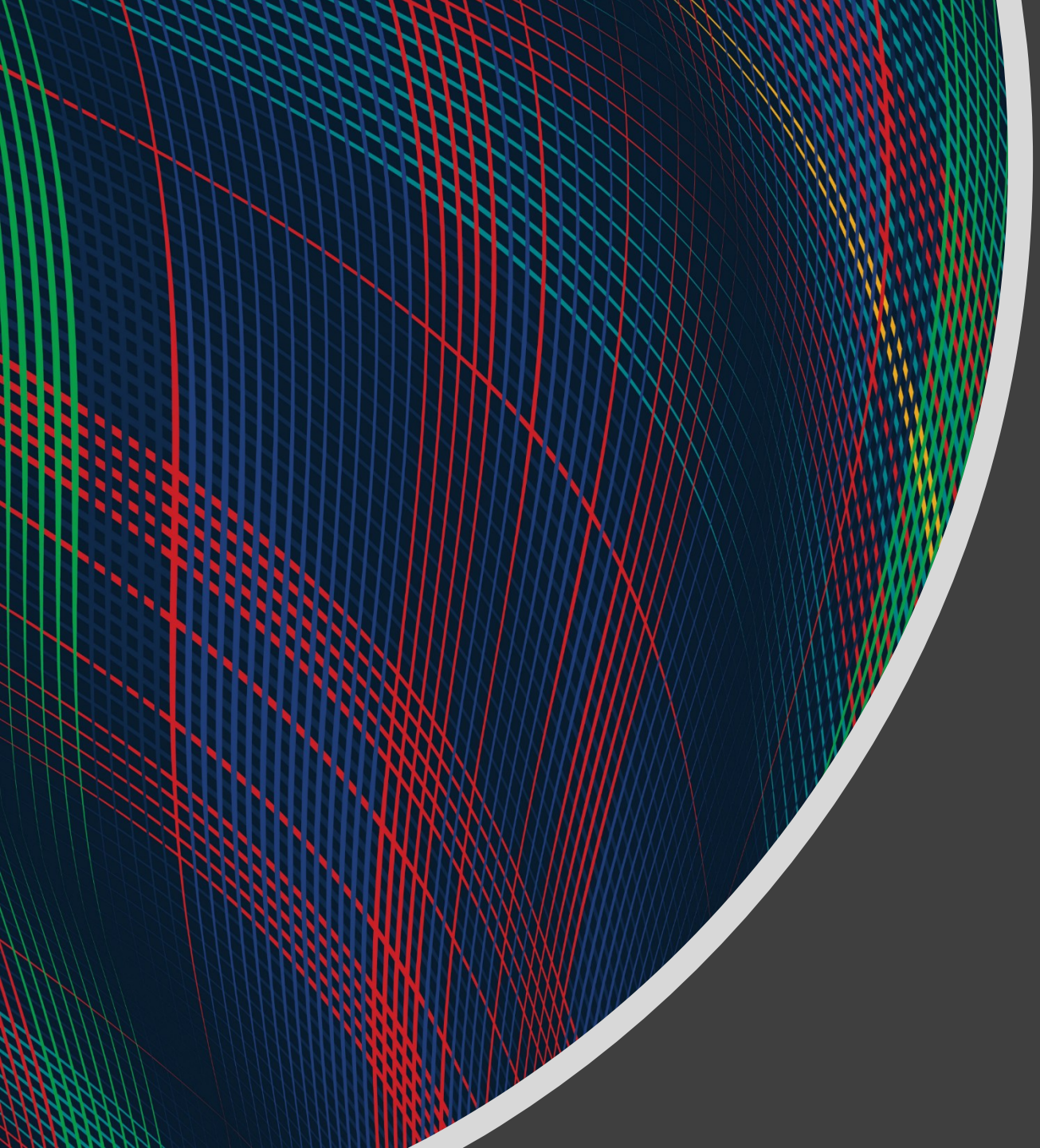
As you walk in

Welcome!

1) Help draw some aliens for our dataset today!
   - Grab a sharpie and some sticky notes
   - Just stick figures, nothing quite this fancy →



07-280
AI & ML I

Instructors:
Nihar Shah & Pat Virtue

Today

Course team

Quick course info

Alien Autoencoders!

What is AI and ML?

Seasons of AI

Example Applications

DALL-E: “Logo of a Scotty dog with a red collar whose brain is made of circuits”

Course Team

Instructors

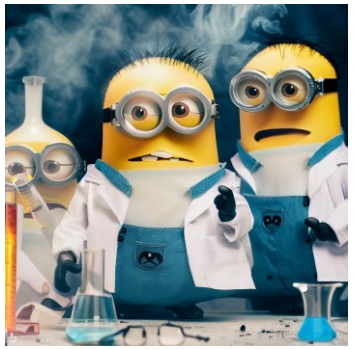
Nihar Shah

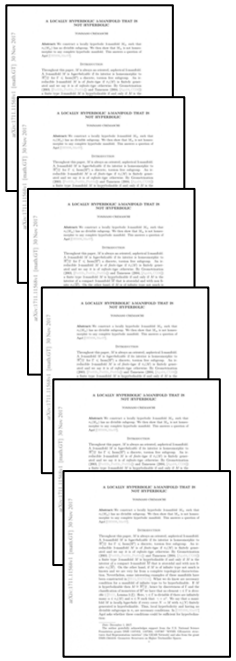
nihars

Education Associate

Nihar Shah

Research on
the Evaluation of Science and the Science of Evaluation





- 😵 Is it correct?
- 😵 Is it good?
- 😵 Is it even real?
- 😵 Should it be funded?

Our research

- Humans + Algorithms
- Empirical performance + mathematical guarantees
- Deployed in evaluation of
  - Over 100,000 papers
  - 1000s of research proposals
  - Competitions
  - Admissions

Course Team

Instructors

Nihar Shah

nihars

Pat Virtue

pvirtue

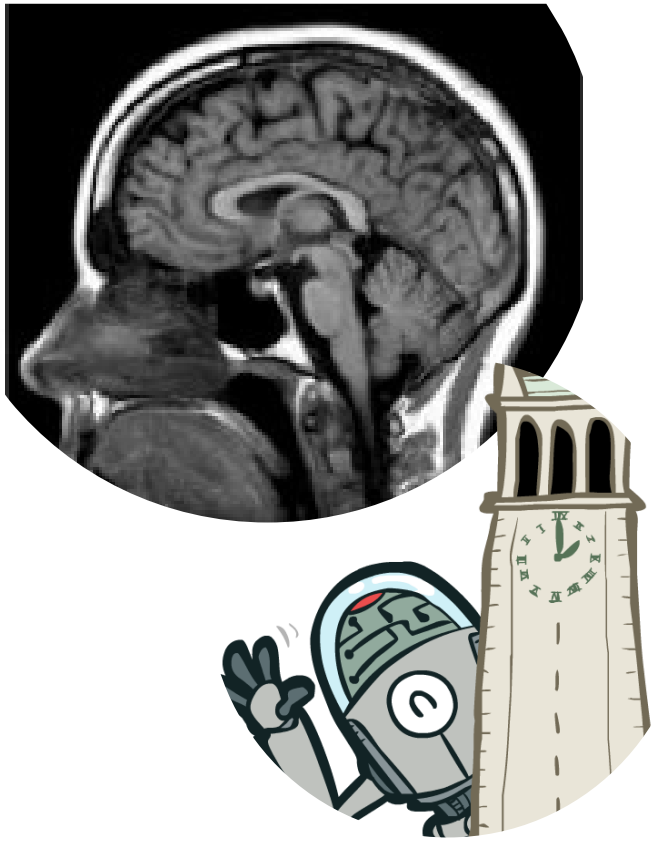
Education Associate

Pat Virtue

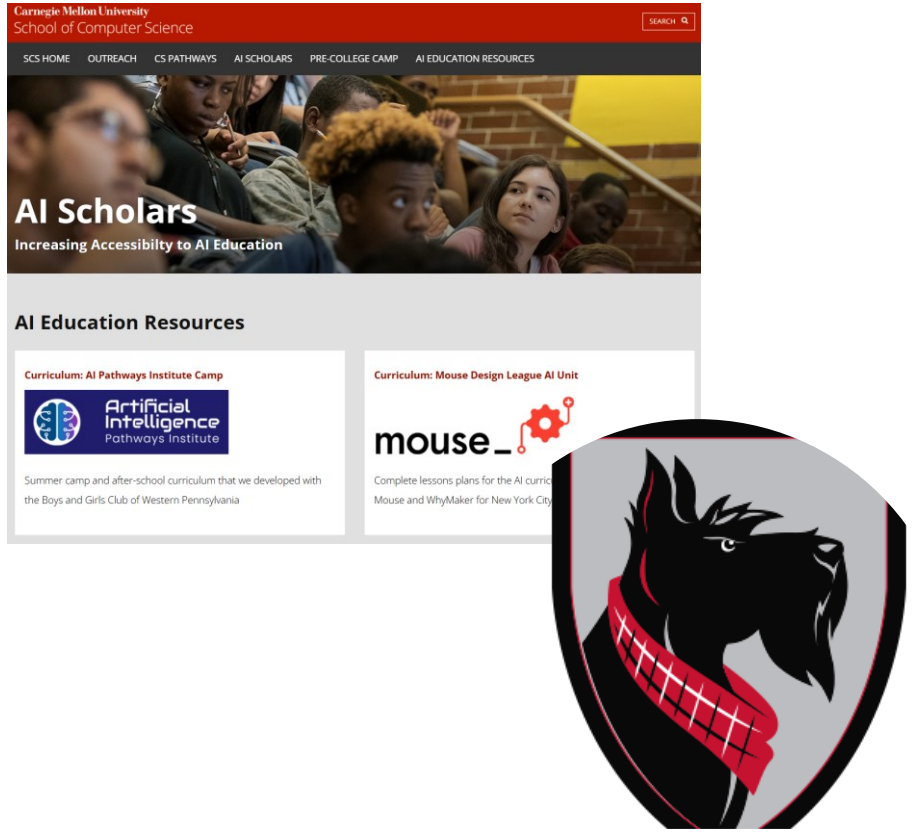
From Medical Imaging background to AI Education Outreach

GE Healthcare

UC Berkeley



Carnegie Mellon University



Course Team

Instructors

Nihar Shah

nihars

Pat Virtue

pvirtue

Education Associate

Brynn Edmunds

bedmunds

Email Brynn, bedmunds@andrew.cmu.edu:

- Exceptions, extensions, etc
  - (may replace with exceptions form)
- Any course logistics

Course Team

Teaching Assistants

Max

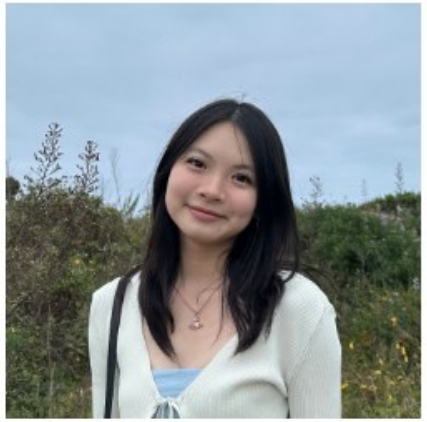
myagnyat

Johnny

johnnyt

Avi

aarya2



Ellyse

ellysel

Roy

roypark

Steven

yiy6

Course Team

Students!!

