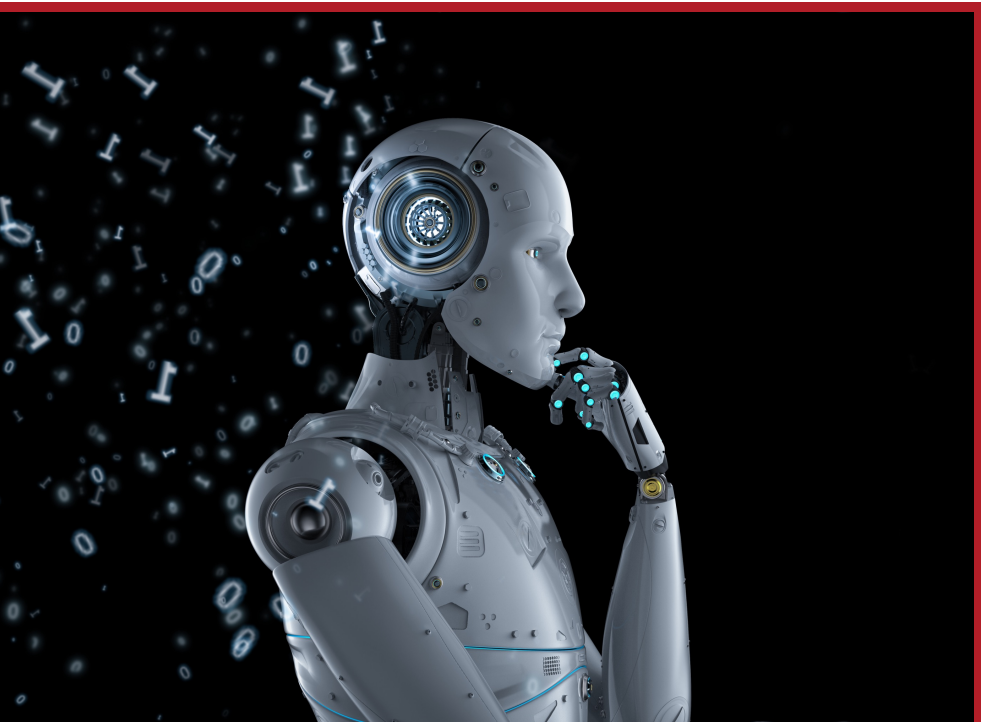
Impacts of AI: COMP3800-03
About Artificial Intelligence
Wentworth Institute of Technology

Artificial Intelligence: Definition



"Artificial Intelligence (AI) is a science and a **set of computational technologies** that are *inspired* by — but typically operate quite differently from —the ways people use their nervous systems and bodies to **sense, learn, reason and take action**."

AI Evolution Factors

Data

Exponential growth of available data, with the introduction of the Internet, social media, proliferation of sensors and smart devices, and the fact that data storage became cheaper

Algorithms

The development of more advanced algorithms has helped AI become more powerful and efficient.

Computing

Back when AI was just beginning to be developed, the computing power was minimal. Computers nowadays can take much more data and heavier algorithms than in the 1950s.

AI <> TIMELINE

1950	Turing publishes the Turing-test. "The point at which a machine has answers like a human"
1955	AI first named by John McCarthy
1956	"First" AI algorithm Logic Theorist by Simon and Newell
1957	Rosenblatt invents the first self learning algorithm with the perceptron
1958	IBM 305, the first hard drive, 5 MB
1969	Backpropagation, one of the most important areas of a neural network, is proposed
1970	IBM 1330, 100MB
1974	Intel produces second generation general purpose chips
1974-1980	First AI winter, the belief in machine learning and AI had dropped after multiple unsuccessful experiments combined with insufficient computing power, network capabilities and database capacity
1985	IBM 0665 hard drive, 40 MB. But much smaller than the 1330
1989	First convolutional neural network developed (used a lot in image recognition)
1991	The internet is open for the public
1992	First versions of natural language solutions set up.
1997	IBM's deep blue defeats Kasparov in Chess
1998	Google's Page rank is published
2000	The adoption of Internet by the masses
2002	Amazon brings cloud computing to the masses
2004	Google develops an algorithm that can handle large amounts of data faster.
2005	Stanford Robot drives automatically
2006	IBM introduces Watson. A question answering machine that later wins from a Jeopardy champion
2010	Worldwide IP traffic exceeds 20 exabytes (20 billion gigabytes) per month
2012	Facebook gets a billion users
2014	There are more mobile devices than humans in the world
2018	Project debater of IBM shows ability to process very large data sets, including millions of news articles across dozens of subjects, and then turn snippets of arguments into full flowing prose—a challenging task for a computer

