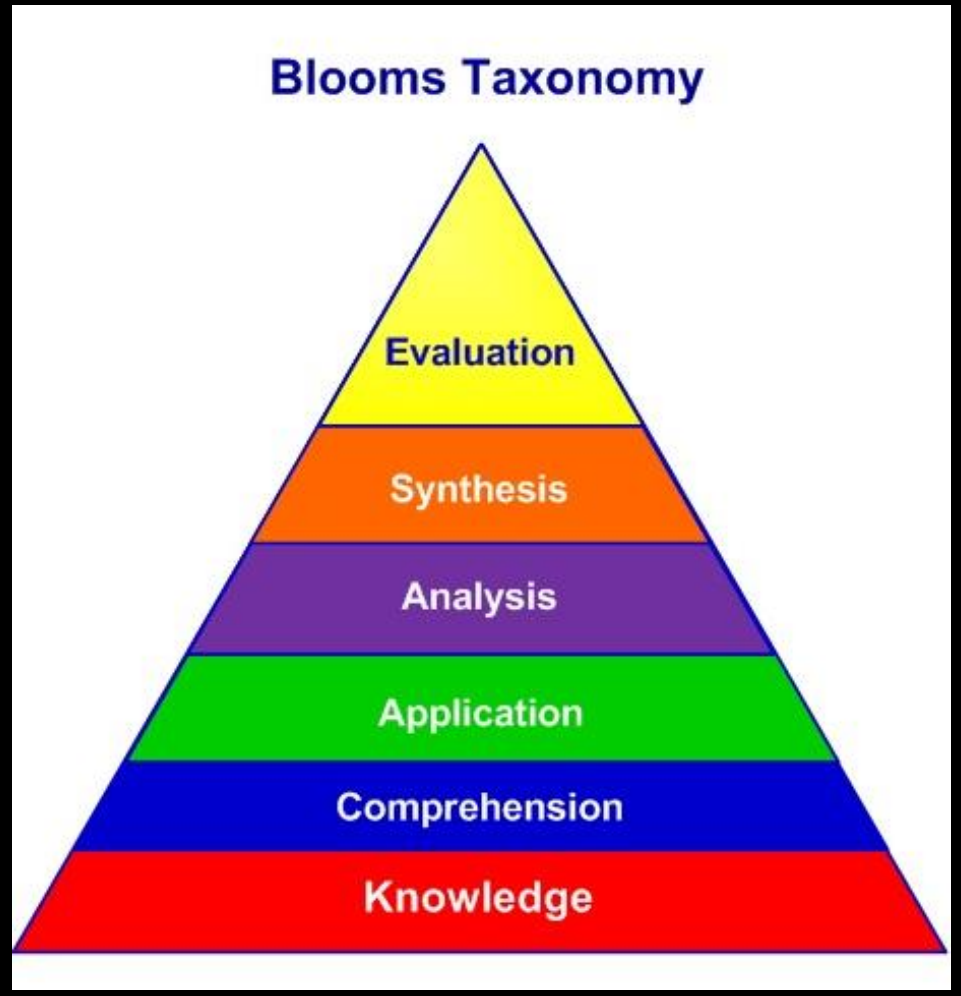
Your turn to play!



Real-world skill tree

Intended learning outcomes

At the end of the session, you should be able to:



