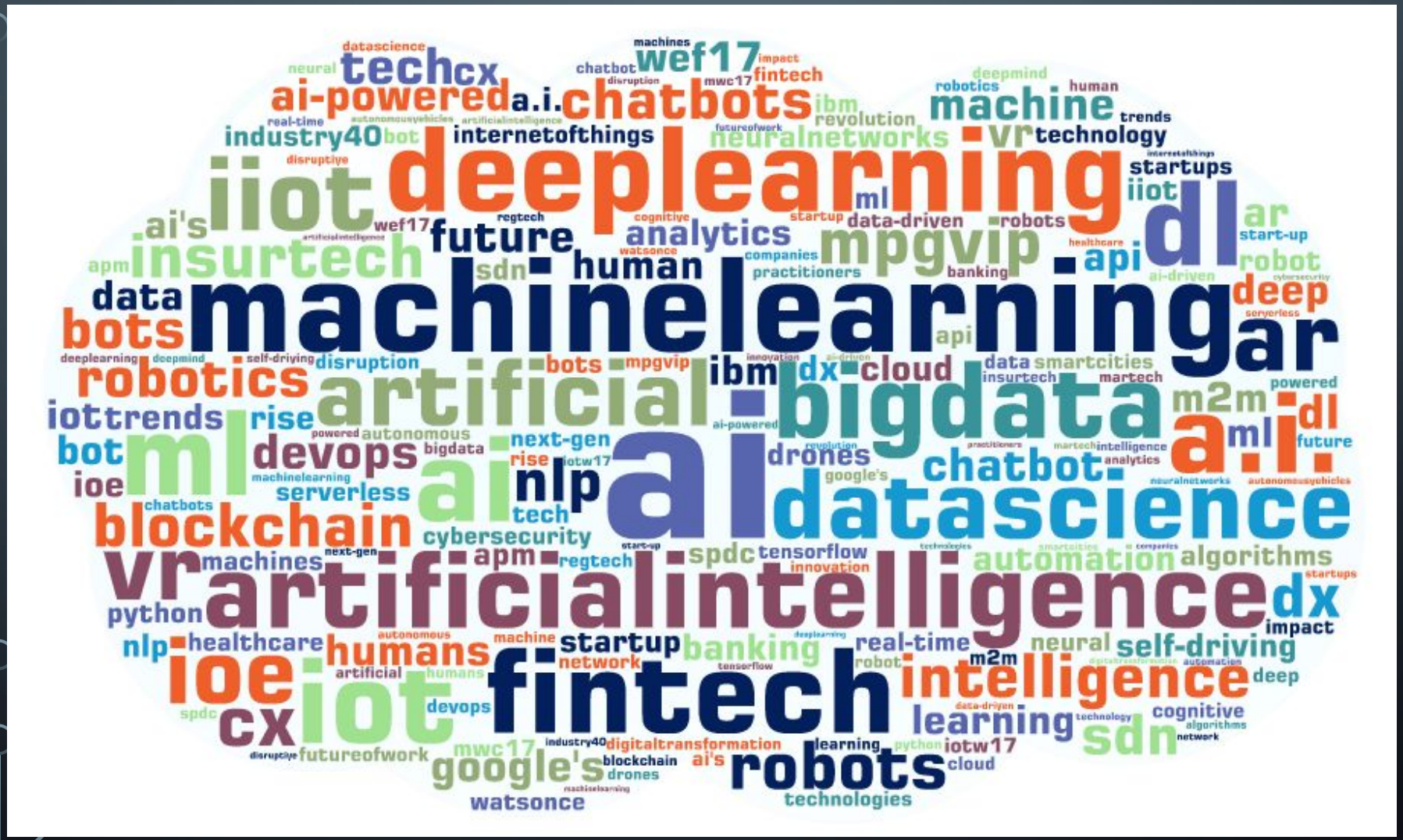
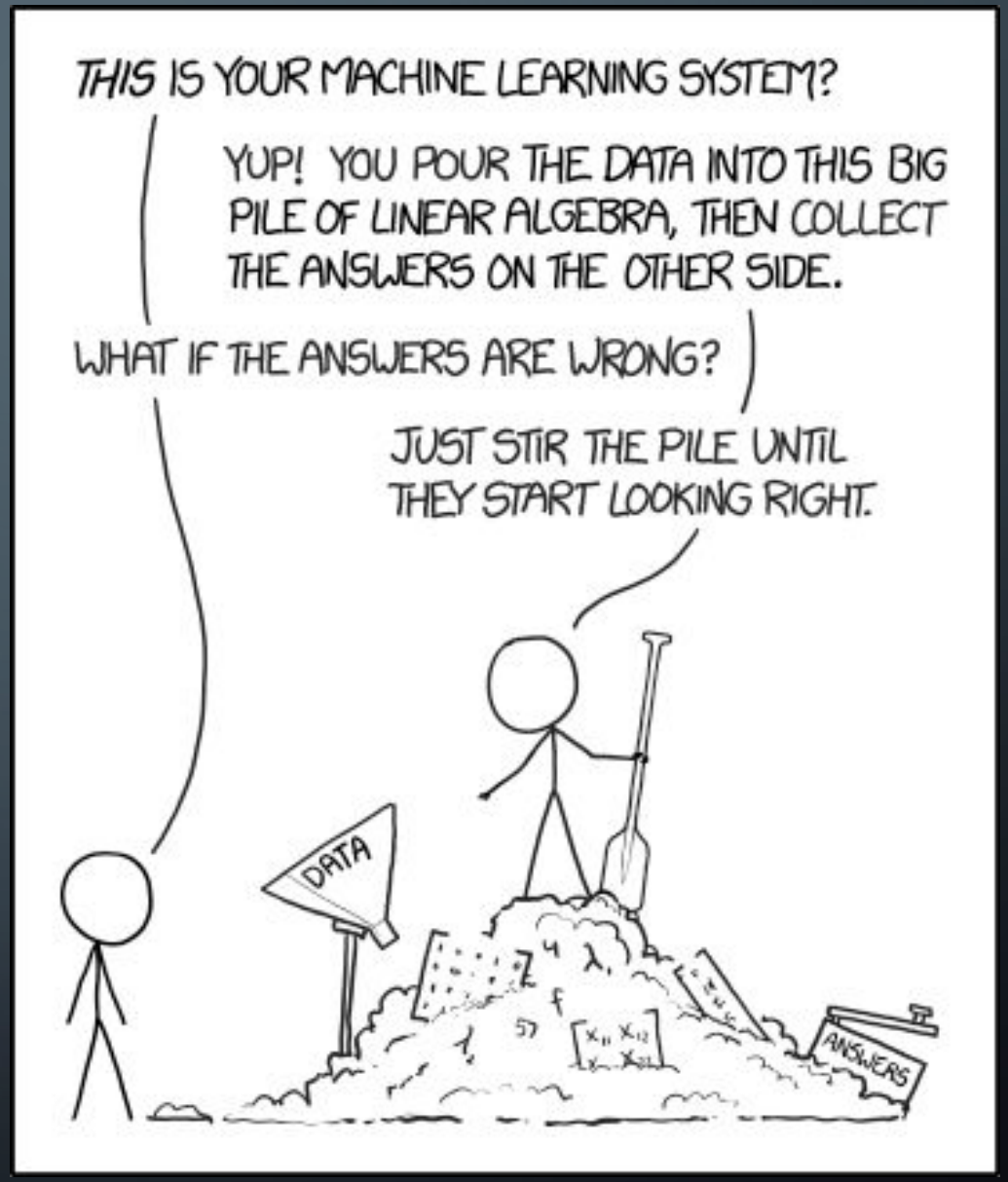
HIGH LEVEL OVERVIEW OF MACHINE LEARNING