Course Information

Website: https://www.cs.cmu.edu/~10315

Communication:

- https://piazza.com/
- E-mail Brynn if Piazza doesn't work:

  bedmunds@andrew.cmu.edu

Important posts!

- Course Infrastructure
- Numpy Tutorial
- Pre-reading (due Wed)
- HW0 (due Thu)
- Lec Preview & Poll Links

Coming soon

- Recitation1 (Fri)
- HW1 (out Fri)

Poll 1

How many 07-280 assignments are due this week?

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Alien Autoencoders Game

Task: Face Generation

https://thispersondoesnotexist.com/

Task: Classification from Features

What is this?

Input:
Image

Predicted Output:
Category

Task: Classification from Features

attributes

What is this?

Input: Image

raw feature (Pixels)

feature extraction

features

pointears
fur
tail
#leg
shape nose

Predicted Output: Category

feature classification

cat

As you walk in

Welcome!

1) Help draw some aliens for our dataset today!
   - See table up front
   - Just stick figures, nothing quite this fancy →

Cartoon alien hi-res...

Freepik

Suesse Aliens Bilder -...

123RF

91,690 Cartoon Alien...

iStock

47,434 Alien Cartoon...

Shutterstock

228,873 Alien Cartoon...

Shutterstock

2,607 Alien Feet Image...

Shutterstock

228,873 Alien Cartoon...

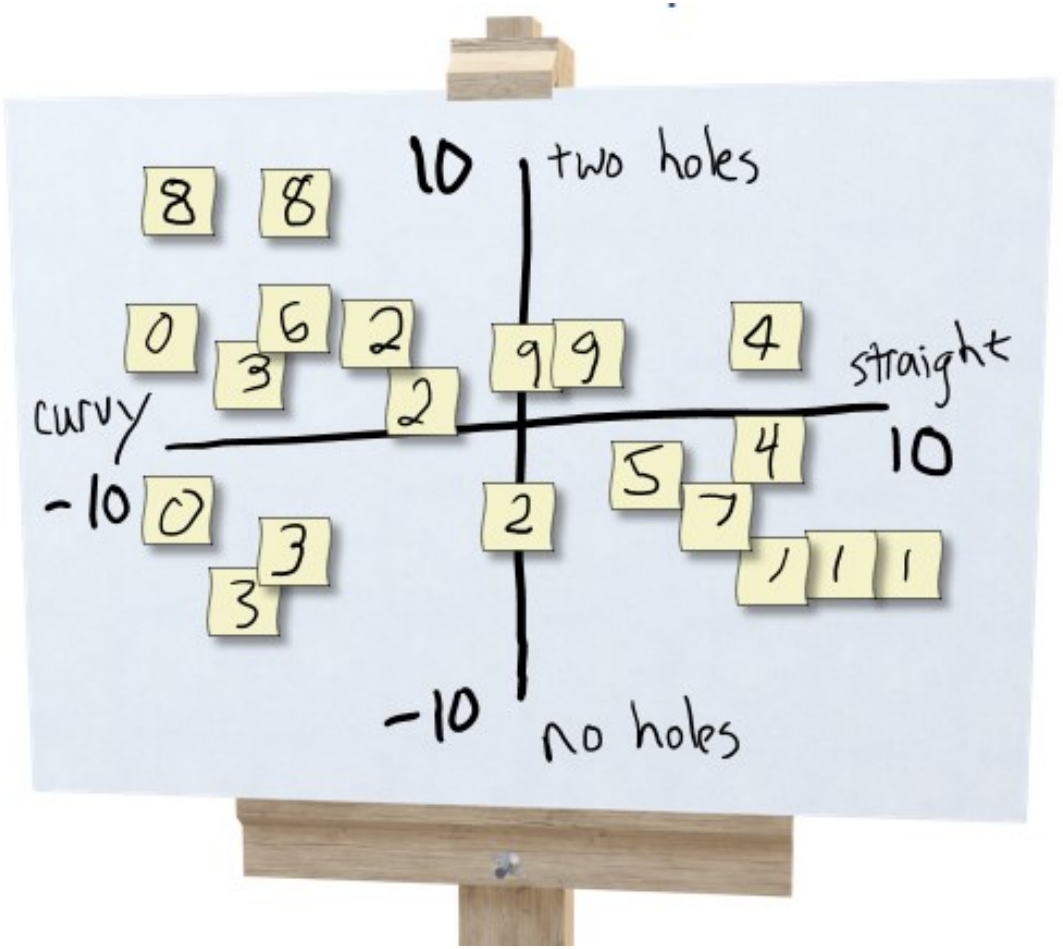
Exercise: Human-defined Feature Space

Try to organize data on a 2-D coordinate plot

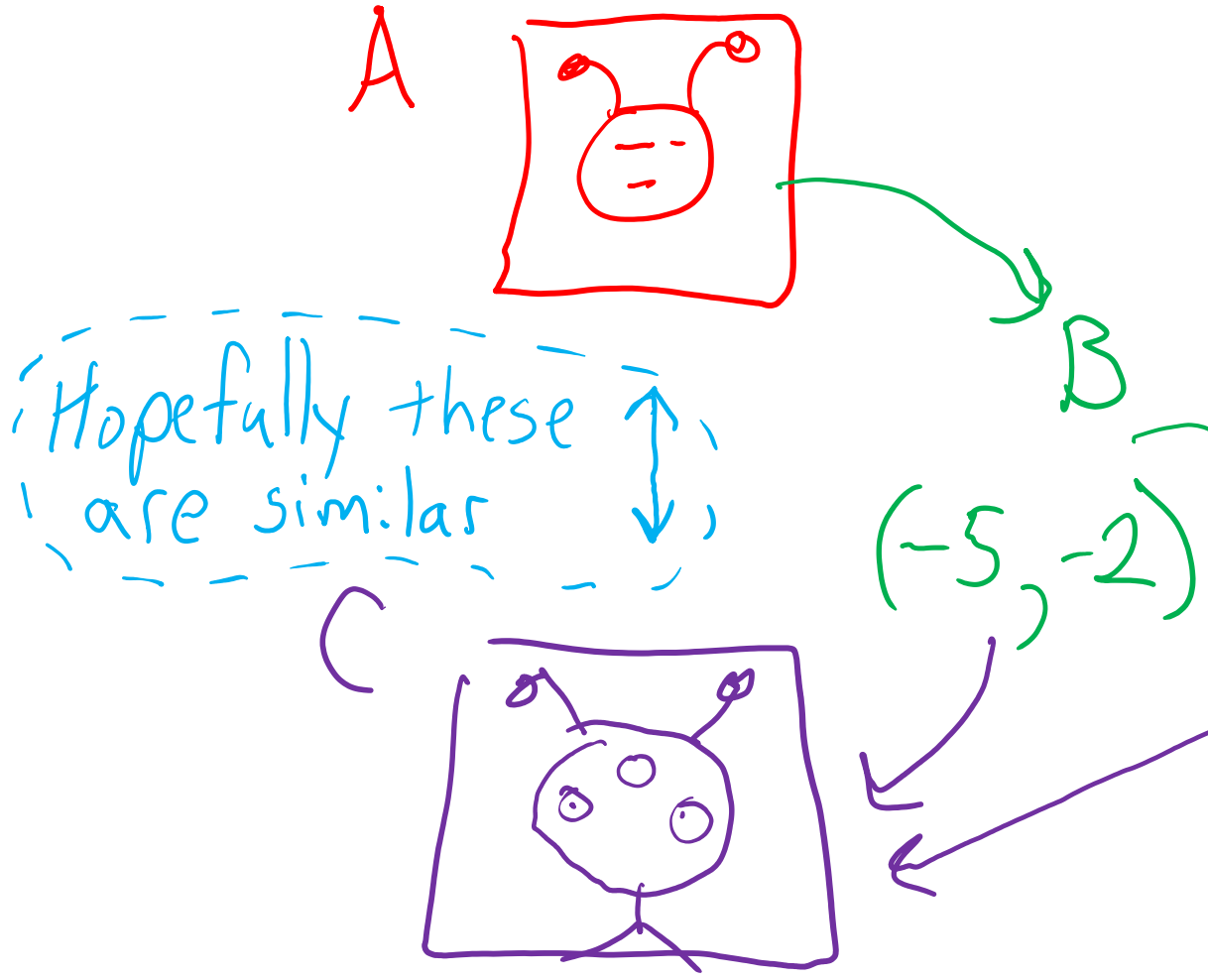
to win the following game:

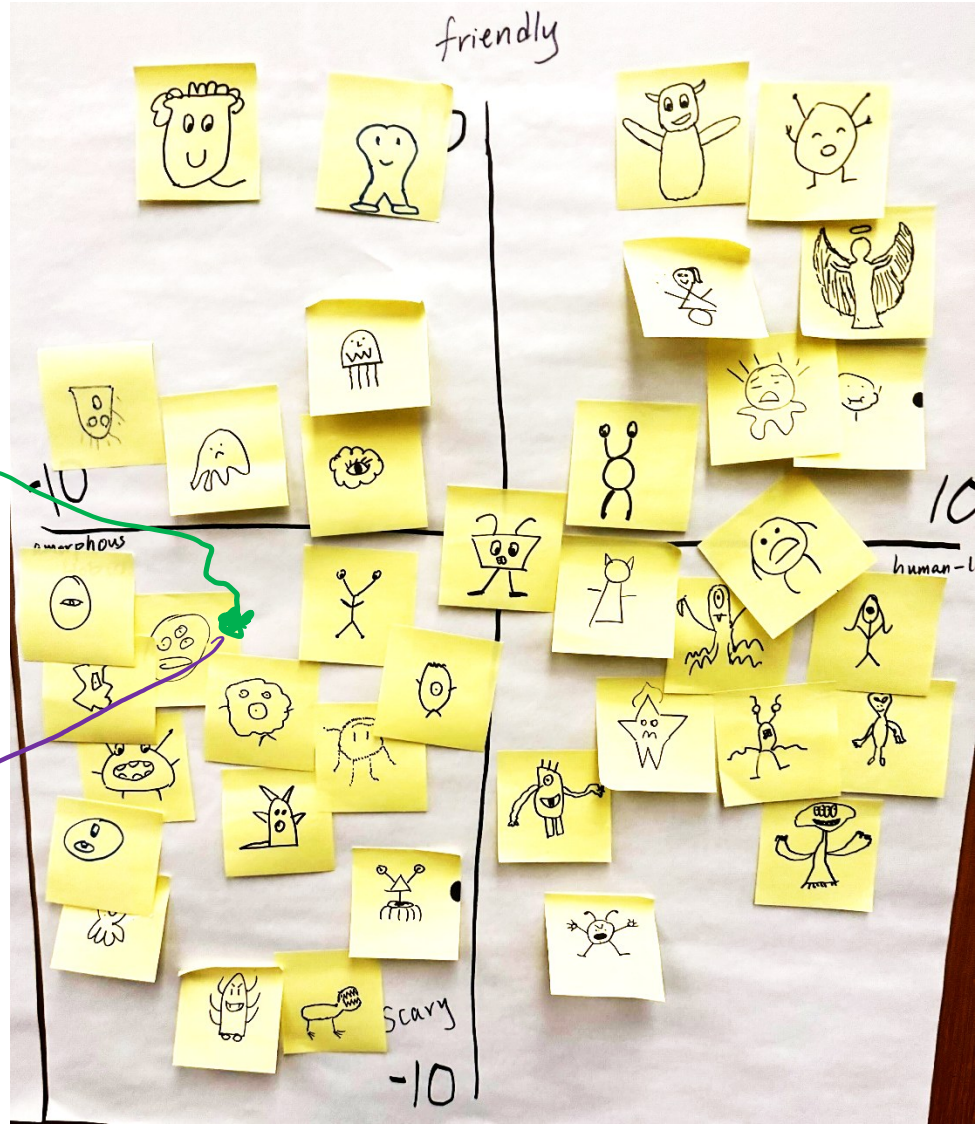
Select three students: A, B, C

1. Student A draws a new alien and hands it to student B
2. Student B thinks about where to plot it and comes up with a 2-D coordinate (*horizonal*, *vertical*)
3. Student C draws a second alien based on coordinate and plot of aliens (*don't peak at drawing from A!*)



