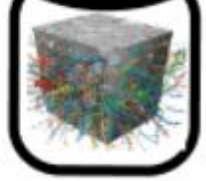
Computer Science and Artificial Intelligence

KHOA CÔNG NGHỆ THÔNG TIN
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

Content

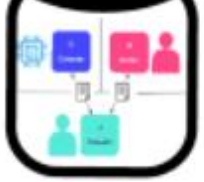
- History of AI
- Basic terminology

History of AI



1943

Evolution of Artificial neurons



1950

Turing Machine

1956

Birth of AI: Dartmouth Conference

1966

First Chatboat : ELIZA

1972

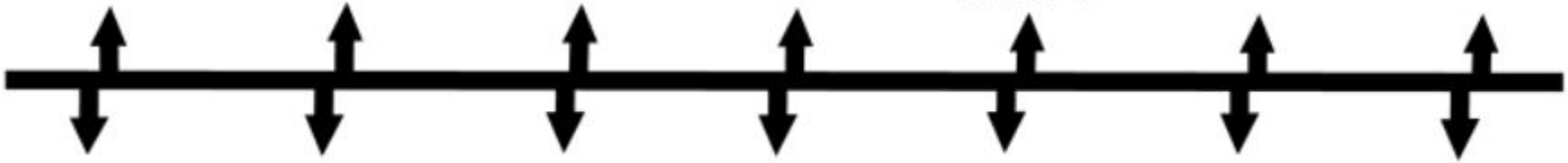
First Intellgence Robot : WABOT -1

1974-1980

First AI winer

1980

Expert Ststem



1987-1993

Second AI Winer

1997

IBM Deep blue : first computer to beat a world chess champion

2002

AI in Home: Roomba

2011

IBM s Watson : Wins a quiz show

2012

Google now

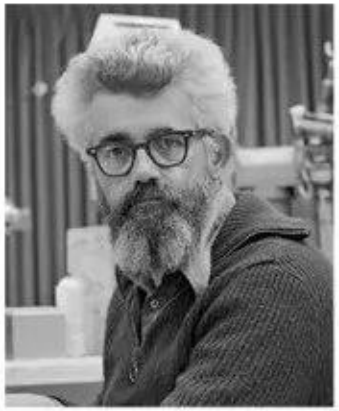
2014

Chatbot Eugene Goostman:Wines a "Turing test

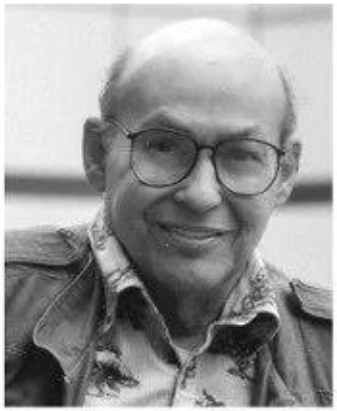
2015

Amazon Echo

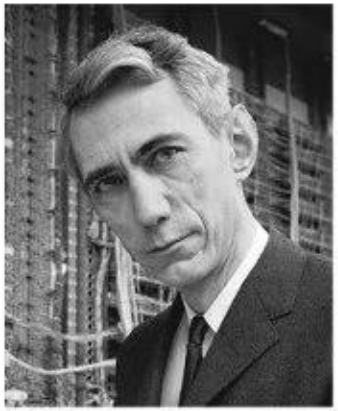
1956 Dartmouth Conference: The Founding Fathers of AI