Define the key concepts of neural networks

Relate these key concepts with each other and other AI tools

Manipulate neural network on a pre-set concrete example

Sketch how to implement neural networks for a specific problem

Appraise how neural Networks can be applied in a given problem

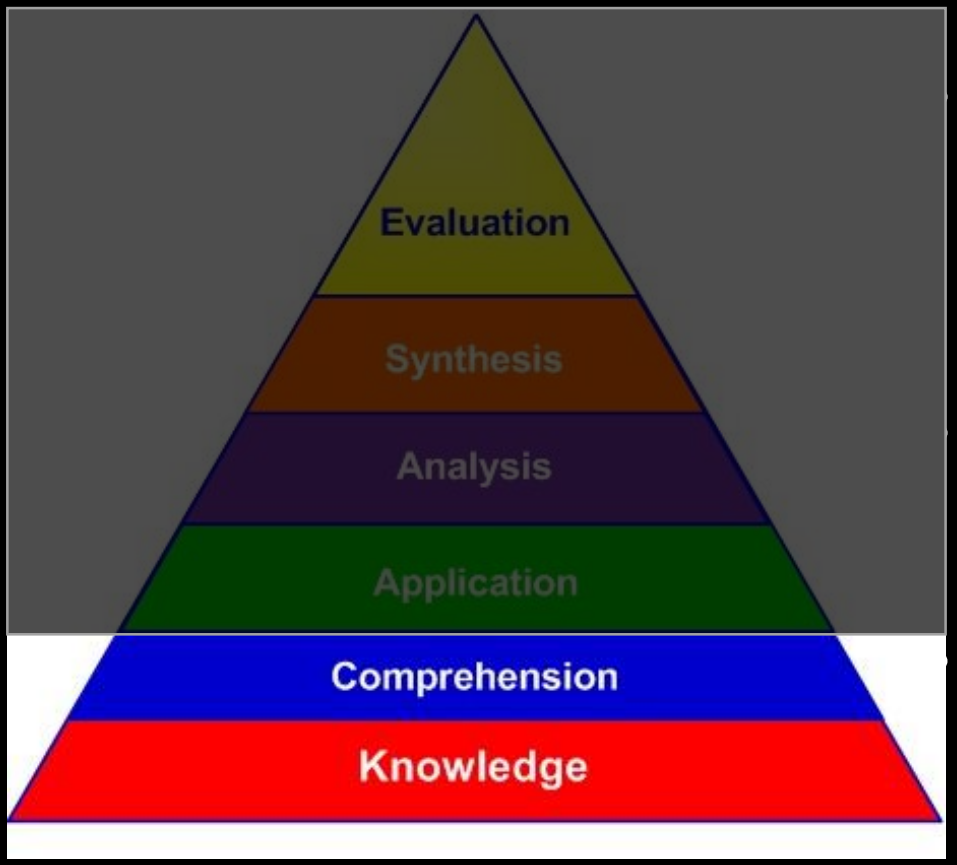
Same as last time: discussions in small groups

- Breakout rooms for ~3x15 minutes
  - Discuss your answers for each part
    - Keep the conversation flowing
  - **10 minutes:** break and questions
- Check the instructions, if it is not already open:

  https://tinyurl.com/instructions-fund-of-ai

No chitchat, be effective

Part A



- **Define** the key concepts of neural networks
- **Relate** these key concepts with each other and other AI tools
- **Manipulate** neural network on a pre-set concrete example
- **Sketch** how to implement neural networks for a specific problem
- **Appraise** how neural Networks can be applied in a given problem

https://tinyurl.com/fundOfAI

Turn on your micro and camera when your question is picked up

Please write your name

On an ideal white board (and in your mind in the exam)

If you cannot come up with, define and relate these concepts, consolidate them during the post-class

Neuron
Weight
Bias
Input/output layers
Hidden layers
Sigmoid function
Backpropagation
Convolutional NN
Deep NN
DFF, RNN, LSTM

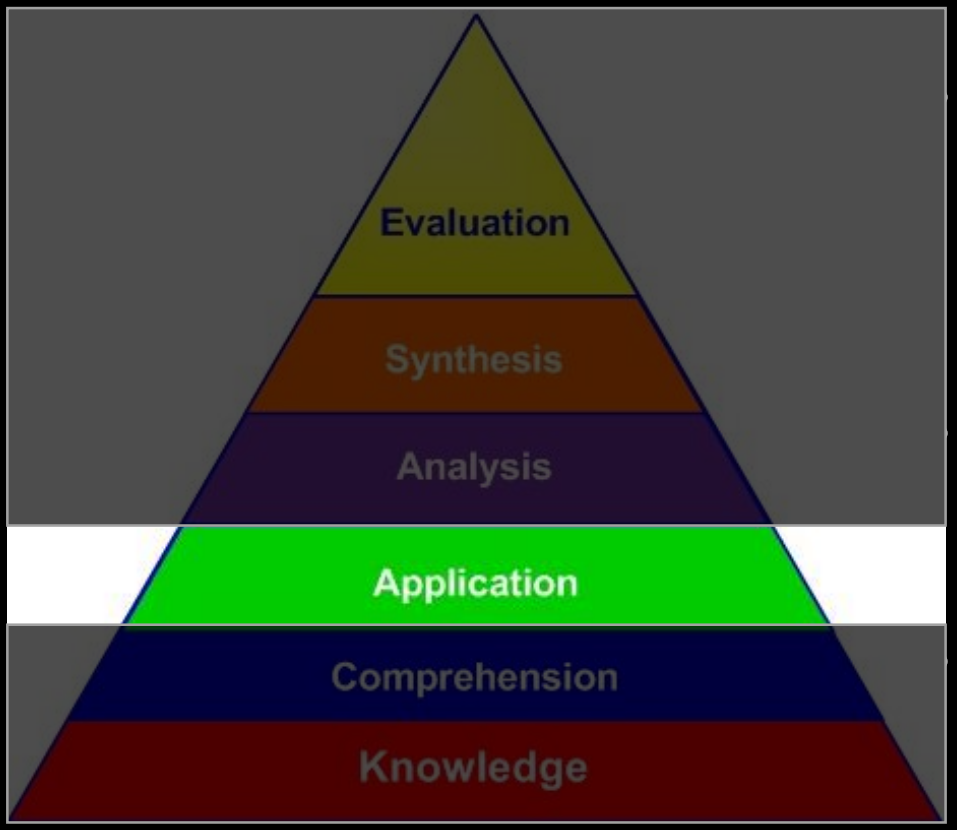
Databases/ datafarms
High-performance computing