Exercise: Human-defined Feature Space

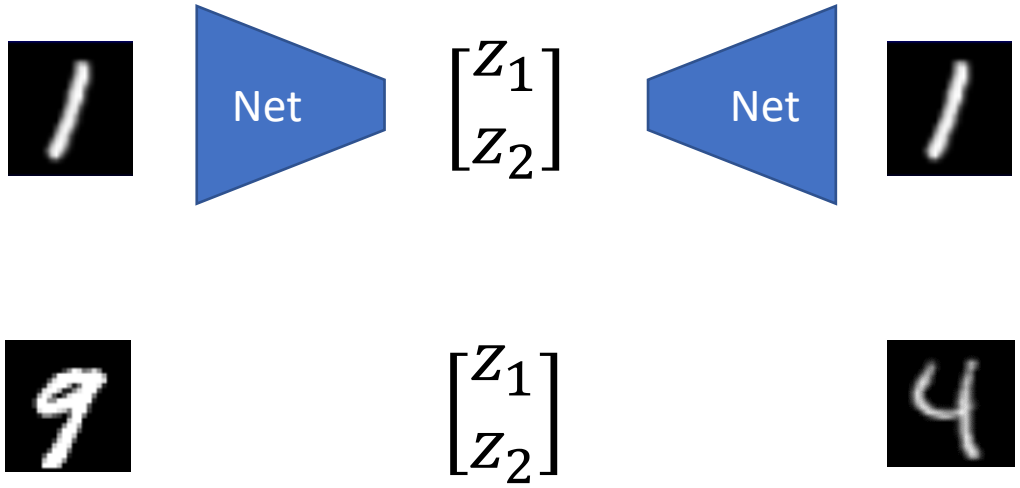


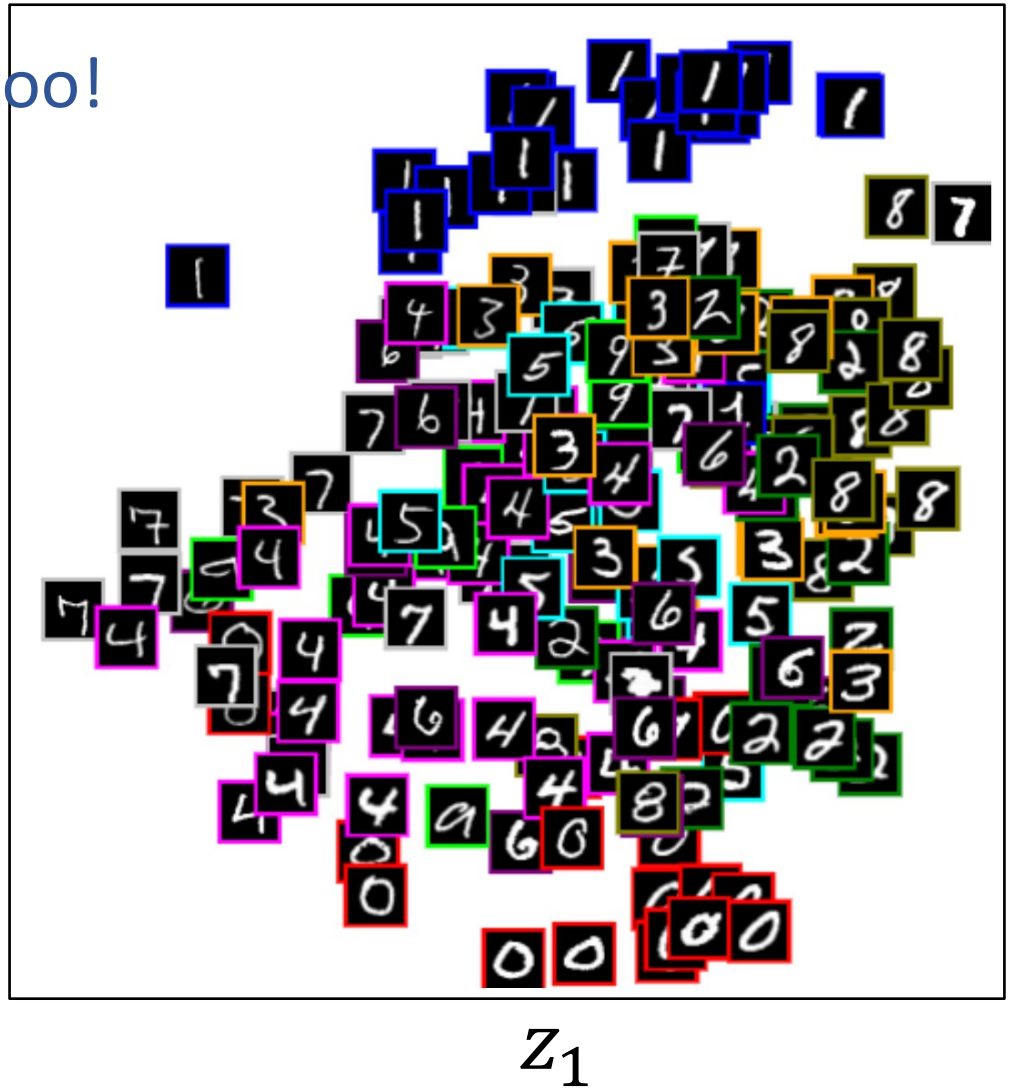


Learning to Organize Data

Neural networks can learn to organization too!

Image → $\begin{bmatrix} z_1 \\ z_2 \end{bmatrix}$ → Image



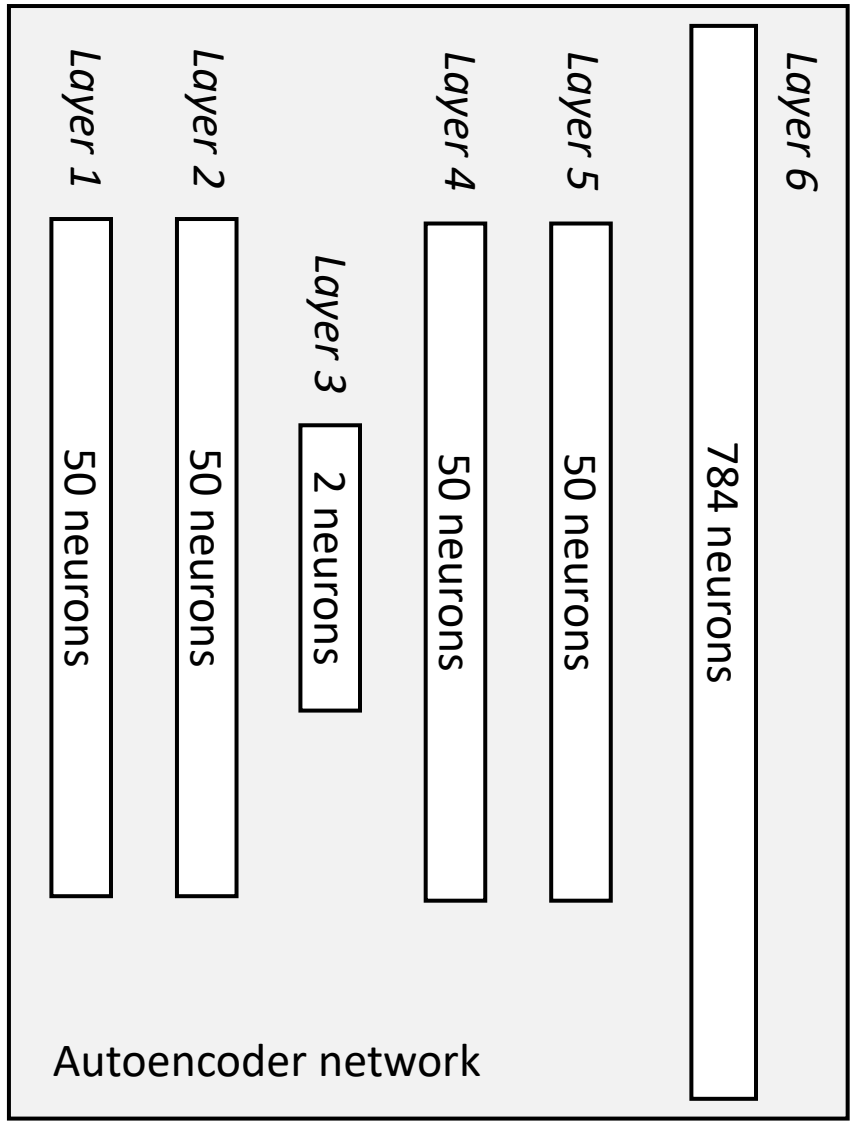


https://cs.stanford.edu/people/karpathy/convnetjs/demo/autoencoder.html

Digit Autoencoder

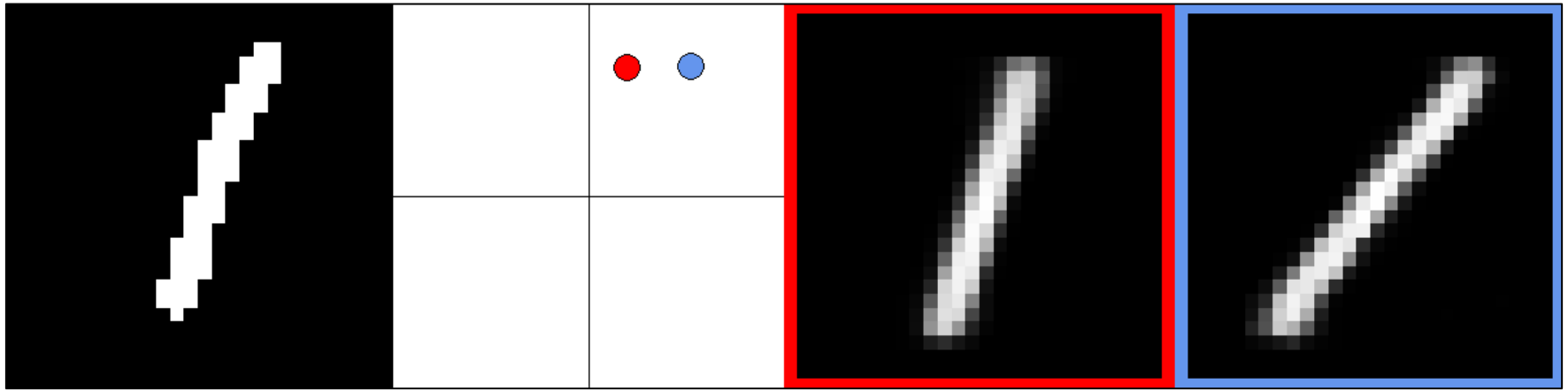
https://cs.stanford.edu/people/karpathy/convnetjs/demo/autoencoder.html

