

Machine Learning with Python

MTH786U/P 2020/21

Introduction

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WHAT IS MACHINE LEARNING?

What is machine learning?



What is machine learning?

In a nutshell:

ML is about building data-driven models that can make predictions or decisions without being explicitly programmed to do so



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In a nutshell:

ML is about building data-driven models that can make predictions or decisions without being explicitly programmed to do so

Is it the same as artificial intelligence?



What is machine learning?

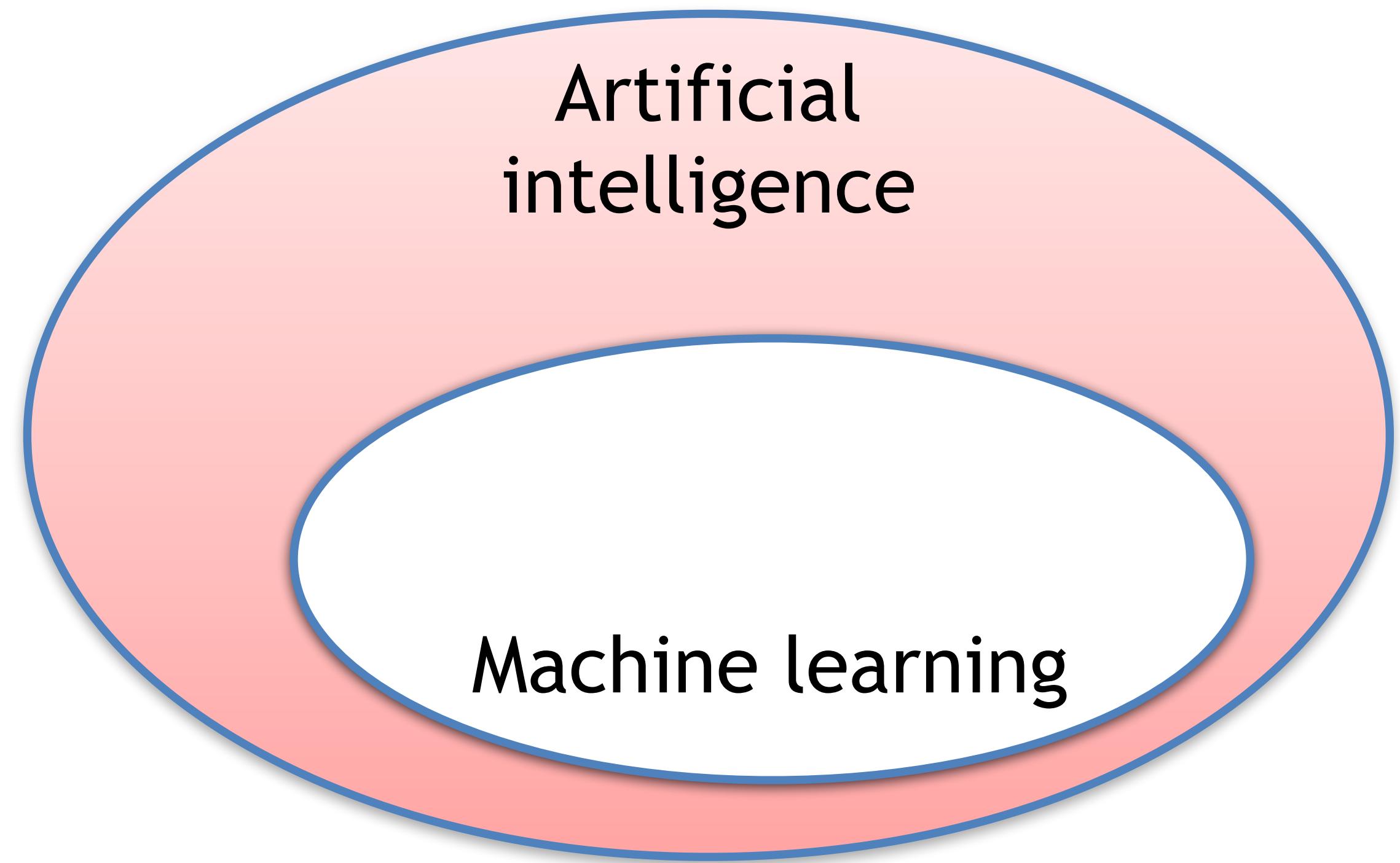
Machine learning \neq artificial intelligence...



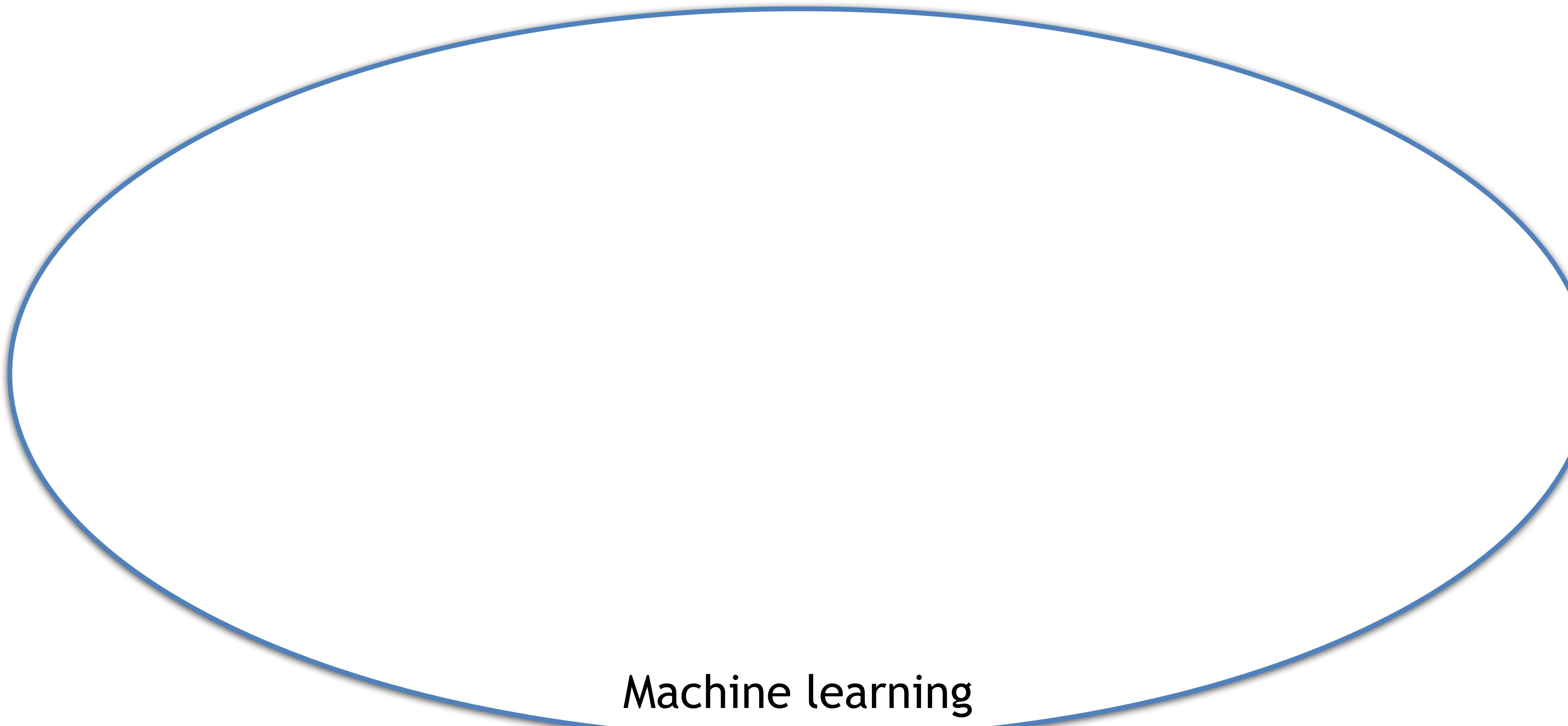
What is machine learning?

Machine learning \neq artificial intelligence...

...but machine learning \subsetneq artificial intelligence

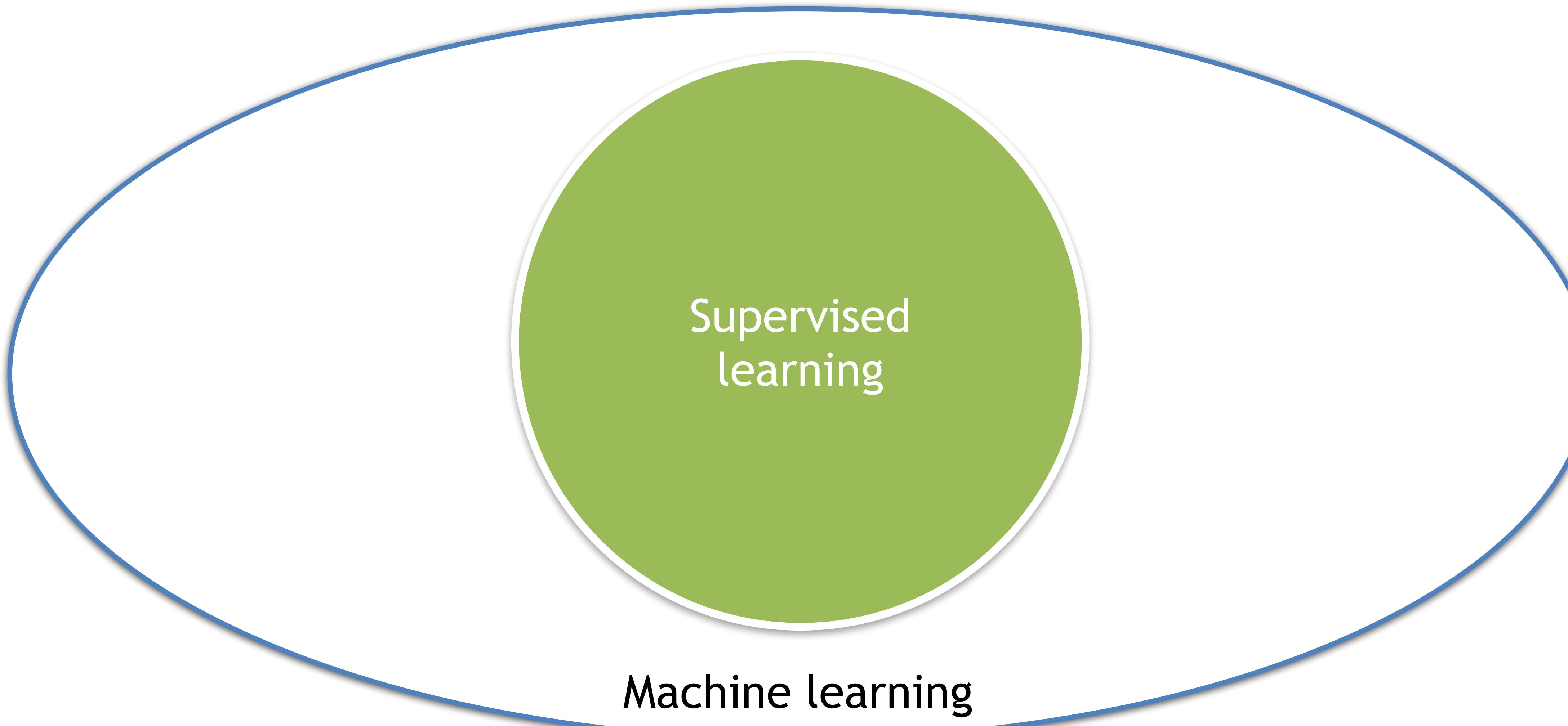


What is machine learning?



Machine learning

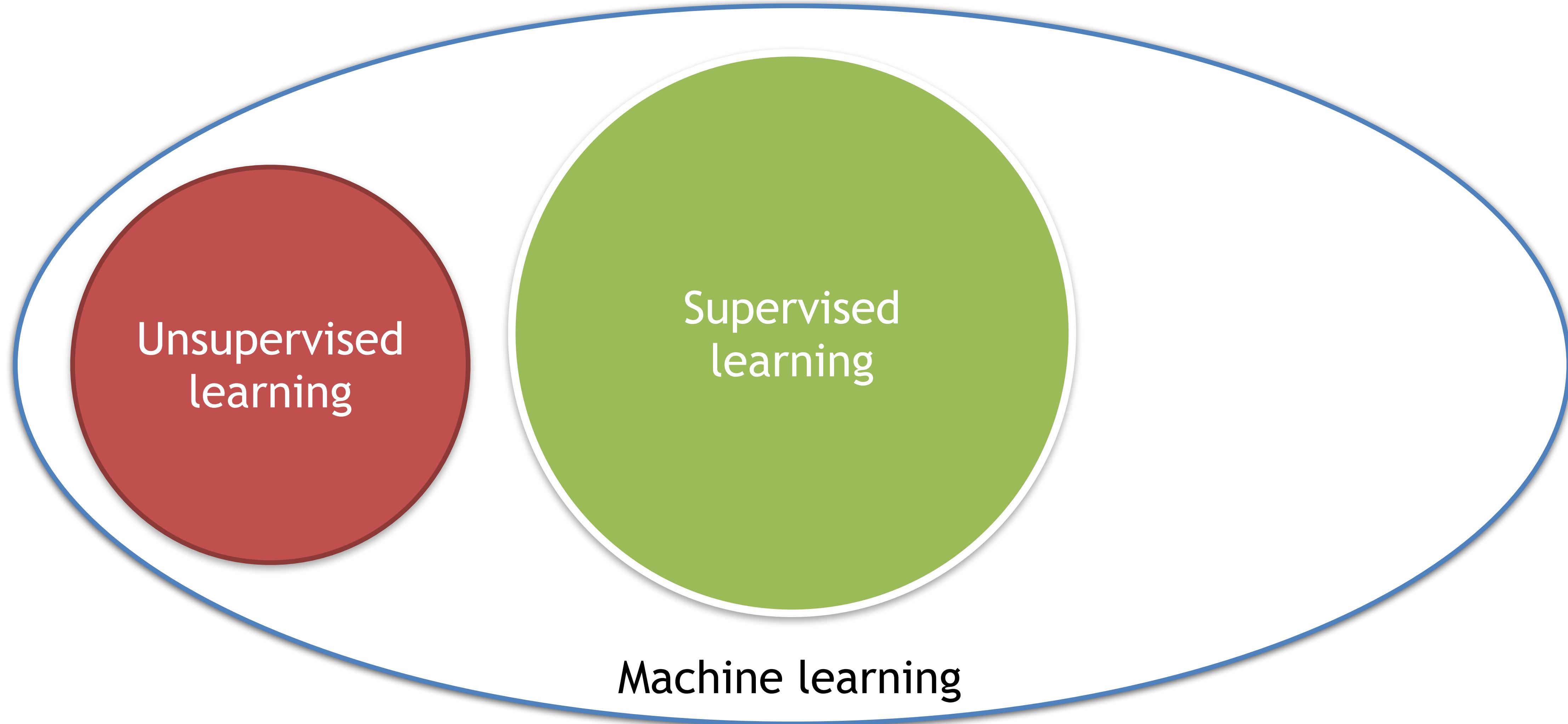
What is machine learning?