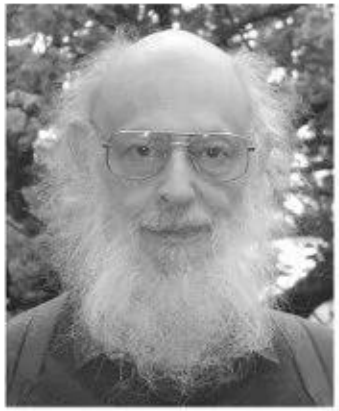
John MacCarthy



Marvin Minsky



Claude Shannon

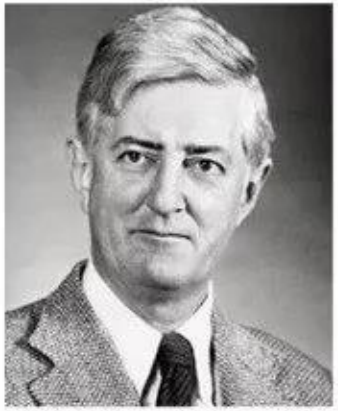


Ray Solomonoff

Alan Newell

Herbert Simon

Arthur Samuel



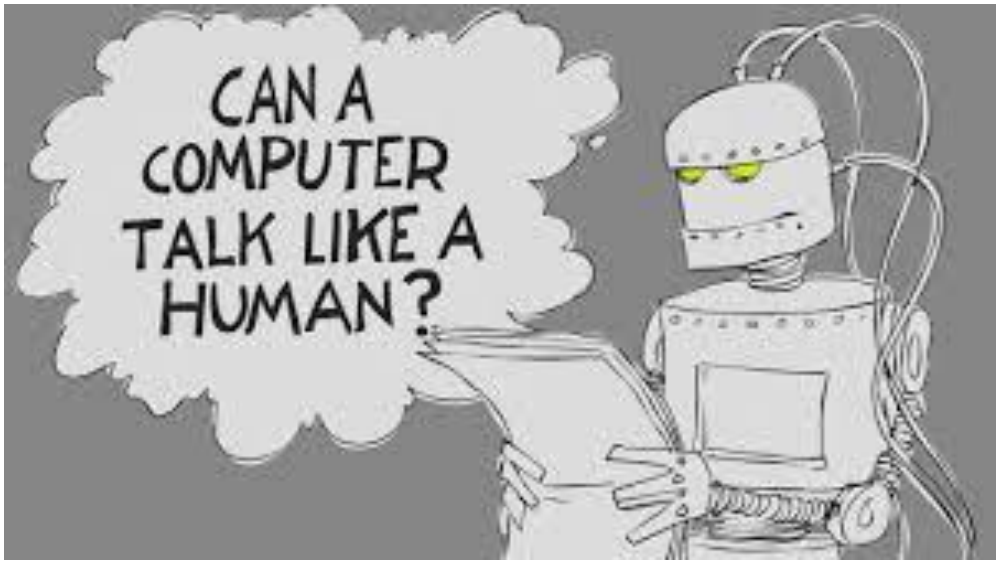
Oliver Selfridge

Nathaniel Rochester

Trenchard More

Turing Test

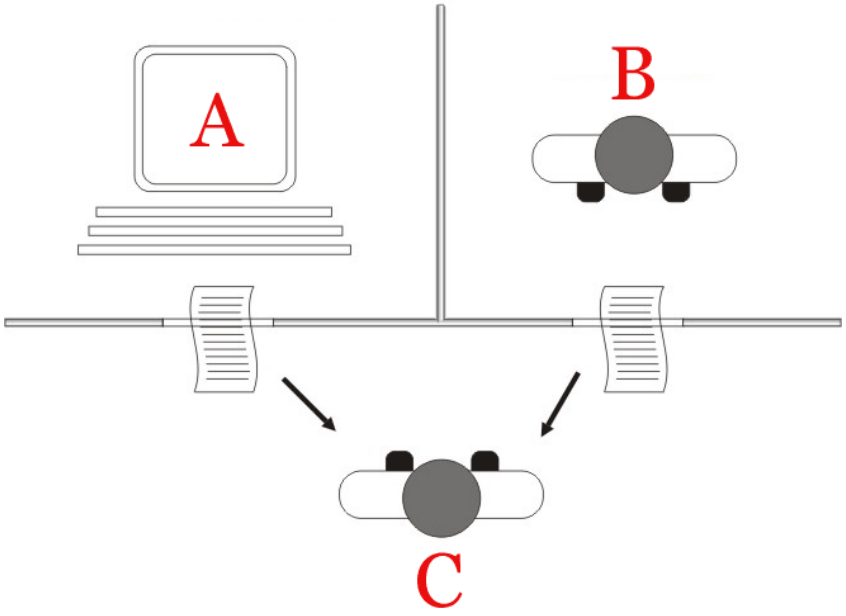
- **Turing test** (proposed by Alan Turing in 1950) has served as a benchmark in measuring progress in the field of artificial intelligence.



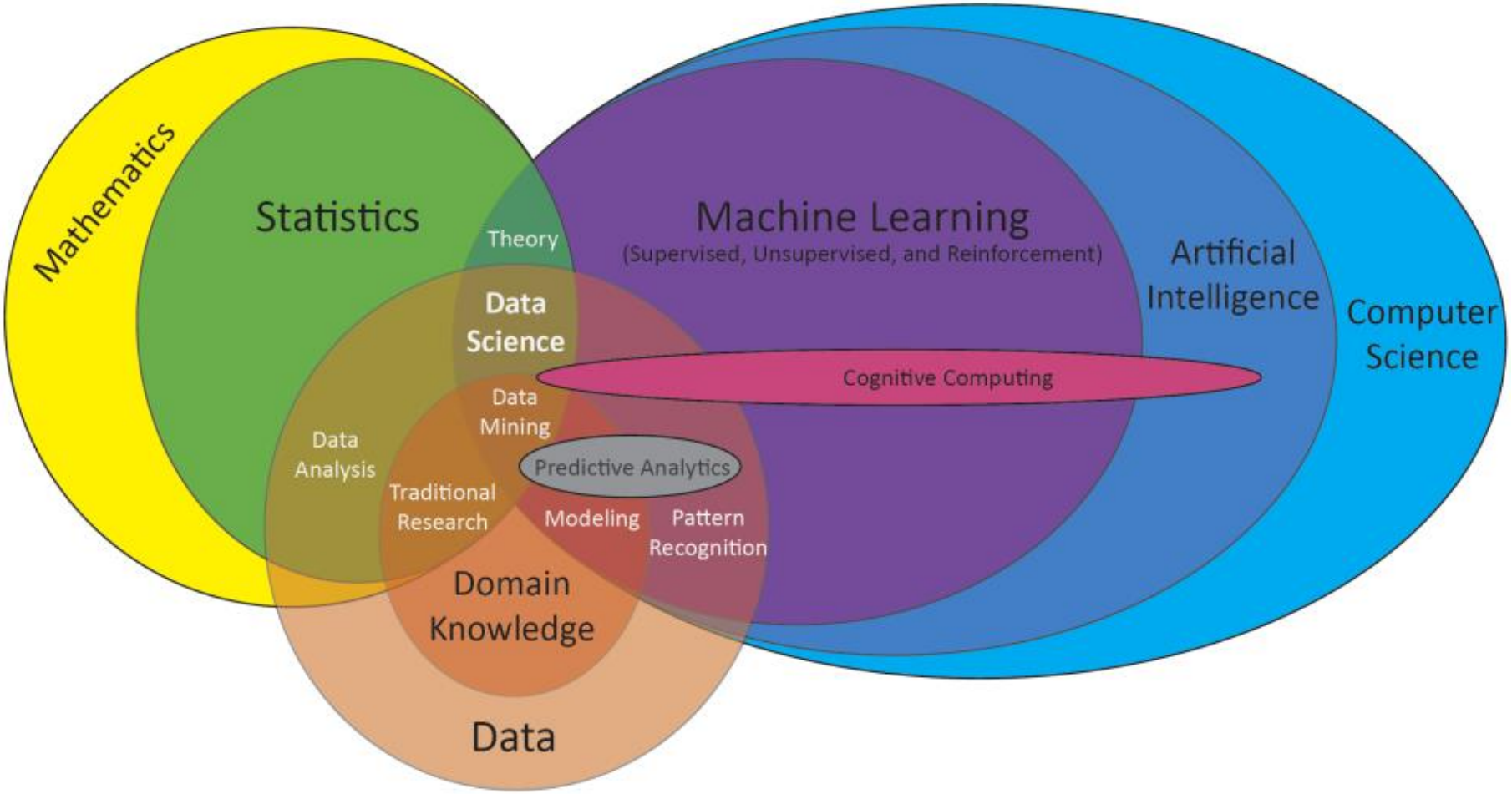
https://www.youtube.com/watch?v=3wLqsRLvV-c