Epoch – THE ML CLUB OF IIITH

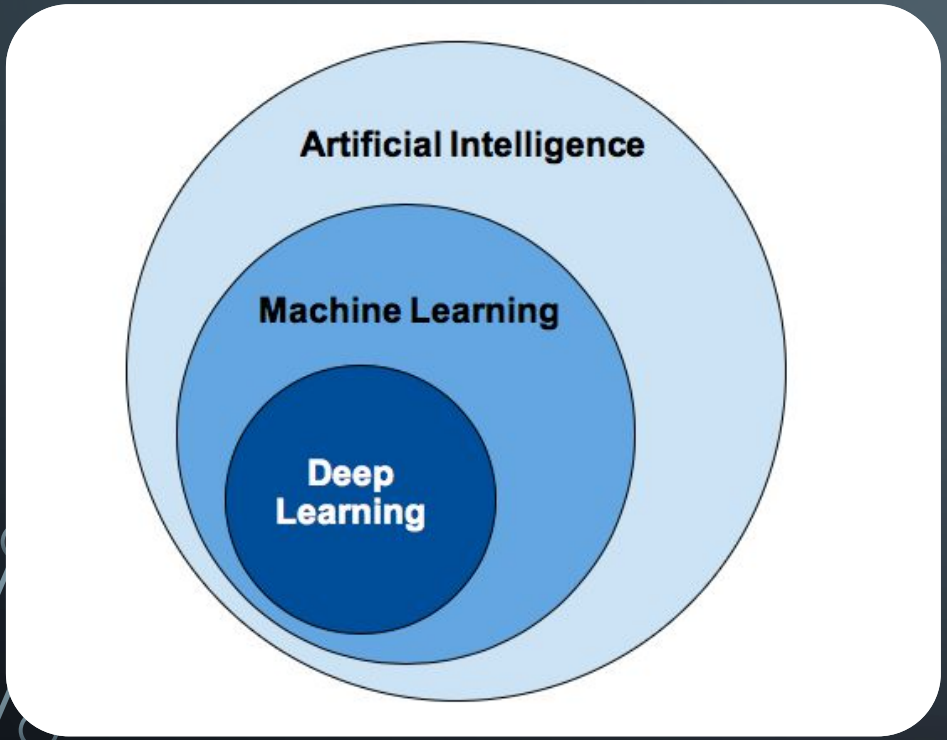
WHAT'S MACHINE LEARNING and other buzzwords



Defining ML


THIS IS YOUR MACHINE LEARNING SYSTEM?
YUP! YOU POUR THE DATA INTO THIS BIG PILE OF LINEAR ALGEBRA, THEN COLLECT THE ANSWERS ON THE OTHER SIDE.
WHAT IF THE ANSWERS ARE WRONG?
JUST STIR THE PILE UNTIL THEY START LOOKING RIGHT.
DATA
ANSWERS

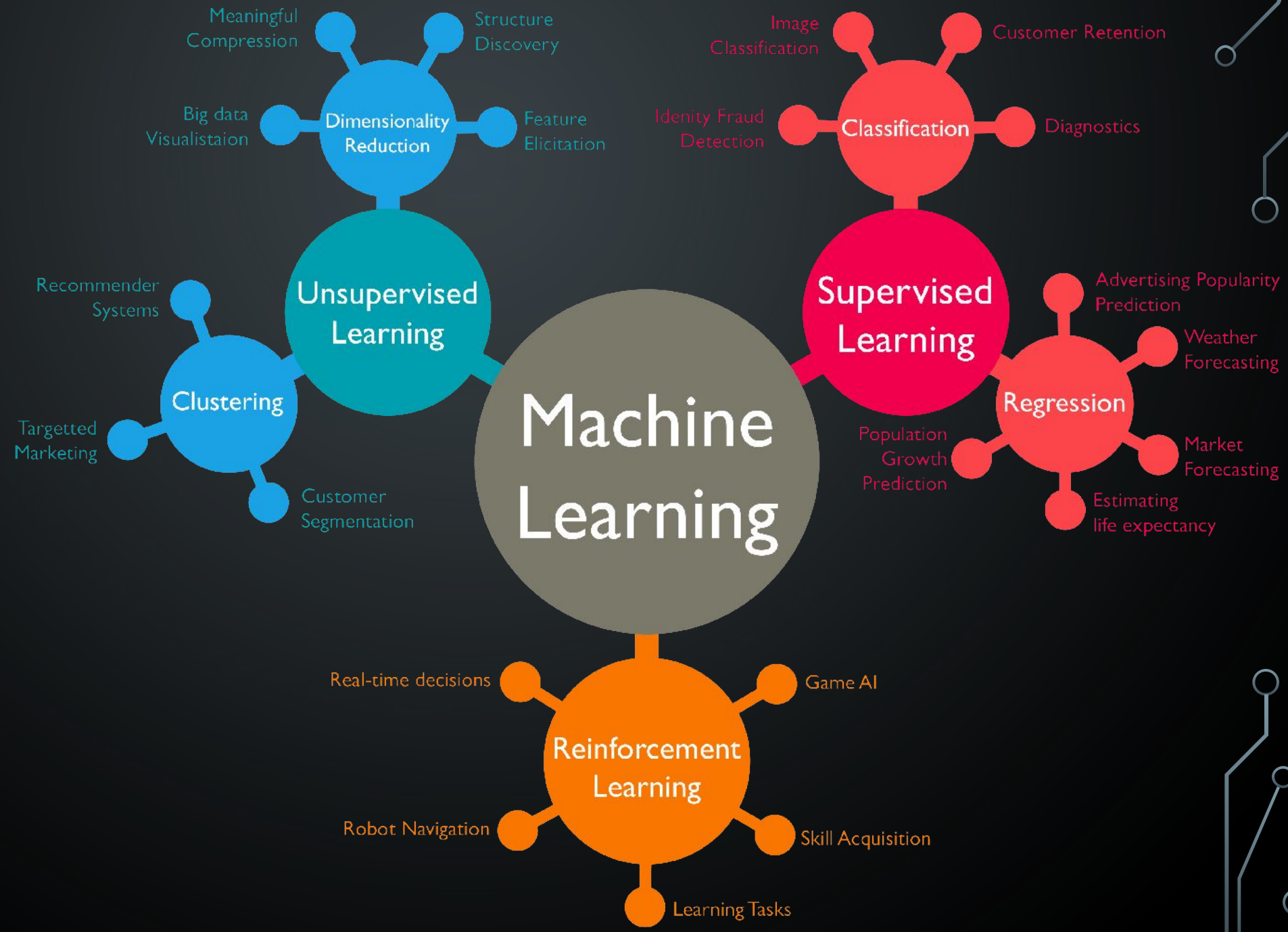
Defining ML formally.