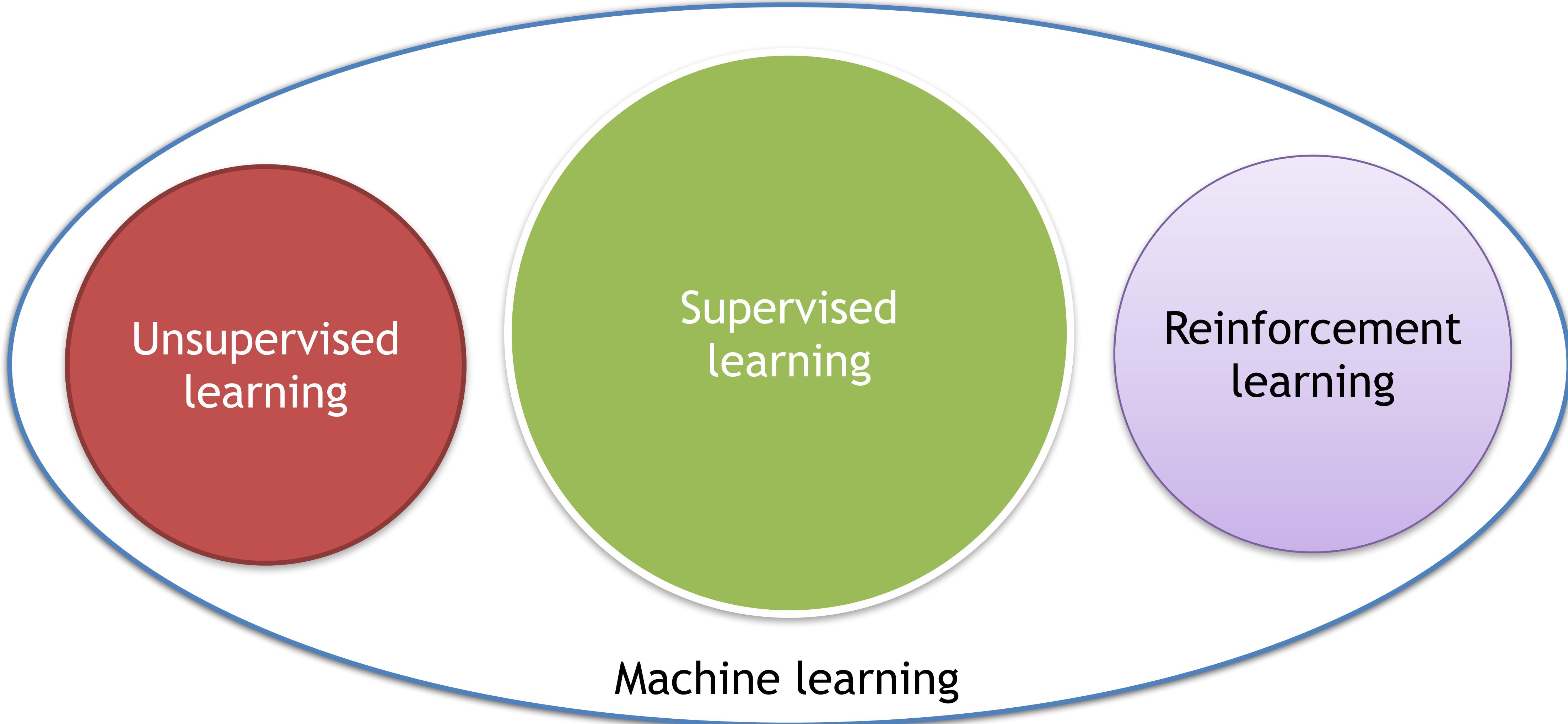
Supervised
learning

Machine learning

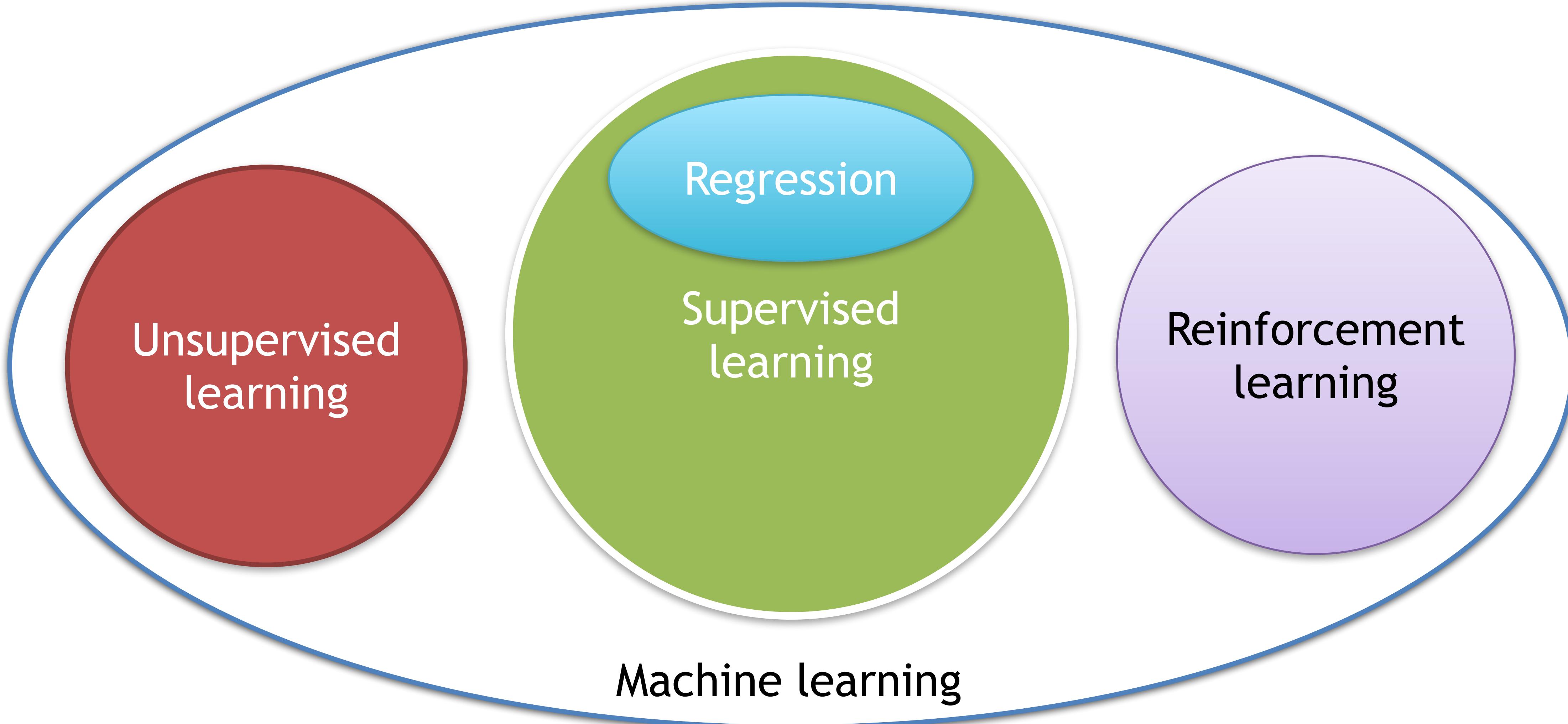
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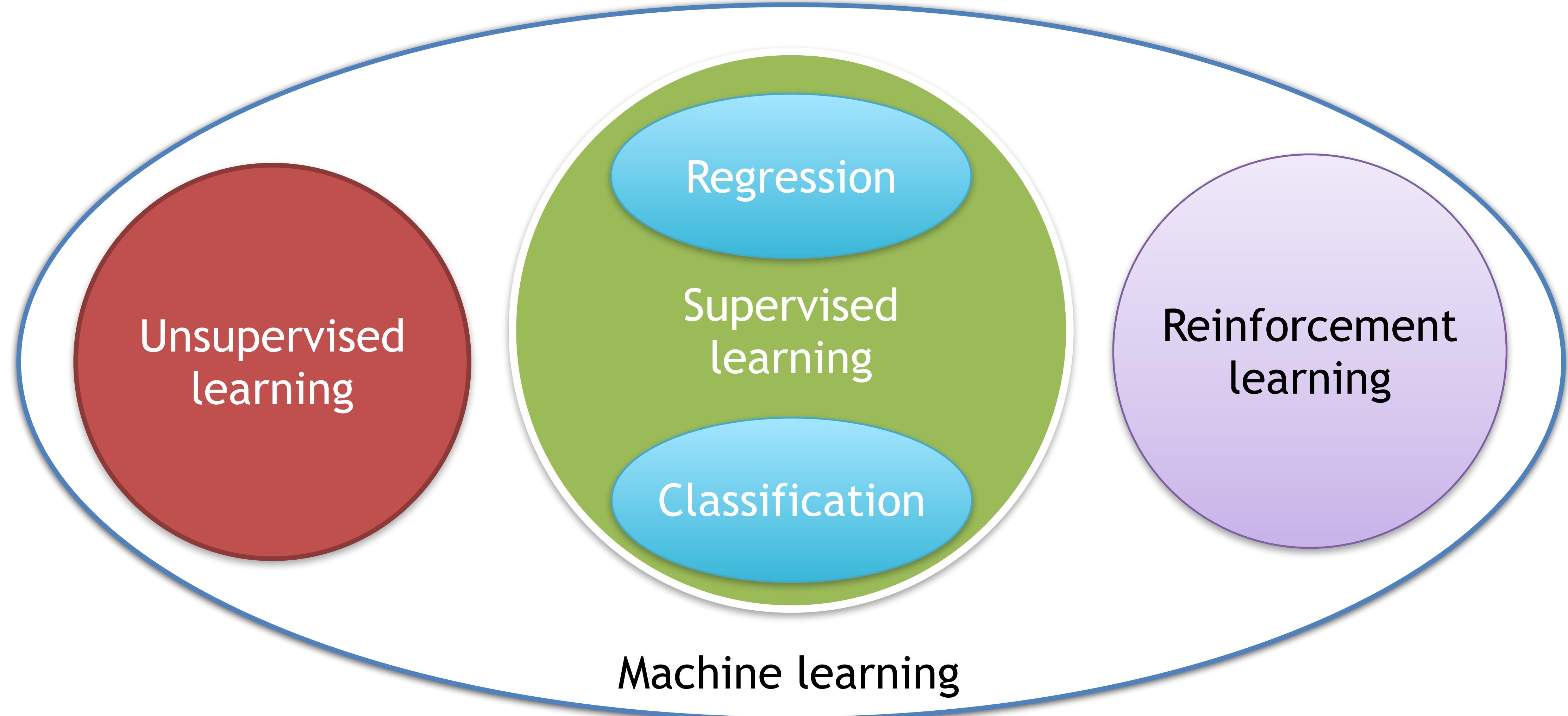
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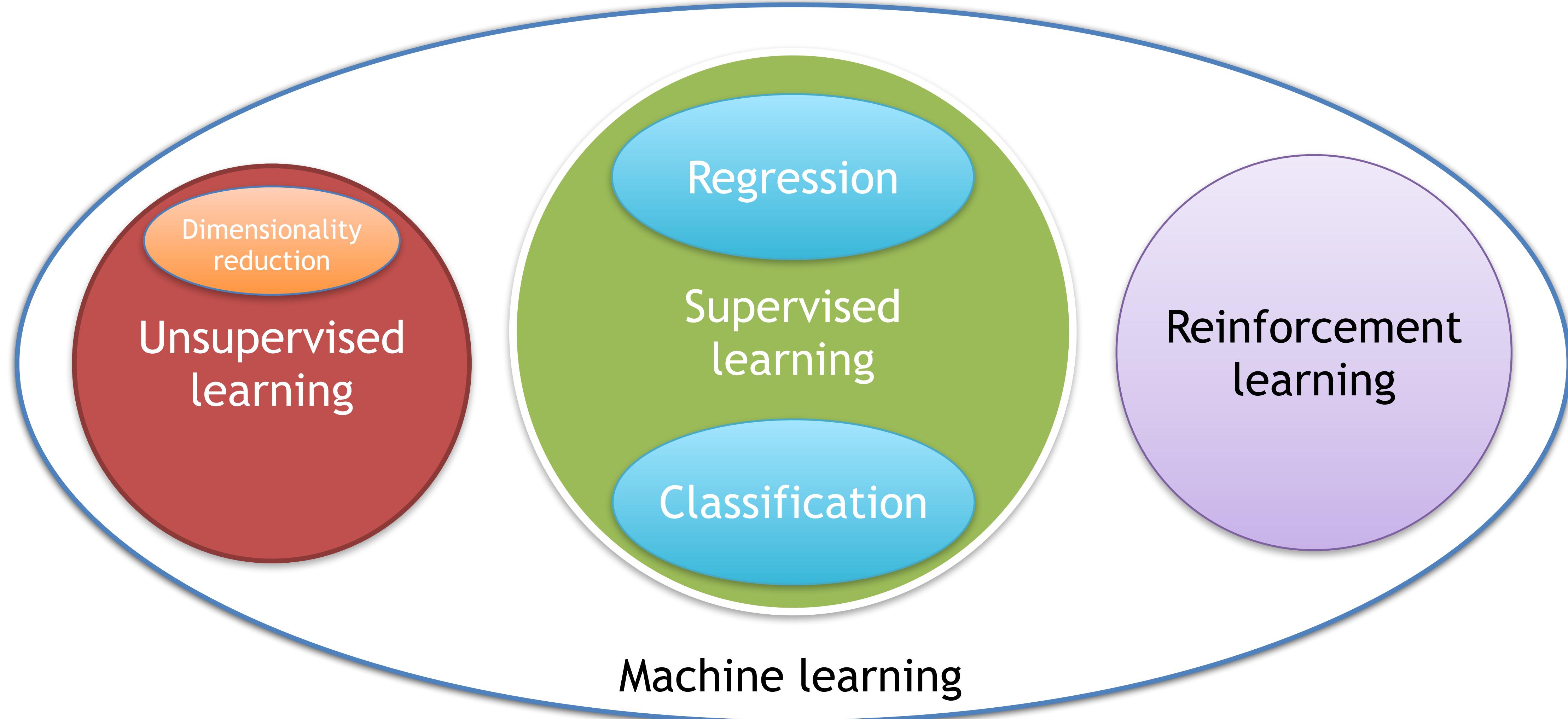
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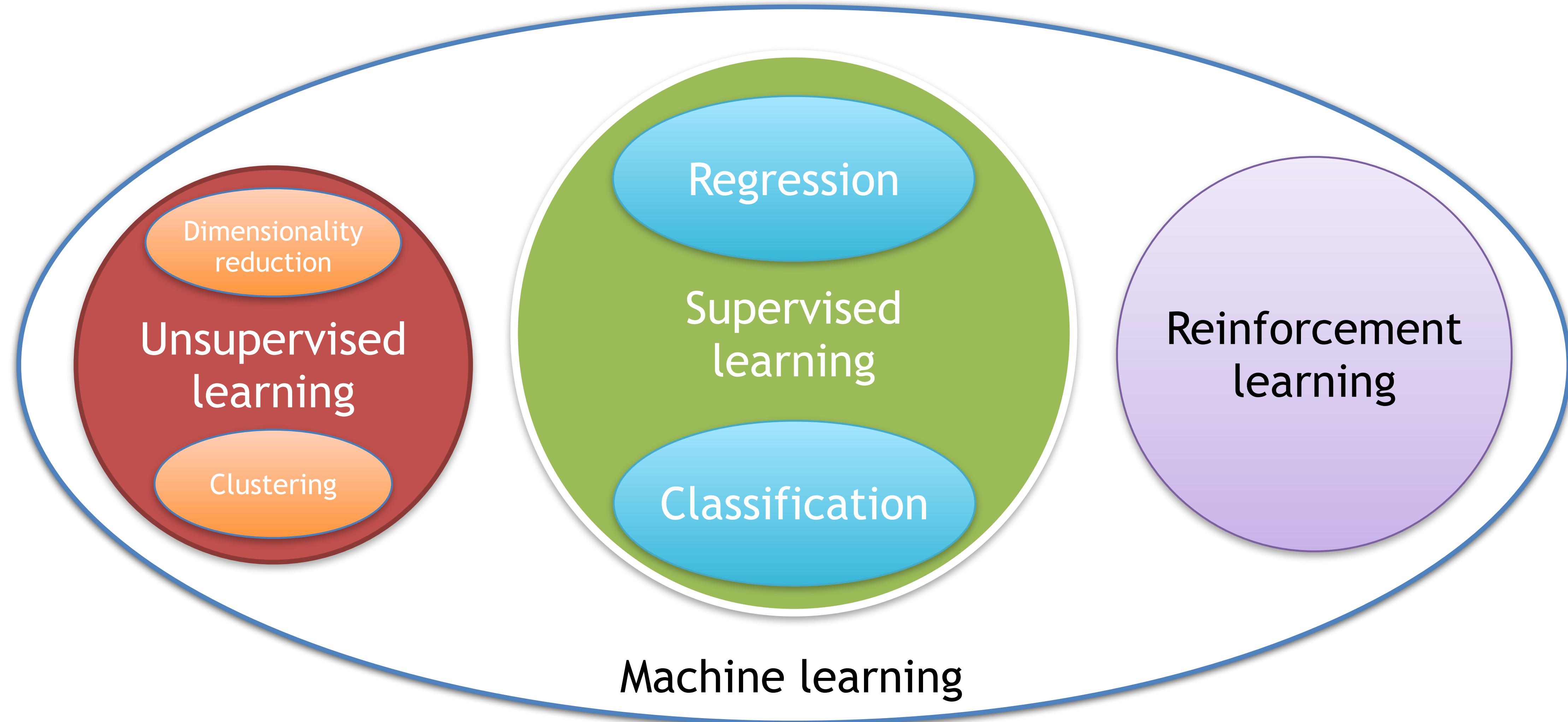
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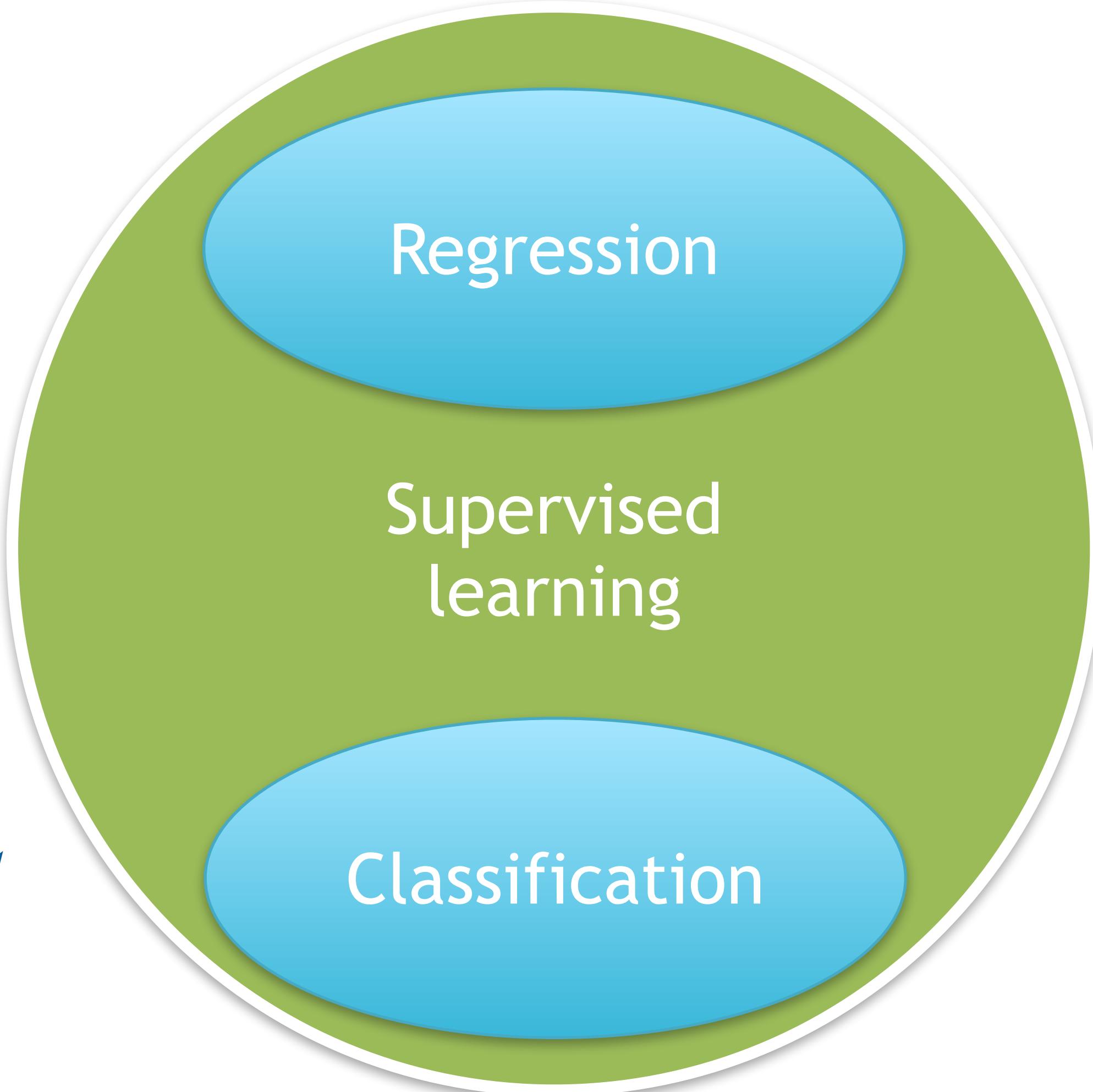
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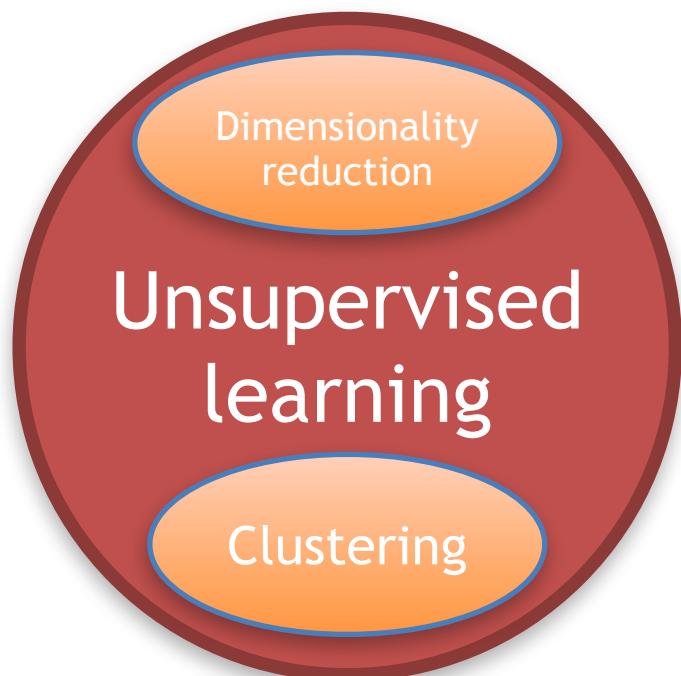
What is machine learning?