January 2011: Jeopardy!

Ken, Watson and Brad

Here is a breakdown of AI…

If I say, **Sky**, you would likely say…. **Blue**

If I say, **grass**, you would likely say…. **Green**

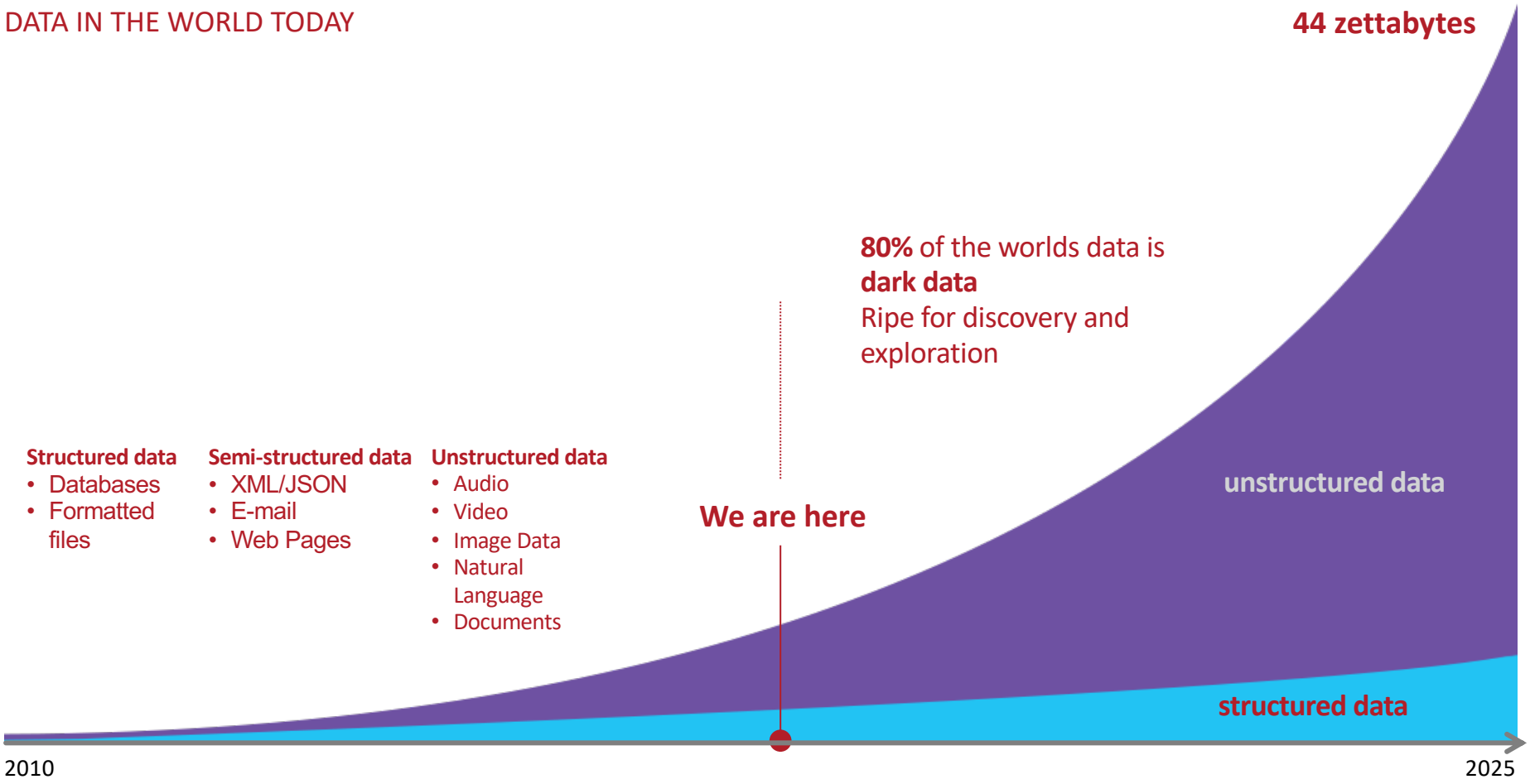
If I say, **AI**, I encourage you to say…. **Machine Learning**

