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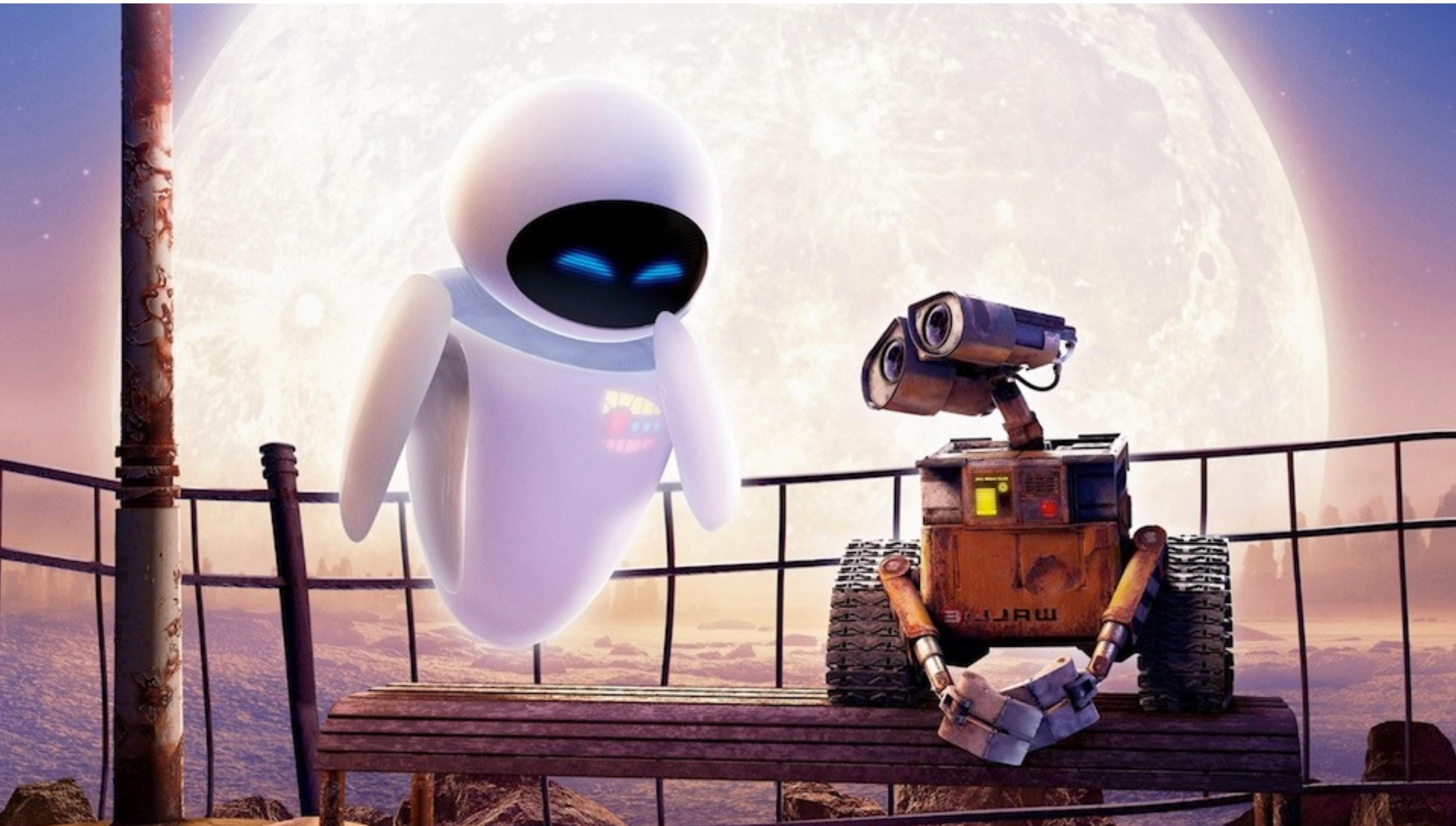


ARTIFICIAL INTELLIGENCE

Overview

- What is Artificial Intelligence and Machine Learning?
- AI: Then, Now, and Next
 - History of AI, State of the Art, the Future
- Machine Learning
 - Type of Problems
 - Type of Learning
 - Machine Learning Process

Envisioning AI in the Past (2008)



AI? What is it?

- (Hopefully) You all (still) know how to program to solve a simple problem.
- What are the differences between AI and basic programming?

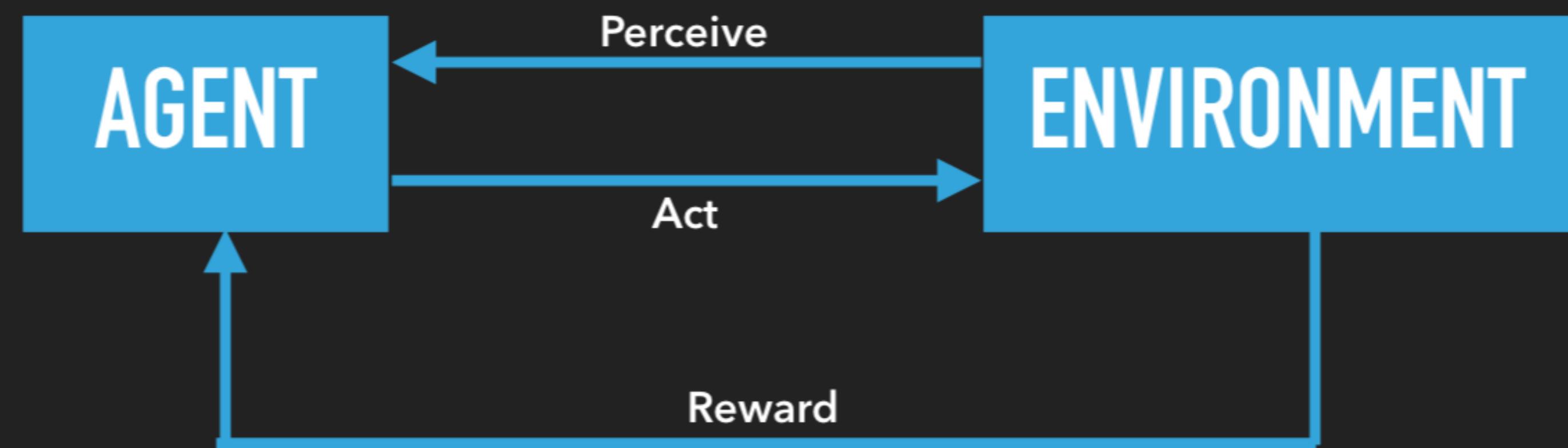
Artificial Intelligence



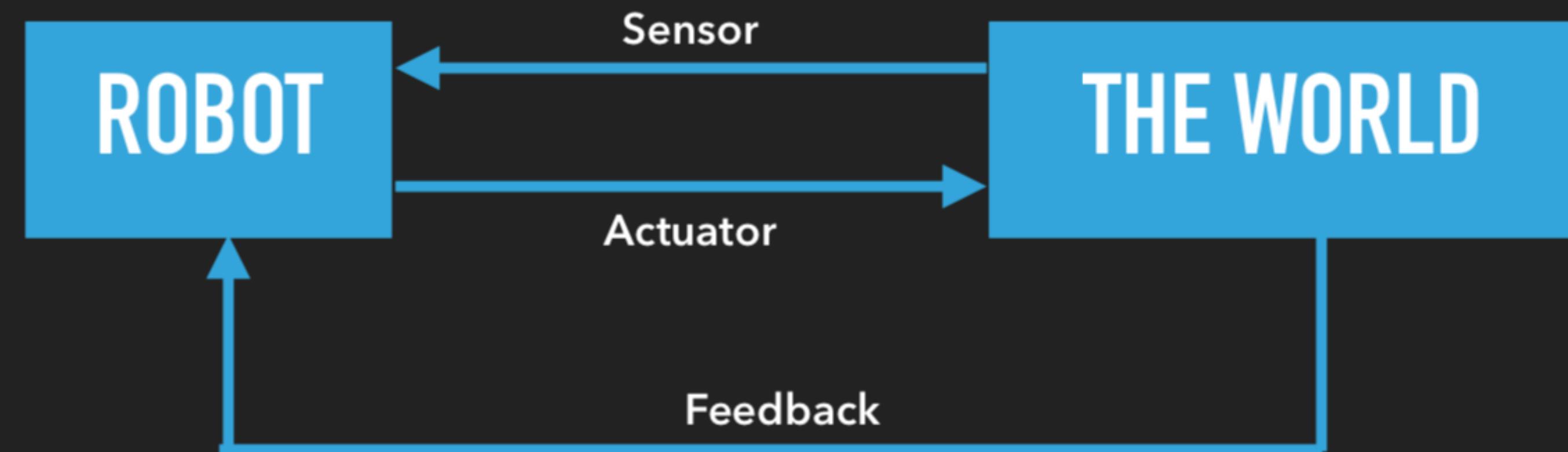
Acting Rationally

- Acting implicitly based on Logic or Reason.
- Basically, the agent takes the best action given the current state.