What is machine learning?



In this module, we solely focus on supervised machine learning &



will be covered in MTH793P

What is supervised machine learning?

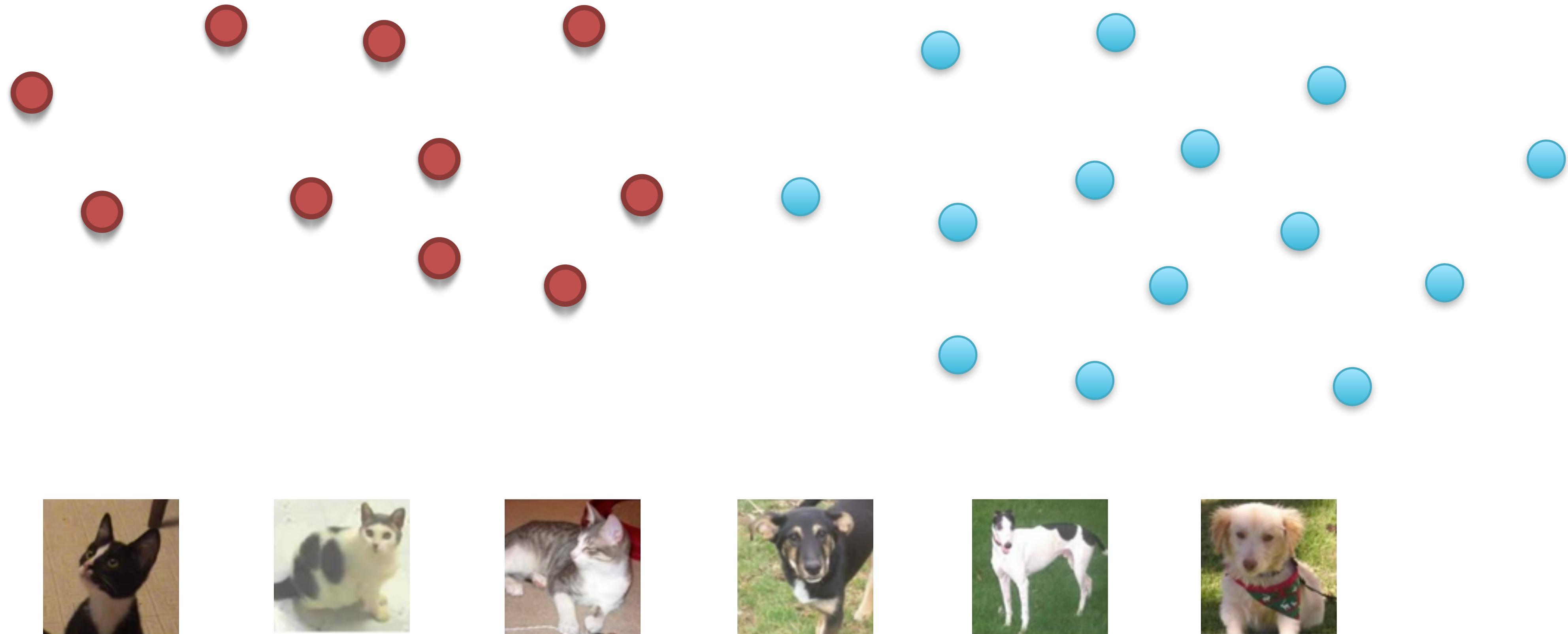
Classification

Example:

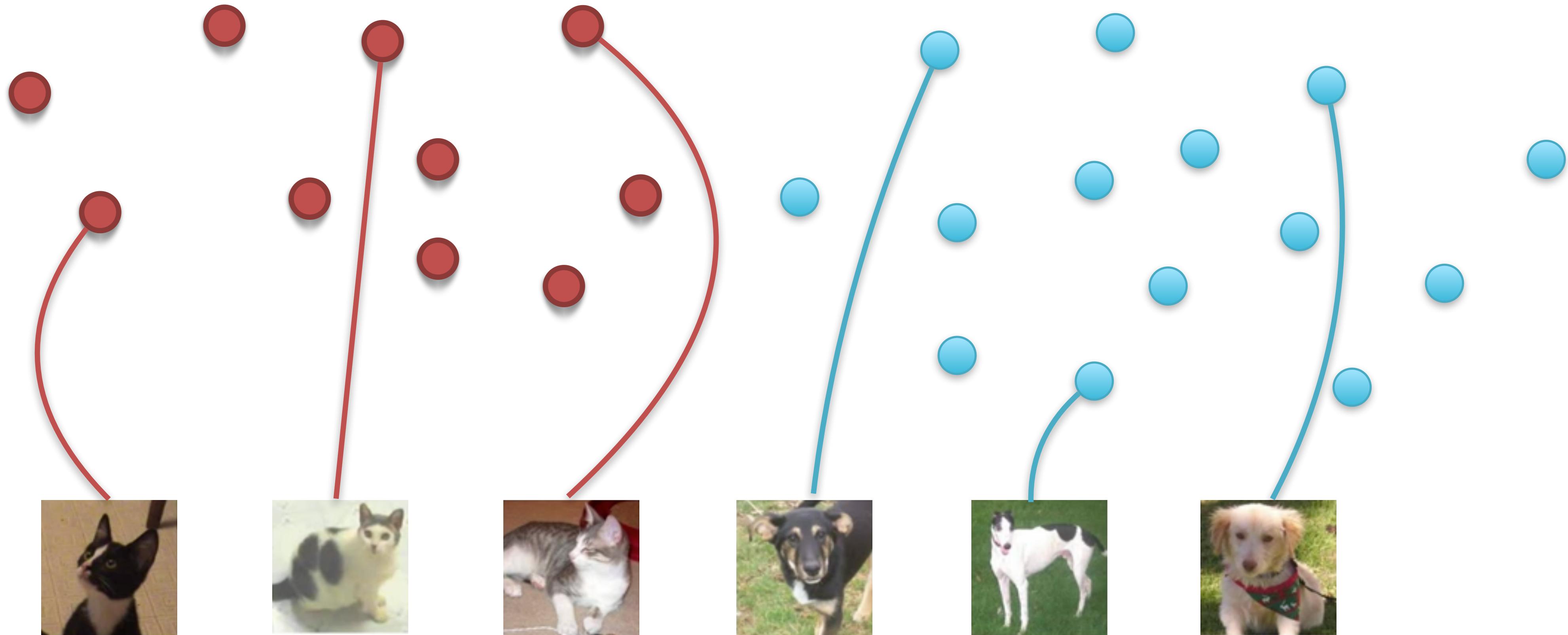


© Steve Dale Pet World

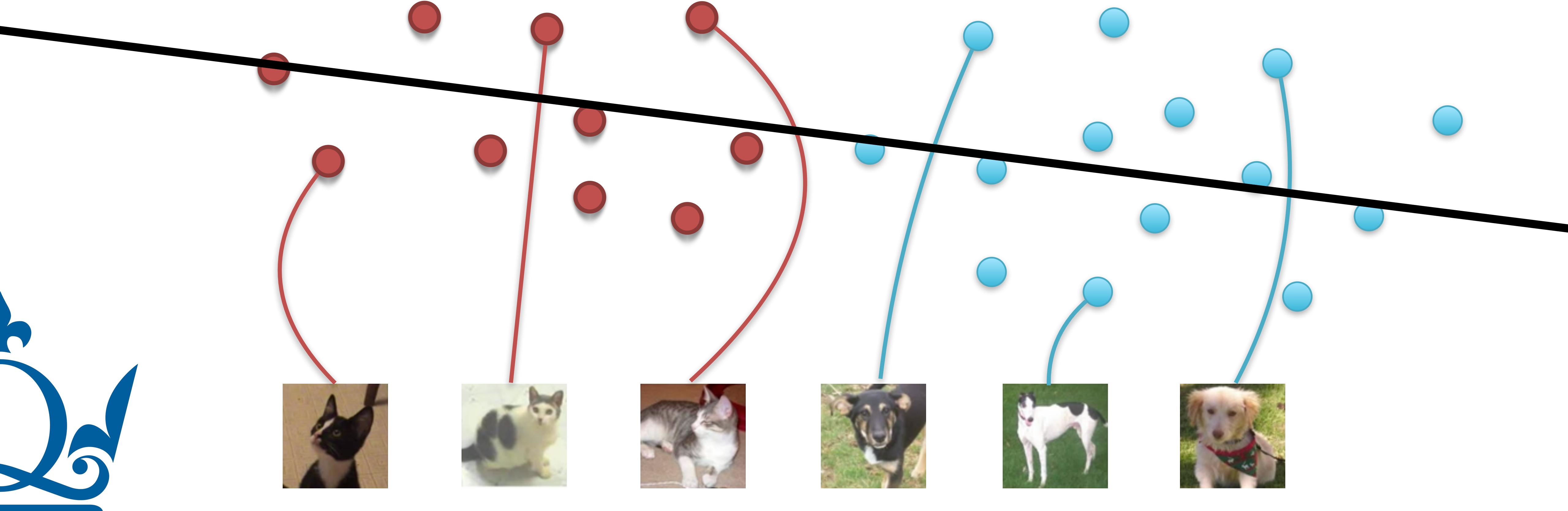
What is supervised machine learning?



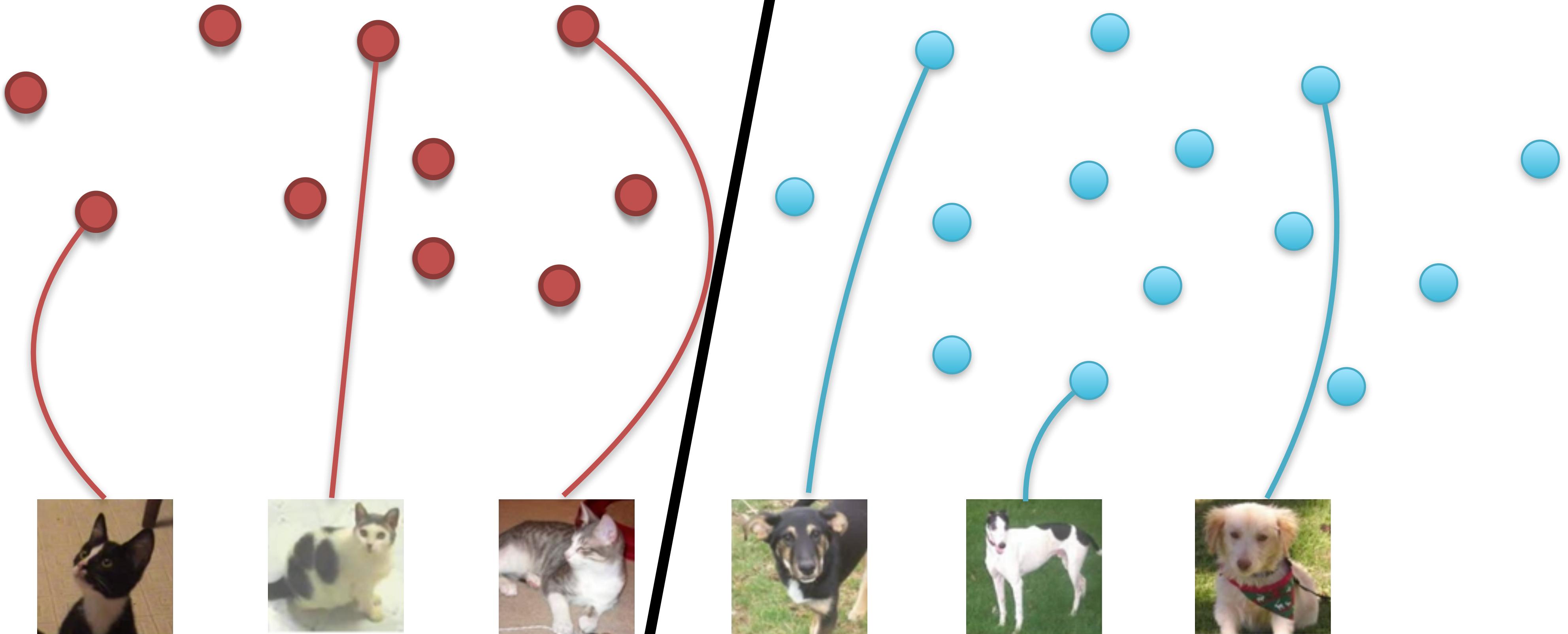
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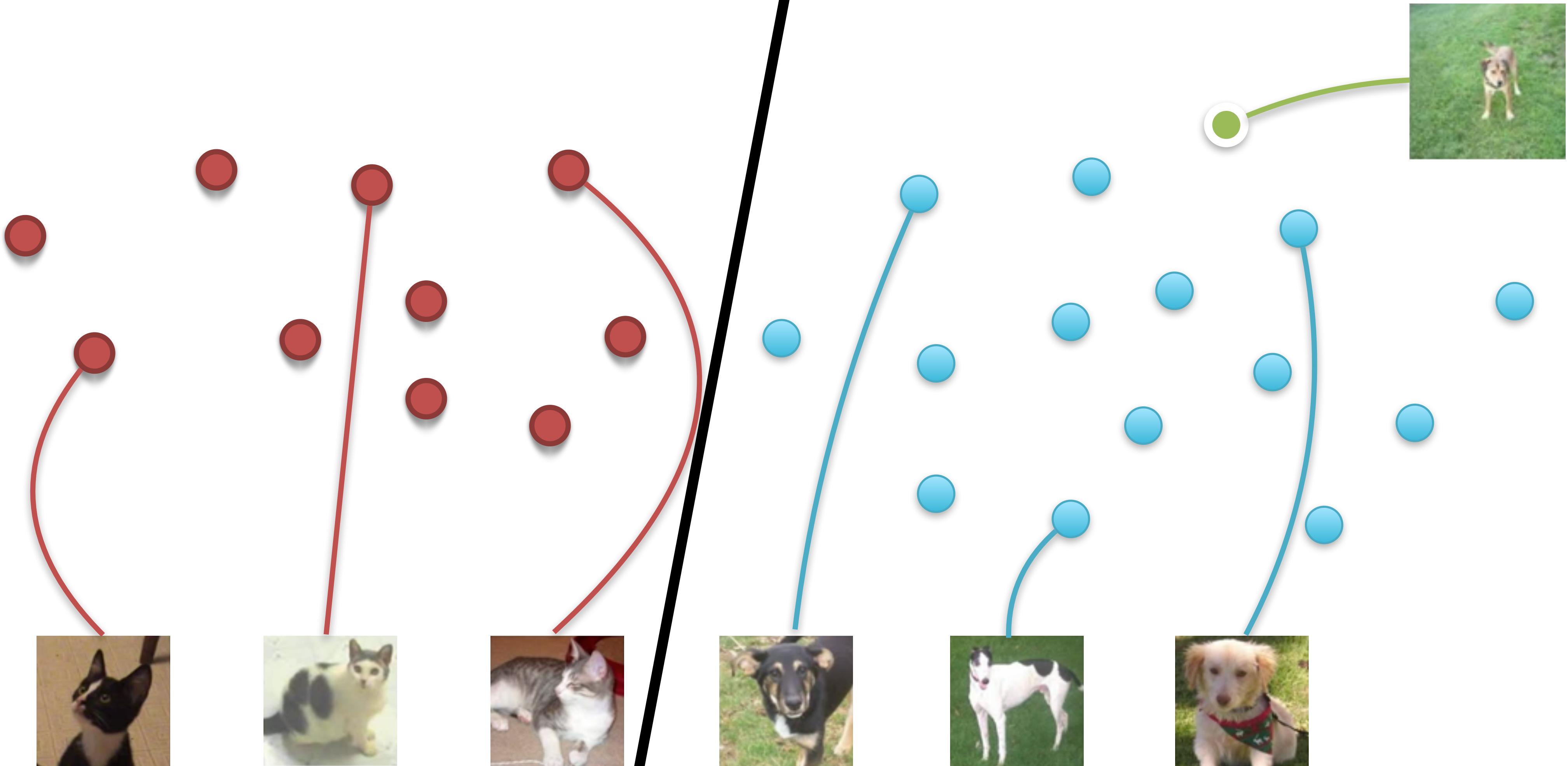
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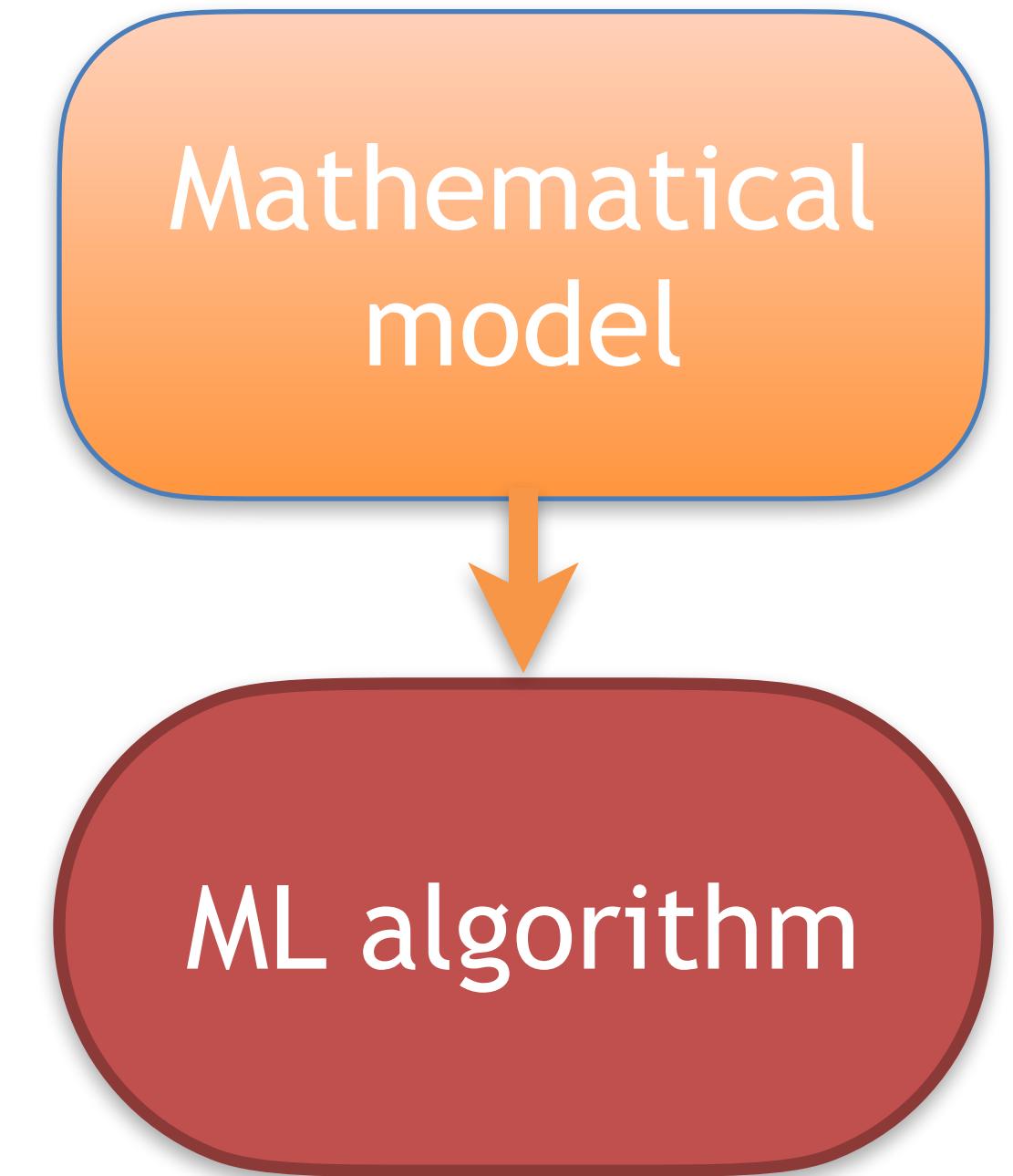


What is supervised machine learning?