Turing Test

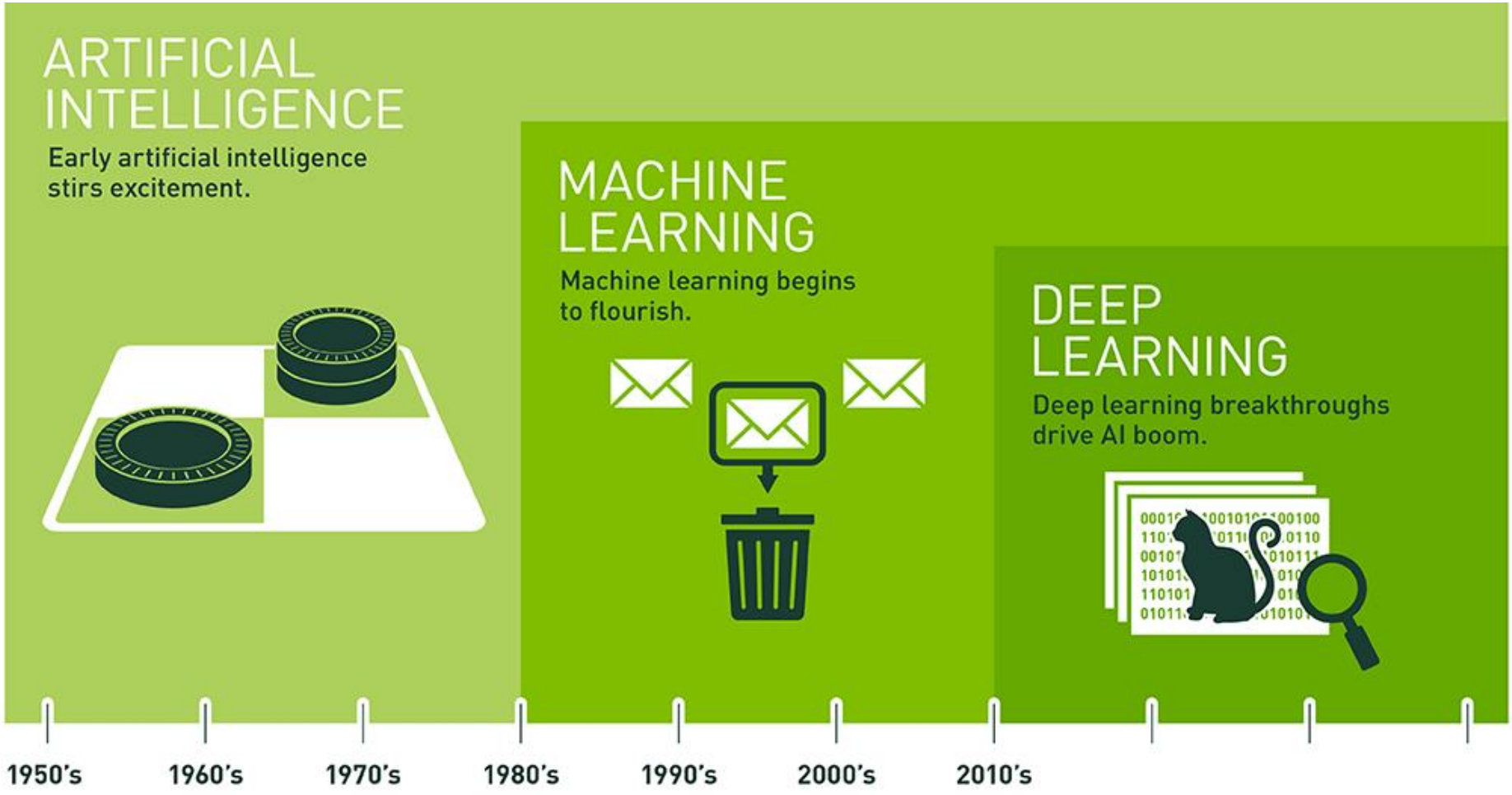
- Test setup: Human interrogator communicates with test subject by typewriter.
- Test: Can the human interrogator distinguish whether the test subject is human or machine?



Research fields related to AI



AI and related concepts



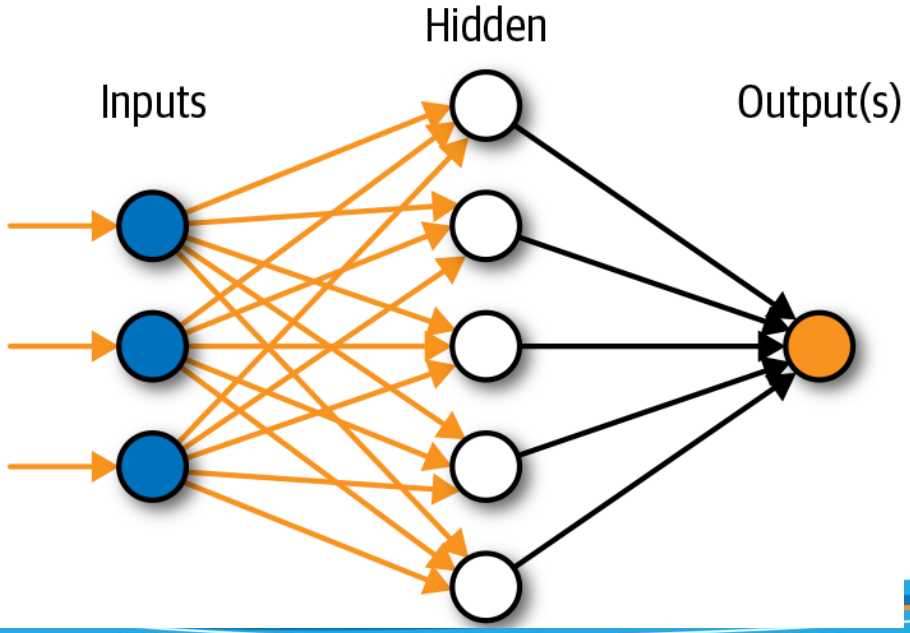
Source: https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

Machine learning

- Machine learning (ML) is a subset of AI that uses computer algorithms to **analyze data** and **make intelligent decisions** based on what it has ***learned, without being explicitly programmed***
- ML algorithms:
  - Trained with large sets of data
  - They learn from examples
  - Do not follow rules-based algorithms

Artificial neural networks

- Take inspiration from biological neural networks
- **Neural network**: a collection of small computing units called **neurons** that take incoming data and learn to make decisions over time.

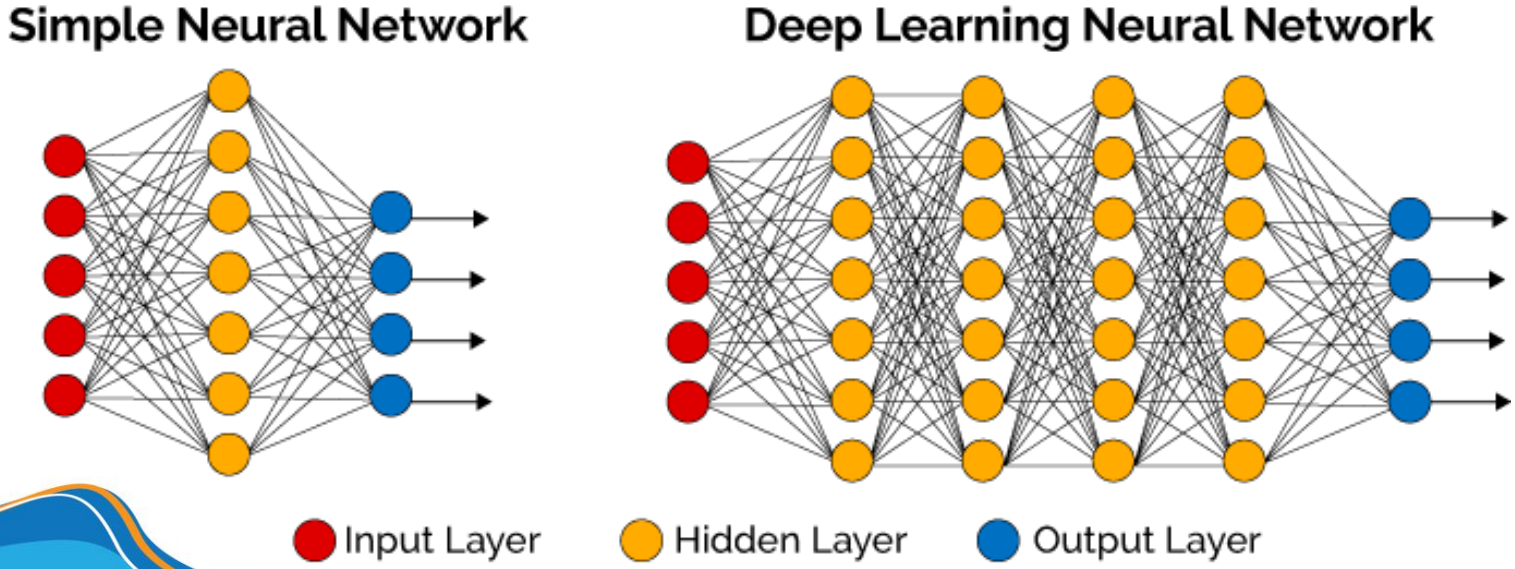


Deep learning

- Deep learning is a specialized subset of Machine Learning that uses layered neural networks to simulate human decision-making.
- Deep learning algorithms:
  - Can label and categorize information and identify patterns.
  - Enables AI systems to continuously learn on the job, and improve the quality and accuracy of results