Input
28x28 = 784 pixels



Digit Autoencoder

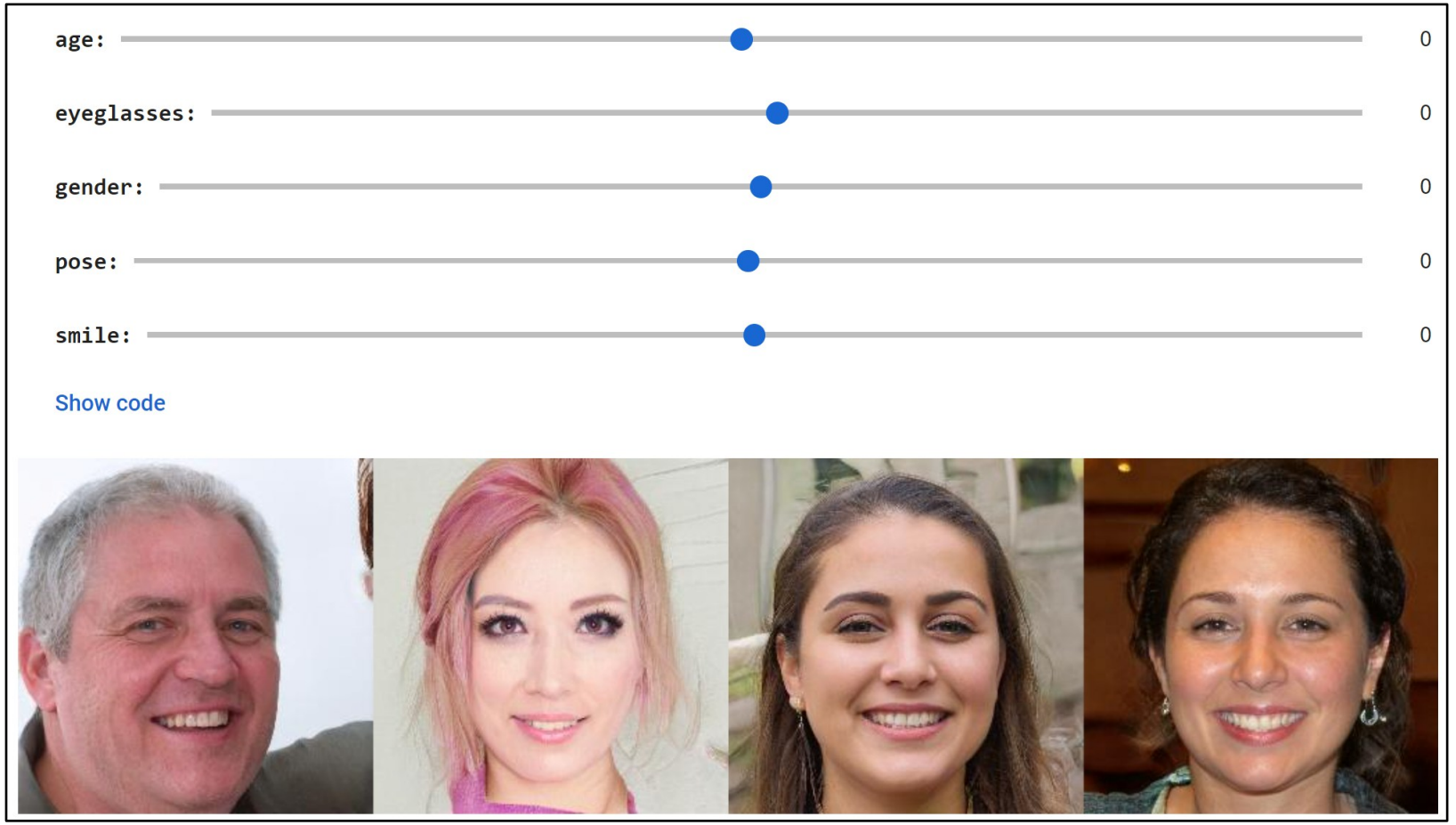
Demo: Using a learned feature space



Face GAN Slider Demo

https://github.com/genforce/interfacegan

https://colab.research.google.com/github/genforce/interfacegan/blob/master/docs/InterFaceGAN.ipynb



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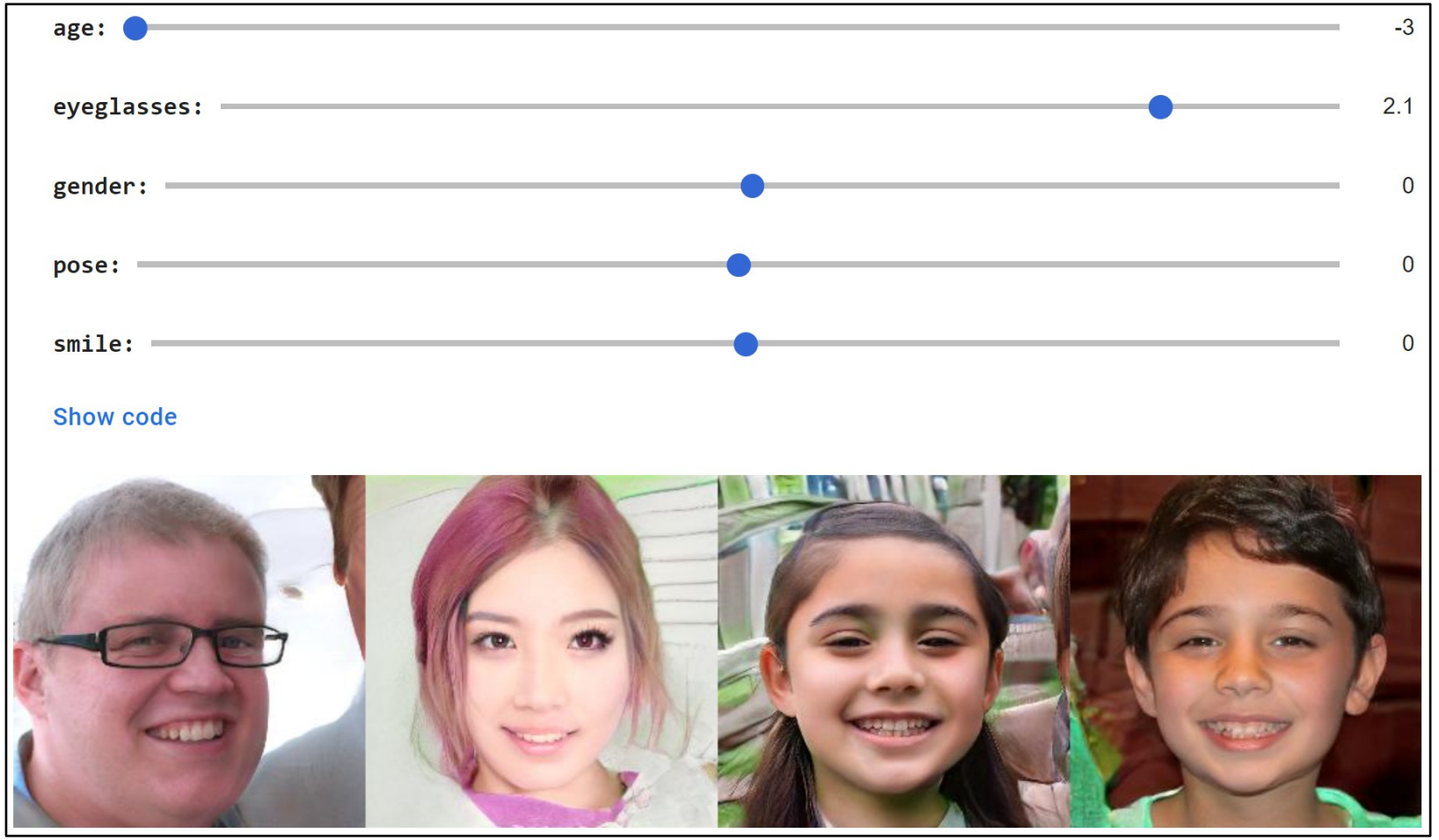

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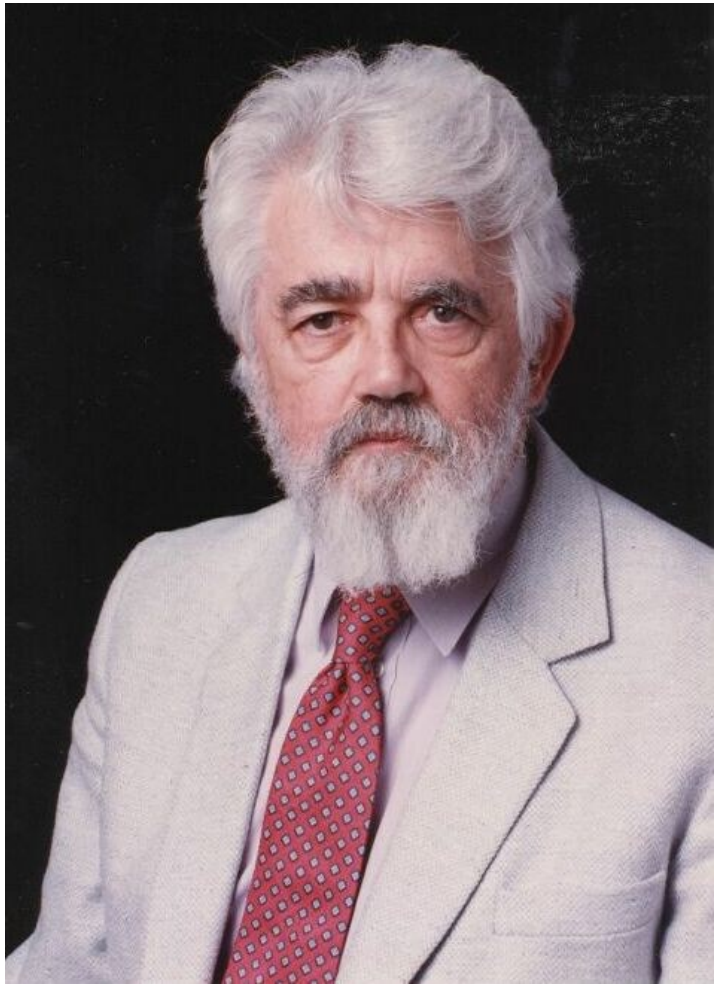
AI Definition by John McCarthy

What is artificial intelligence

- It is the science and engineering of making intelligent machines, especially intelligent computer programs