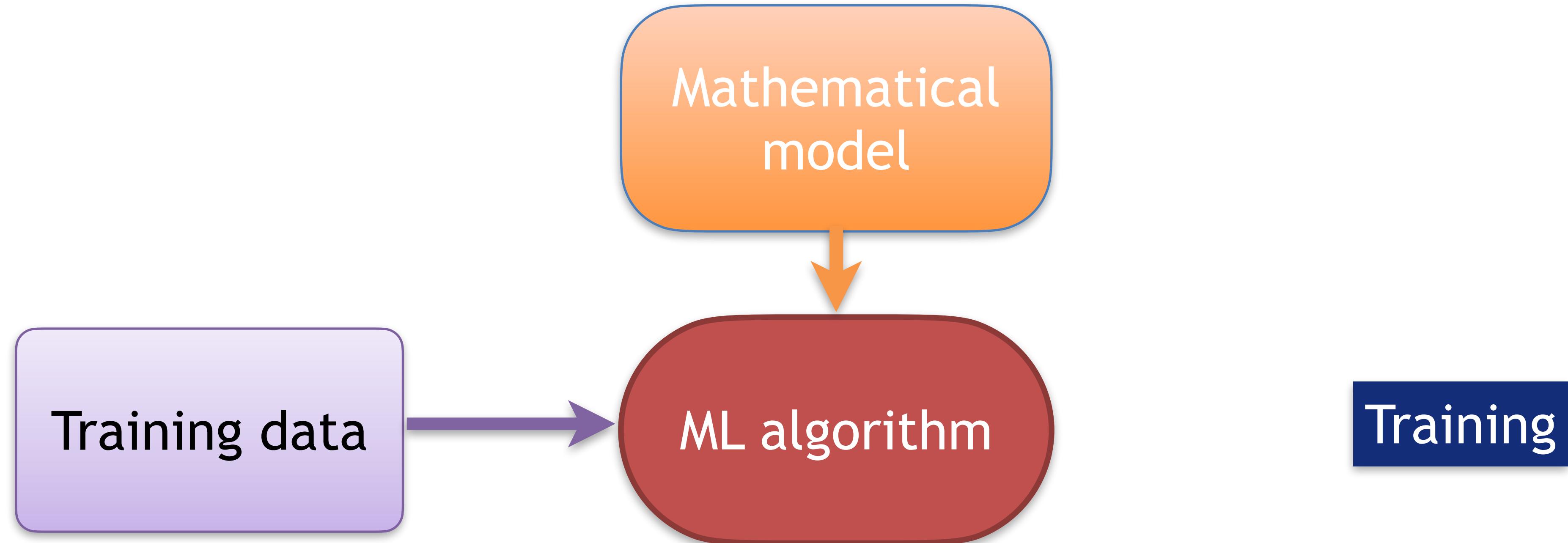
Mathematical
model



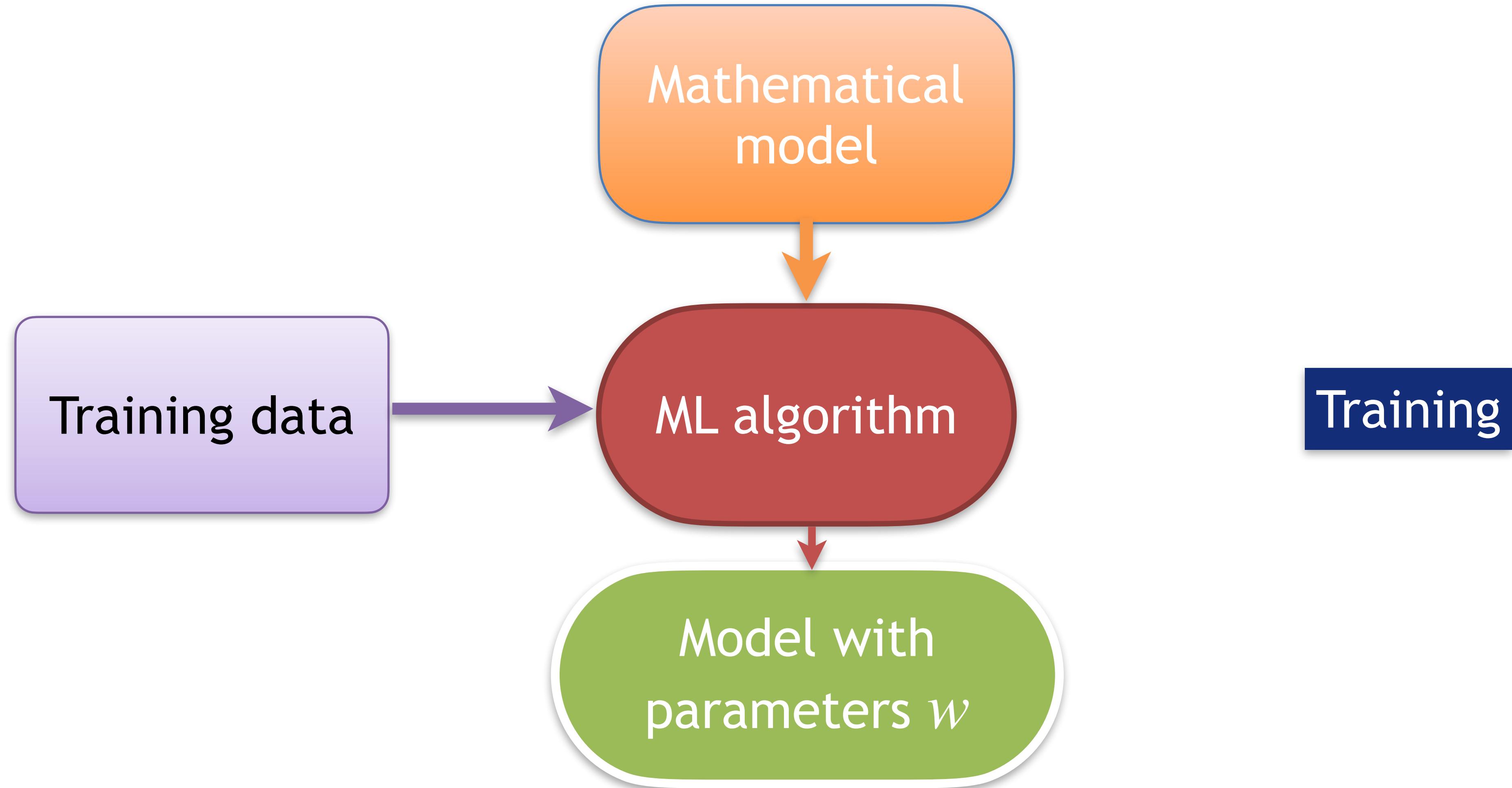
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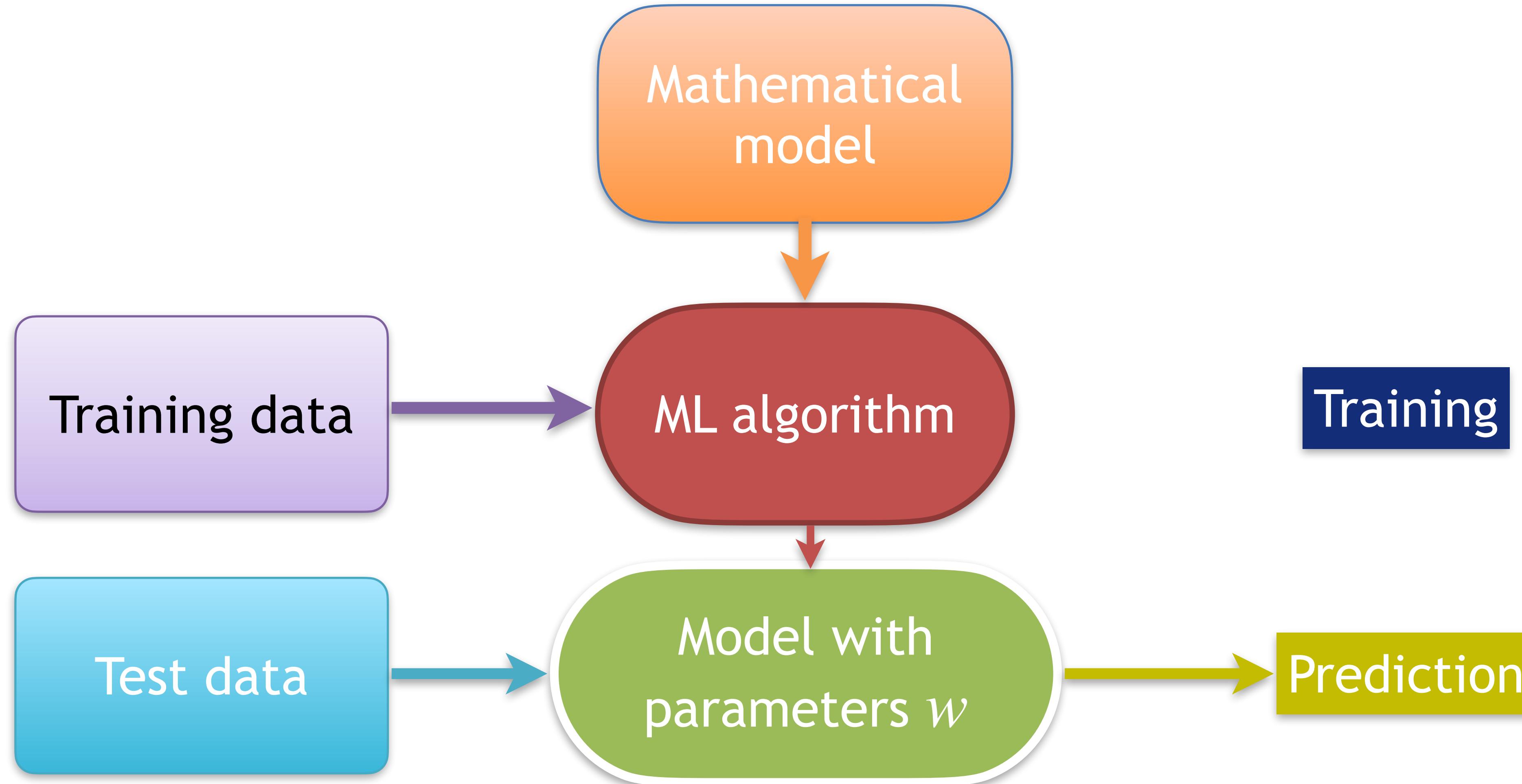
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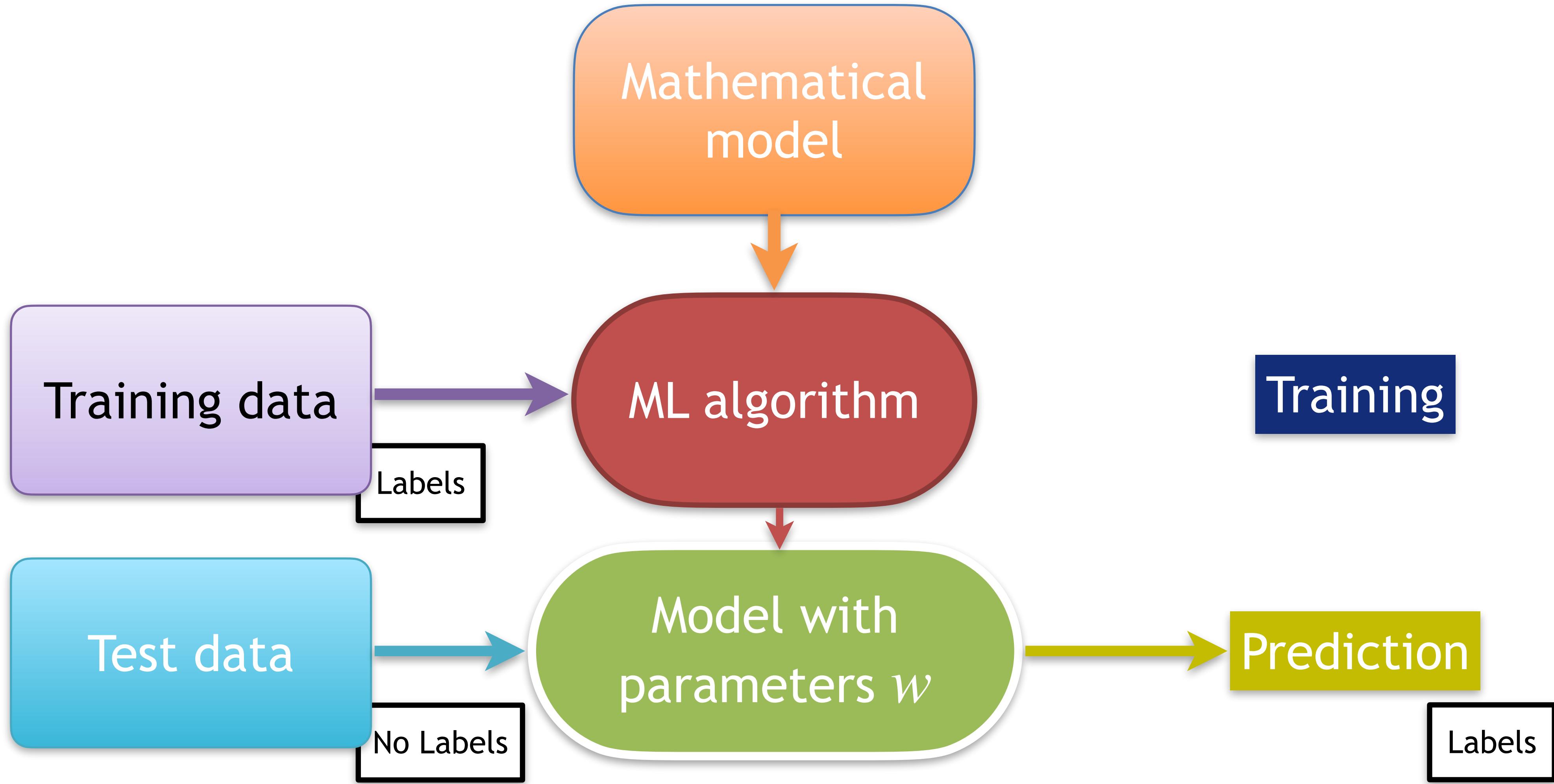
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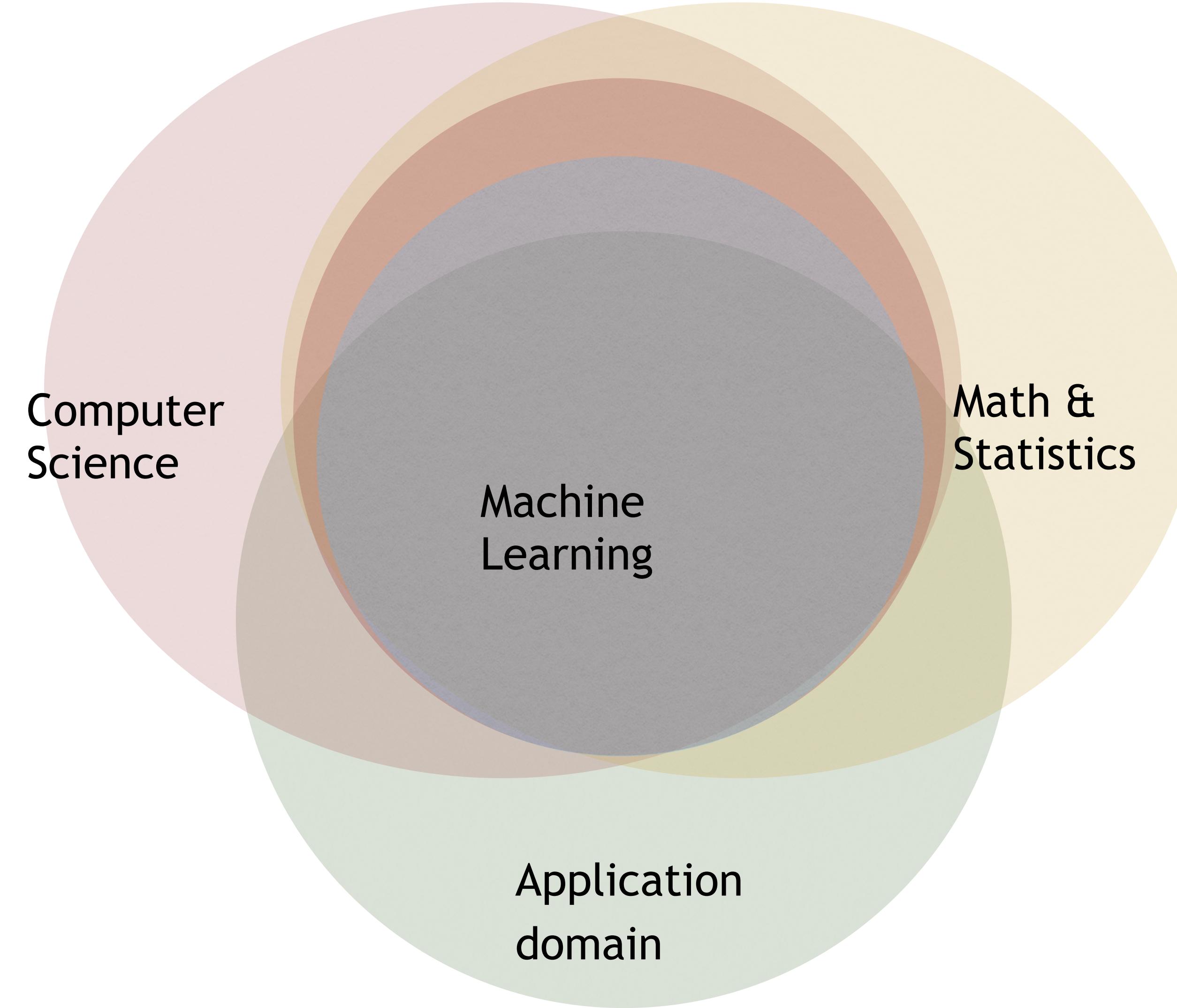
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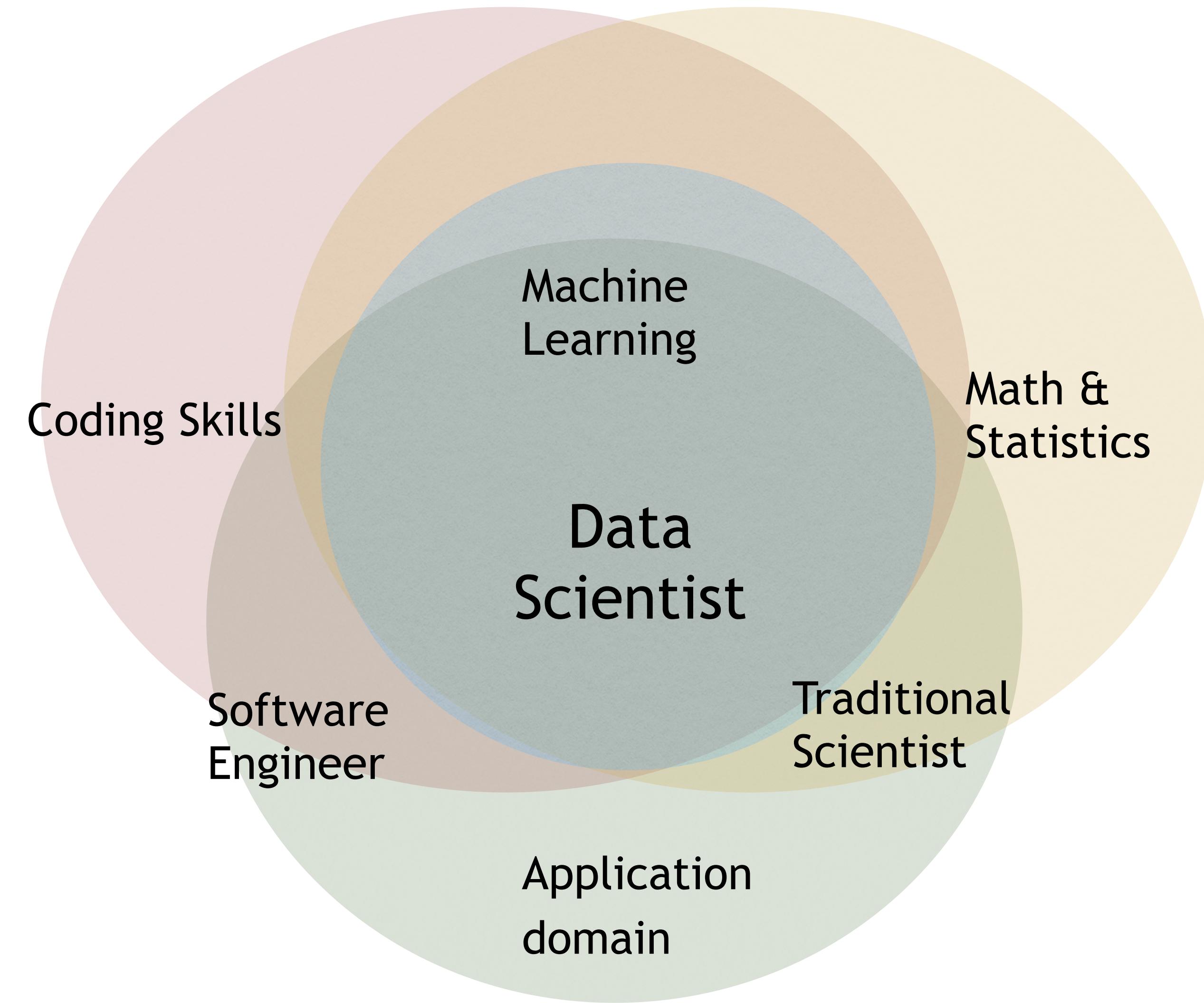
What is supervised machine learning?