Deep learning

- Deep learning become **more efficient as the datasets increase** in volume, as opposed to other machine learning algorithms that may **plateau as data increases**
- Reason for Deep learning rise
  - More Data (Big data)
  - Better hardware (GPU)



Data Science

- **Data science** is the *process* and *method* for extracting *knowledge* and *insights* from large volumes of disparate data.
- Related field:
  - Mathematics
  - Statistical analysis
  - Data visualization
  - Machine learning

Data Science

- Data Science use AI techniques to derive insight from data.
  - Use machine learning algorithms and deep learning models to extract meaning and draw inferences from data.
- There is some intersection between AI and data science, but one is not a subset of the other.
- Both AI and Data Science can involve the use of big data that is significantly large volumes of data.

Robotics

- Robotics means building and programming robots so that they can operate in complex, real-world scenarios.
- In a way, robotics is the ultimate challenge of AI since it requires a combination of virtually all areas of AI

Robotics

- Robotics means building and programming robots so that they can operate in complex, real-world scenarios.
- In a way, robotics is the ultimate challenge of AI since it requires a combination of virtually all areas of AI:
  - Computer vision and speech recognition
  - Natural language processing, information retrieval, and reasoning under uncertainty
  - Cognitive modeling and affective computing (systems that respond to expressions of human feelings or that mimic feelings)

Quiz 1

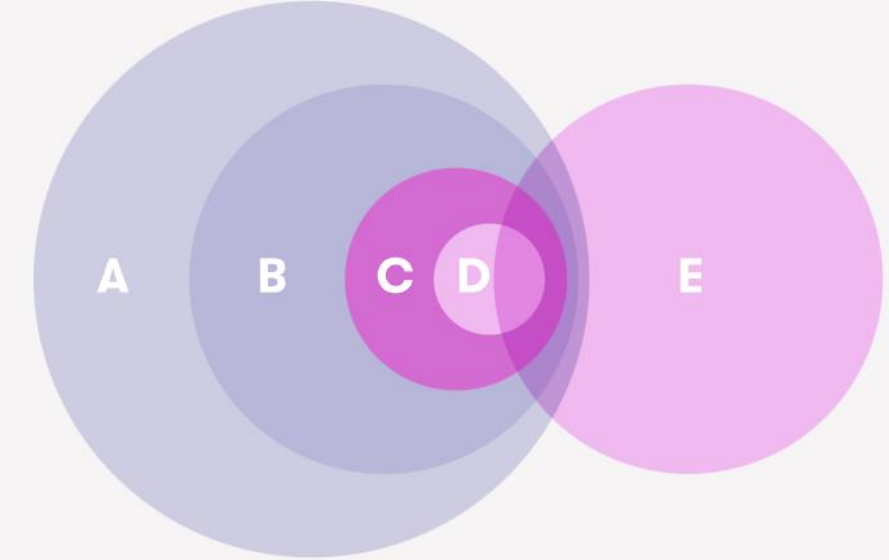
- Is the following an application of Machine Learning and AI: A machine that beats human in a game in which all rules and moves have been pre-programmed into the machine - true or false?
  A. TRUE
  B. FALSE

Quiz 2

- Data Science is a subset of AI that uses machine learning algorithms to extract meaning and draw inferences from data.
  - TRUE
  - FALSE

Quiz 3

- Where to put: **AI**, **machine learning**, **computer science**, **data science**, and **deep learning**.
- A
- B
- C
- D
- E



Quiz 4

- Determine which AI-related fields are involved in them

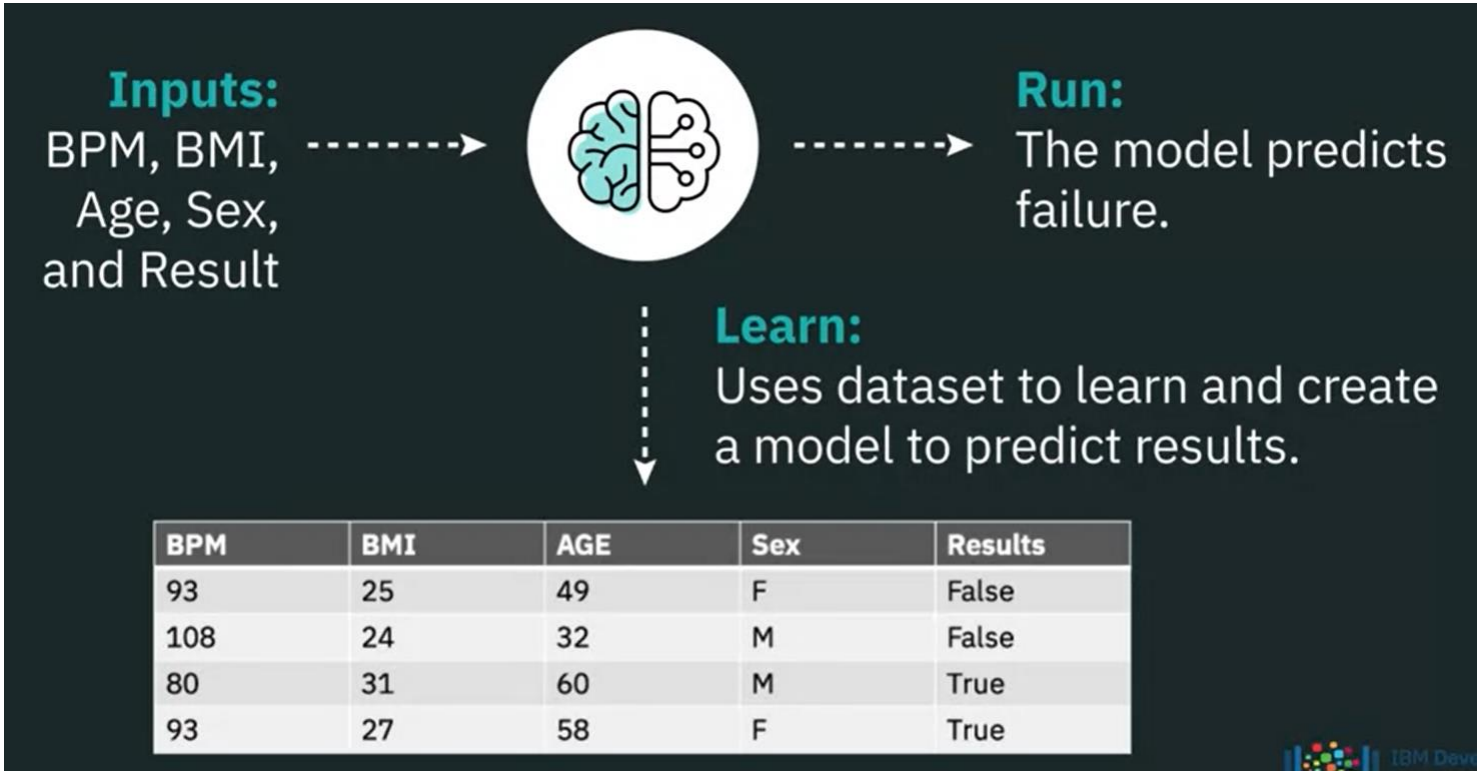
	Statistics	Robotics	Machine learning
Autonomous car			
Steering a rocket into orbit			
Online ad optimization			
Customer service chatbot			
Summarizing voting results			