What is intelligence

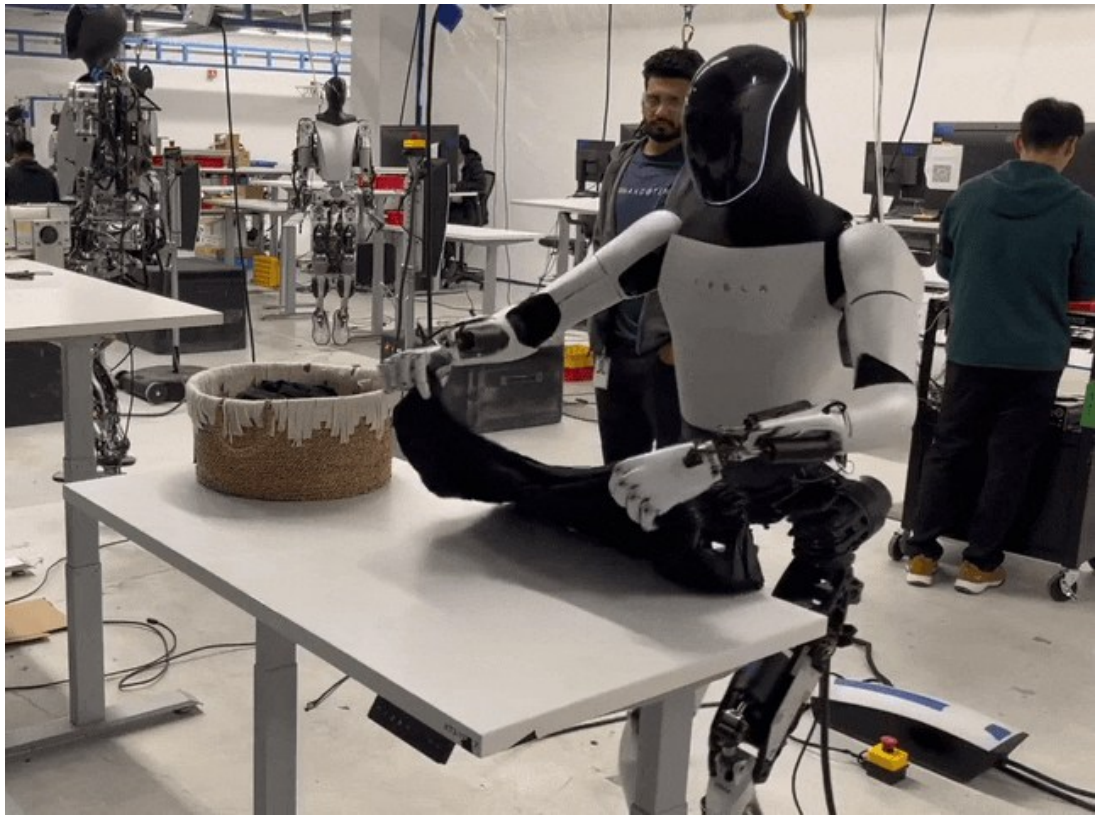
- Intelligence is the computational part of the ability to achieve goals in the world



http://www-formal.stanford.edu/jmc/whatisai/whatisai.html

What is artificial Intelligence?

Why is folding clothes a research problem while robots are actively being used to assemble cars in factories?



AI Definition (Pat's Version)

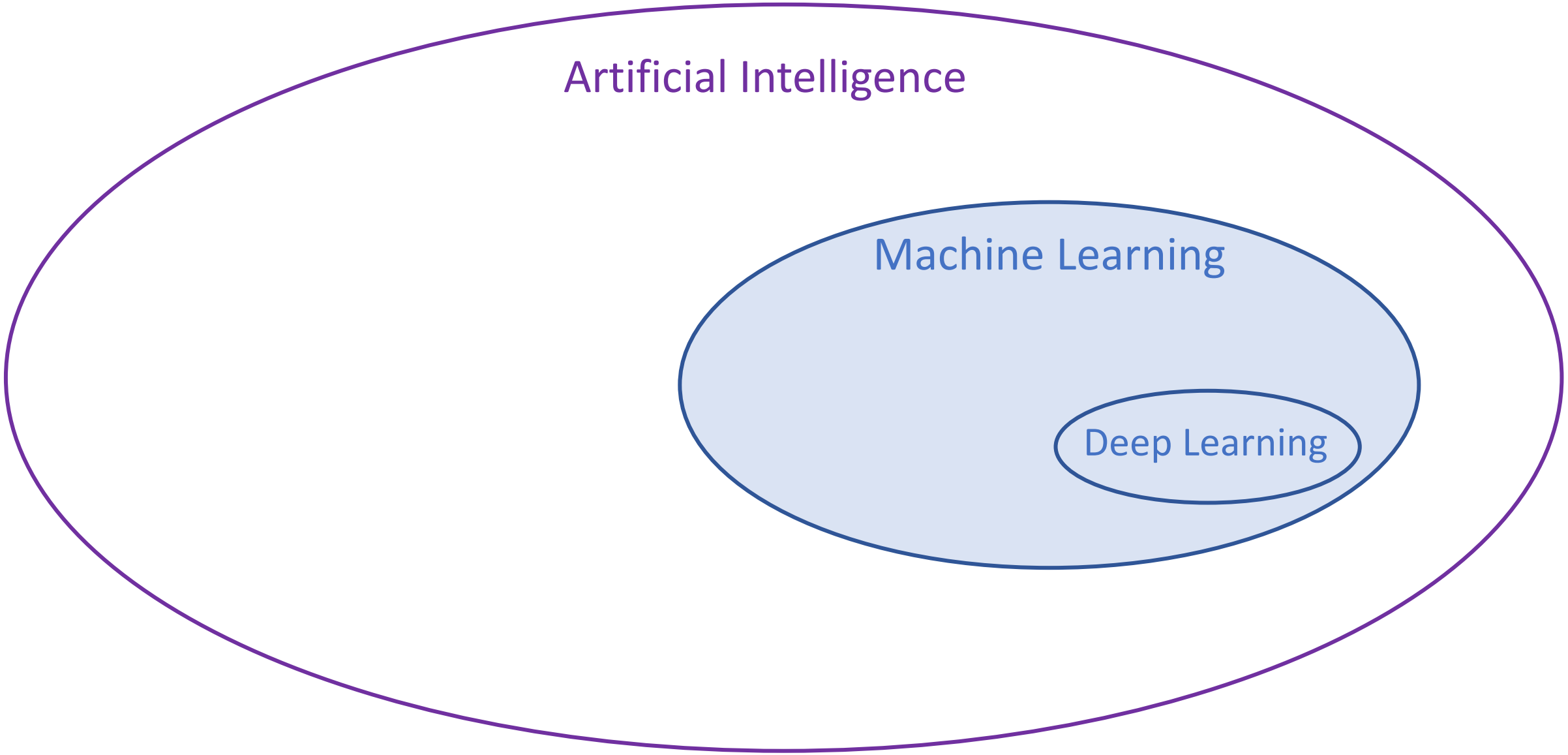
What is intelligence

- Intelligence is the ability to perform well on a task that involves uncertainty

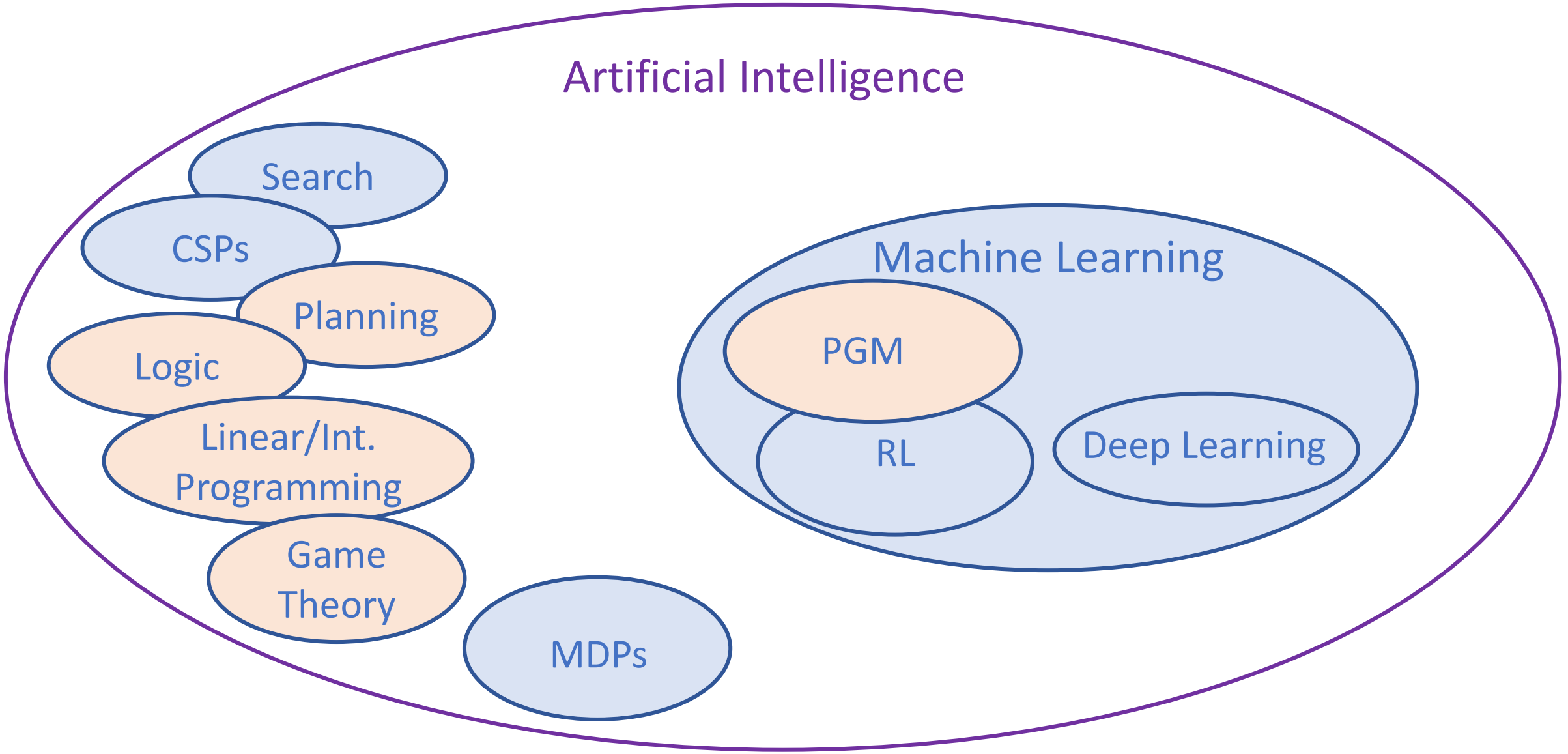
Intelligence is not binary

- How **well** an agent performs and how much **uncertainty** is involved will determine how intelligent we consider the agent to be

Artificial Intelligence vs Machine Learning?



Artificial Intelligence vs Machine Learning?