If I say, **machine learning**, I'd like to think… **Prediction / Classification**

1) Supervised learning	**Regression**	**Classification**	**Naïve Bayes**	**KNN**
2) Unsupervised learning	**Apriora**	**K-means**	**Clustering**	
3) Reinforcement learning	**Markov Decision Process**		**Q-learning**	

…and what comprises **algorithms'** favorite food???…. **Data**

DATA IN THE WORLD TODAY



Cognitive systems

Probabilistic: Self-improving

Traditional systems

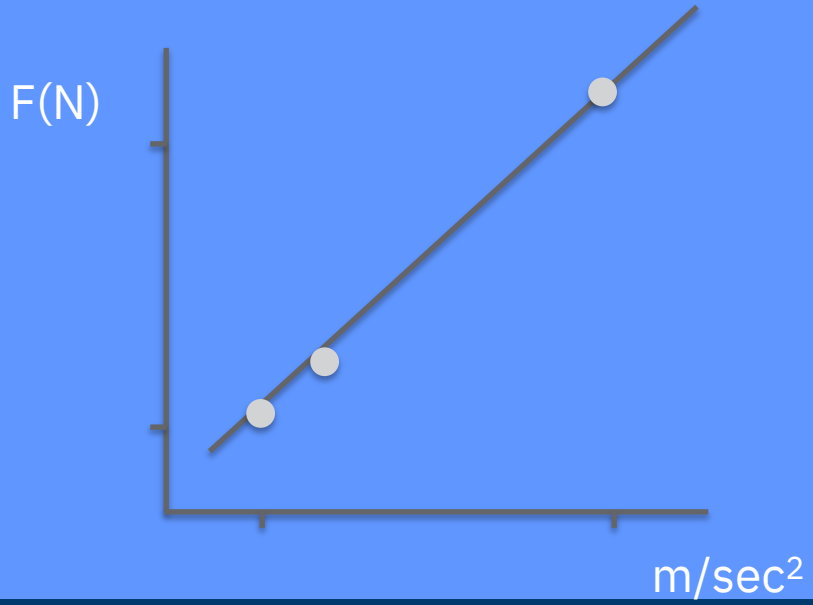
Deterministic: Static

Traditional

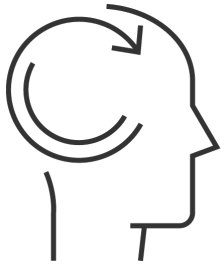
Deterministic Systems

F=ma

C=2Kg

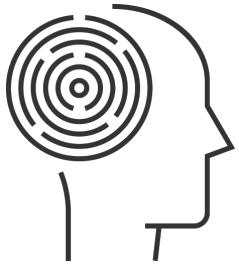


Cognitive Systems understand, reason, learn and interact



Understanding

Cognitive systems understand like humans do.