Machine Learning

- Build **model** to classify and make predictions from provided data.
  - Do no follow rules-based algorithms
  - Train with large set of data

Machince learning

- **Problem**: Determine if heart will fail

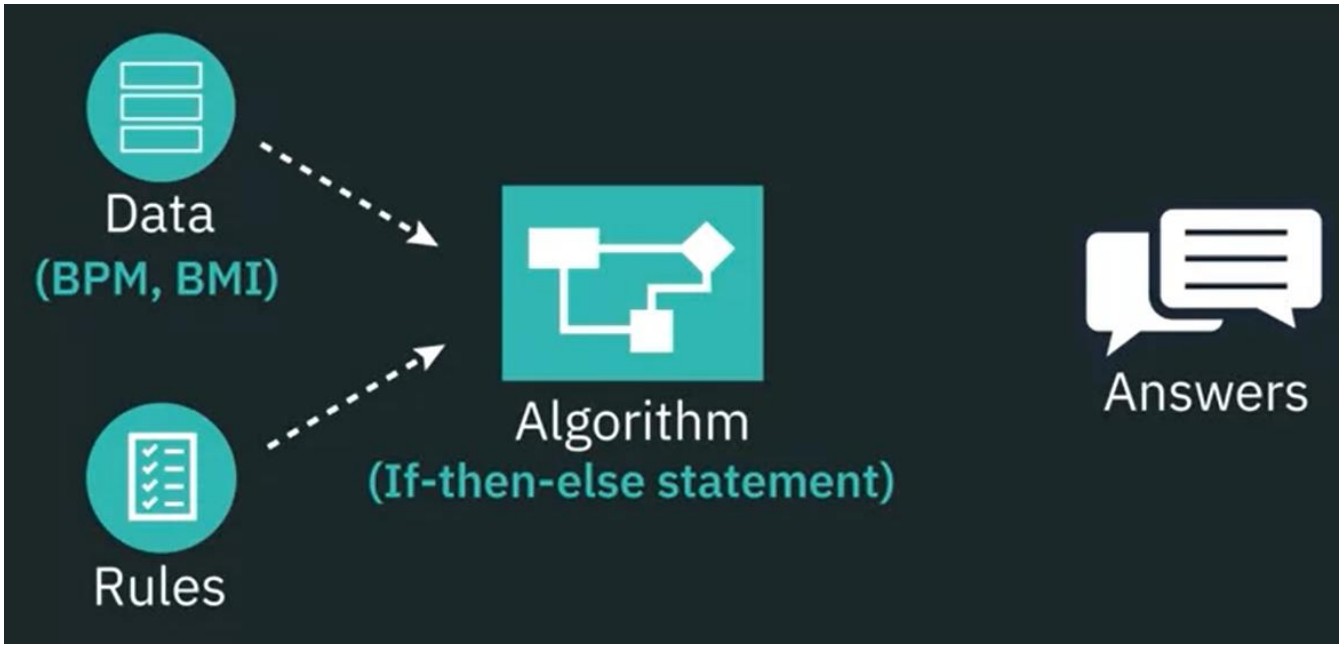


BPM	BMI	AGE	Sex	Results
93	25	49	F	False
108	24	32	M	False
80	31	60	M	True
93	27	58	F	True

Source: https://www.coursera.org/learn/introduction-to-ai/lecture/39OeD/machine-learning

Machince learning

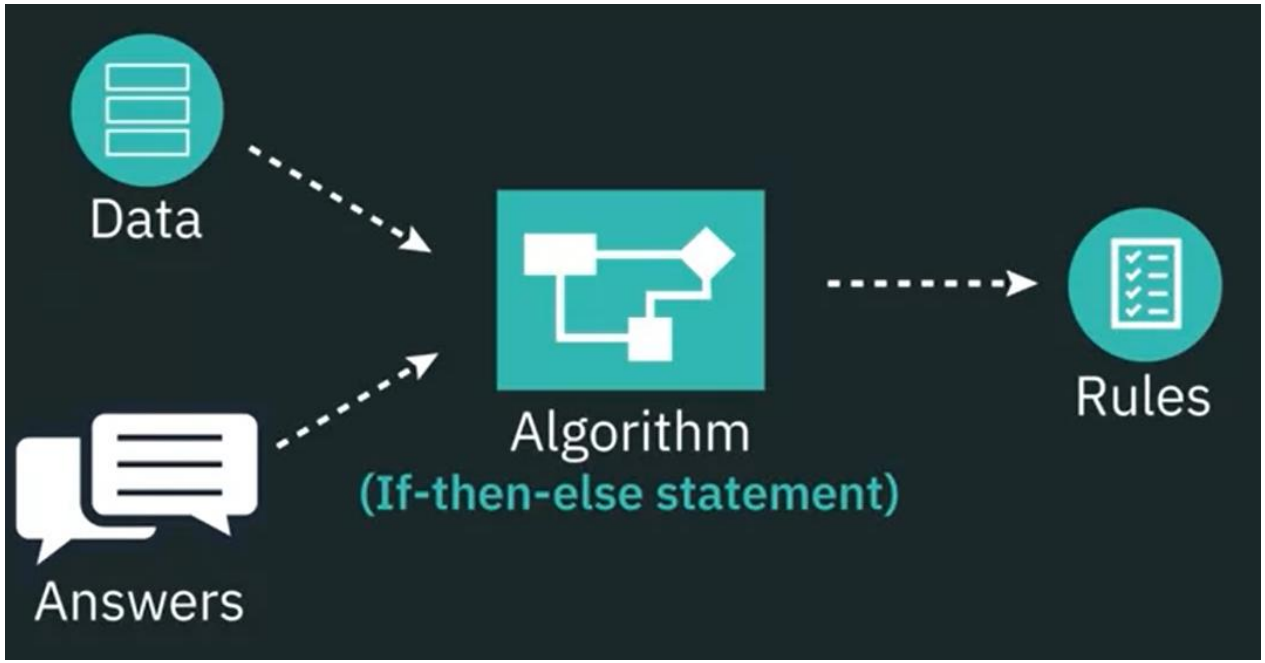
- **Traditional programing:**



Source: https://www.coursera.org/learn/introduction-to-ai/lecture/39OeD/machine-learning