Machine Learning:-

- is the field of study that gives computers the capability to learn without being explicitly programmed.
- is one of the most exciting technologies that one would have ever come across.
- gives the computer that which makes it more similar to humans: The ability to learn.

TYPES OF MACHINE LEARNING



SUPERVISED LEARNING

- currently most successful subfield.
- Labelled data is available.
- Main task is to learn the function mapping inputs to outputs.
- Learning from example.
  - One way is to minimize a loss function.
  - different kinds for different applications.

branches into two broad tasks

Regression

outputs a target value (numerical) based on input parameters.

Classification

gives a categorical label corresponding to the input parameters.

Applications of Supervised learning

stock market predictions

body part recognition (random forests)

Real-Time Human Pose Recognition in Parts from Single Depth Images

Jamie Shotton Andrew Fitzgibbon Mat Cook Toby Sharp Mark Finocchio
Richard Moore Alex Kipman Andrew Blake
Microsoft Research Cambridge & Xbox Incubation

Abstract

We propose a new method to quickly and accurately predict 3D positions of body joints from a single depth image, using no temporal information. We take an object recognition approach, designing an intermediate body parts representation that maps the difficult pose estimation problem into a simpler per-pixel classification problem. Our large and highly varied training dataset allows the classifier to estimate body parts invariant to pose, body shape, clothing, etc. *Finally we generate confidence-scored 3D proposals of several body joints by reprojecting the classification result and finding local modes.*

The system runs at 200 frames per second on consumer hardware. Our evaluation shows high accuracy on both