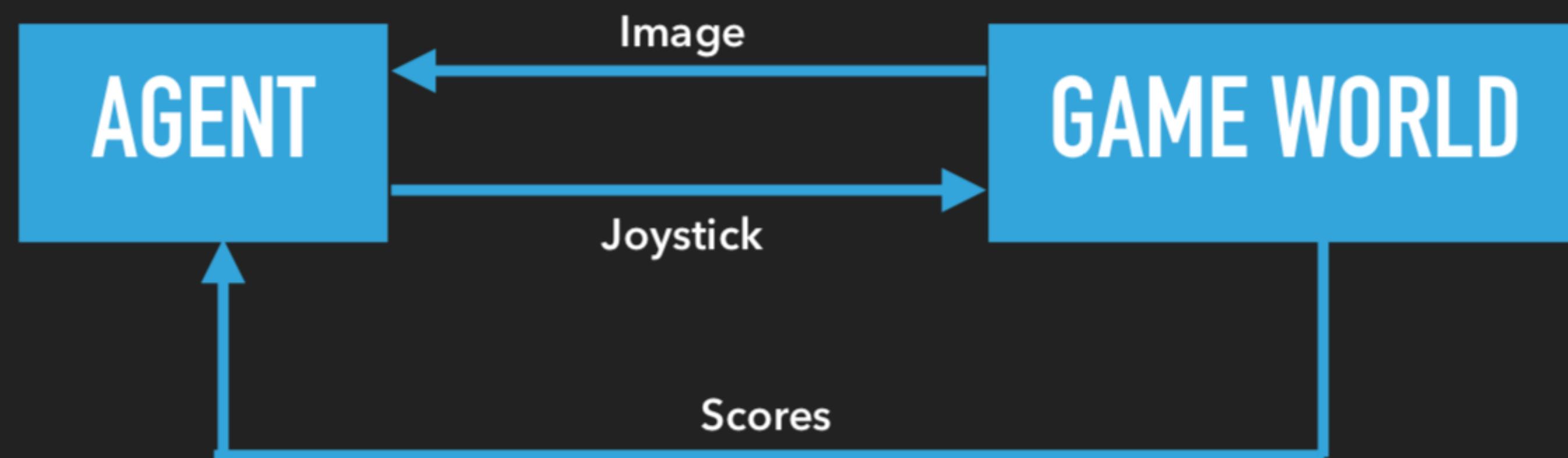
AN INTELLIGENT AGENT



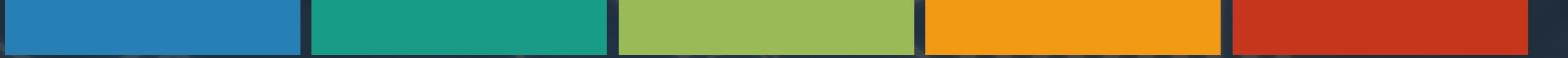
AI IN ROBOTICS



AI IN GAMES



Where are we today?

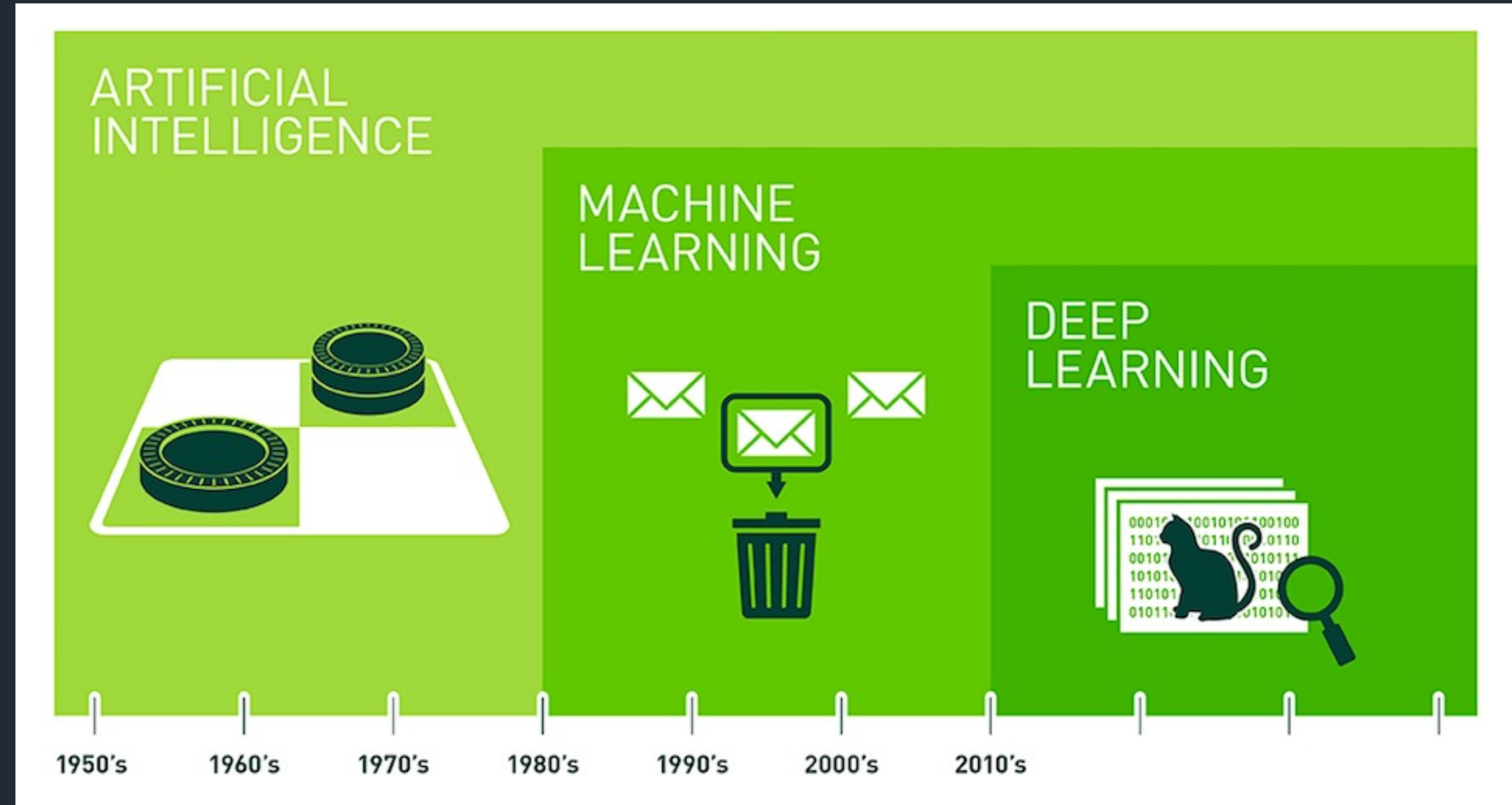
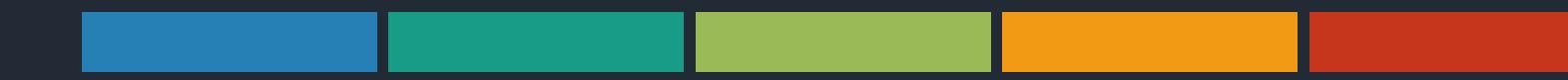