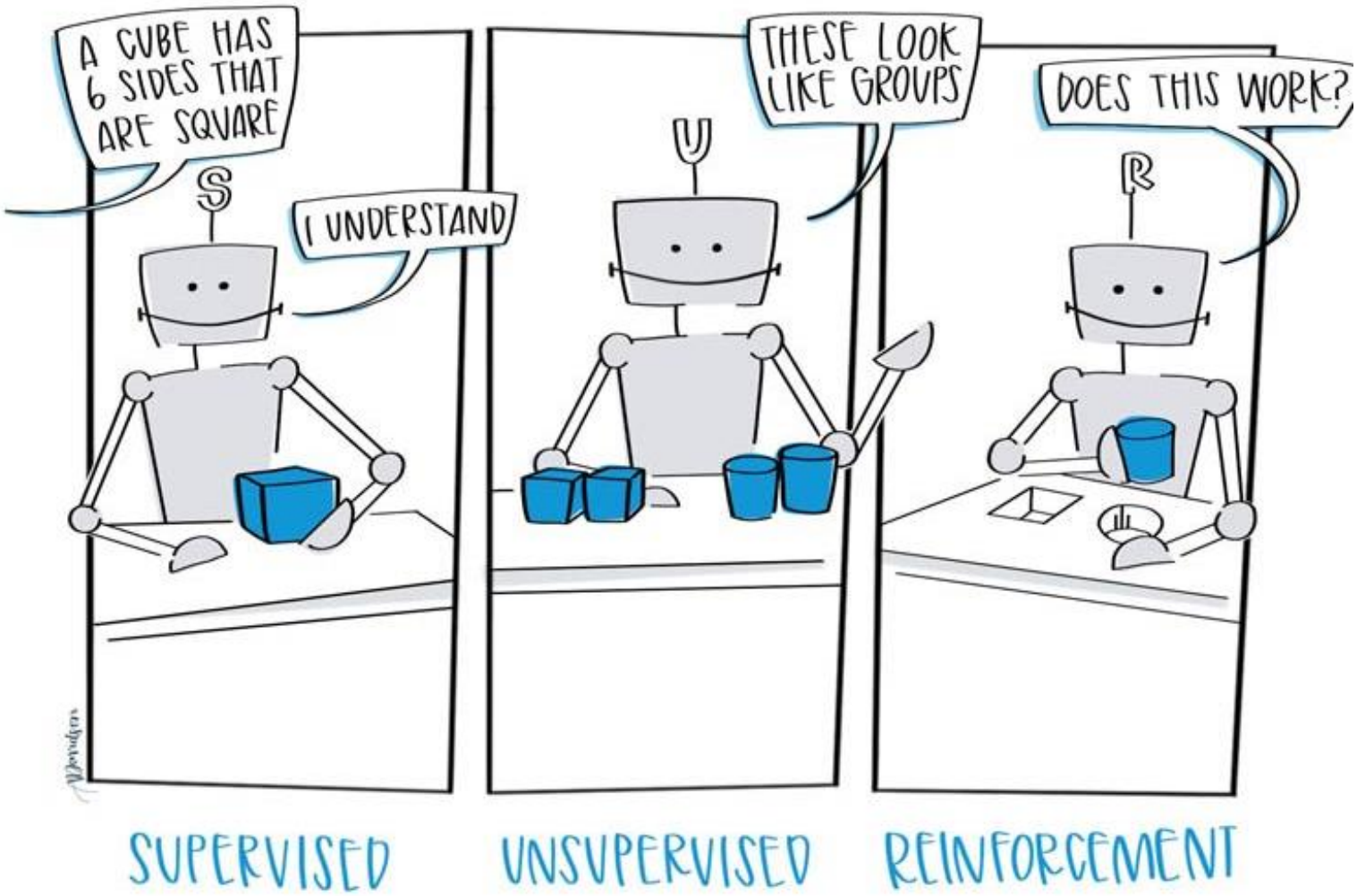
Machince learning

- **ML approach:**



Source: https://www.coursera.org/learn/introduction-to-ai/lecture/39OeD/machine-learning