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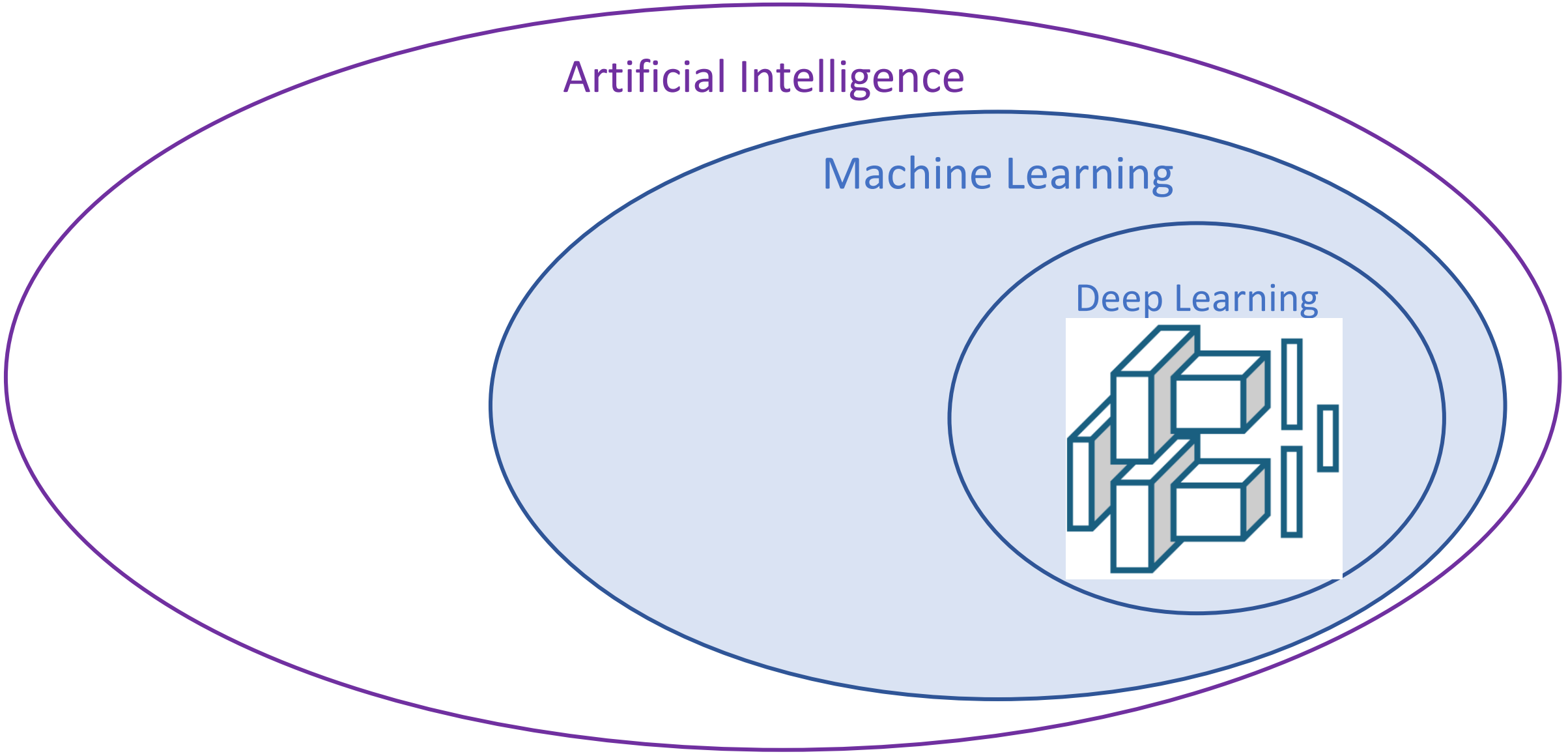

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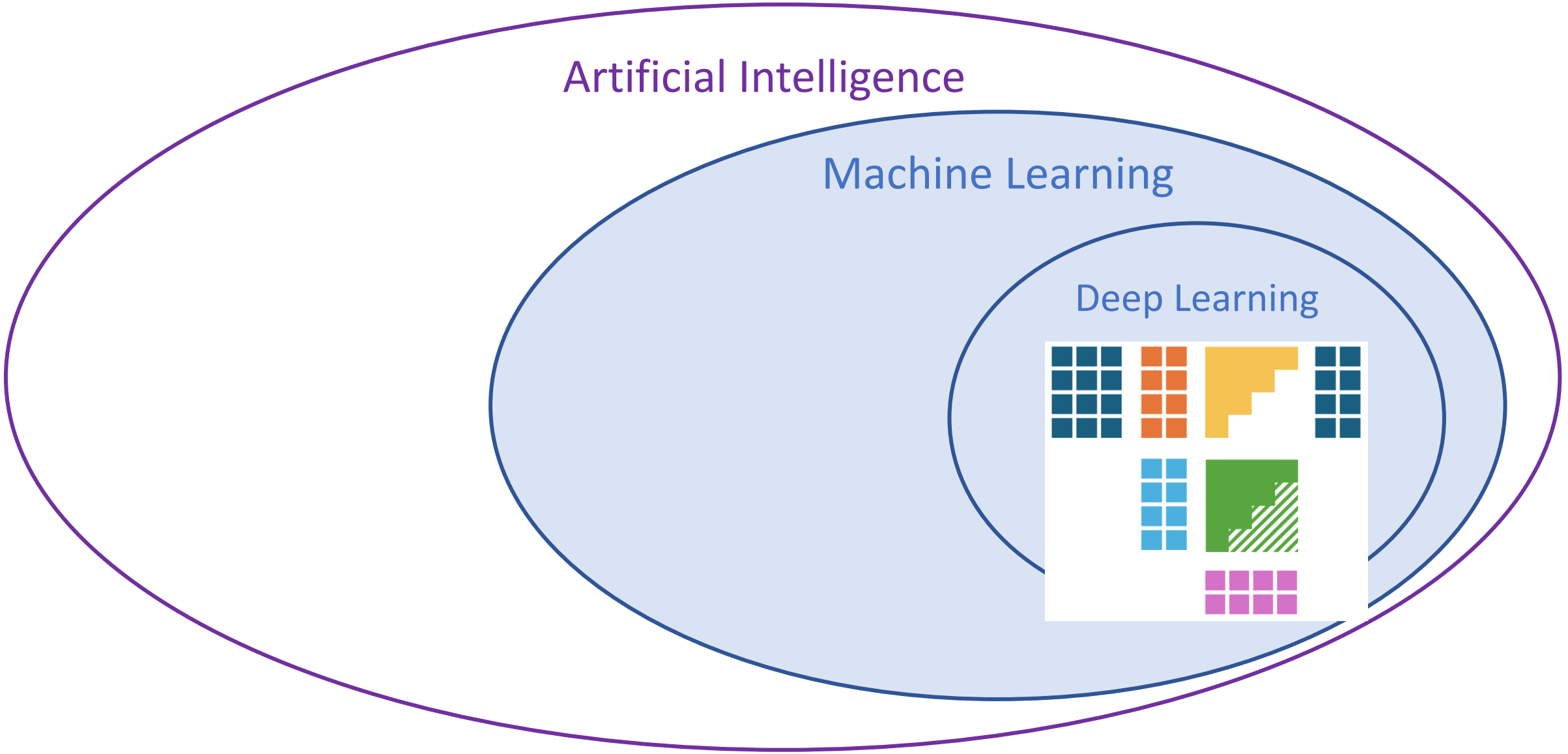
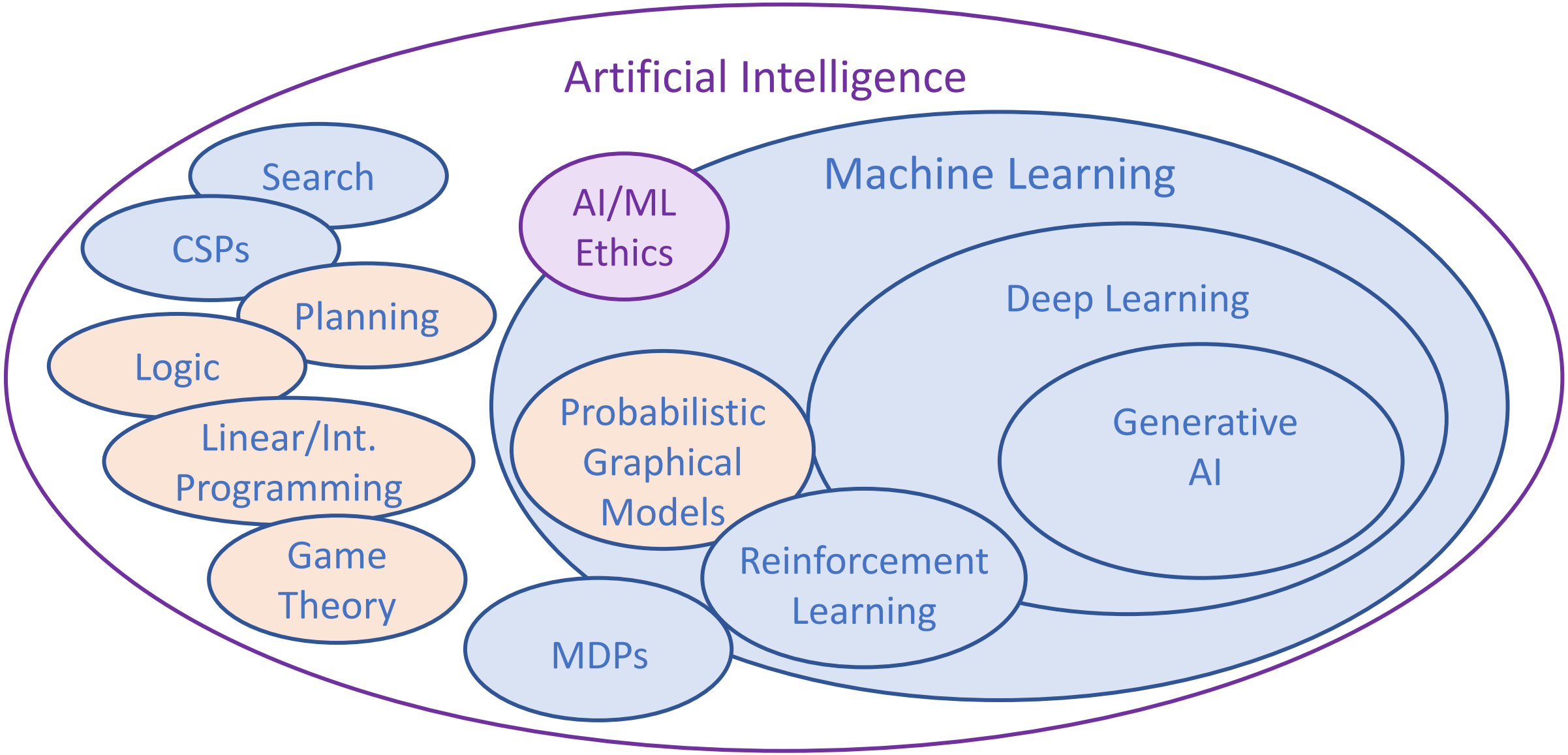


Artificial Intelligence vs Machine Learning?