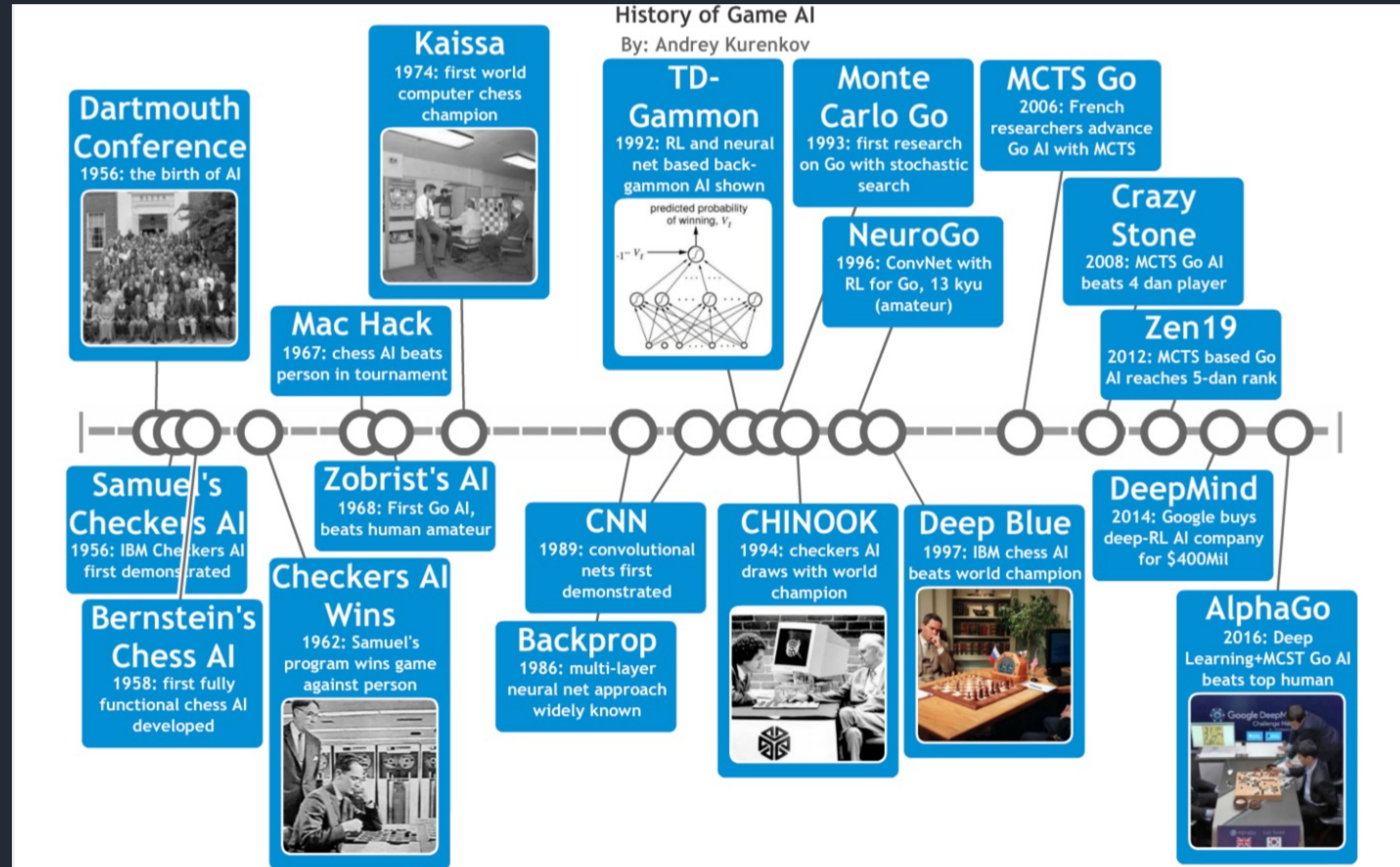
What are the real world applications of AI?

The State of the Art

Based on your experience, what are the states of the art in AI?

Deep Learning





$$e = \frac{L}{2\pi} \int \frac{\Delta \Psi}{k} = \frac{\Delta x}{2\pi} = \frac{x_2 - x_1}{2\pi}$$

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$$X_L = \frac{U_m}{I_m} = \omega L = 2\pi f$$

$$\frac{\chi_{AB}}{\Phi_E} = \frac{|E_{PA} - E_{PB}|}{\Phi} = |\varphi_A - \varphi_B| / T = \frac{4 n_1 n_2}{(n_2 + n_1)^2}$$

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$$M_\odot = \frac{4\pi^2 r^3}{3\pi T^2}$$

$$f_0 = \frac{1}{2\pi \sqrt{CL}} \quad \sigma = \frac{\Omega}{S} \quad M =$$

$$S I_m^2 = U_m^2 \left[\frac{1}{R_f} + \frac{1}{R_s} \right]$$



INTRODUCTION TO MACHINE LEARNING

Machine Learning



The Most Basic Understanding



- It's all about letting computer learns what '____' is associated to what '____'.
- Example: given a picture, computer outputs what object appears in the picture (human, car, tree?).
- Example: given inputs from sensors and cameras, the robotic algorithm pushes out the appropriate movement.

EXAMPLES OF MACHINE LEARNING APPLICATIONS

SPAM CLASSIFICATION



- Email (text) as the input -> Go into classification model -> Output the answer whether this is spam or not.
- Big email platforms can identify spams with 99% accuracy.

Chrome File Edit View History Bookmarks People Window Help LINE WD QQ + 100% Wed 12:07 PM

machine learning - Google Search

Secure | https://www.google.co.th/search?q=machine+learning&oq=machine+learning&aqs=chrome..69i57j69i60l2j69i61j0j... ☆ New

Google machine learning

All Images News Videos Books More Settings Tools

About 18,000,000 results (0.69 seconds)

Machine Learning | Coursera

<https://www.coursera.org/learn/machine-learning> ▾

About this course: Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome.

Machine learning - Wikipedia

https://en.wikipedia.org/wiki/Machine_learning ▾

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. Arthur Samuel, an American pioneer in the field of computer gaming and artificial intelligence, coined the term "Machine Learning" in 1959 while at IBM.

Top stories



Workday buys SkipFlag
to bolster machine



Are Artificial Intelligence
And Machine Learning



Unstructured content:
An untapped fuel



Machine learning

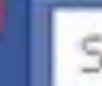
Field of study

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. [Wikipedia](#)