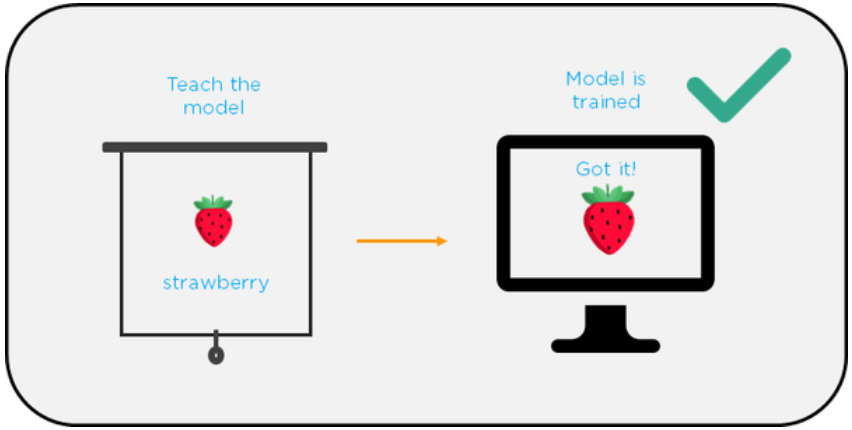
Types of machine learning



Source: https://www.ceralytics.com/3-types-of-machine-learning/

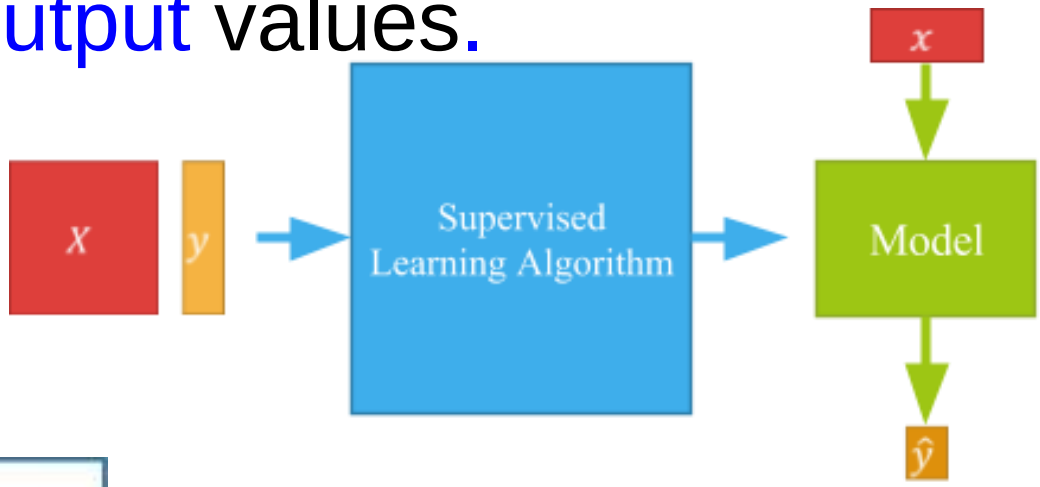
Supervised learning

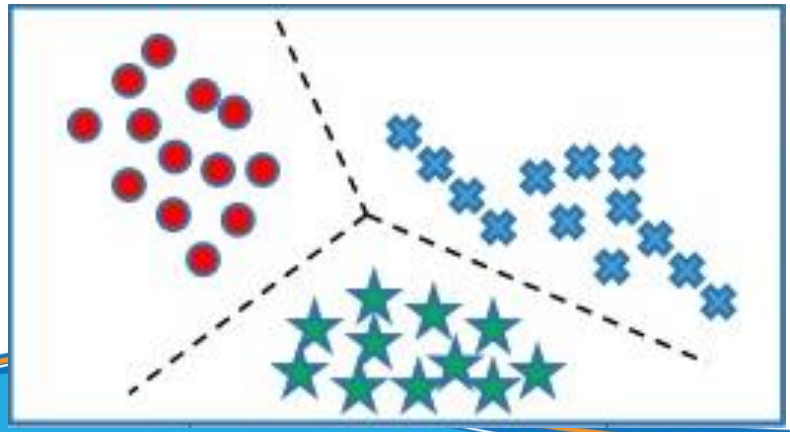
- Task of learning a function that maps an input to an output based on example input-output pairs.
- An algorithm trained on human-labeled data. The more samples you provide a supervised learning algorithm, the more precise it becomes in classifying new data.



Supervised learning

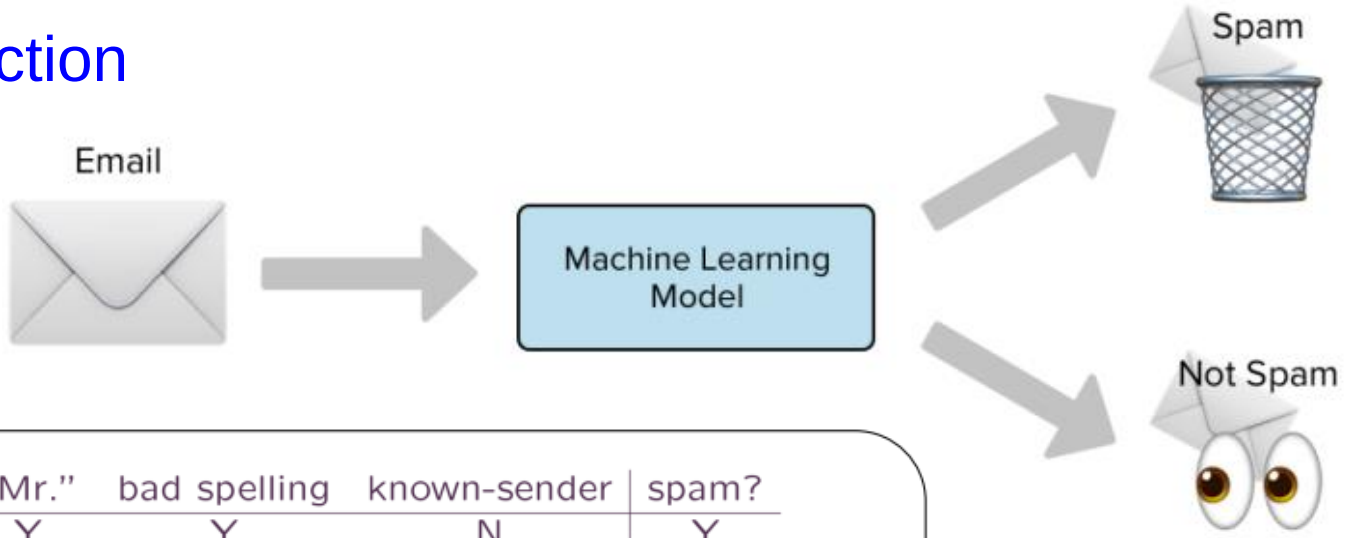
- Learn a function that maps an input to an output based on examples, which are pairs of input-output values.





Supervised learning: Examples

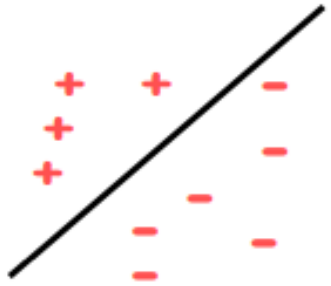
- Spam detection



	"money"	"pills"	"Mr."	bad spelling	known-sender	spam?
	Y	N	Y	Y	N	Y
	N	N	N	Y	Y	N
	N	Y	N	N	N	Y
example	Y	N	N	N	Y	N (label)
	N	N	Y	N	Y	N
	Y	N	N	Y	N	Y
	N	N	Y	N	N	N

Reasonable RULES

- Predict SPAM if unknown AND (money OR pills)
- Predict SPAM if 2money + 3pills – 5 known > 0



Linearly separable

Classification vs. Regression

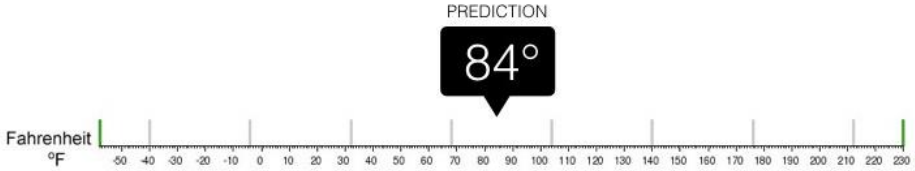
- Train a model to predict a categorical dependent variable
- Case studies: predicting disease, classifying images, predicting customer churn, buy or won't buy, etc.

Classification vs. Regression

- Train a model to predict a continuous dependent variable
- Case studies: predicting height of children, predic stock prices, etc.

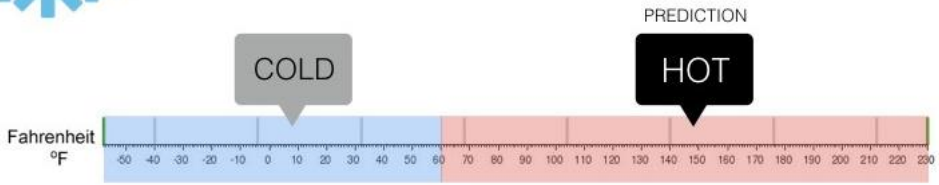
Regression

What is the temperature going to be tomorrow?