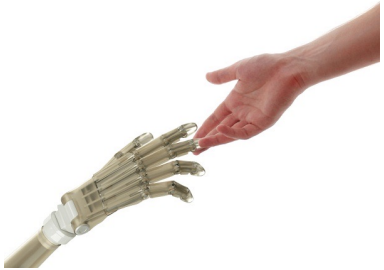


Reasoning

They reason underlying ideas and concepts. They debate. They infer and extract concepts.

Learning

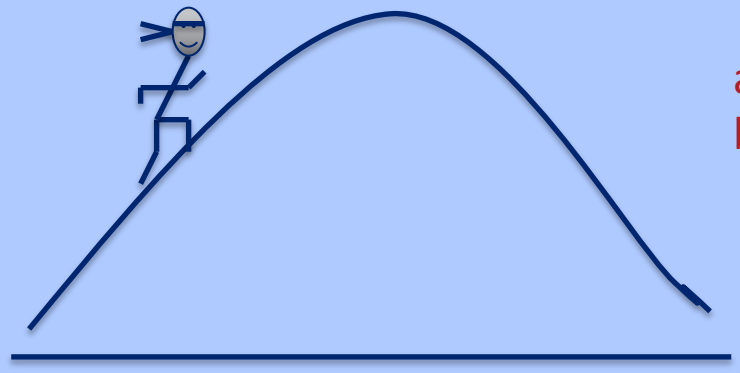
They never stop learning. Advancing with each new piece of information, interaction, and outcome. They develop “expertise.”



Interact

… Allowing them to interact with humans.

Machine learning is blind



Climb to the top of the hill
Under two conditions:

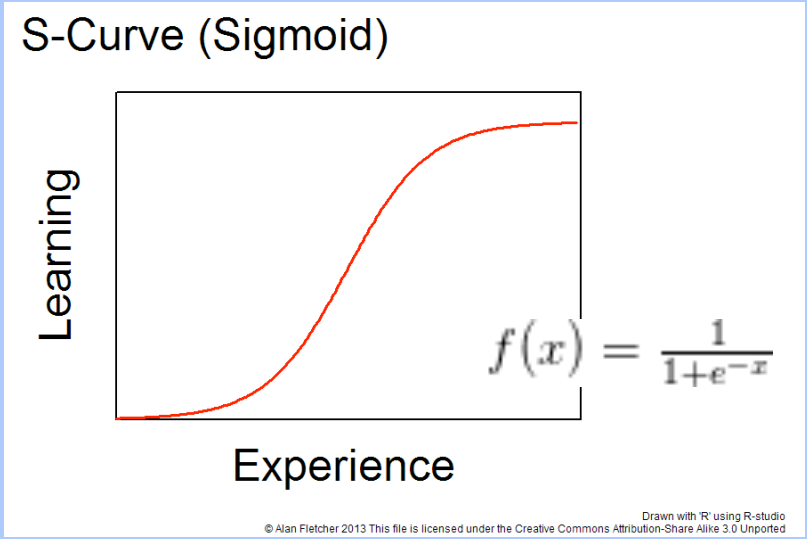
a) Must do it blindfolded
b) In as minimum steps as possible