ML and its broader context



ML and jobs

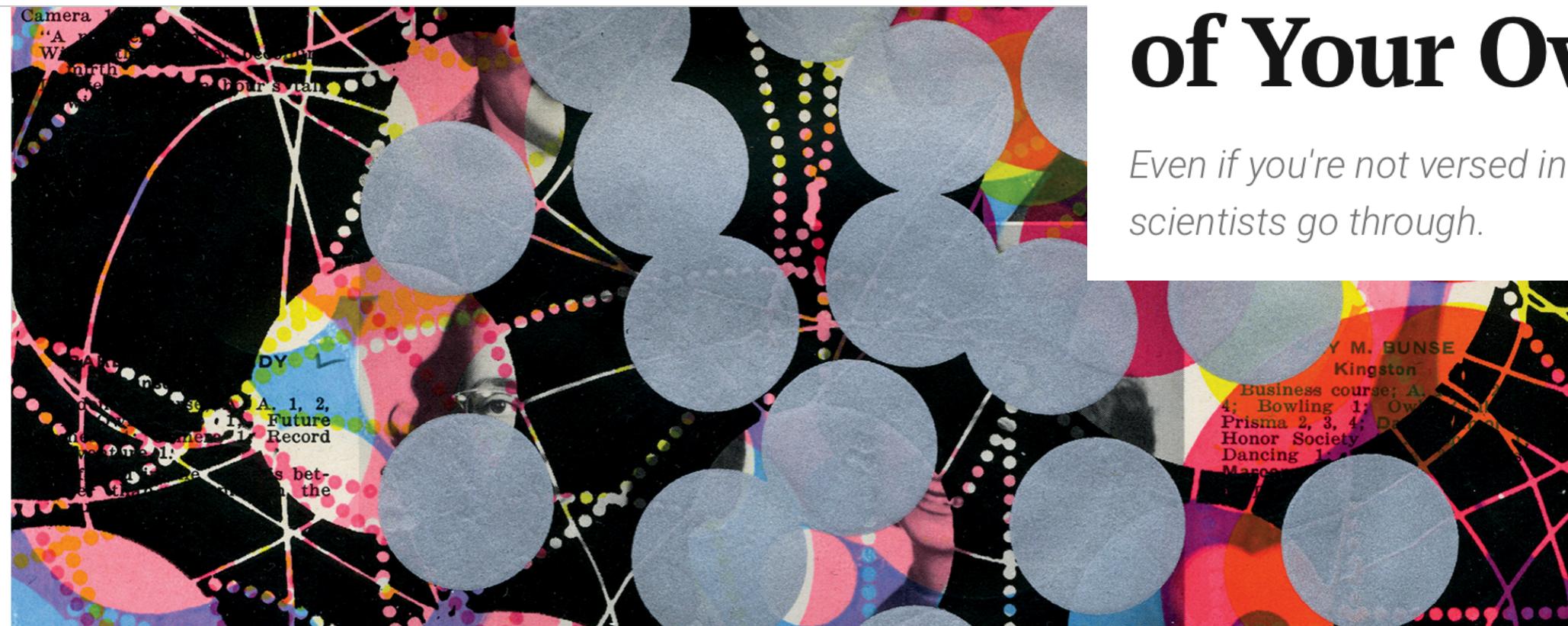


ML and jobs



Harvard Business Review

Coronavirus Magazine Popular Topics Podcasts Video Store The Big Idea Visual Library F



Artwork: Tamar Cohen, Andrew J. Buboltz, 2011, silk screen on a page from a high school yearbook, 8.5" x 12"

DATA

Data Scientist: The Sexiest Job of the 21st Century

by Thomas H. Davenport and D.J. Patil

From the October 2012 Issue

WHAT TO READ NEXT

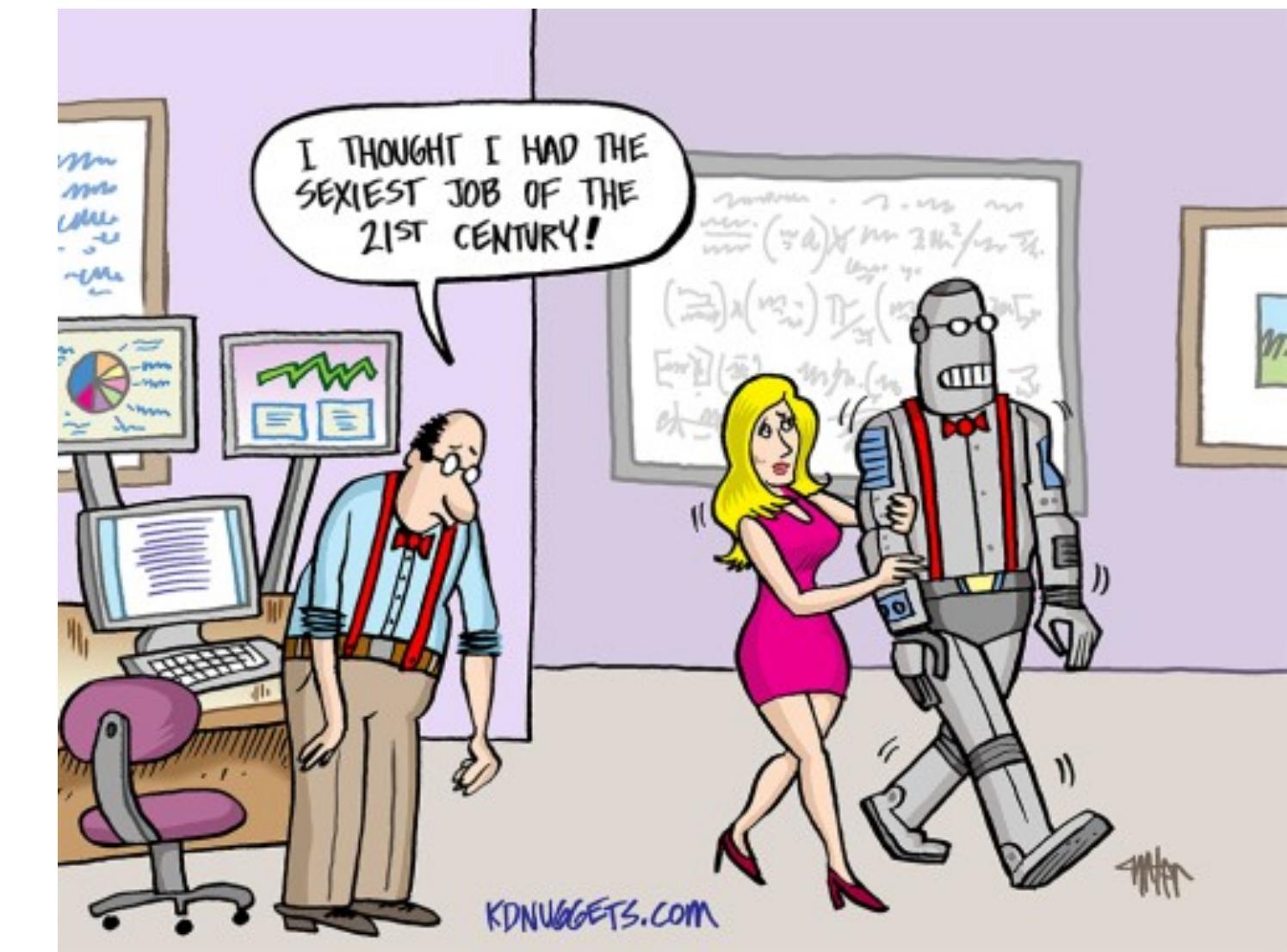


What Data Scientists Really Do, According to 35 Data Scientists

DATA SCIENTISTS

Is 'Data Scientist' the 'Sexiest Job of the 21st Century'? And How Do You Get One of Your Own?

Even if you're not versed in advanced analytics and data science, you can understand the thought process data scientists go through.



ML and jobs

Royal Society: Dynamics of Data Science

Ensuring a Healthy Data Science Skills Landscape Across All Sectors in the UK

Britain is facing “explosive demand” for data science skills and its education system needs to change to keep up, according to a Burning Glass Technologies analysis commissioned by the [Royal Society](#).

Demand for data scientists and data engineers tripled over the past five years, rising 231%. That’s much faster than job postings overall in the UK, which rose 36%, according to the report, “Dynamics of data science skills.”

Different regions saw different growth rates, from 79% in Wales to 269% in the North West and 563% in Northern Ireland. On average, salaries for these roles is £64,376, up 22% over the same period.

JOB OF THE 21ST CENTURY

by Thomas H. Davenport and D.J. Patil

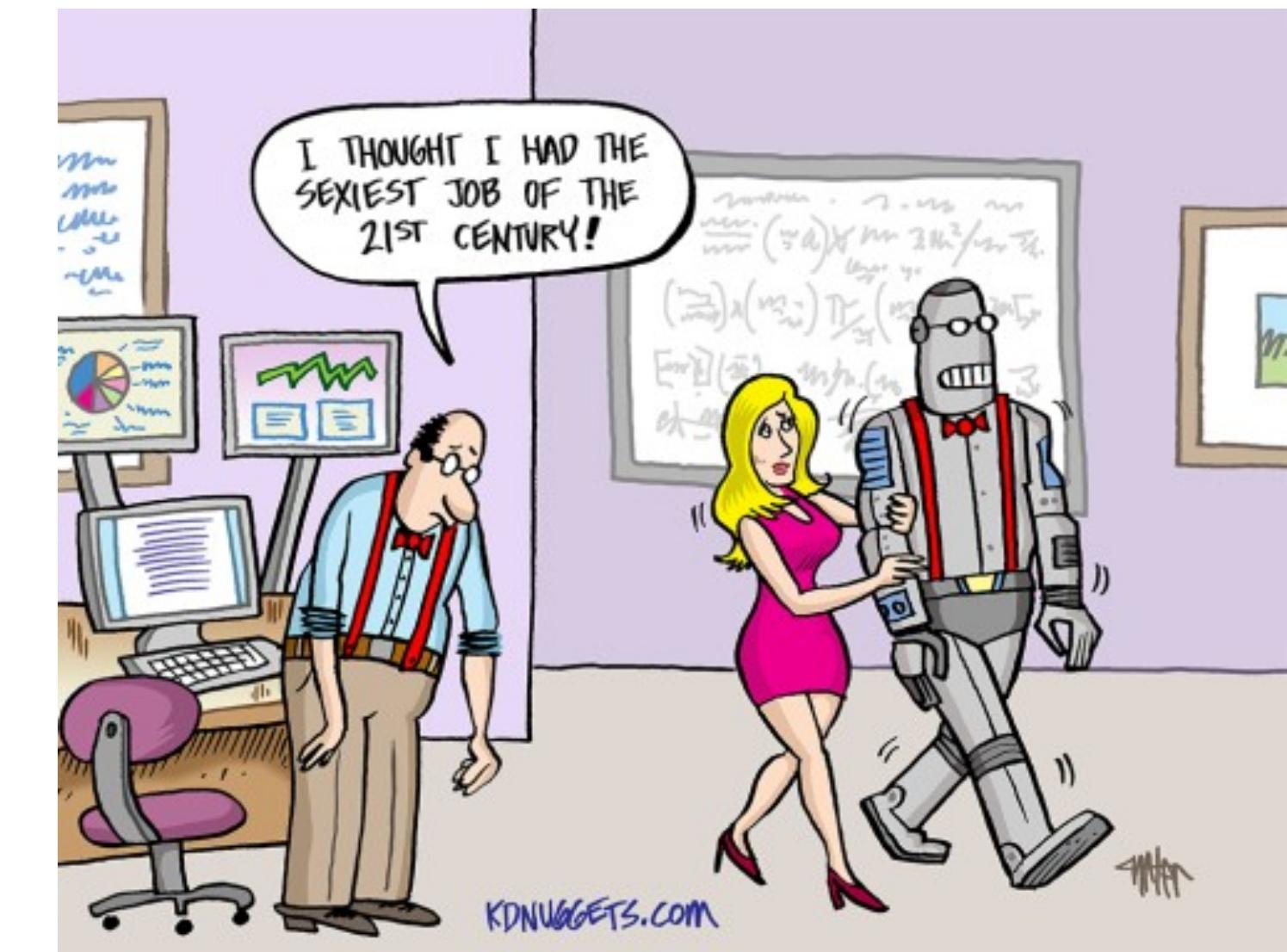
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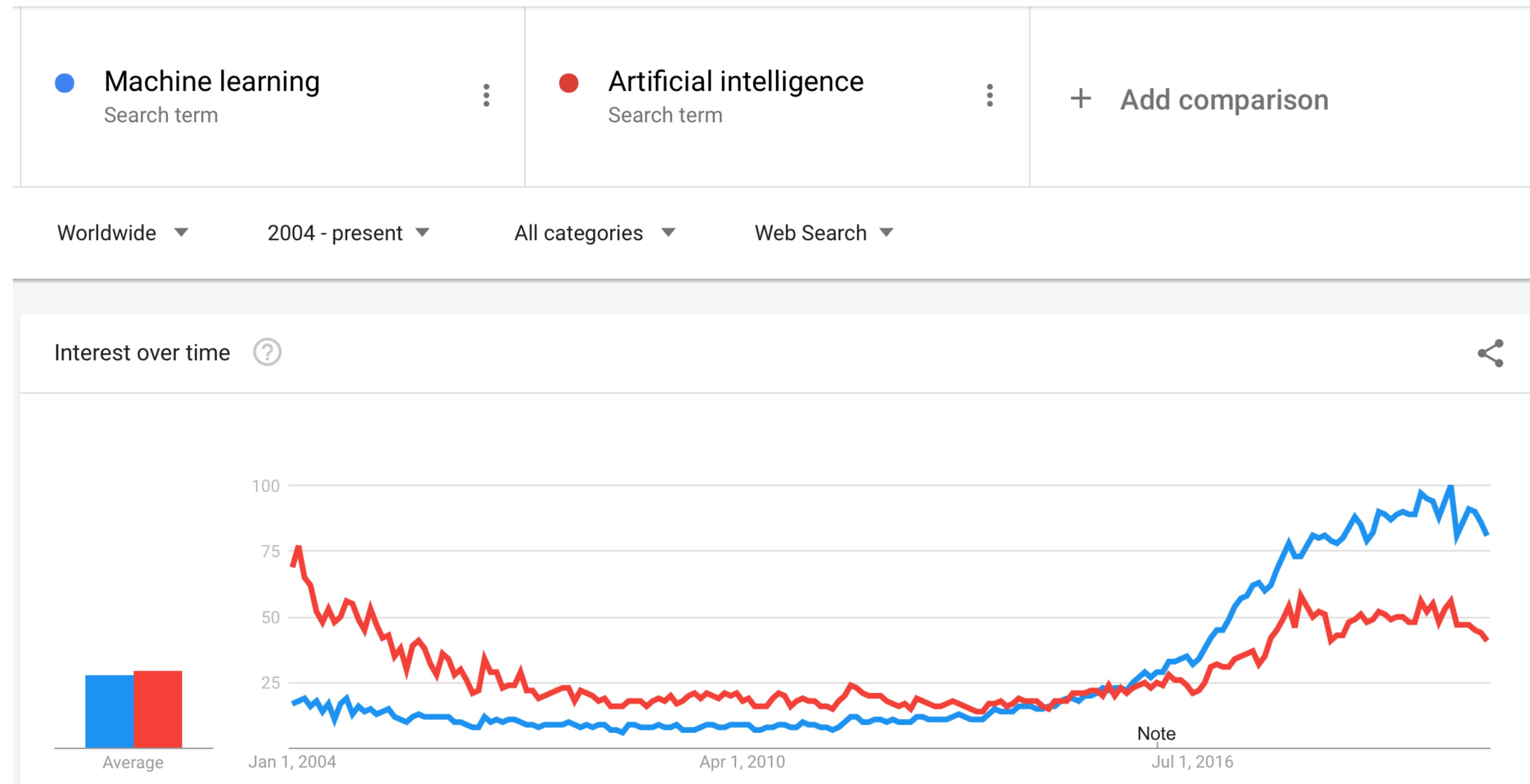
What Data Scientists Really Do,
According to 35 Data Scientists