Pattern recognition
Test loss
Training loss
Features
Training data (cross-validation)
Overtraining/overfitting
Black box

Classification
Gradient descent
Grounding problem

Data
Data collection
Computation time
Energy expenses
Hardware expenses

Second activity: Application

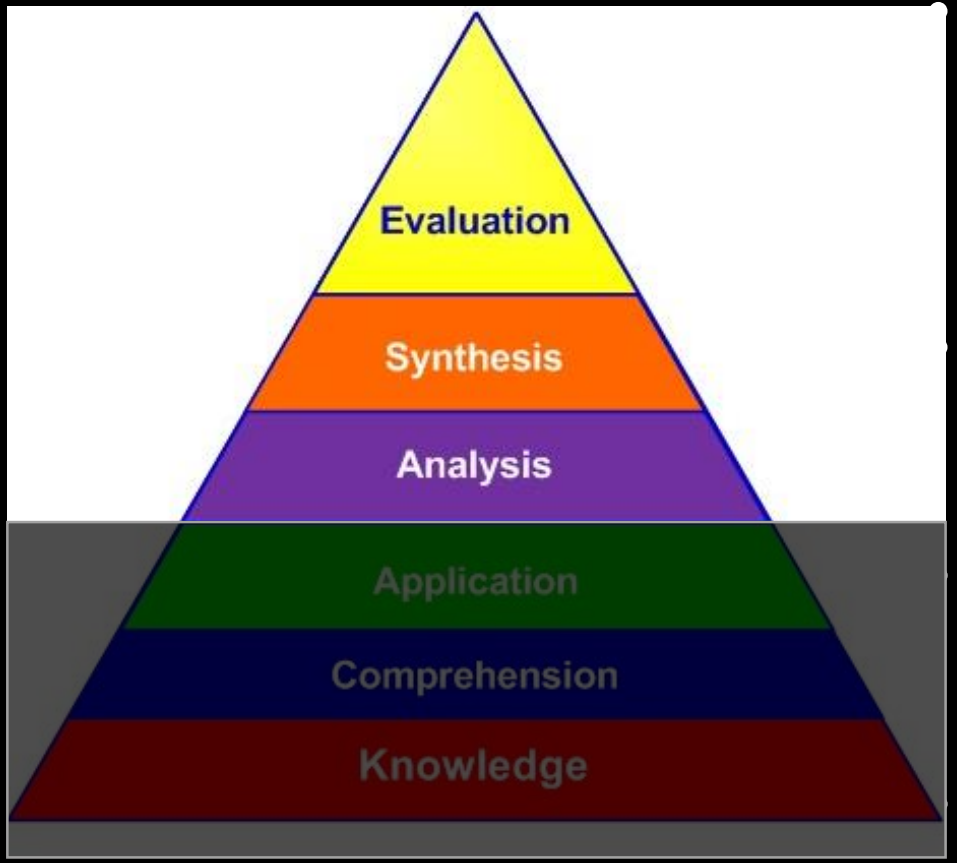


- **Define** the key concepts of neural networks
- **Relate** these key concepts with each other and other AI tools
- **Manipulate** neural network on a pre-set concrete example
- **Sketch** how to implement neural networks for a specific problem
- **Appraise** how neural Networks can be applied in a given problem