Feedback

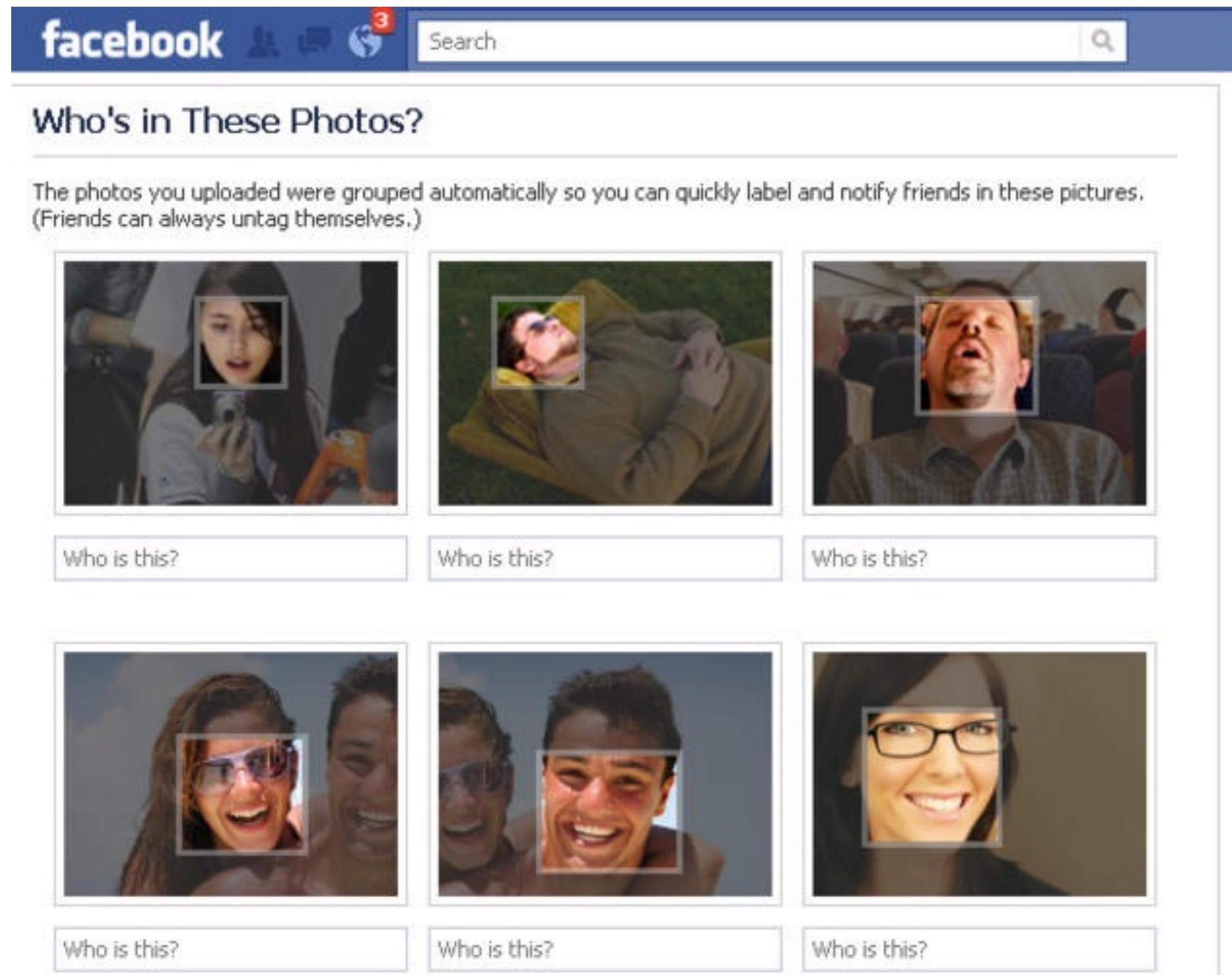
GOOGLE SEARCH ENGINE

FACEBOOK FACE TAGGING

facebook    3 Search Home

Who's in These Photos?

The photos you uploaded were grouped automatically so you can quickly label and notify friends in these pictures.
(Friends can always untag themselves.)

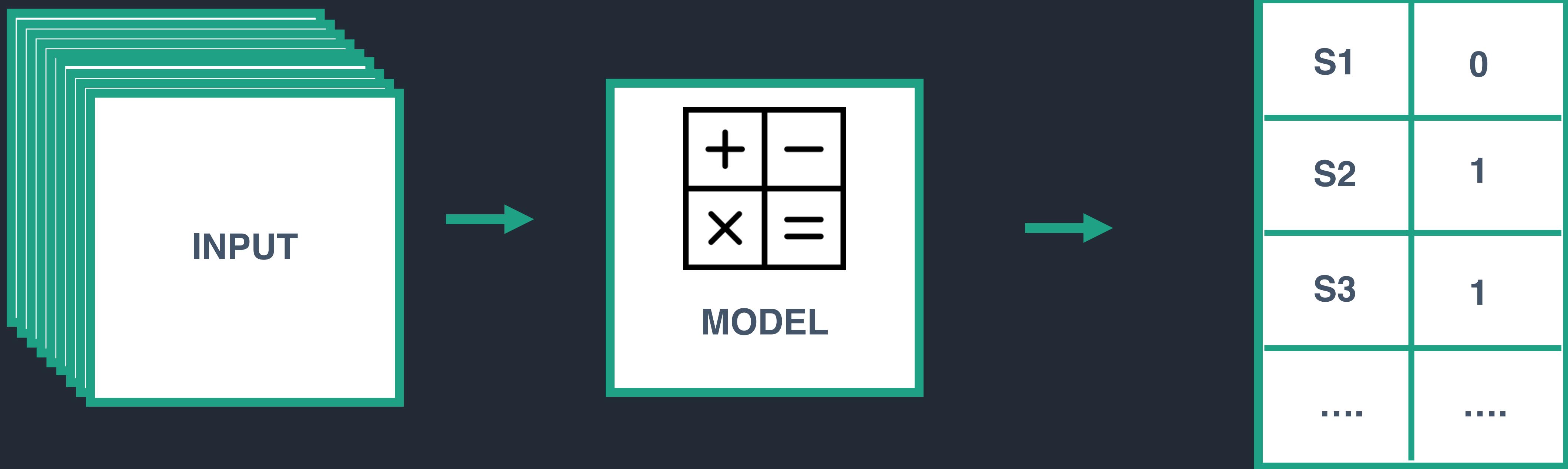


Who is this? Who is this? Who is this?

Who is this? Who is this? Who is this?

- People provide Facebook the images and tags of names in the photos.
- Over time Facebook learned to associate names with faces and can automatically recognize these people.

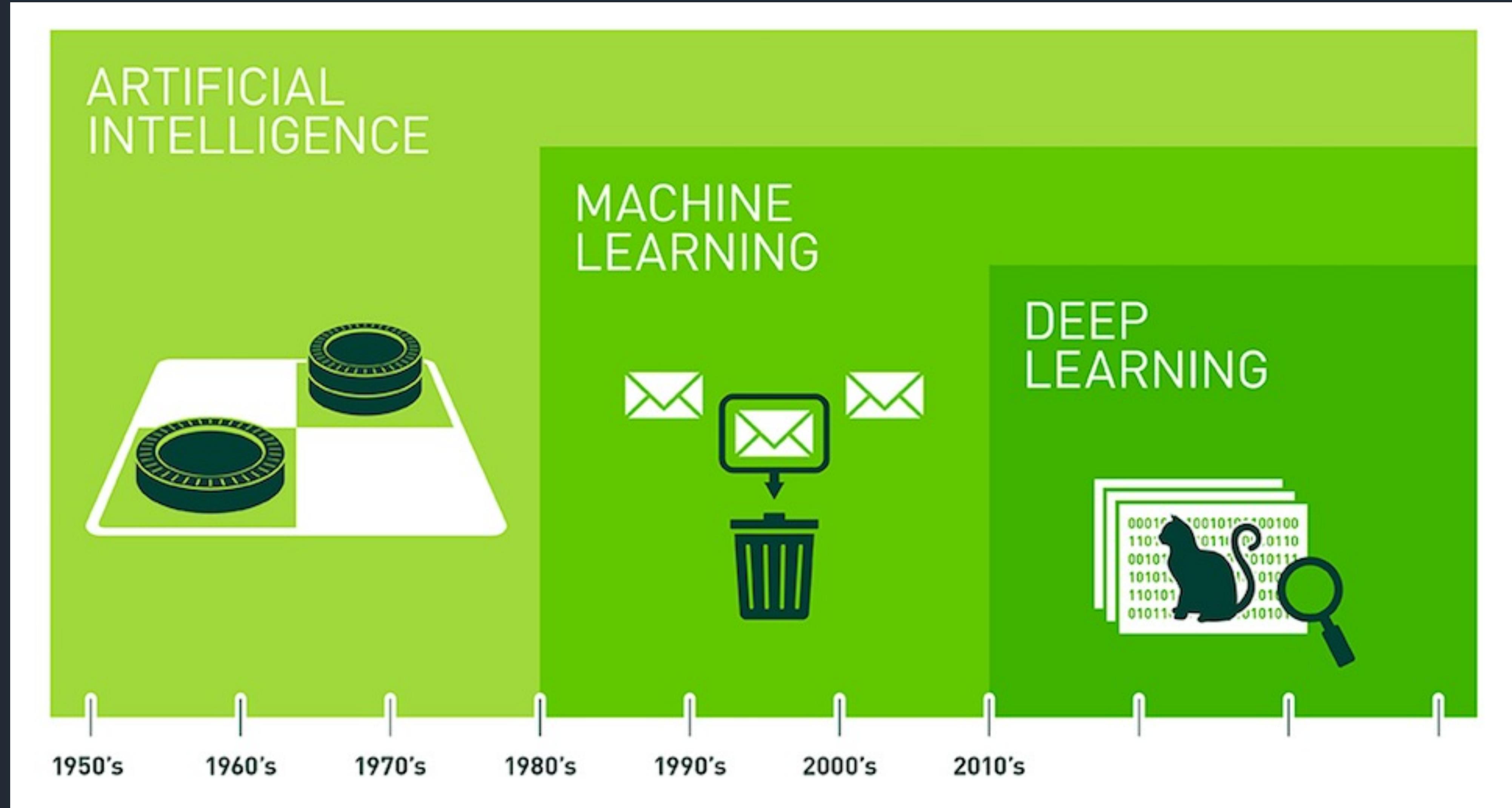
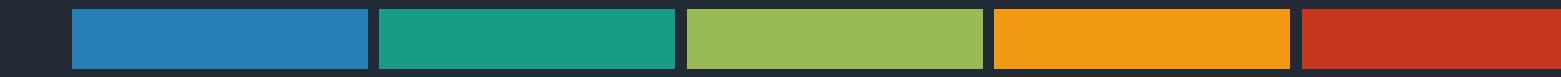
INPUT - MODEL - OUTPUT