The S-Curve is everywhere…

It is Logistical Regression
It is dichotomous, bi-modal

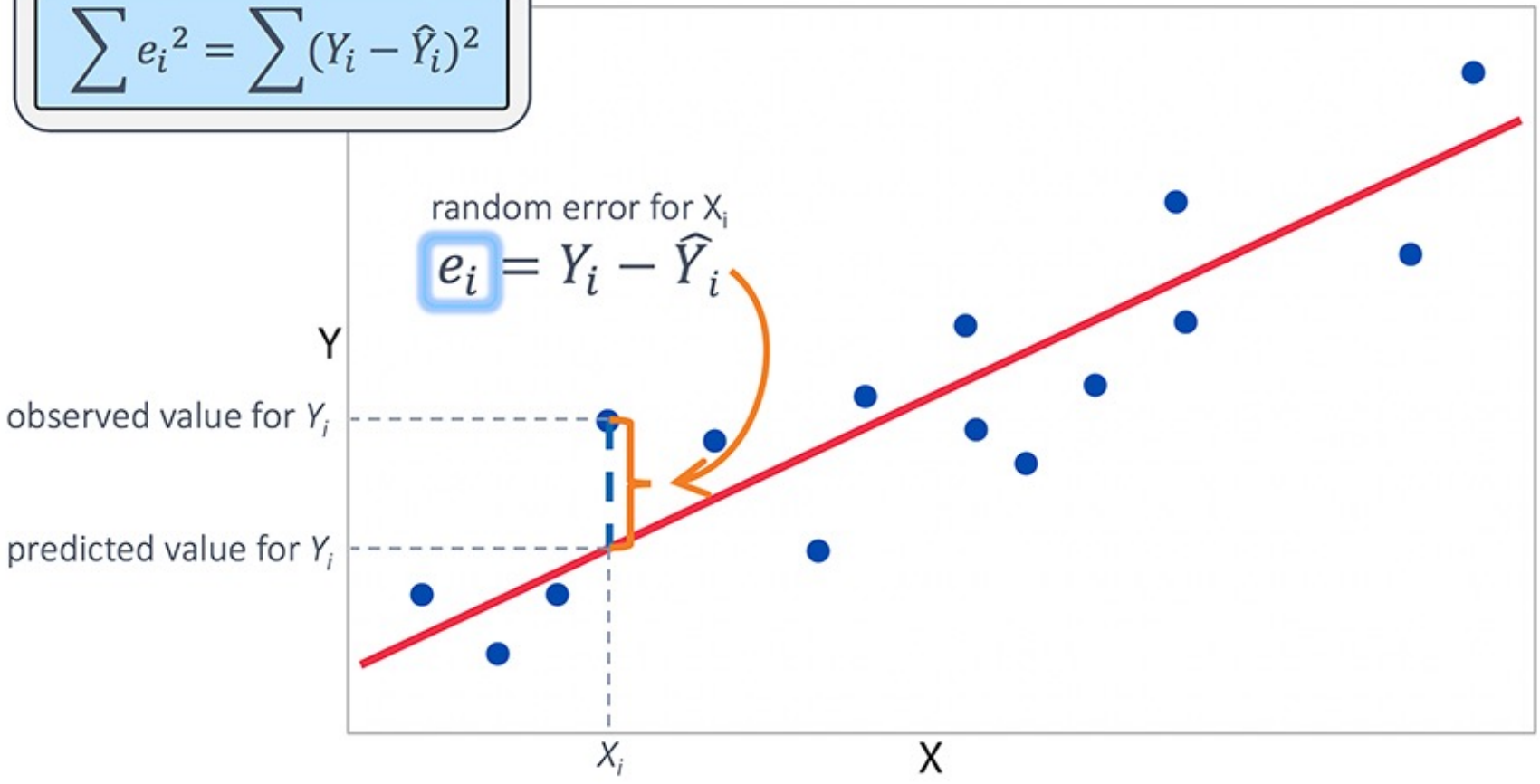
You would likely use:

- Support Vector Machines
- Random Forest Trees
- Bayesian Inferences



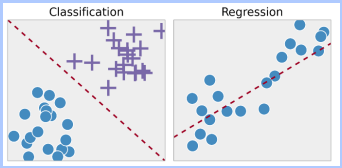
Method of Least Squares

$$\sum e_i^2 = \sum (Y_i - \hat{Y}_i)^2$$

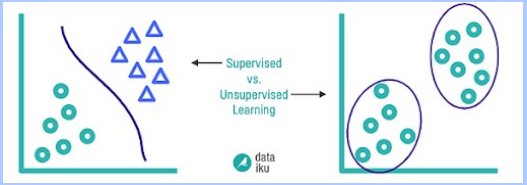


What are the three machine learning approaches?