https://tinyurl.com/fundOfAI

Turn on your micro and camera when your question is picked up

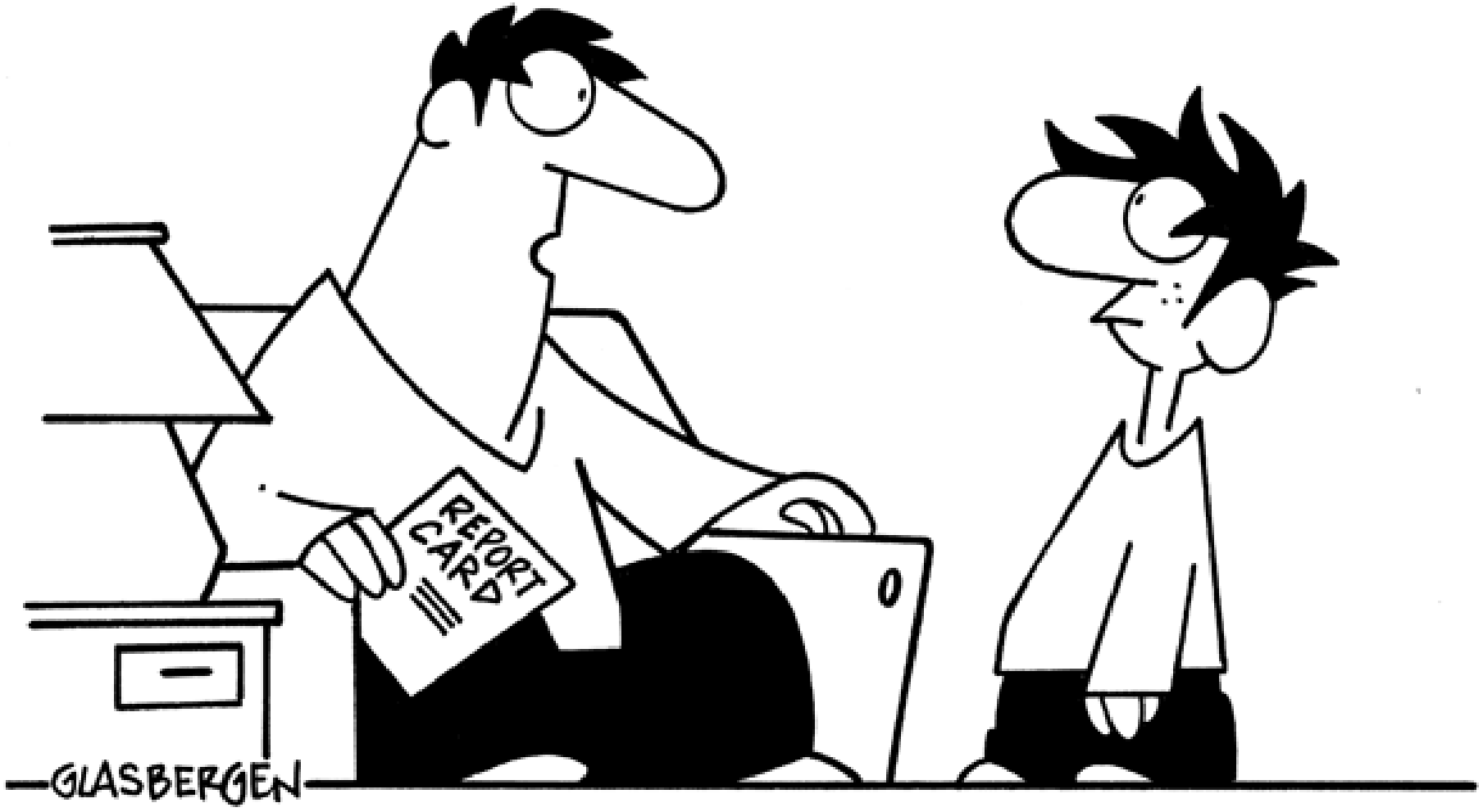
Third activity: Analysis



- **Define** the key concepts of neural networks
- **Relate** these key concepts with each other and other AI tools
- **Manipulate** neural network on a pre-set concrete example
- **Sketch** how to implement neural networks for a specific problem
- **Appraise** how neural Networks can be applied in a given problem