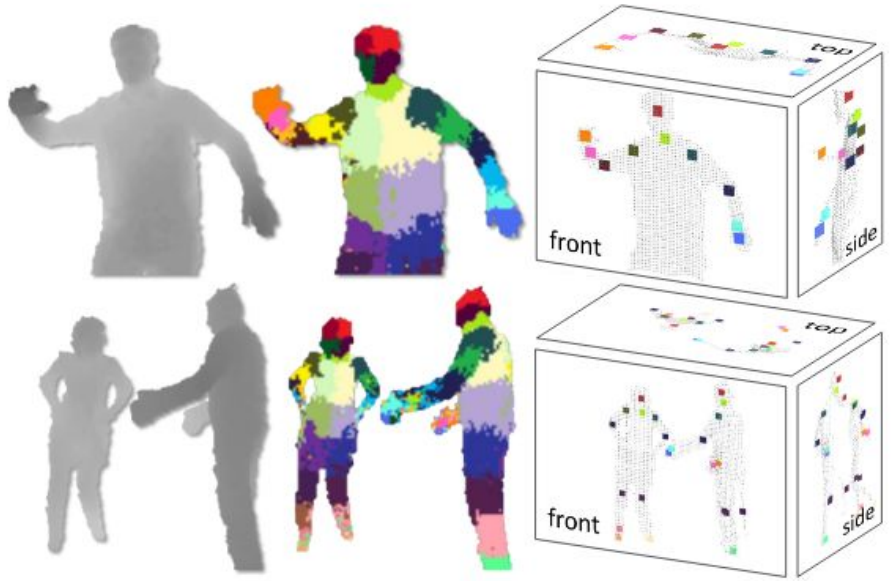


Figure 1. **Overview.** From an single input depth image, a per-pixel

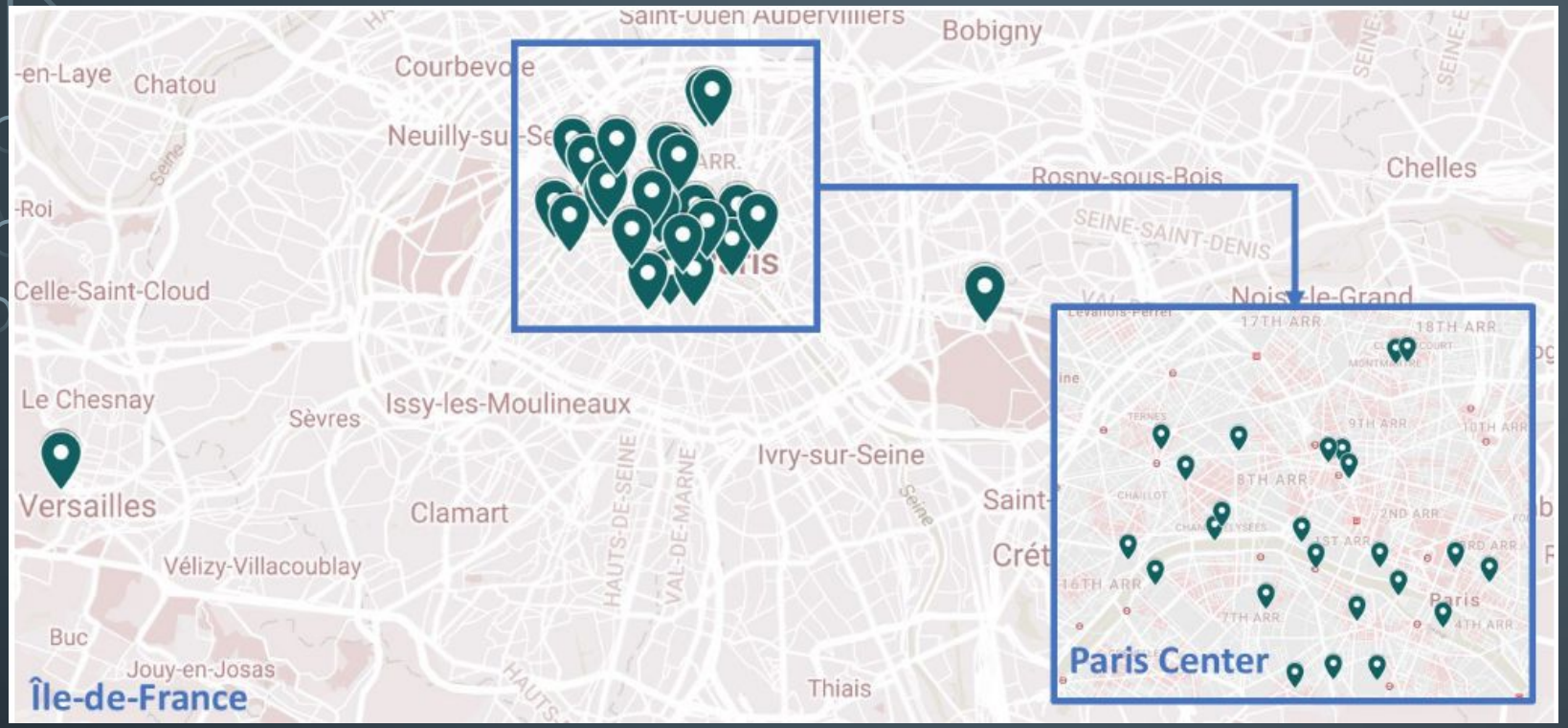
Object recognition

UNSUPERVISED LEARNING

- Unlabelled data
- Inferring patterns:-
  - association mining (recommending based on past choices)
  - anomaly detection (pointing out unusual data points in the dataset)
  - clustering