- Supervised learning

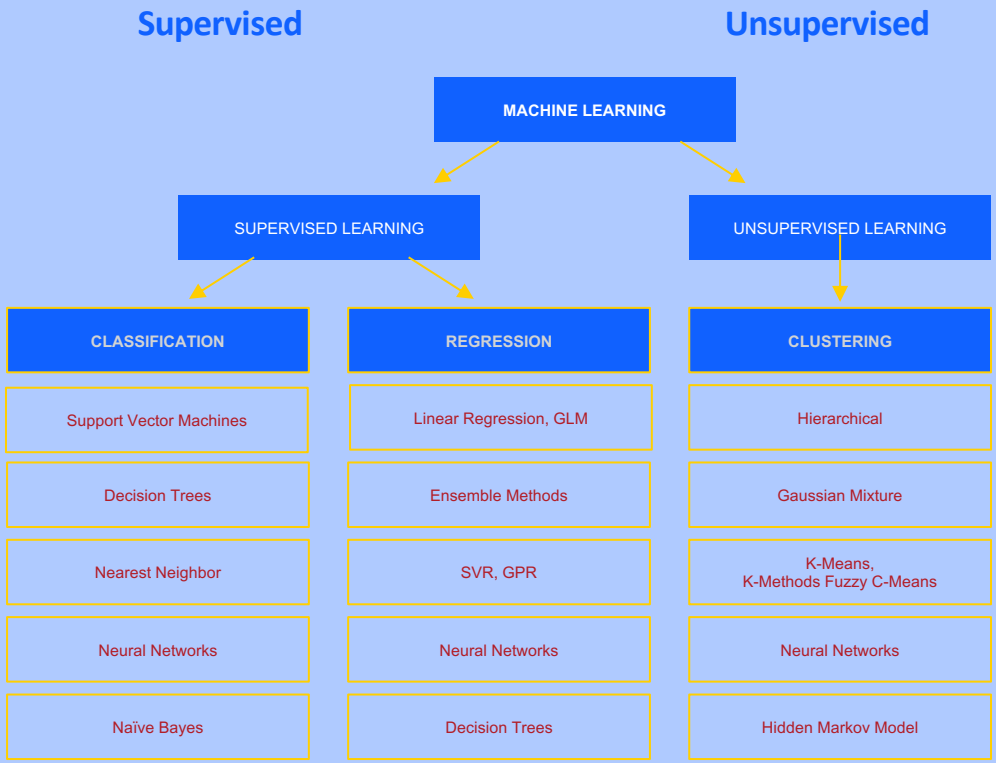


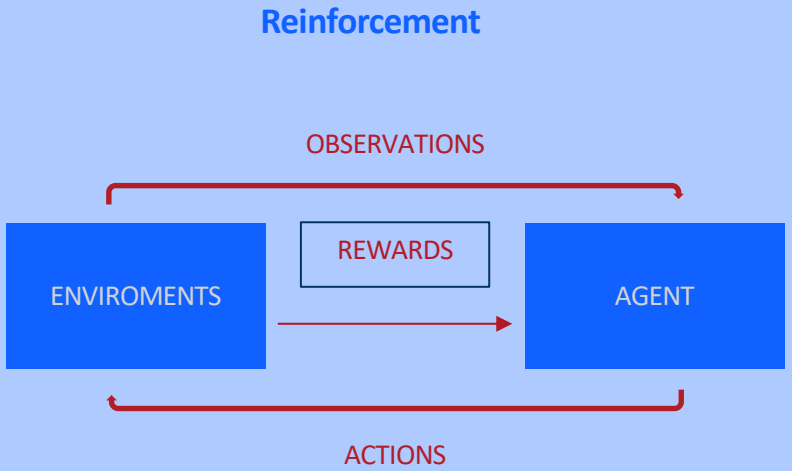
- Unsupervised learning



- Reinforcement learning

Algorithms used with machine learning methods





Supervised vs. Unsupervised Machine Learning

Parameters	Supervised ML techniques	Unsupervised ML techniques
Process	In a supervised learning model, input and output variables are given.	In unsupervised learning model, only input data will be given
Input data	Algorithms are trained using labeled data.	Algorithms are used against data which is not labeled
Algorithms used	Support vector machine, Neural network, Linear and logistics regression, random forest, and Classification trees.	Unsupervised algorithms can be divided into different categories: like Cluster algorithms, K-means, Hierarchical clustering, etc.
Computational complexity	Supervised learning is a simpler method.	Unsupervised learning is computationally complex
Use of data	Supervised learning model uses training data to learn a link between the input and the outputs.	Unsupervised learning does not use output data.
Accuracy of results	Highly accurate and trustworthy method.	Less accurate and trustworthy method.
Real-time learning	Learning method takes place offline.	Learning method takes place in real time.
Number of classes	Number of classes is known.	Number of classes is not known.
Main drawback	Classifying big data can be a real challenge in Supervised Learning.	You cannot get precise information regarding data sorting, and the output as data used in unsupervised learning is labeled and not known.

What is reinforcement learning

- Reinforcement Learning is a feedback-based Machine learning technique in which an agent learns to behave in an environment by performing the actions and seeing the results of actions.
- For each good action, the agent gets positive feedback, and for each bad action, the agent gets negative feedback or penalty.
- In Reinforcement Learning, the agent learns automatically using feedbacks without any labeled data, unlike supervised learning.
- Since there is no labeled data, so the agent is bound to learn by its experience only.

When do I use reinforcement learning

- RL solves a specific type of problem where decision making is sequential, and the goal is long-term, such as **game-playing, robotics**, etc. The agent interacts with the environment and explores it by itself.