Seasons of AI…

Summer: 1940s, 50s, early 60s

First mathematical model of neurons: Pitts & McCulloch (1943)

Beginning of artificial neural networks

Perceptron, Rosenblatt (1958)

Winter: Late 1960s, 70s

Collapse of early promises

Perceptron can’t even learn the XOR function

Don’t know how to train multi-layer perceptrons (aka deep neural nets)

1960s Backpropagation algorithm for training

- but not much attention

Summer: 1980s

Expert (rule based) systems

1986 Backpropagation reinvented / popularized

- “Learning representations by back-propagating errors,” Rumelhart, Hinton, Williams, Nature, 323, 533—536, 1986

Successful applications: Character recognition, autonomous cars,…

Winter 1990s

Vapnik and collaborators develop SVM (1993)

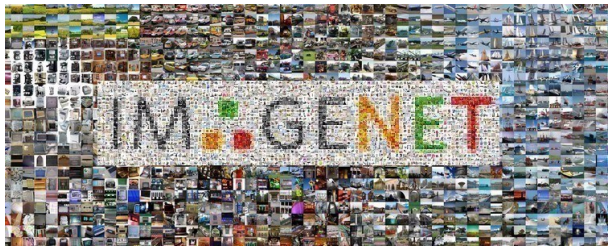
- Shallow architecture
- SVM almost kills the ANN research

Training deeper networks consistently yields poor results.

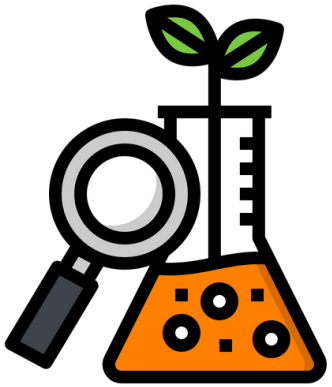
Exception: deep convolutional neural networks, LeCun 1998.

2010s onwards

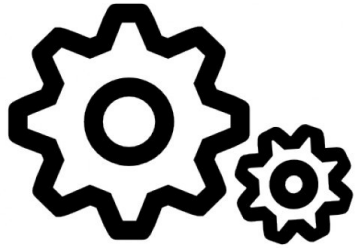
Processing



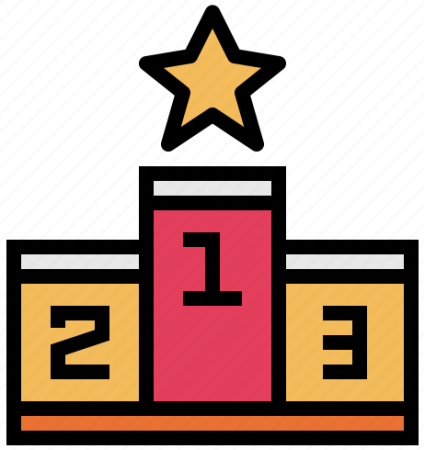
Data



Research



Engineering



"ImageNet Classification with Deep Convolutional Neural Networks," Krizhevsky, Sutskever, Hinton, Imagenet competition winner 2012.

Academia

Industry

Late 2010s onwards

Scaling

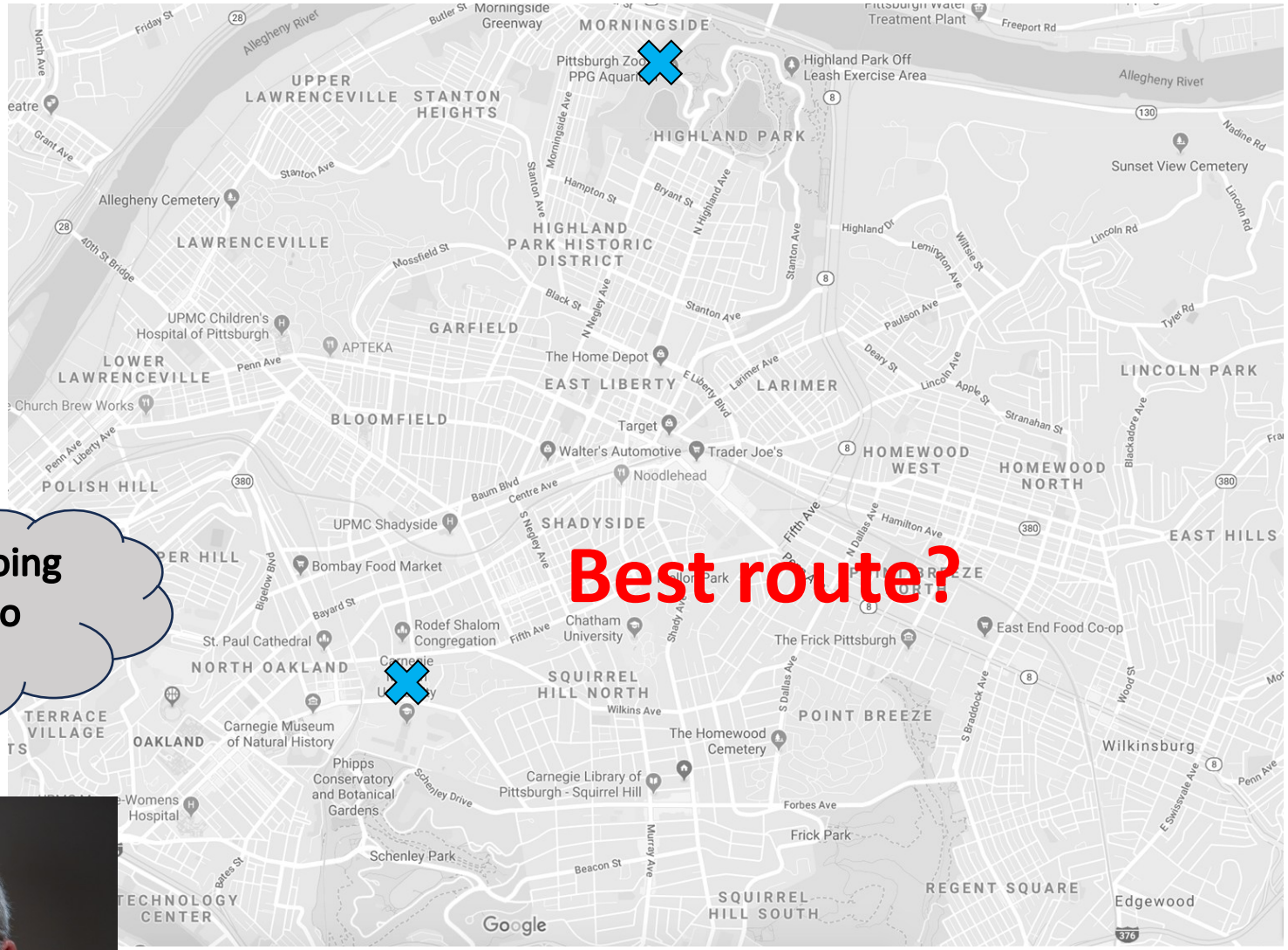
Attention mechanisms, Transformers

2022: ChatGPT released

Diffusion models

Generative AI

Some applications…



I feel like going to the zoo today!