'Scientist' the 'Sexiest Job of the Century'? And How Do You Get One Now?

advanced analytics and data science, you can understand the thought process data



ML popularity



ML and jobs

The usual suspects

facebook

NETFLIX

Google amazon.co.uk®



Linkedin

ML and jobs

The usual suspects

facebook

NETFLIX

Google

amazon.co.uk®



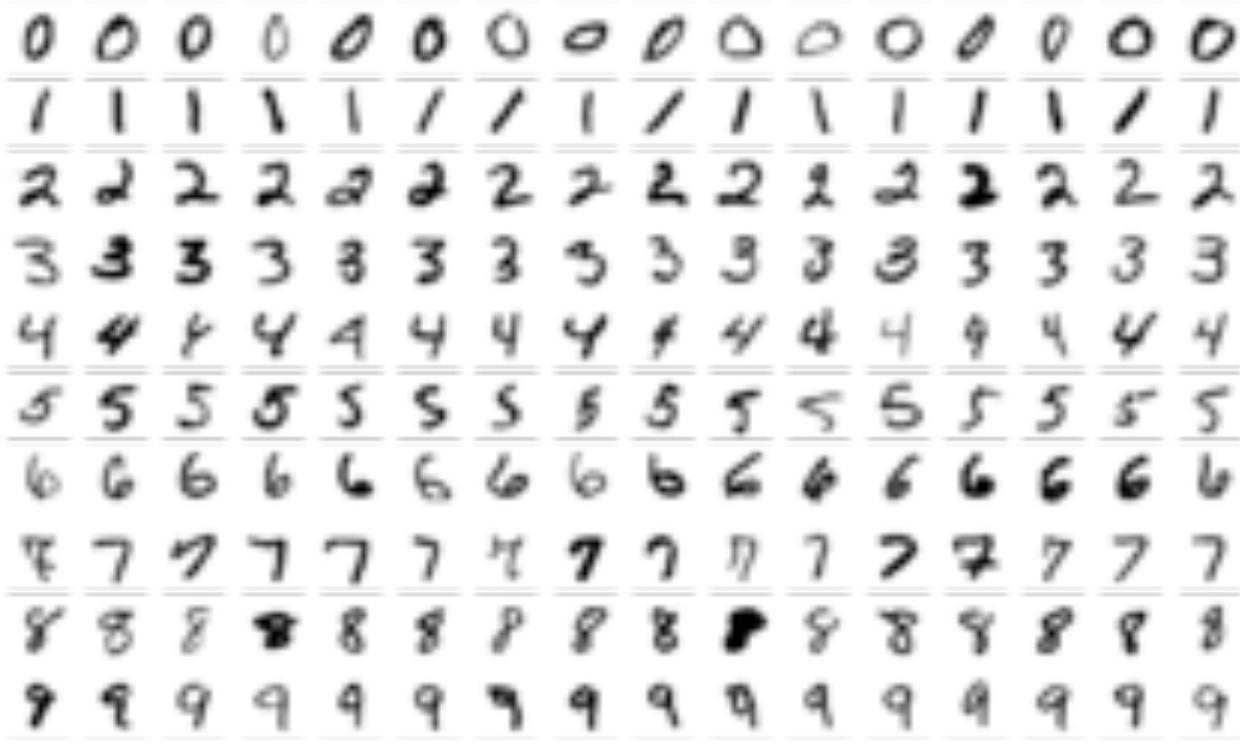
Linkedin

No longer just them

Majority of industries hiring data scientists



Image data



MNIST

Optical character
recognition (OCR)

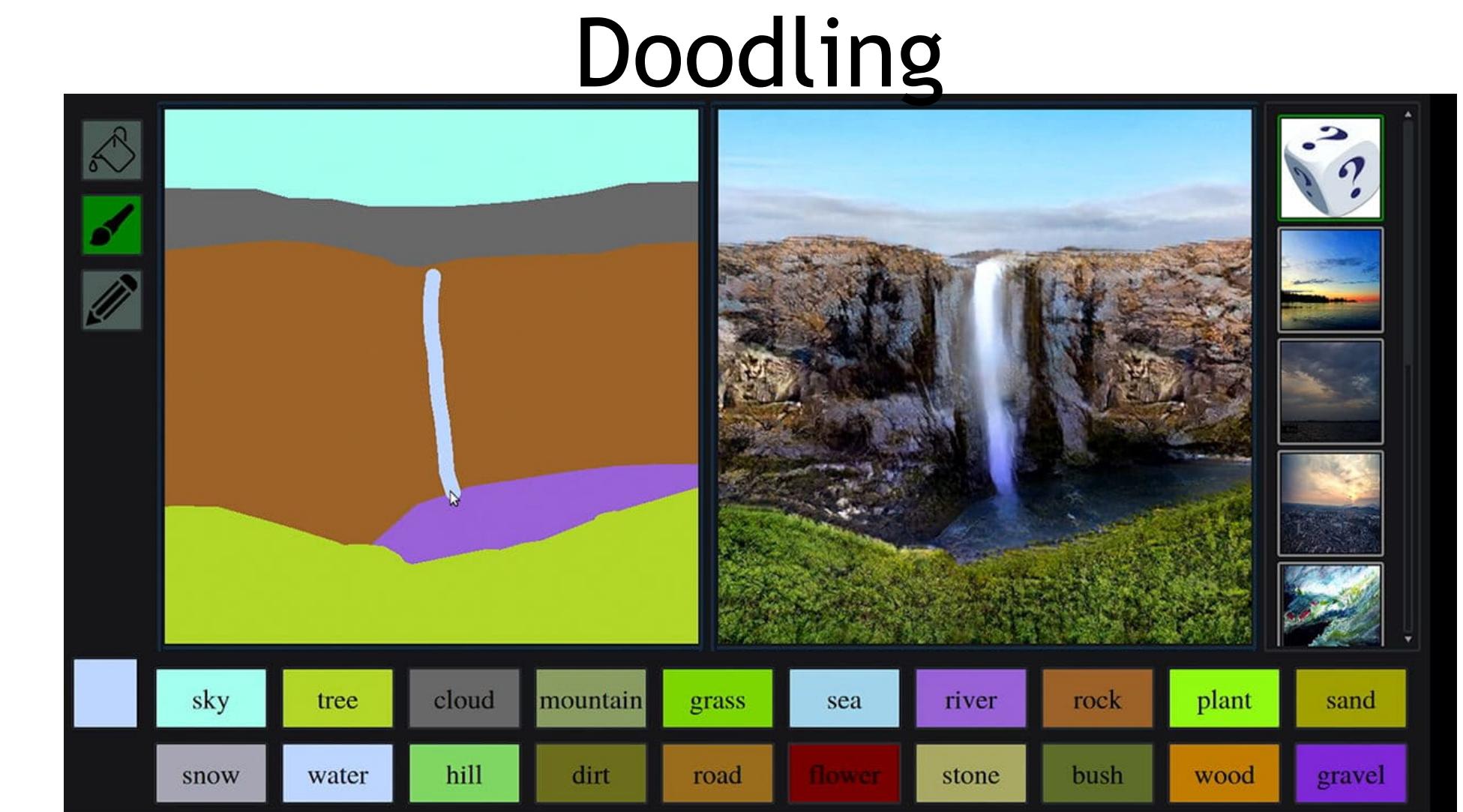


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Self-driving cars



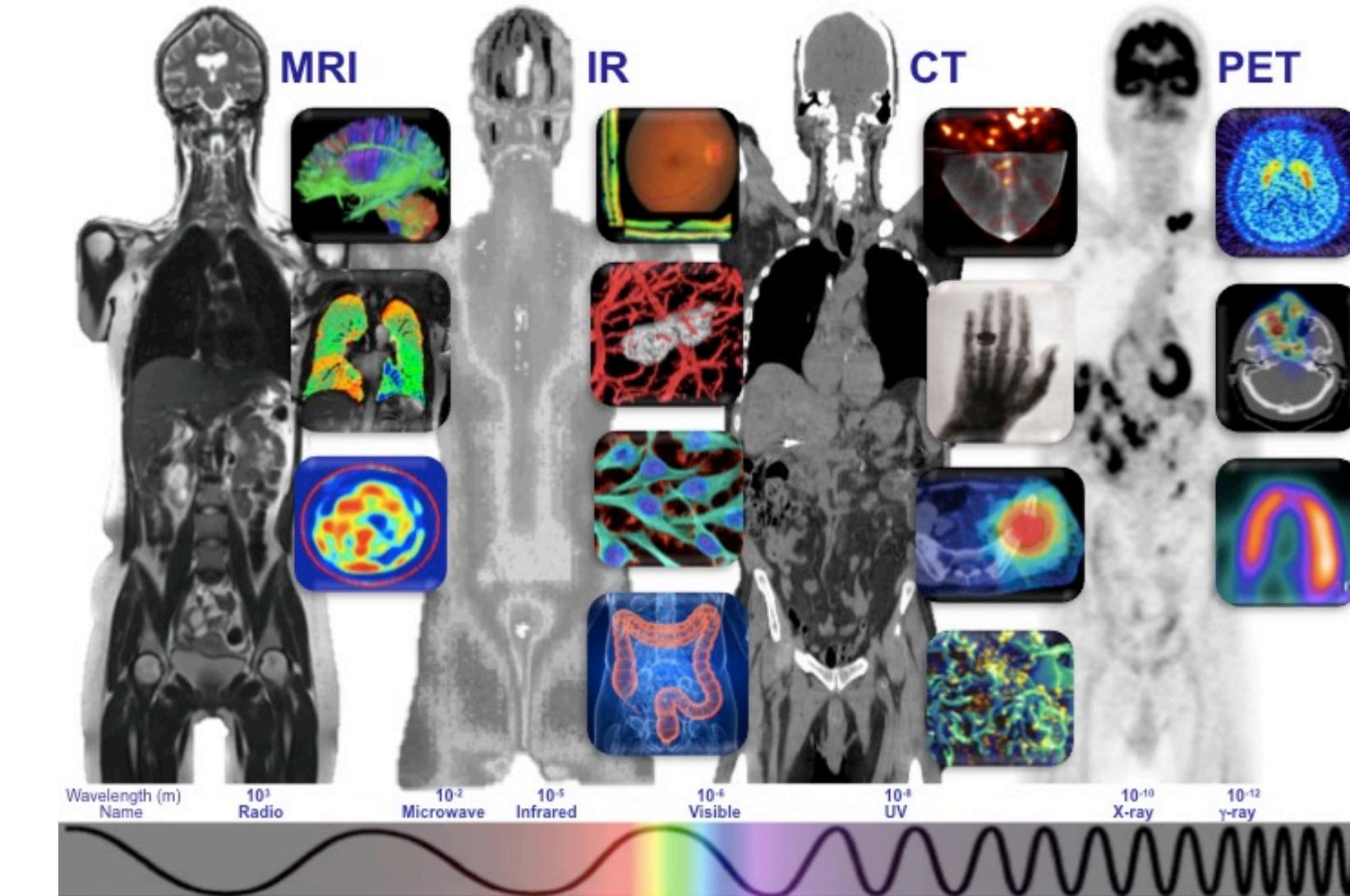
GTSRB



Doodling

Medical image processing

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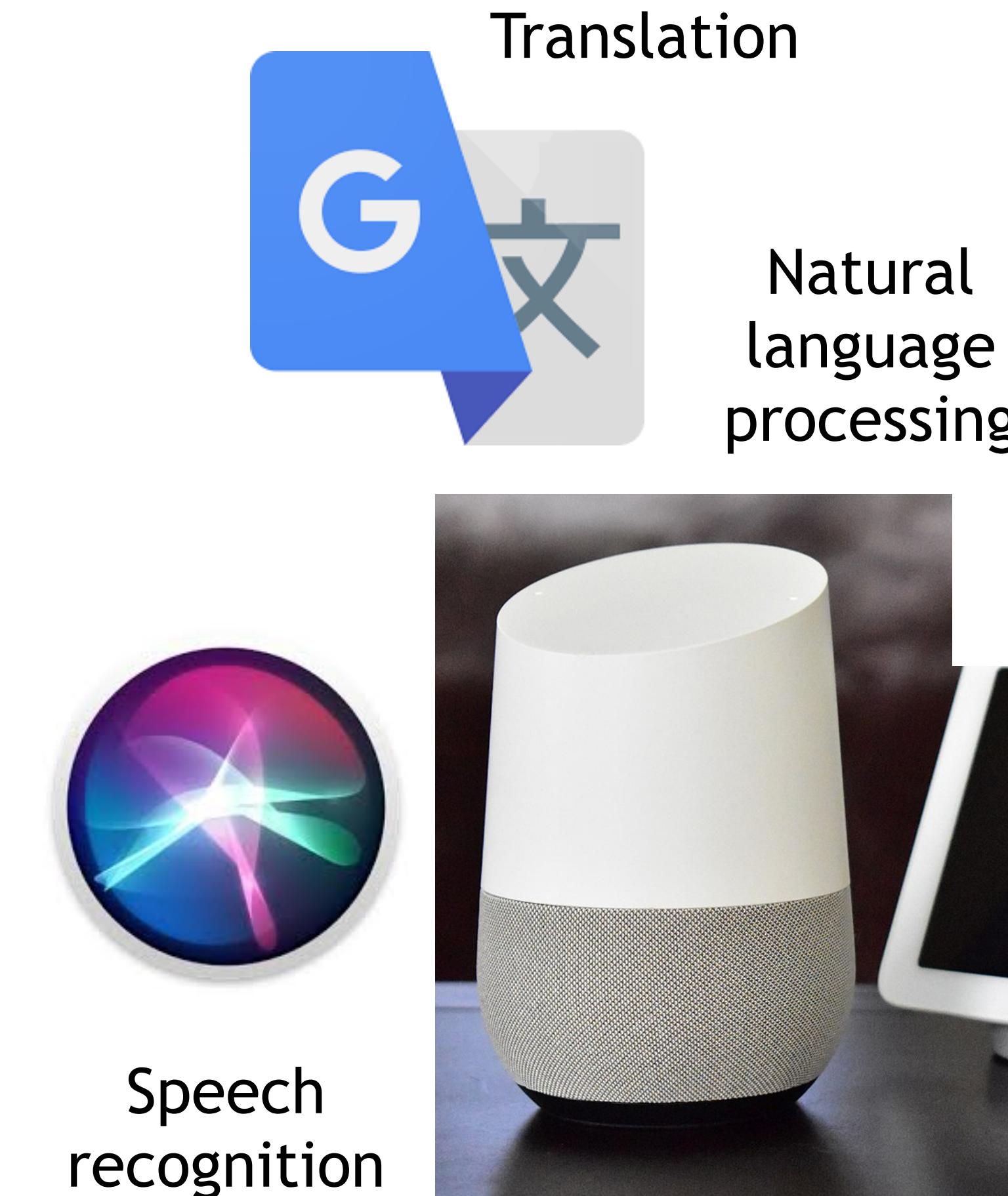
Text & audio data