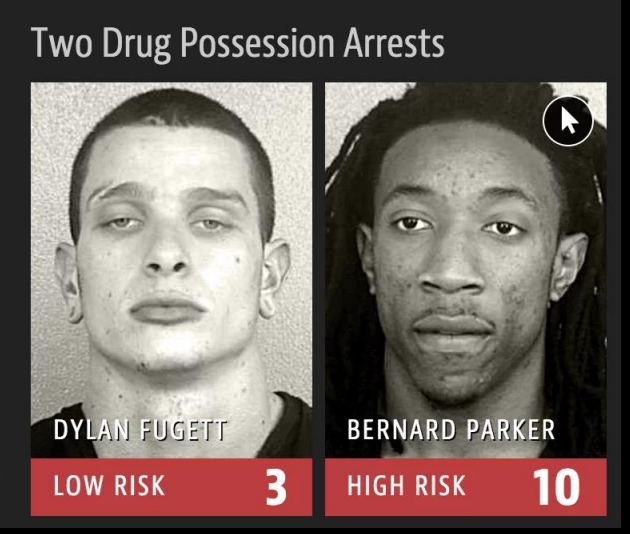
https://tinyurl.com/fundOfAI

Turn on your micro and camera when your question is picked up



**"I probably remember 20% of the stuff
I learned in school and forgot the other 90%."**

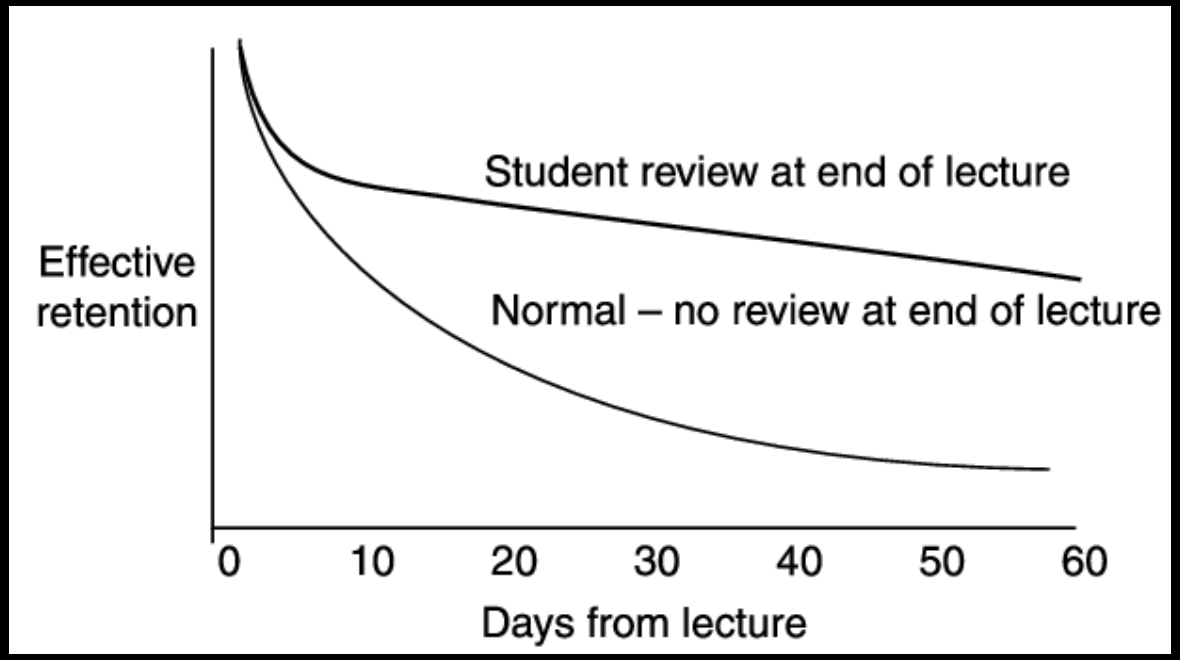
Take home message



- Neural networks are vaguely inspired from human neurons but they are widely different. They just use data for greedily adjusting many parameters
- Neural networks excel for input recognition
- Neural network hype is a fallacy: they just fixed the last problem of a long chain
- Neural networks are fragile: unexplainable arbitrary answers
- Neural networks are a sensitive tool: financial costs (power games), prone to bias, they generate a lot of social inequality

Anchoring

https://tinyurl.com/fundOfAI-LR



This is anchoring:
State what you learned

Write your answers on a sheet of paper if you can (though it helps us to know what you learned)

Save your feedback for later