Another View of Machine Learning



AI vs ML vs DL



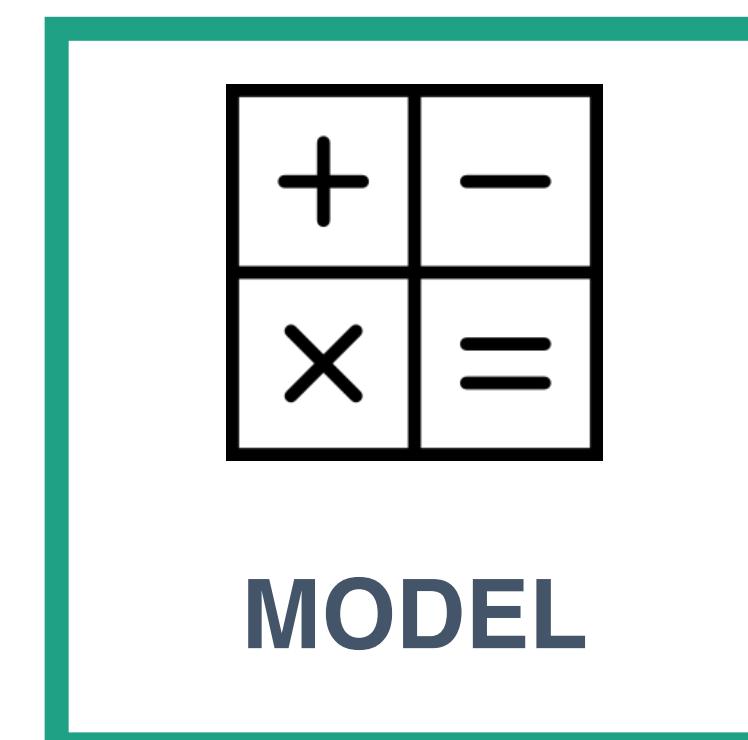


CLASSIFICATION AND REGRESSION

REGRESSION PROBLEM



- Property size
- Property age
- Bedrooms
- Bathrooms
- Parking size

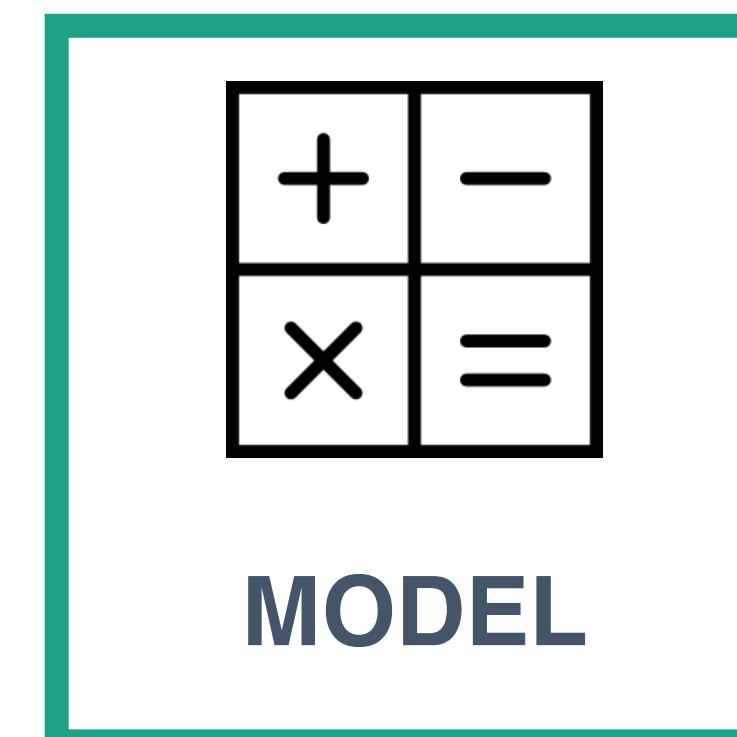


How much should
we sell the property?
(the answers range
from 0 to 1B)

CLASSIFICATION PROBLEM



- Property size
- Property age
- Bedrooms
- Bathrooms
- Parking size



Tell me, what type of property is this?
(residential or commercial)

Regression & Classification



- **Regression Problem**
 - The answers models come up with are continuous numbers.
- **Classification Problem**
 - The answers models come up with are discrete categories.
 - Note that you can apply both approaches to the same dataset!

Regression or Classification?



- Predict if a Titanic passenger would survive or not?



Regression or Classification?



- Predict the house price?
- Predict the letter grade of a student?
- Predict GPA of a student?
- Predict the next president of the United States of America?
- Predict the year that AI will take over the world?

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$$= \frac{1}{\mu_0} (\vec{E} \times \vec{B})$$

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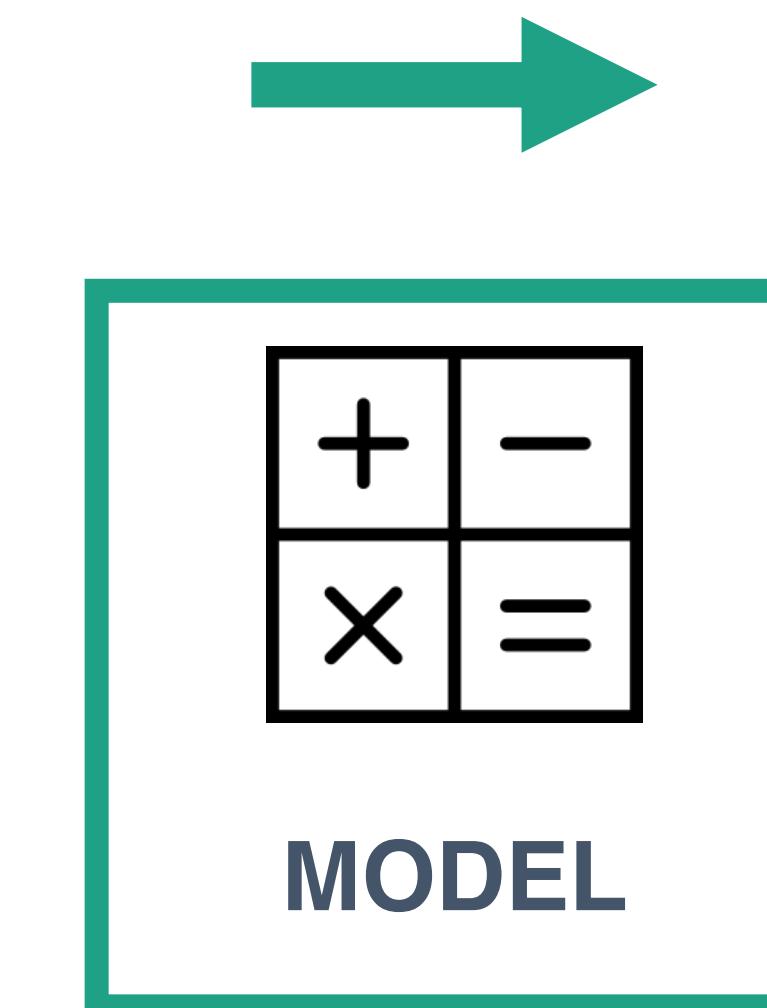


SUPERVISED AND UNSUPERVISED LEARNING

SUPERVISED LEARNING



- Property size
- Property age
- Bedrooms
- Bathrooms
- Parking size



REGRESSION

How much should we sell the property?
(the answers range from 0 to 1B)

CLASSIFICATION

Tell me, what type of property is this?
(residential or commercial)

SUPERVISED LEARNING

- We collect a lot of data points from the past,
e.g. Collecting property qualities, property prices,
and property types.
- We use the past data to fit the model
e.g. Teaching it to understand what quality map
with what prices and what types.
- When the model encounters new samples where
the answers are not available, it will use knowledge
from past data to provide answers.