IBM Watson



Text to speech



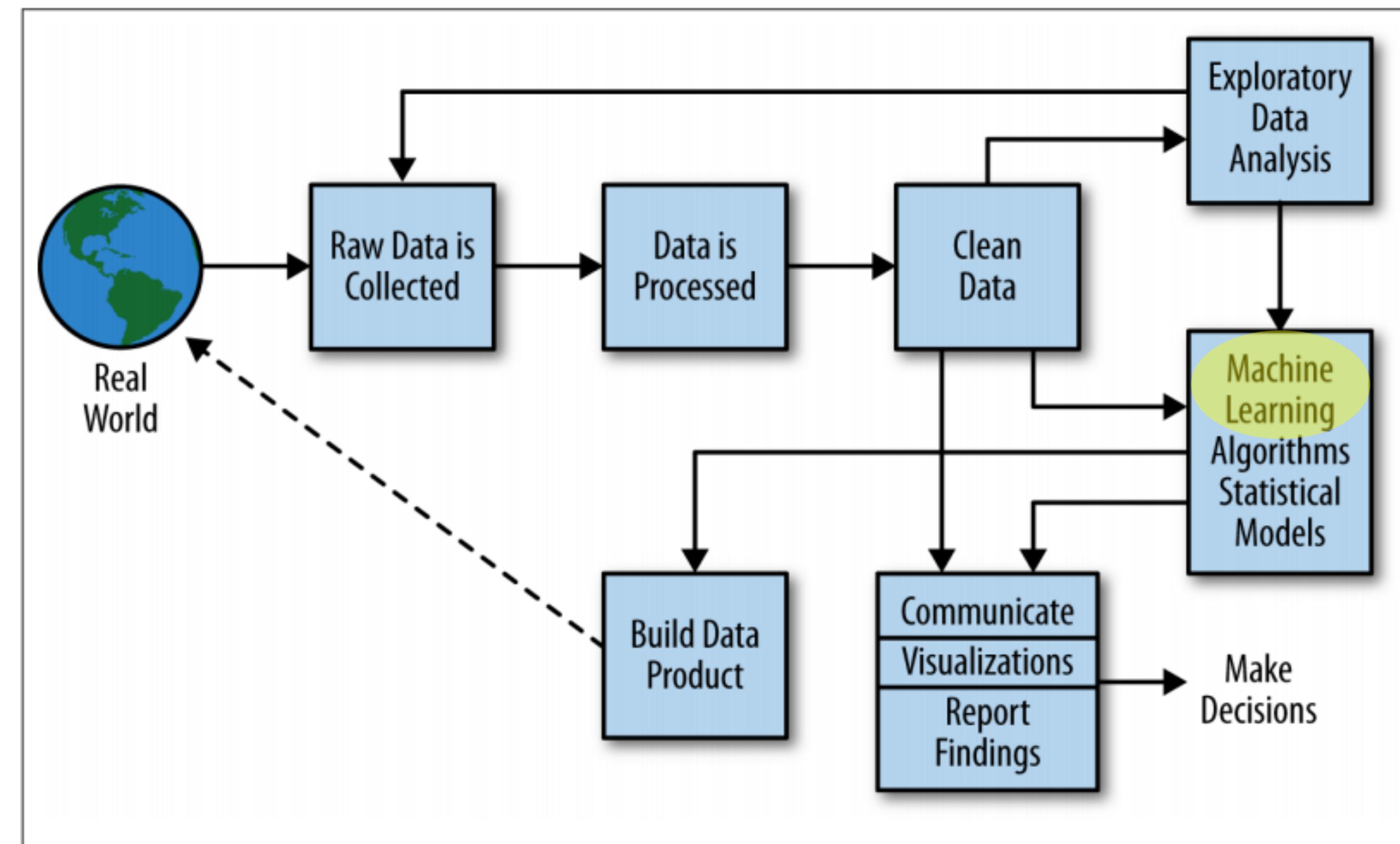
Translation

Natural
language
processing



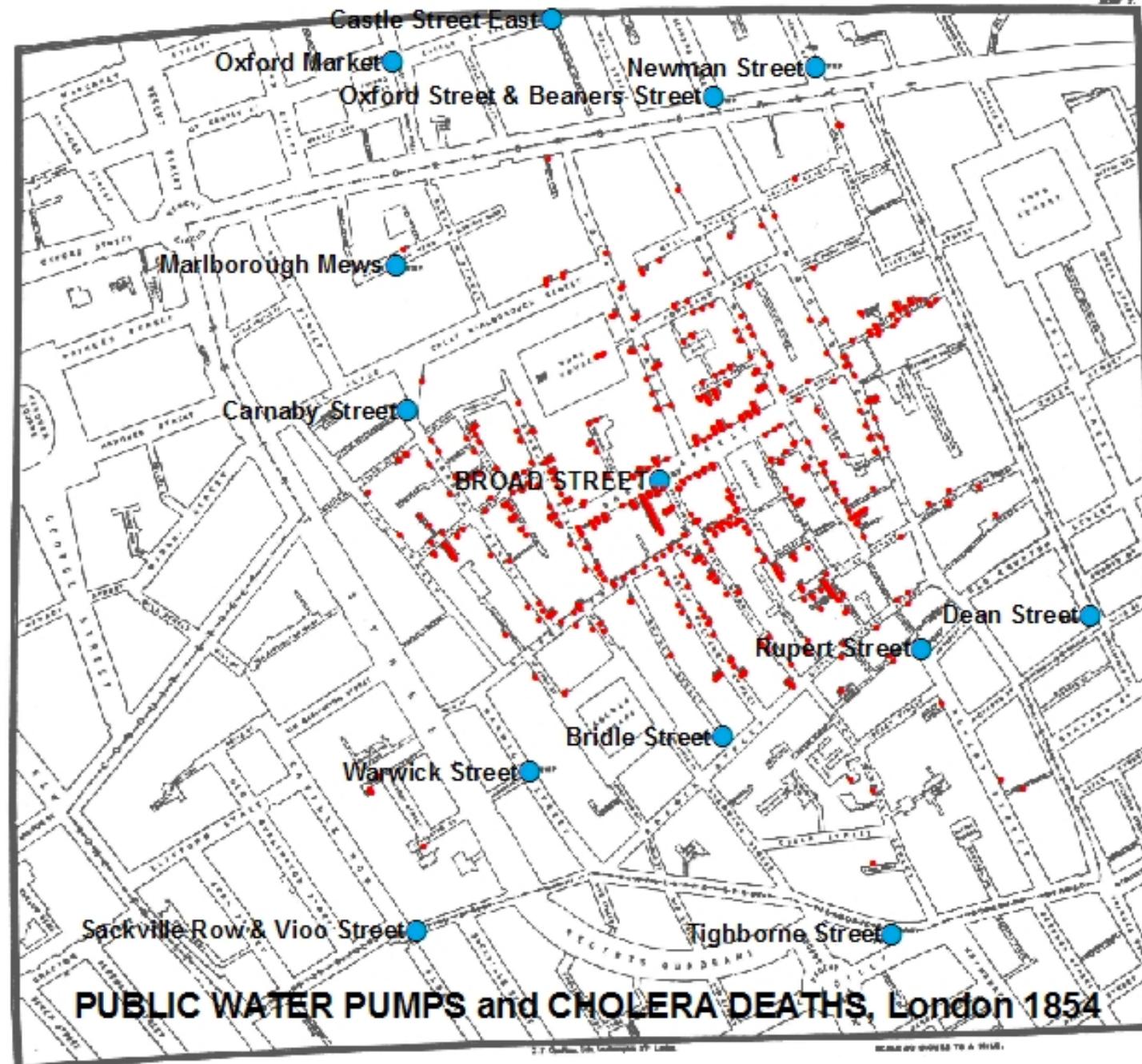
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Machine learning is only a small part

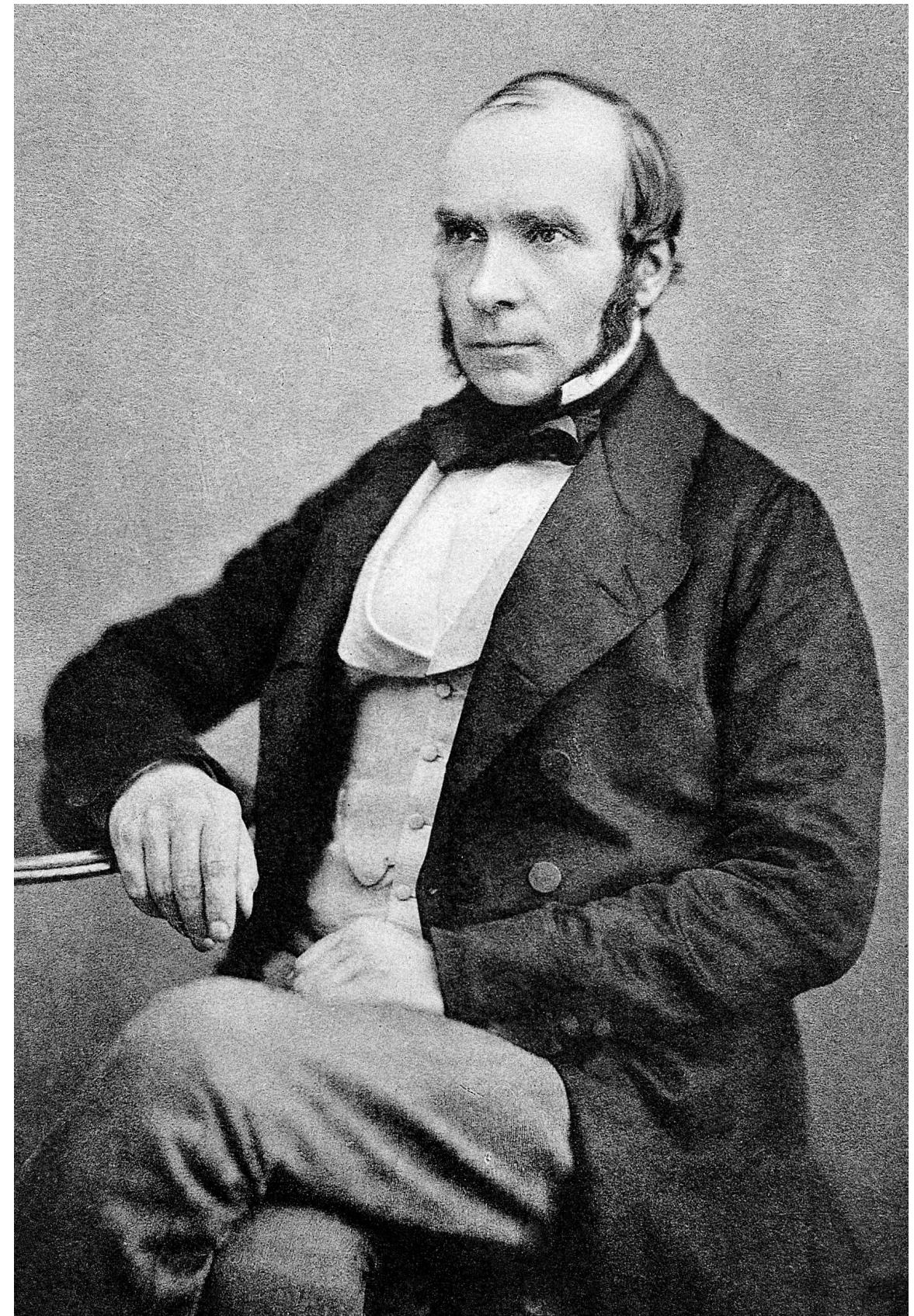


From Schutt and O’Neil “Doing Data Science”

Machine learning is not new



1854 Broad Street
cholera outbreak

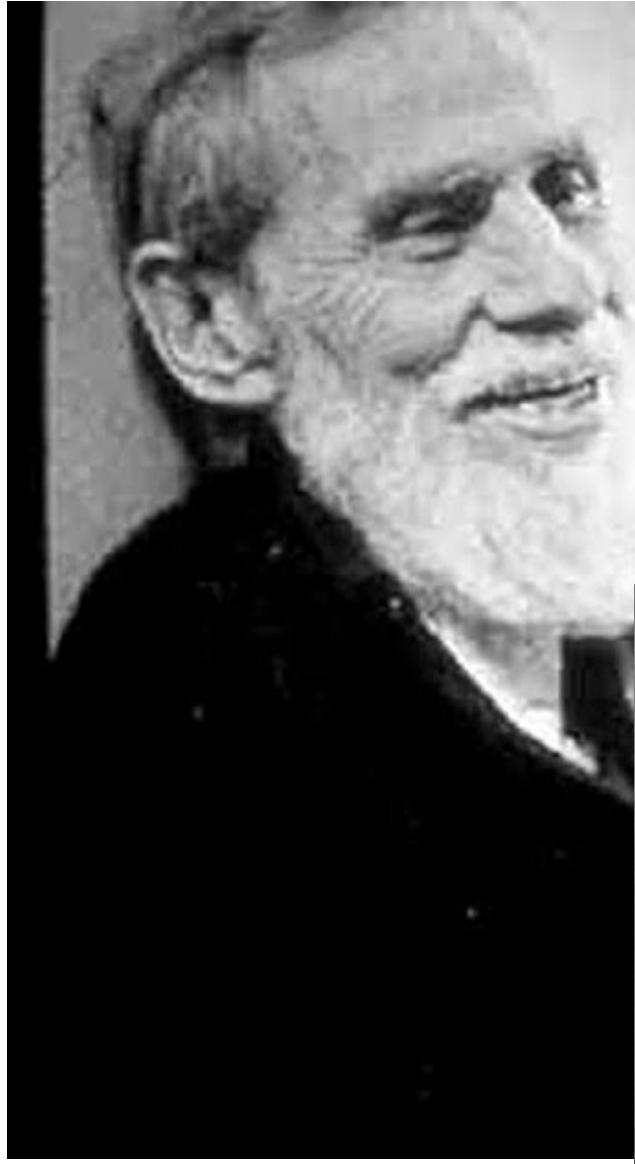


John Snow. ©Wikimedia commons



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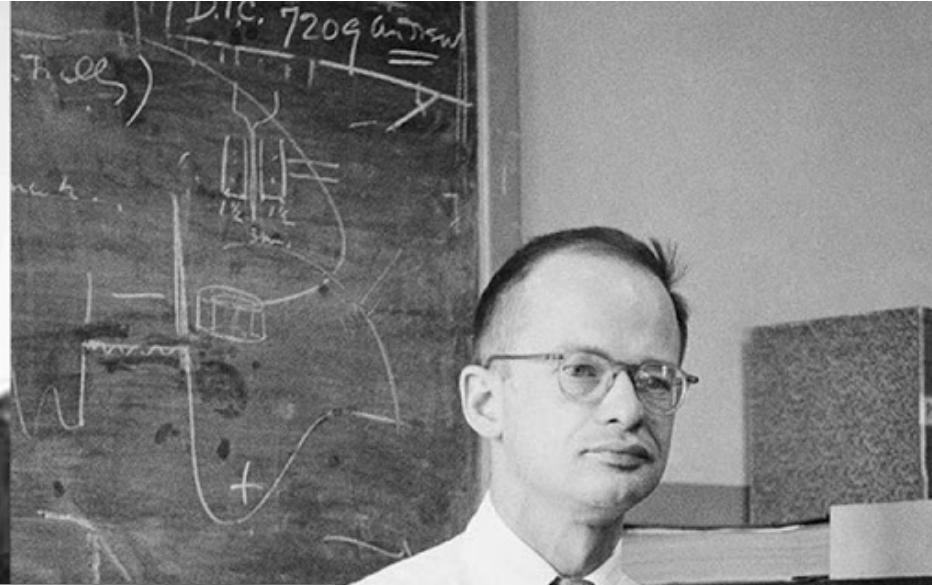
Machine learning is not new



McCulloch



Turing



Pitts



Samuel



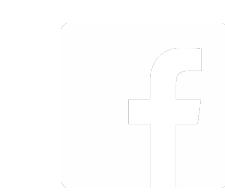
Rosenblatt



What has changed?

1950s: 10^3 FLOPS

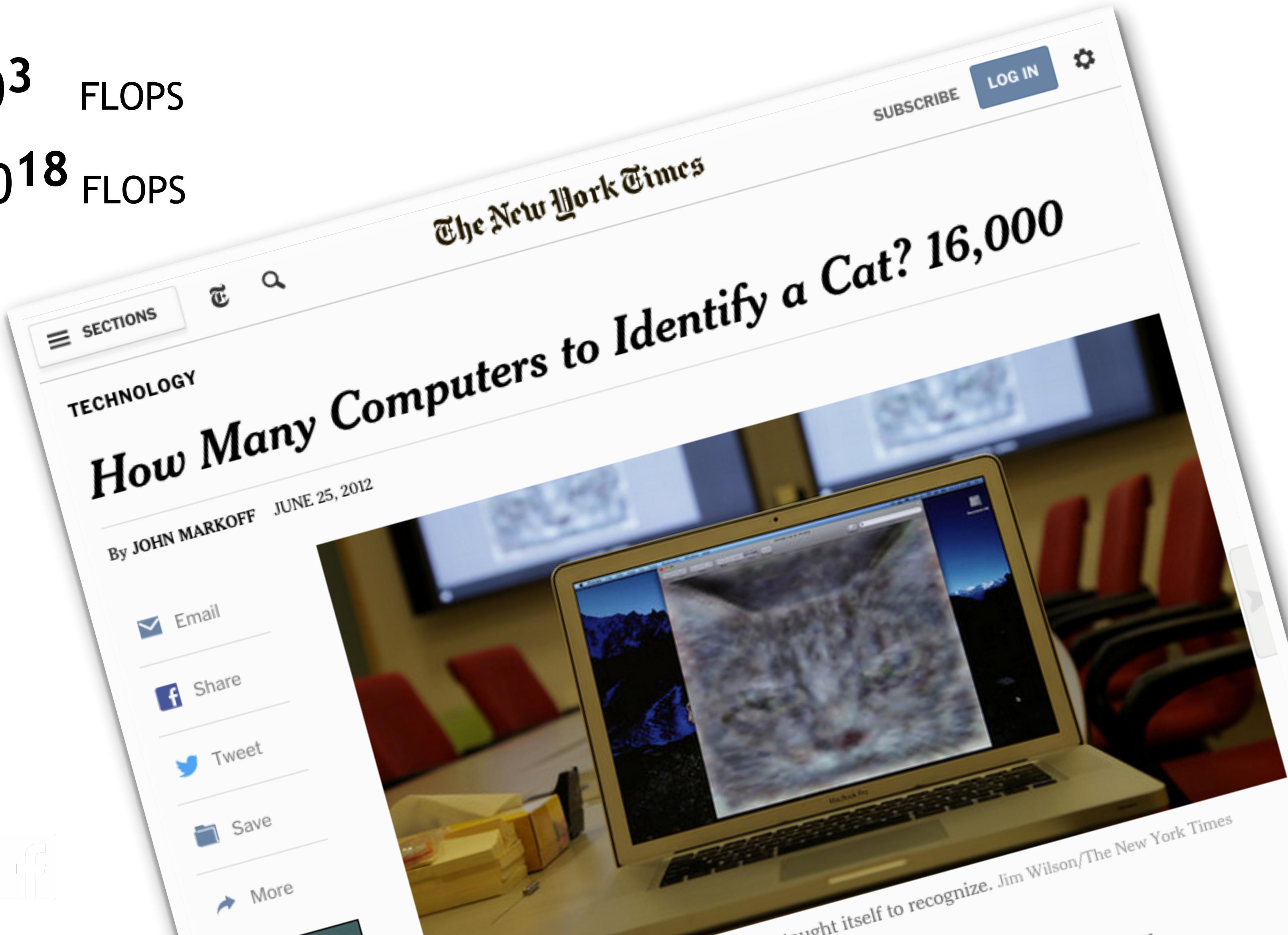
2020: 10^{18} FLOPS



What has changed?