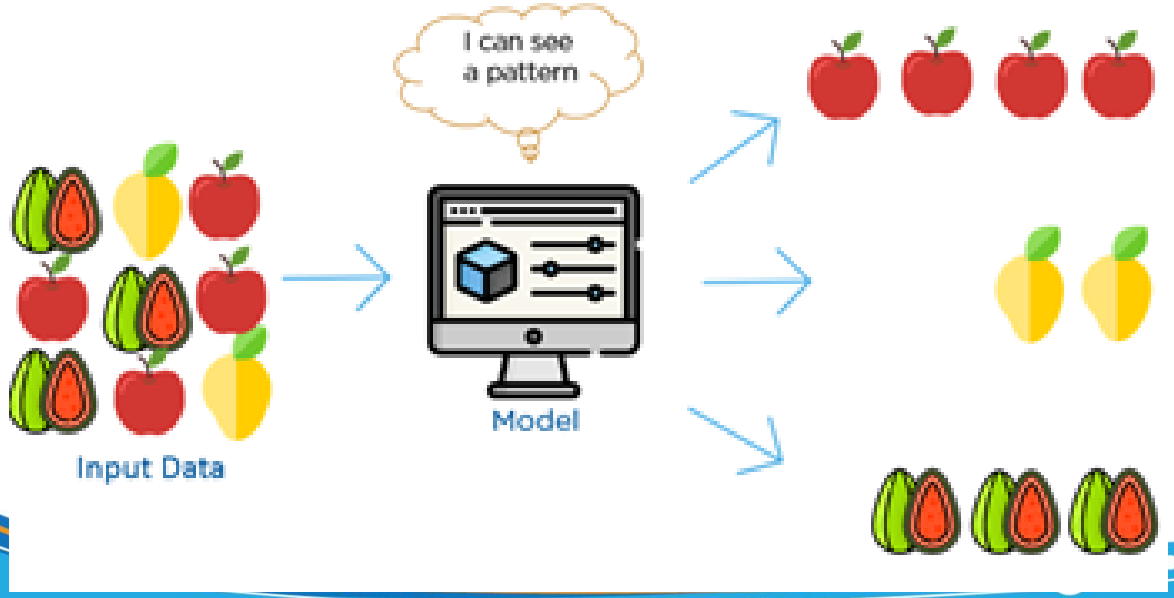
Classification

Will it be Cold or Hot tomorrow?



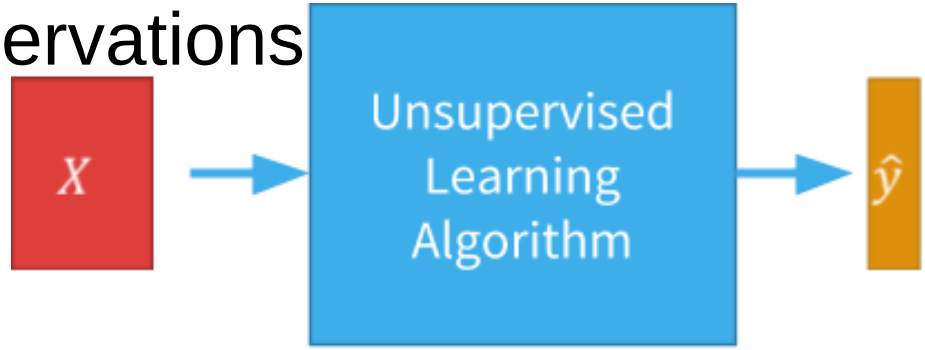
Unsupervised Learning

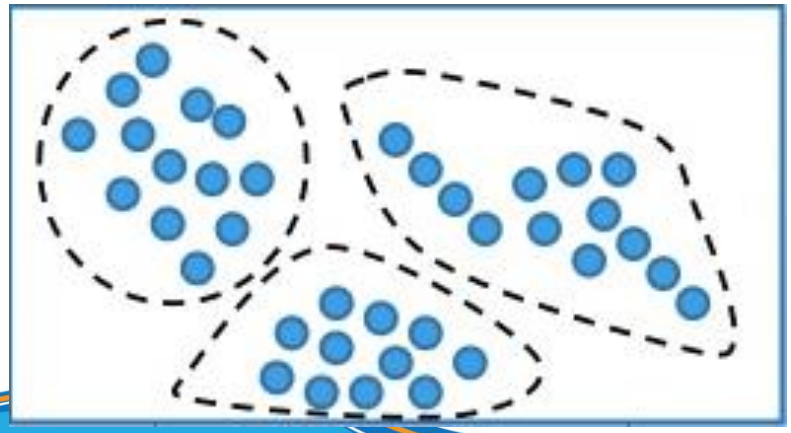
- Learns from test data that has not been labeled, classified or categorized.
- Unsupervised learning identifies commonalities in the data and reacts based on the presence or absence of such commonalities in each new piece of data.



Unsupervised learning

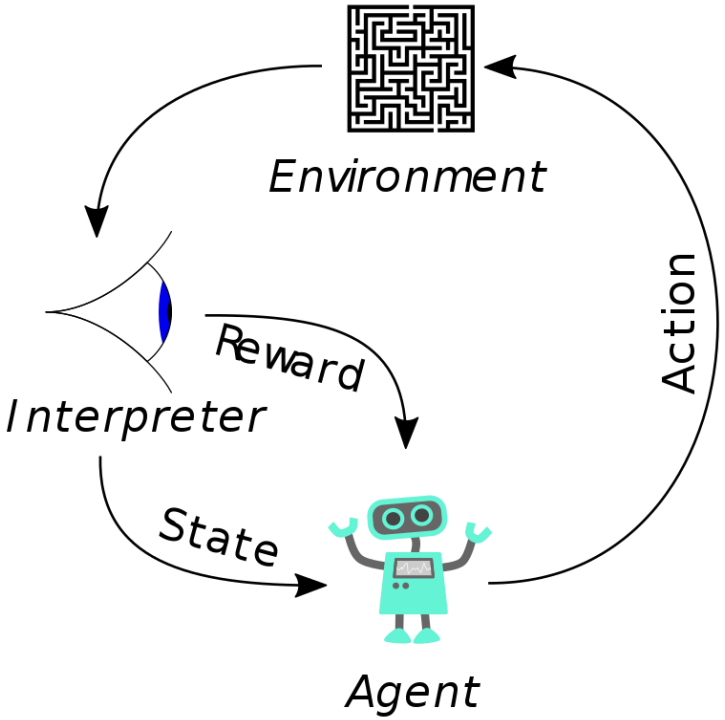
- Infer a function to describe hidden structure from "unlabeled" data
  - A classification (or categorization) is not included in the observations





Reinforcement learning

- The agent learns from the environment by interacting with it and receives rewards for performing actions.



Learning to ride a bike requires trial and error, much like reinforcement learning. (Video courtesy of Mark Harris, who says he is “learning reinforcement” as a parent.)

Reinforcement learning: Examples

https://www.youtube.com/watch?v=gn4nRCC9TwQ

Quiz 5

- Which of the following are attributes of Machine Learning?
  - A. Takes data and answers as input and use these inputs to create a set of rules that determine what the Machine Learning model will be
  - B. Machine learning algorithms can be continuously trained and used in the future to predict values
  - C. Defines behavioral rules by comparing large data sets to find common patterns
  - D. In Machine Learning models, when we submit inputs, we get answers based on predefined rules

Quiz 6

- We can use reinforcement learning to teach a machine to play chess.
  A. TRUE
  B. FALSE

Reference

- 1. Introduction to Artificial Intelligence (AI), coursera.