SUPERVISED LEARNING

Classification



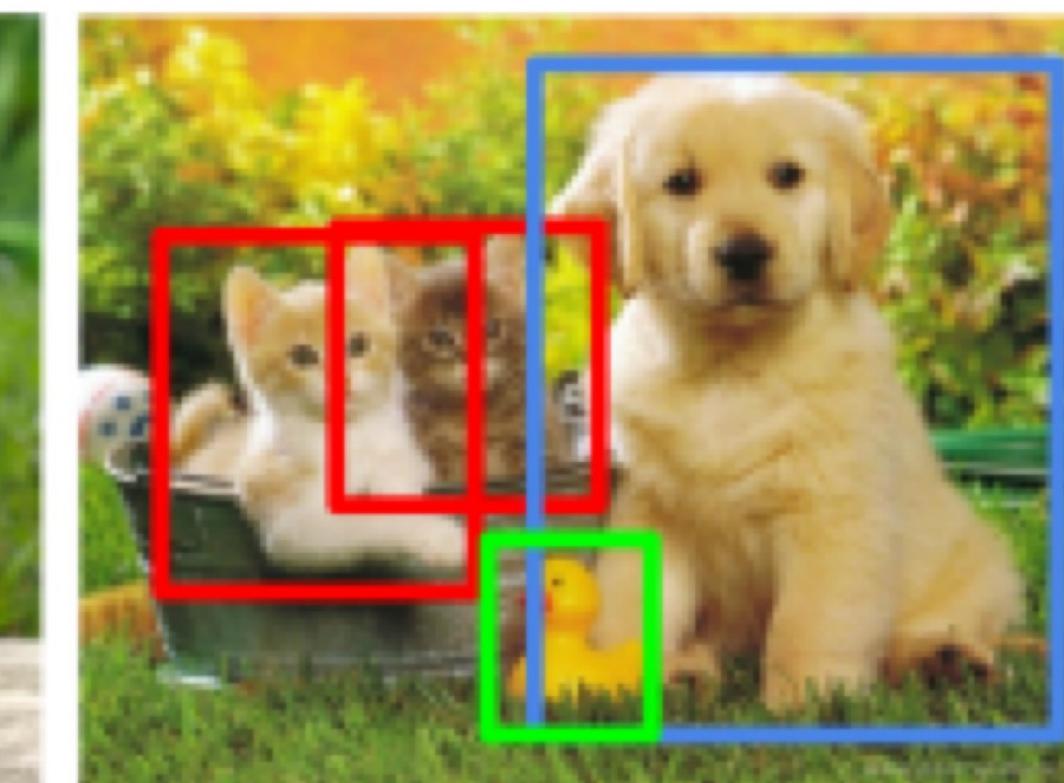
CAT

Classification + Localization



CAT

Object Detection



CAT, DOG, DUCK

Instance Segmentation



CAT, DOG, DUCK

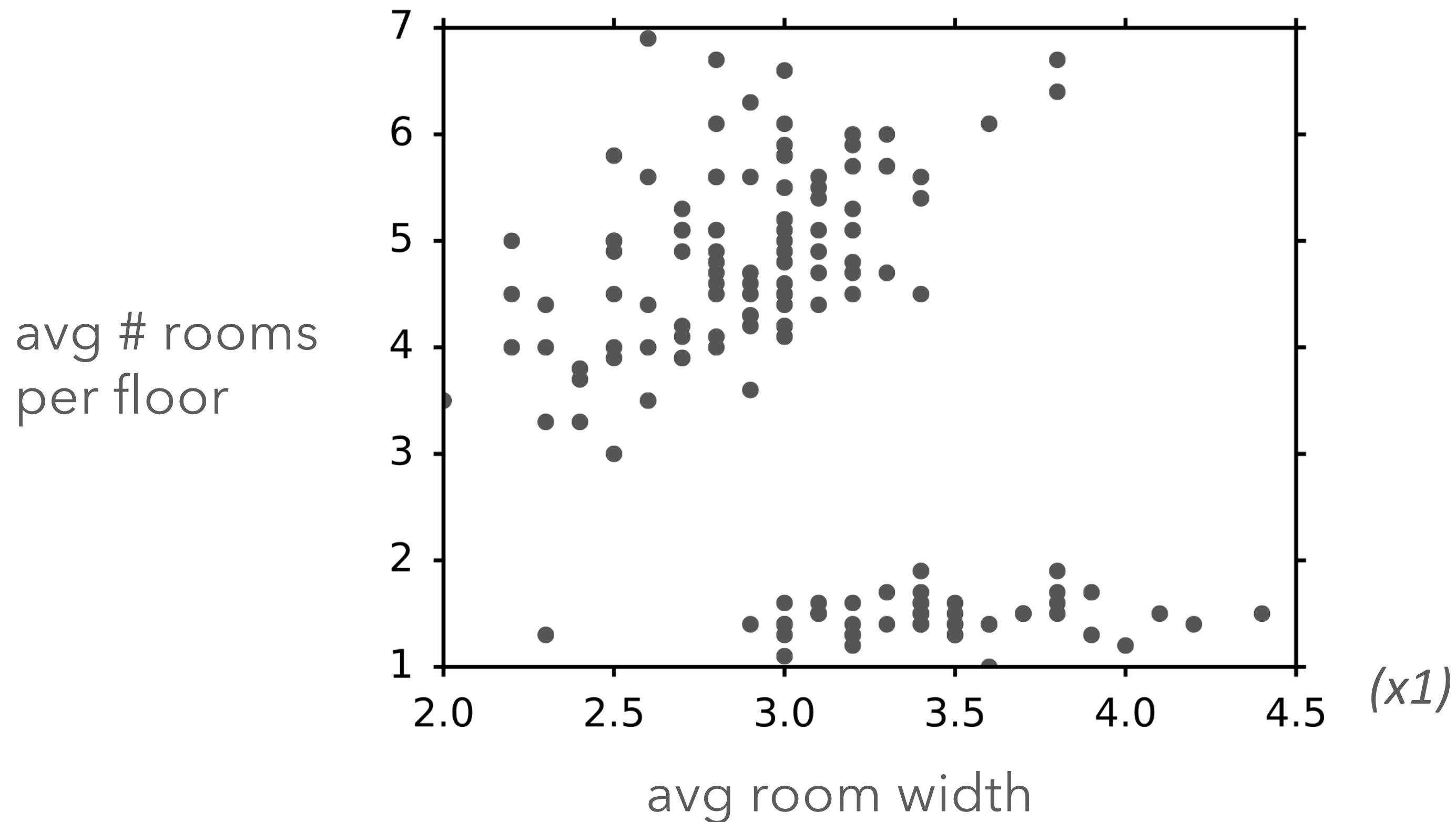
Single object

Multiple objects

SUPERVISED LEARNING

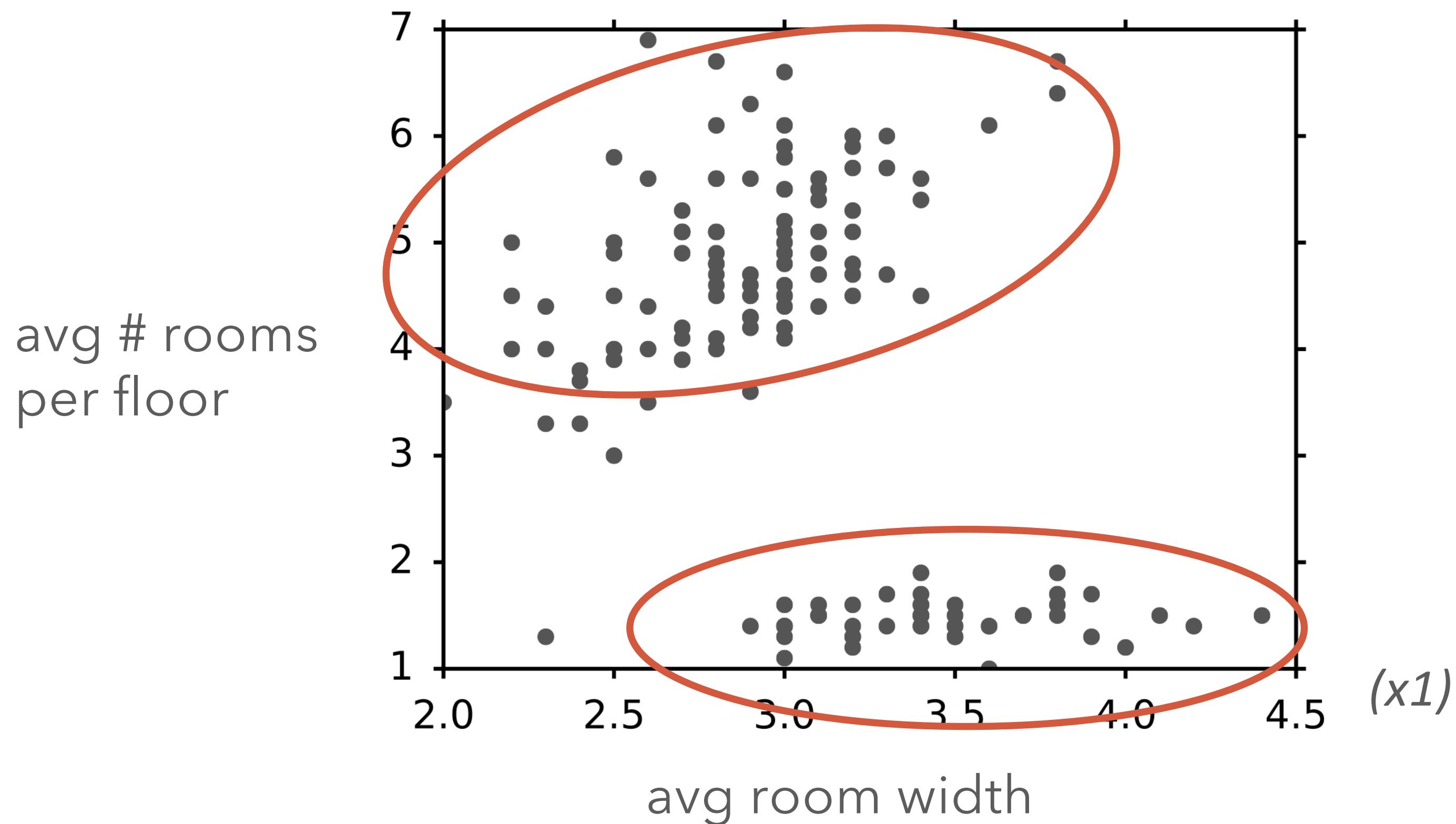
- Requires a lot of manually-labeled data.
- Requires business people to help decide “what to predict” (sometimes it’s hard to know what is the most useful thing to predict).
- Requires business people to identify and gather “appropriate inputs”.
- If done right, they are the most simple and reliable techniques to use.
They are the core of most AI systems we see today.

UNSUPERVISED LEARNING



- What if you want to predict property categories, but don't know the answers in advance?