1950s: 10^3 FLOPS

2020: 10^{18} FLOPS

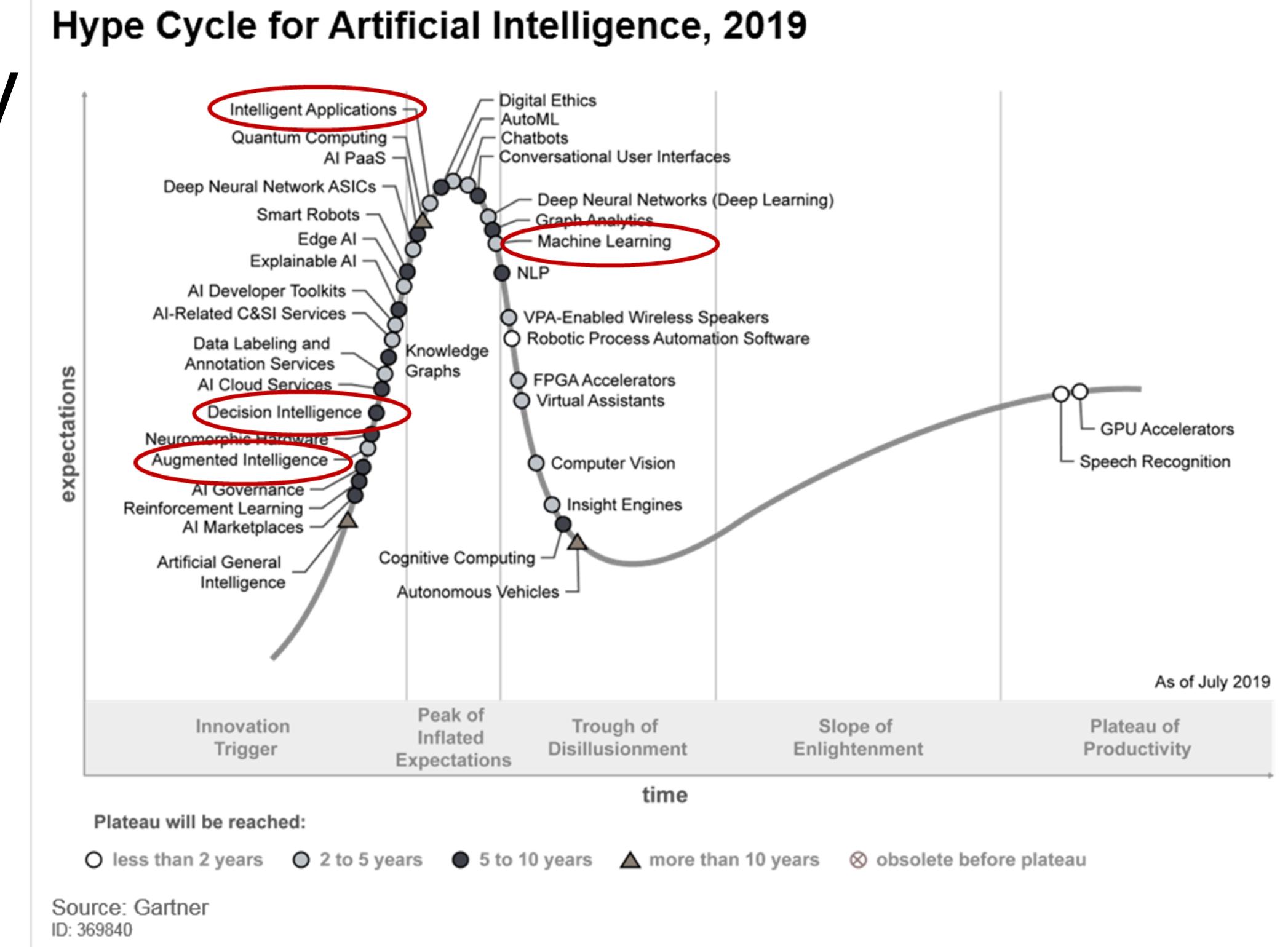


Challenges



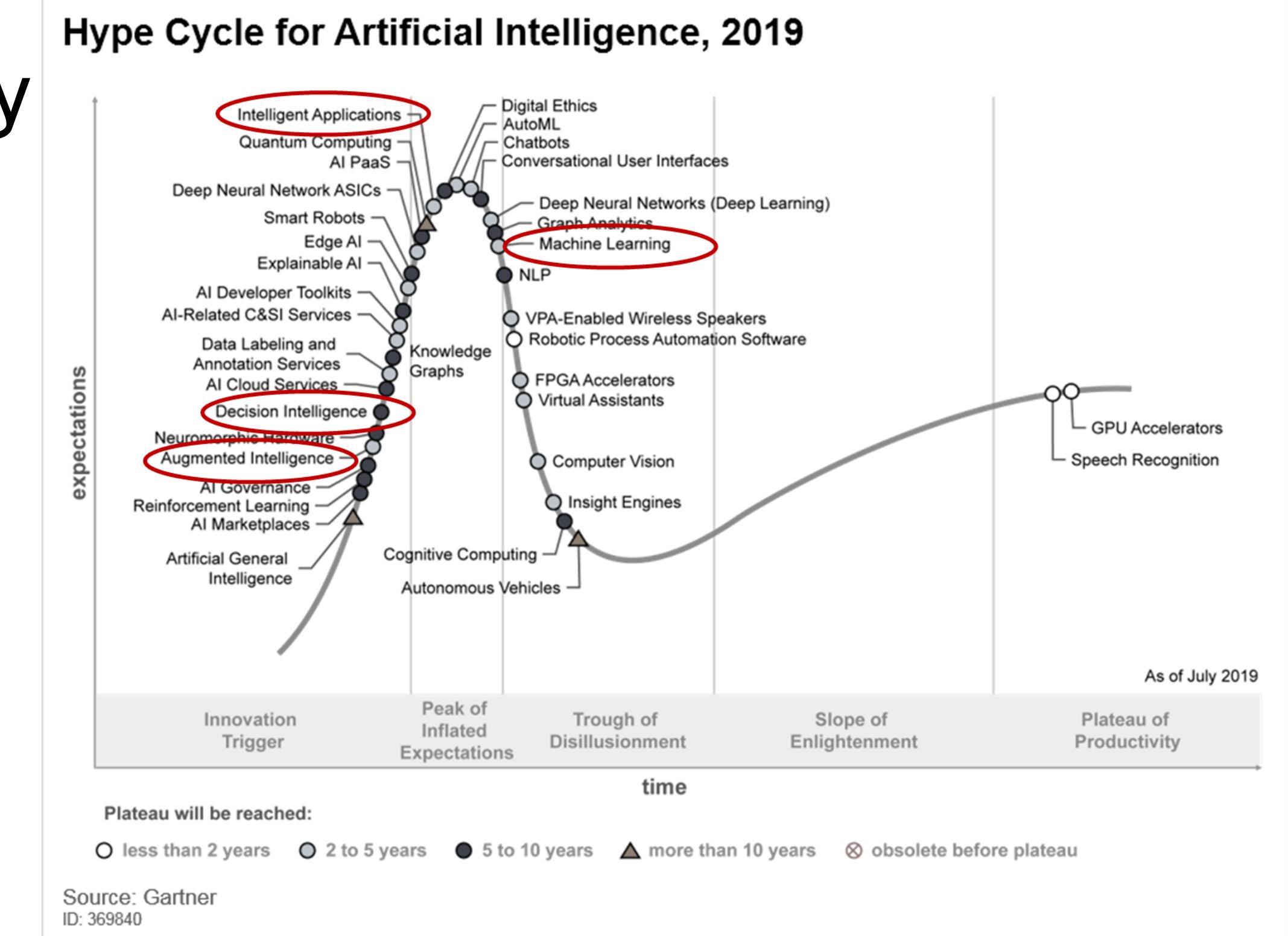
Challenges

- Hype, i.e. cycles of AI and ML popularity



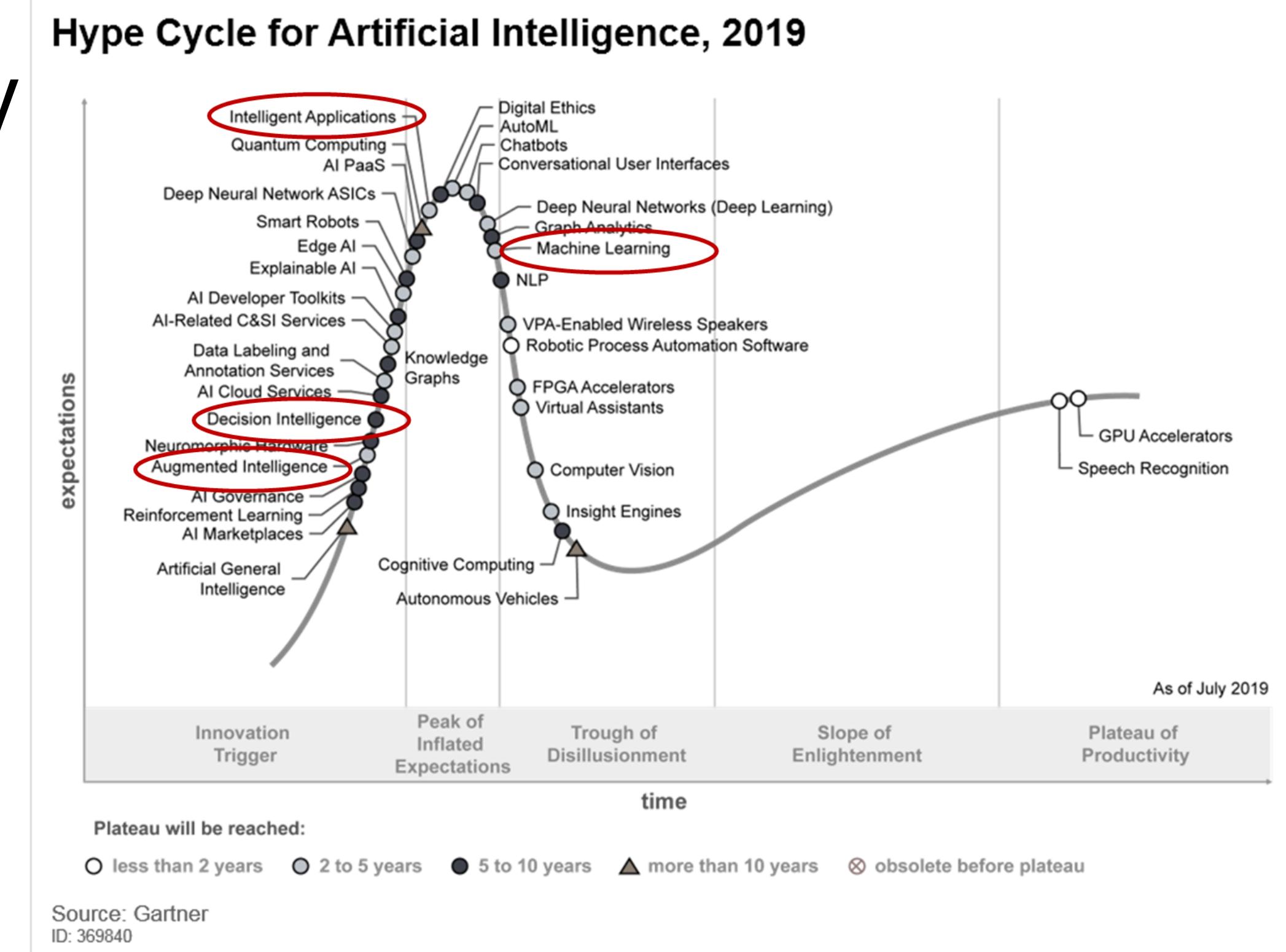
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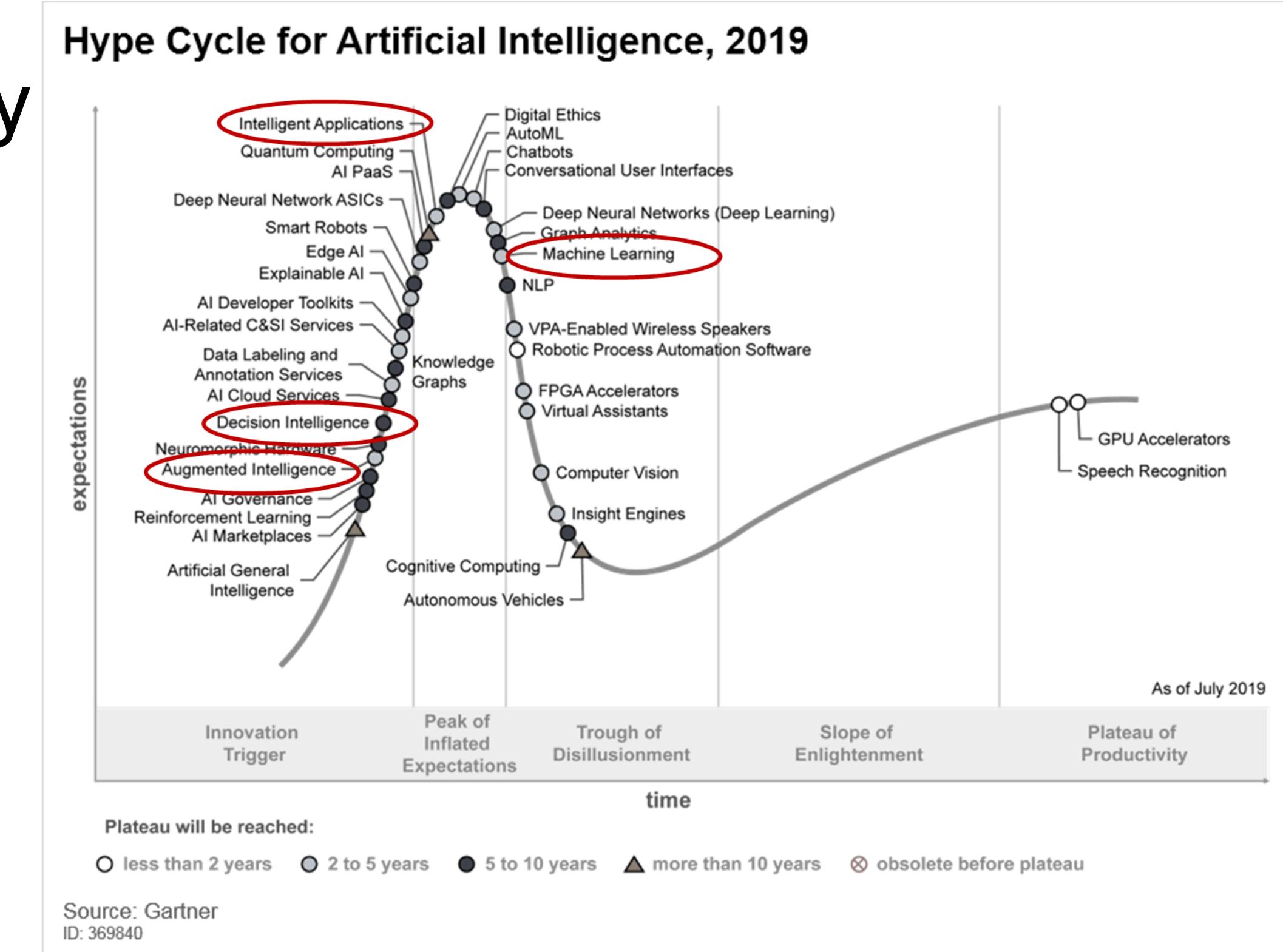
Challenges

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- Lack of Interpretability



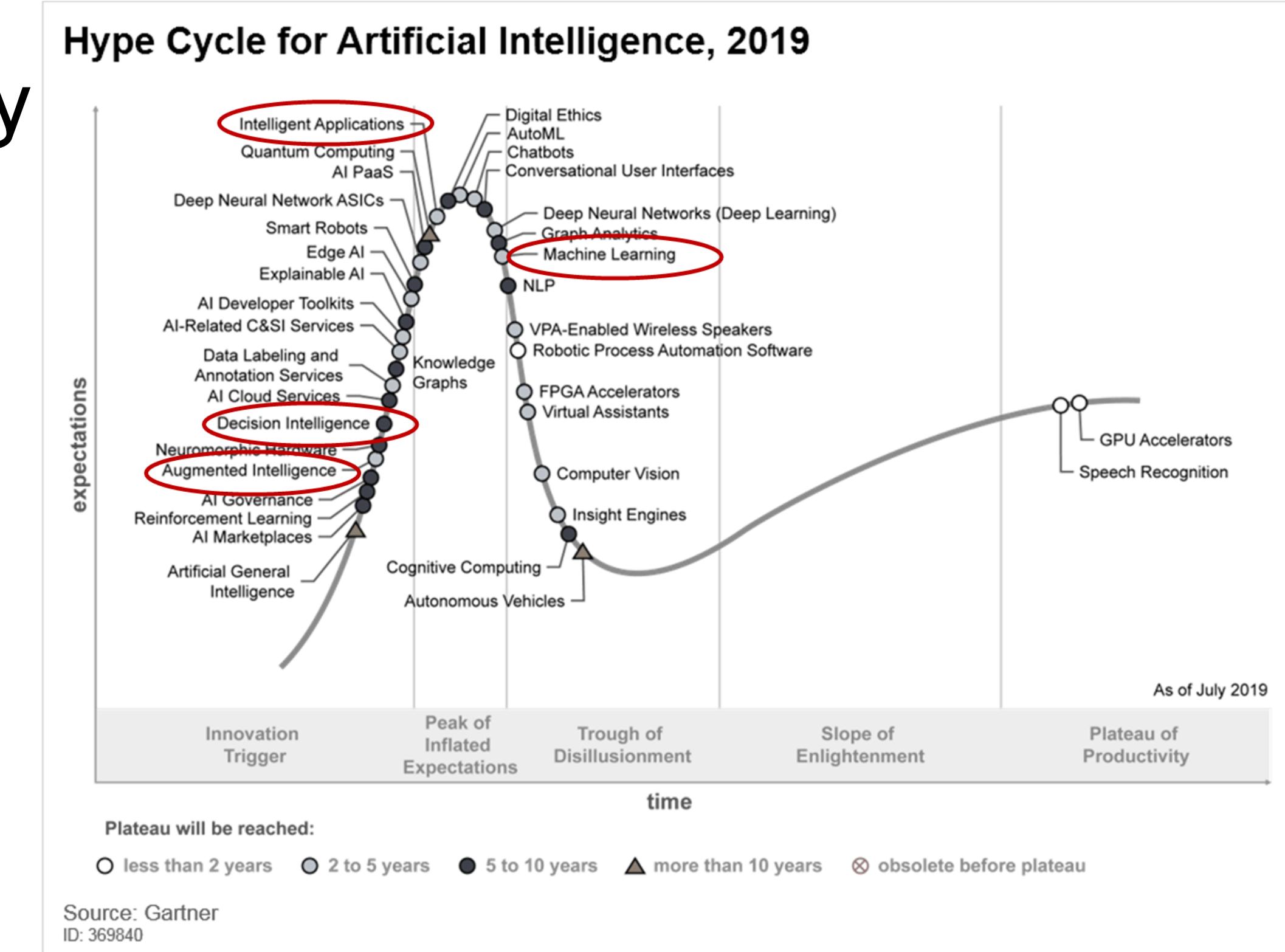
Challenges

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- Social Implications: threats from super-human AI? Job losses?



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- Hype, i.e. cycles of AI and ML popularity
- Data Ethics, Privacy, Fairness
- Lack of Interpretability
- Social Implications: threats from super-human AI? Job losses?



We need: scientific method, reproducible research,
open source and open data

Correlation ≠ causation*

What we not cover in this module: causal inference**

Number of people who drowned by falling into a pool
correlates with
Films Nicolas Cage appeared in