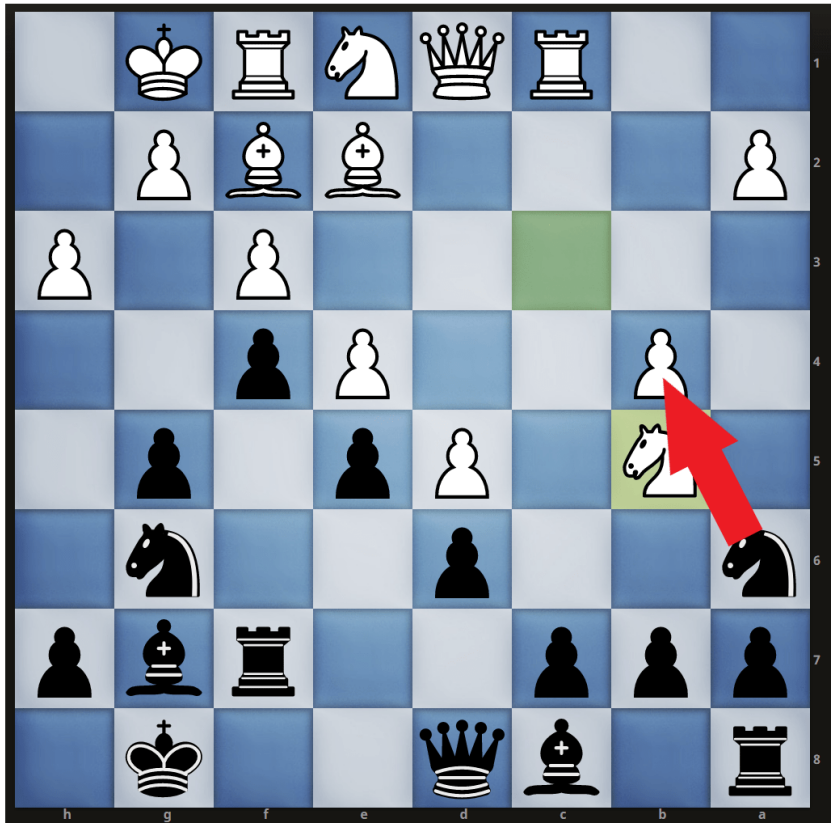
SEARCH

Find best path from initial to goal state under uncertainty

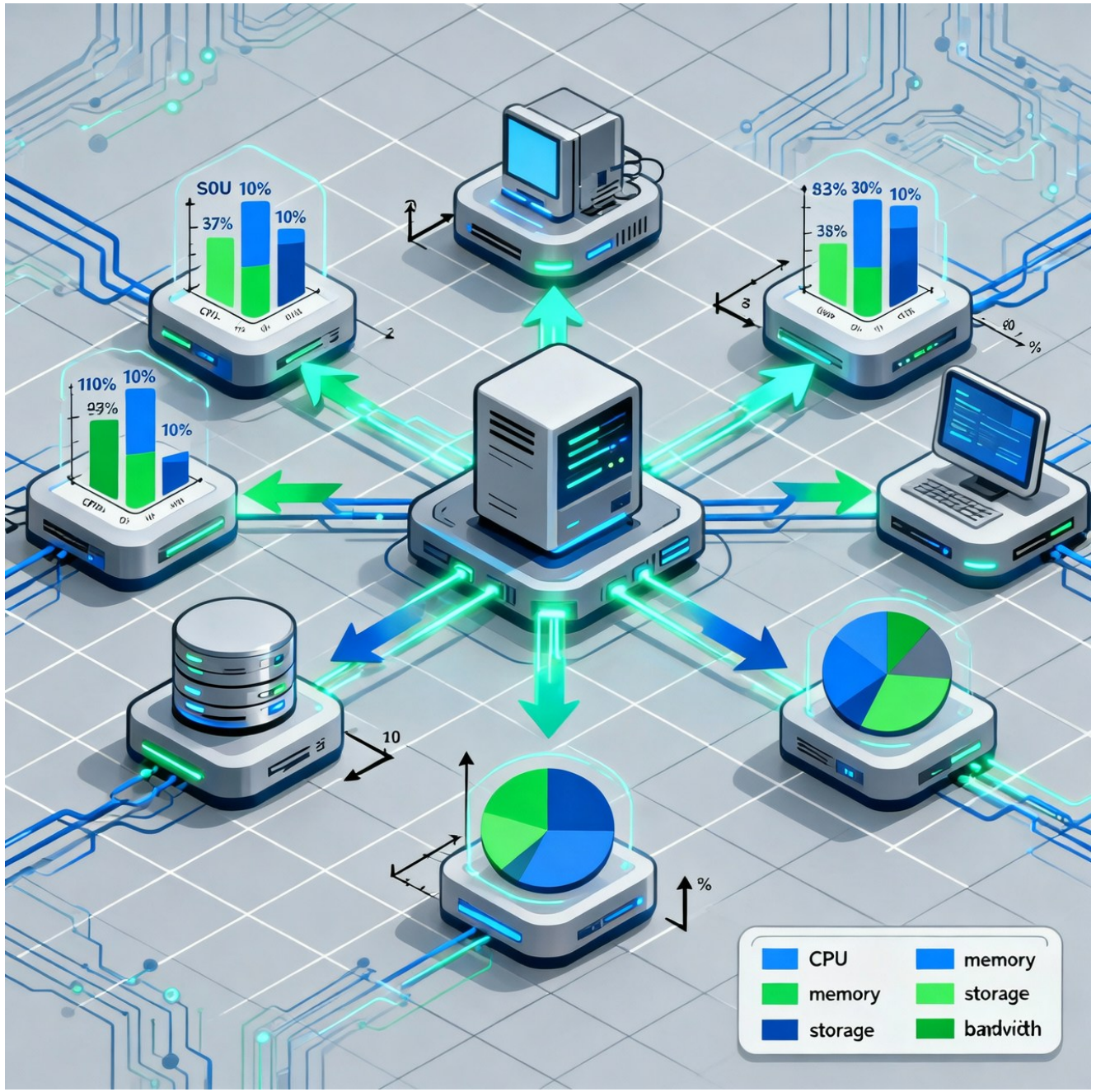
SEARCH

What my opponent thinks my plan is

What my plan is



https://www.chess.com/forum/view/fun-with-chess/funny-chess-pictures-1

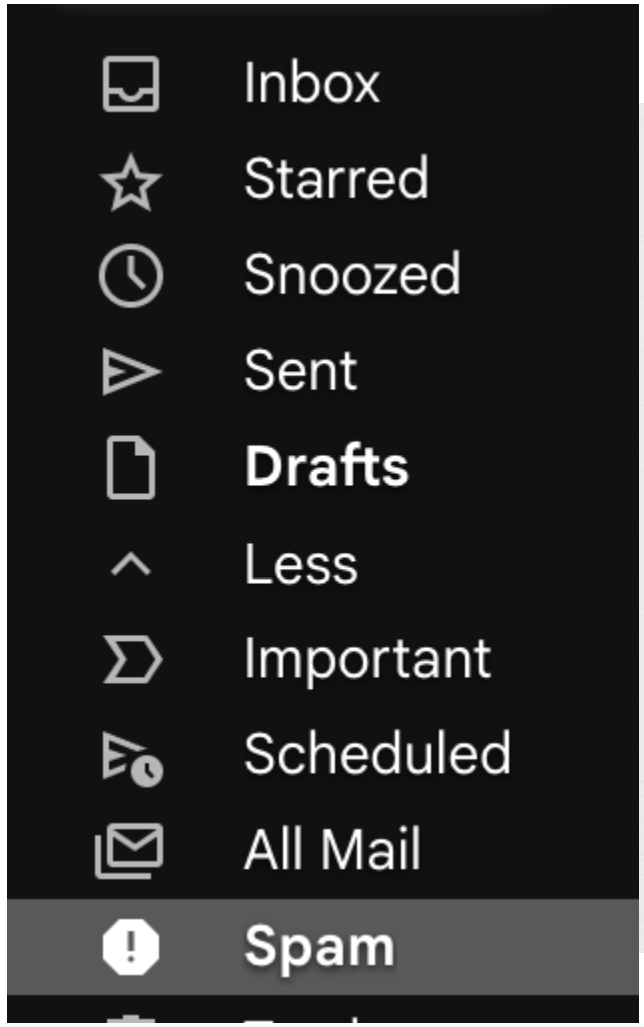


OPTIMIZATION

Find maximum or minimum subject to constraints

MACHINE LEARNING

Learn from examples, identify patterns



Inbox (1) More More

Dear Pat,

I am a king on deathbed. I want to transfer a million dollars to you. Please give me your bank account details and password.

Pat

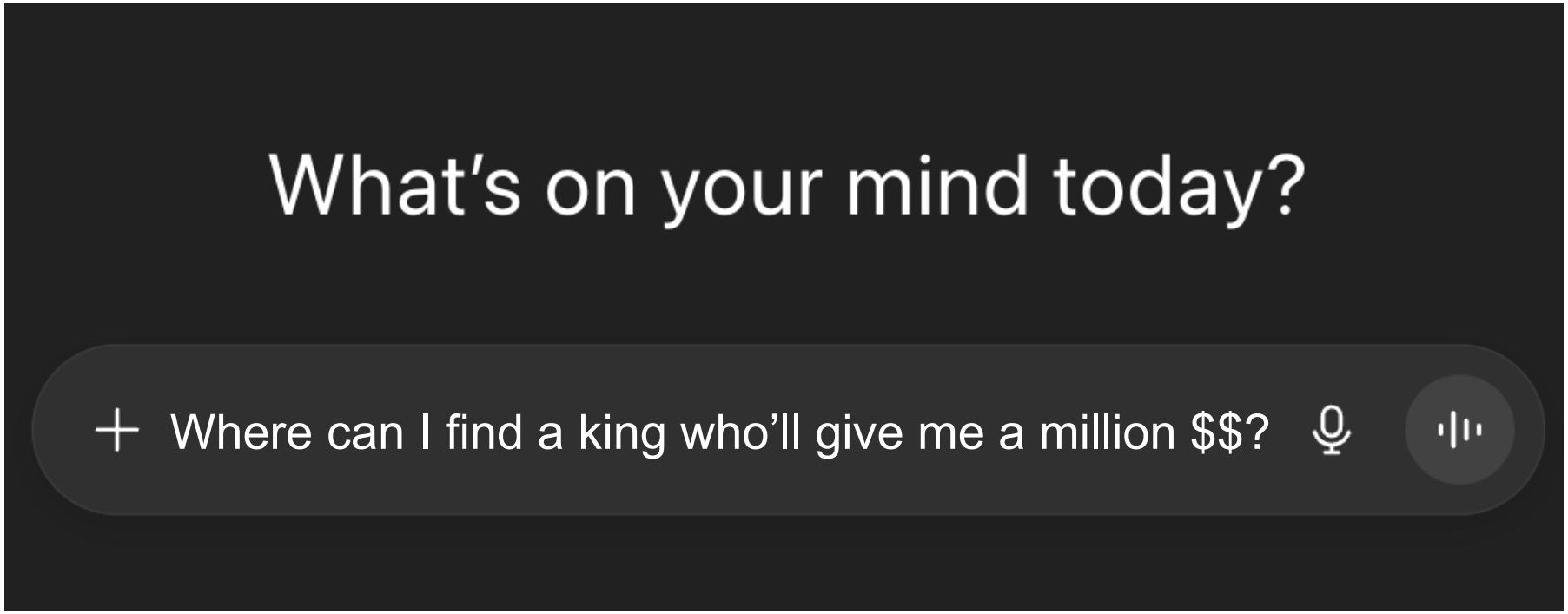
Sure, here you go...

Bank Name	Firstbank

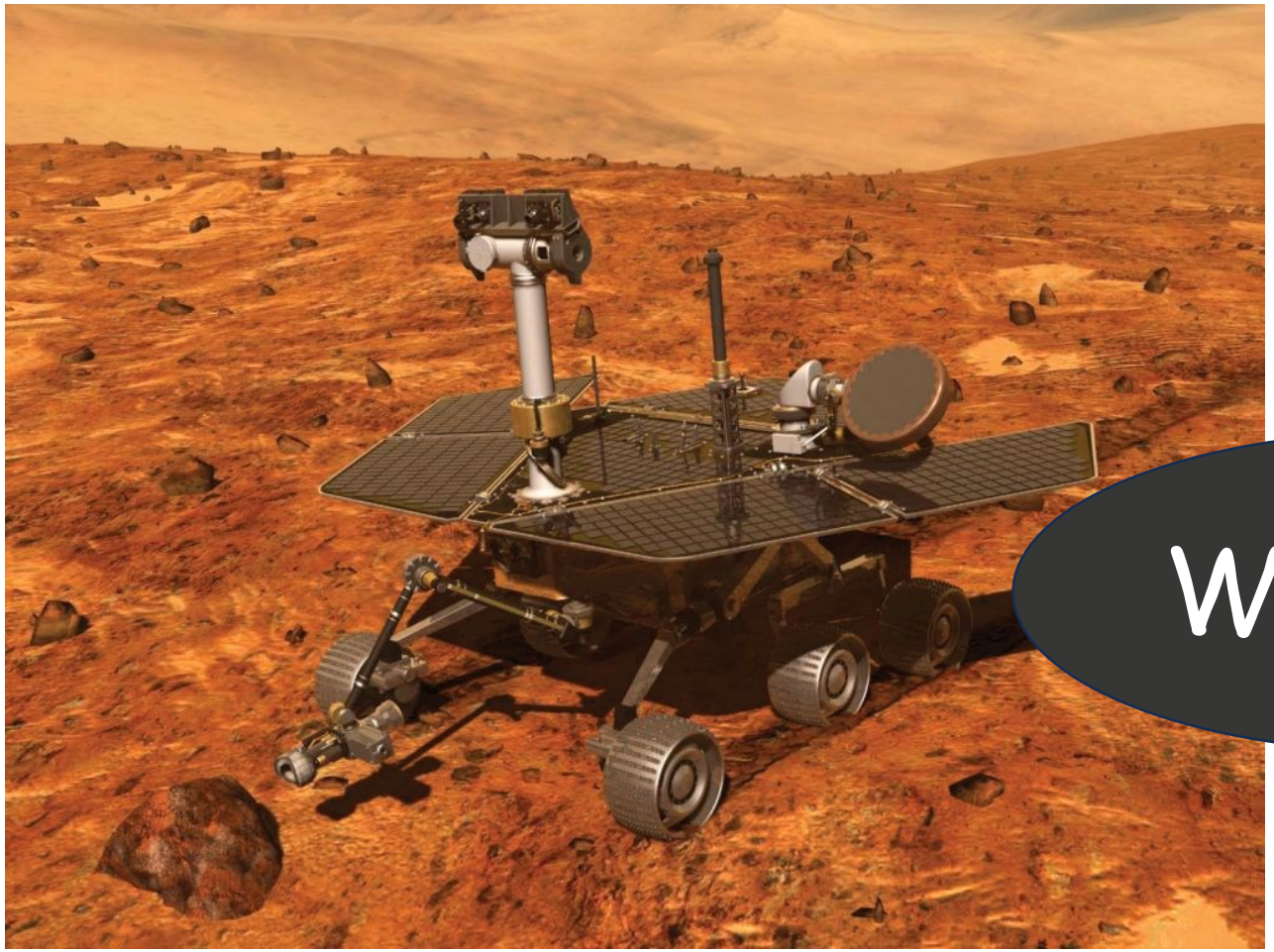

R

LANGUAGE MODELS

Predicting and generating text from patterns in text data.



REINFORCEMENT LEARNING



Learning to take appropriate actions by rewarding desired behaviors and penalizing undesired ones.

Wheeee!!

(More next semester in 07-380)