- You have to infer categories from the structure of the data.
- You are going to use unsupervised learning in this case.

UNSUPERVISED LEARNING



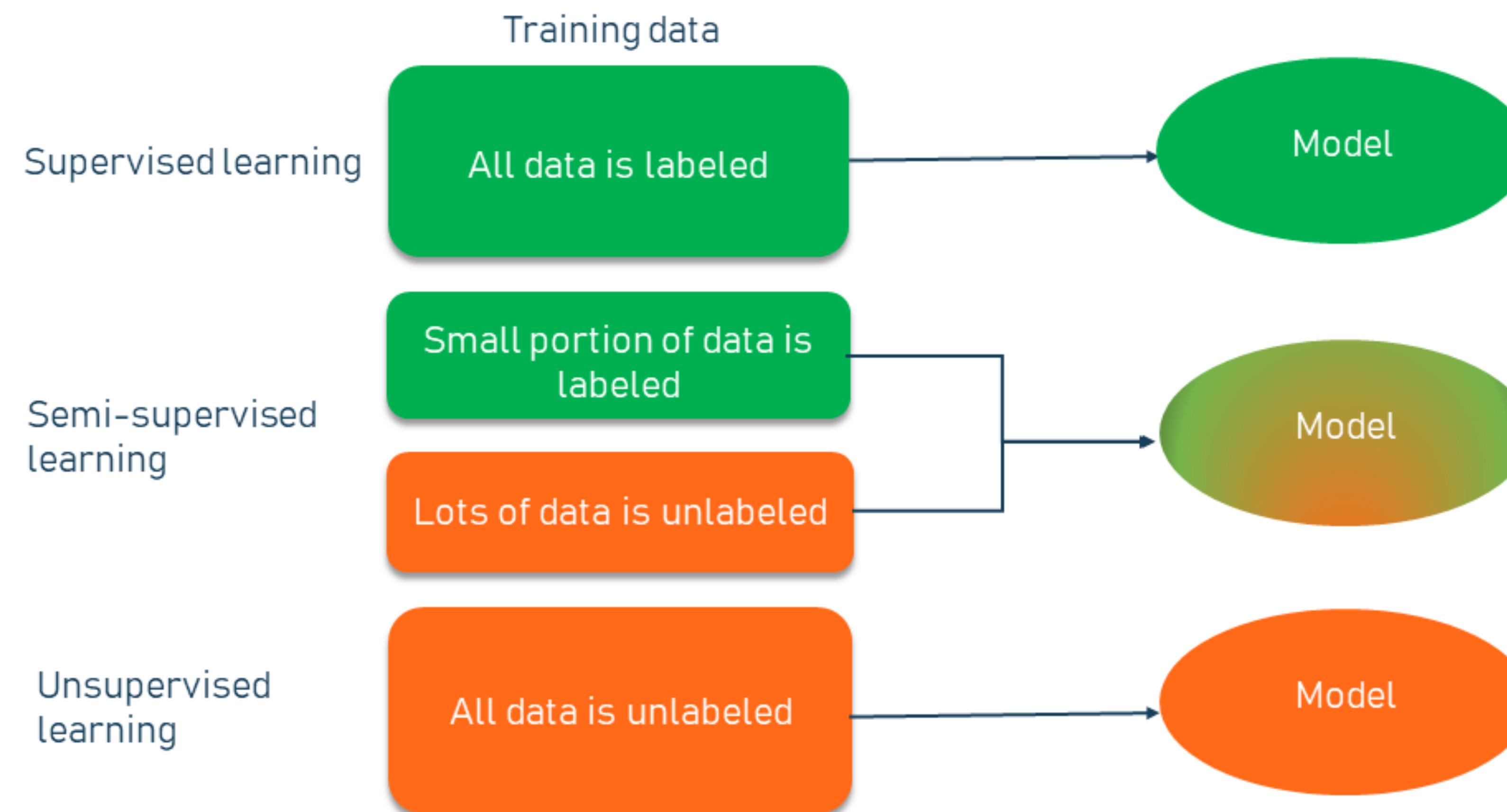
- What if you want to predict property categories, but don't know the answers in advance?
- You have to infer categories from the structure of the data.
- You are going to use unsupervised learning in this case.

supervised v.s. unsupervised learning



- **Supervised learning**
 - The answers are included in the training data, note that answers can be numerical or categorical.
- **Unsupervised learning**
 - You would like to discover the categories, you usually don't even know how many categories or what categories are there.
 - Note that you can apply both approaches to the same dataset!