- The primary goal of an agent in reinforcement learning is to improve the performance by getting the maximum positive rewards.
- The agent learns with the process of hit and trial, and based on the experience, it learns to perform the task in a better way. Hence, we can say that ***"Reinforcement learning is a type of machine learning method where an intelligent agent (computer program) interacts with the environment and learns to act within that."*** How a Robotic dog learns the movement of his arms is an example of Reinforcement learning.
- The agent continues doing these three things (**take action, change state/remain in the same state, and get feedback**), and by doing these actions, the agent learns and explores the environment.
- The agent learns that what actions lead to positive feedback or rewards and what actions lead to negative feedback penalty. As a positive reward, the agent gets a positive point, and as a penalty, it gets a negative point.

Three major AI calibers

Artificial Narrow Intelligence (ANI):

Sometimes referred to as *Weak AI*, Artificial Narrow Intelligence is AI that specializes in *one* area. ANI can beat Jeopardy! World champion. Ask it to figure out a better way to store data on a hard drive, and it'll look at you blankly.

Artificial General Intelligence (AGI):

Sometimes referred to as *Strong AI*, or *Human-Level AI*, Artificial General Intelligence refers to a computer that is as smart as a human *across the board*—a machine that can perform any intellectual task that a human being can.

Artificial Superintelligence (ASI):

Oxford philosopher and leading AI thinker Nick Bostrom defines superintelligence as "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills." Artificial Superintelligence ranges from a computer that's just a little smarter than a human to one that's trillions of times smarter—across the board.

Becoming an AI

Stage One: Calculations (mathematics)

Stage Two: Execution (algorithms/methods)

Stage Three: Analysis (regression)

Stage Four: Supervised Learning (optimization)

Stage Five: Unsupervised Learning (problem solving)

Stage six: Unsupervised Asking (rhetorical learning/bounded action)

Stage Seven: Unsupervised Action (doing/unbounded action)

A.H. Chu https://medium.com/quality-works/the-algorithm-that-will-save-humanity-or-destroy-it-4089b87c6793#.b7gu9x1vr

Median Expert Prediction for AGI (2040)

Median Expert Prediction for ASI (2060)

1900

2000

Today

2100

waitbutwhy.com