SUPERVISED LEARNING vs SEMI-SUPERVISED LEARNING vs UNSUPERVISED LEARNING

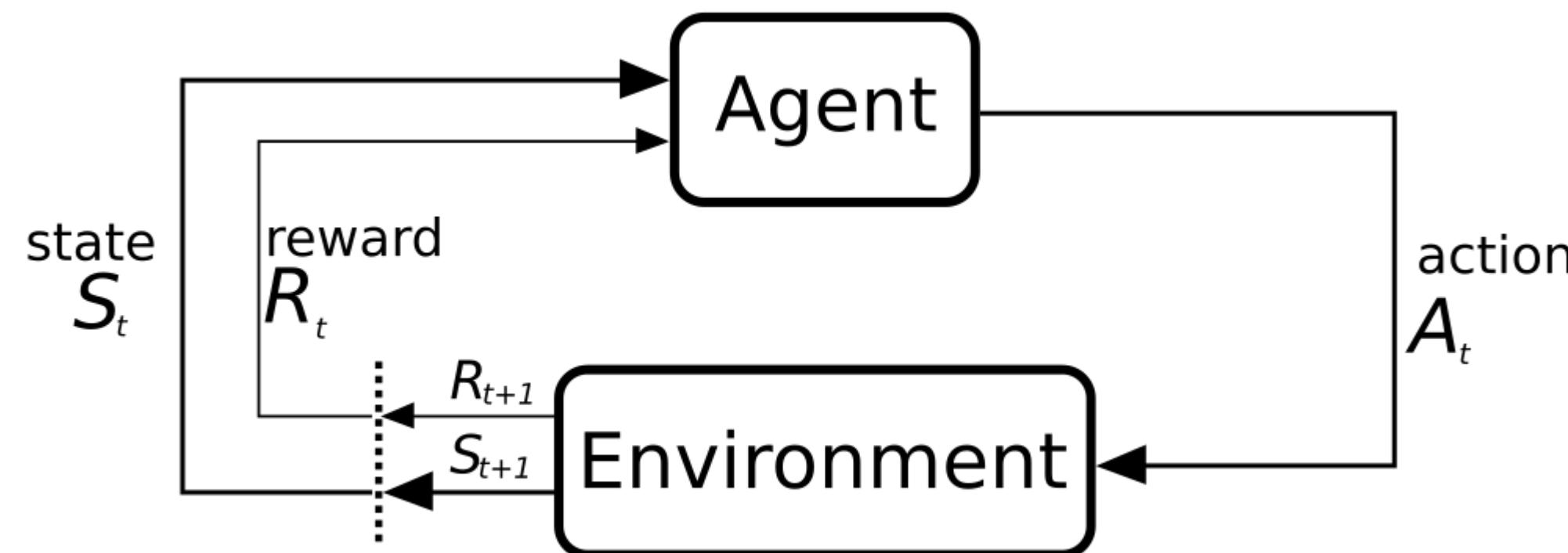


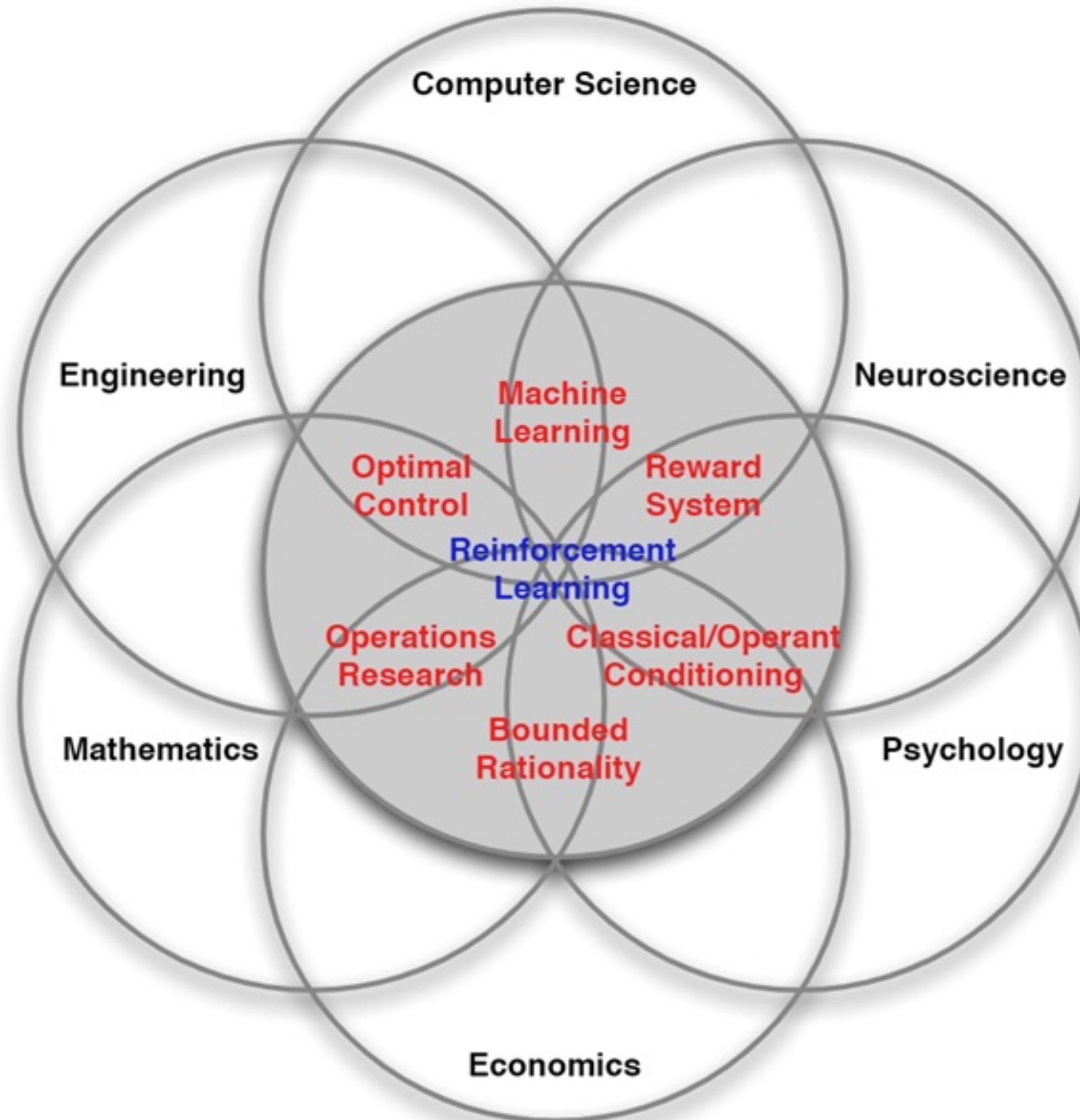


REINFORCEMENT LEARNING

REINFORCEMENT LEARNING

- Environment defines a set of states, actions, and rewards. Models is trained to understand what actions to take, at what states, to optimize rewards.
- Example: given stock prices (states) and let bots decide each day to buy, sell, or hold a particular stock (actions), bots will make decisions to optimize rewards (profit).





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$$= \frac{1}{\mu_0} (\vec{E} \times \vec{B})$$

$$E_k = \frac{\hbar^2}{8mL^2} \quad r = \frac{1}{r}$$

$$E = \frac{\hbar k^2}{2m} \quad 1 \text{ pc} = \frac{1 \text{ AU}}{r}$$

$$g_f = \frac{1}{2\pi \sqrt{CL}} \quad S = \frac{\Omega}{I_m^2} \quad M =$$



ML PROCESS

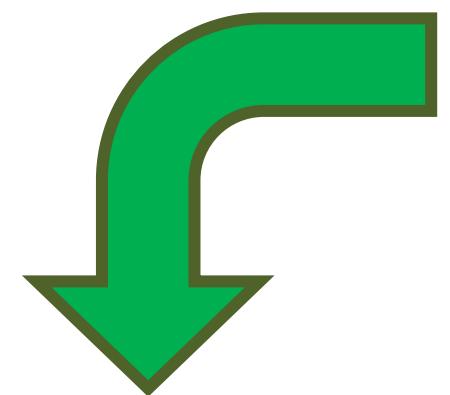
ML Cycle

Gathering Data

Data Acquisition

- Pre-existing dataset
- Survey
- Internet

ML Cycle



Gathering Data

Data Preprocessing

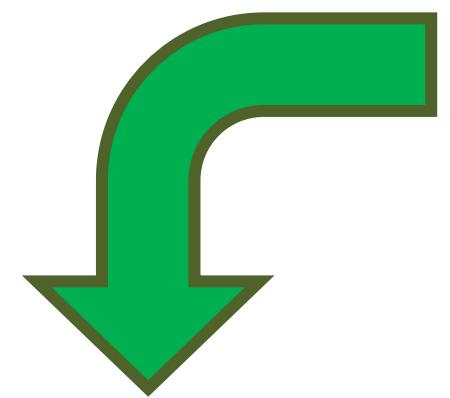
Prepare the data for the model to learn

- Usually, the data is 'dirty'. We need to 'clean' it.
- Missing data, bad distribution, skew data

Feature Engineering

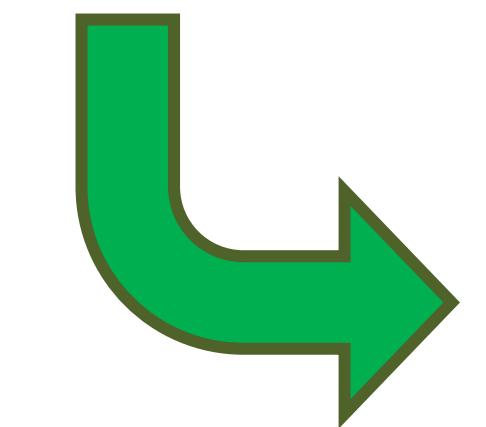
- The gathered data may not be in the form that we want
- We need to transform some features of the dataset

ML Cycle



Gathering Data

Data Preprocessing



Model Building

Build and Train the model
Tune the model

ML Cycle