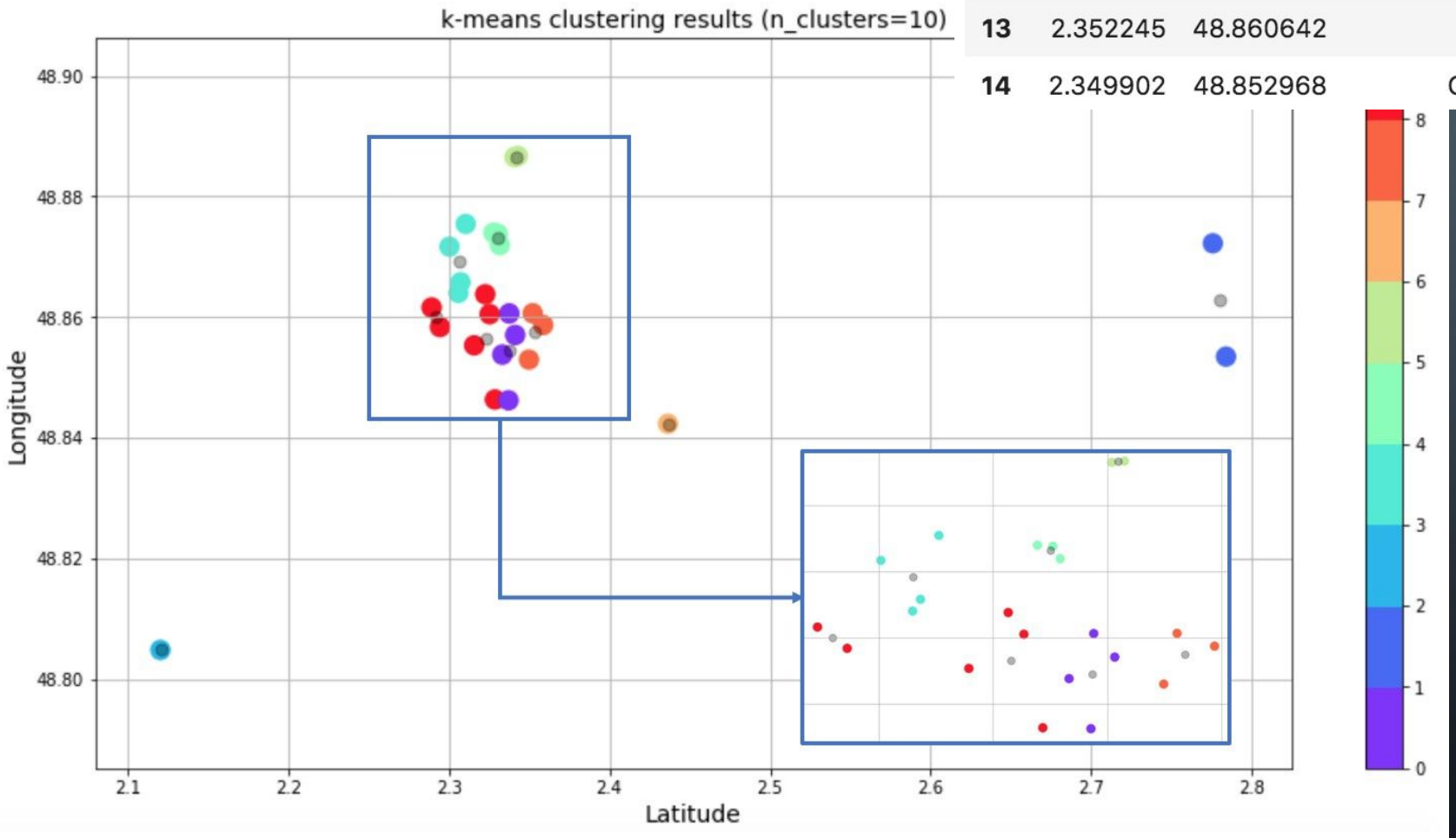
Applications of Unsupervised Learning

Geo-location clustering

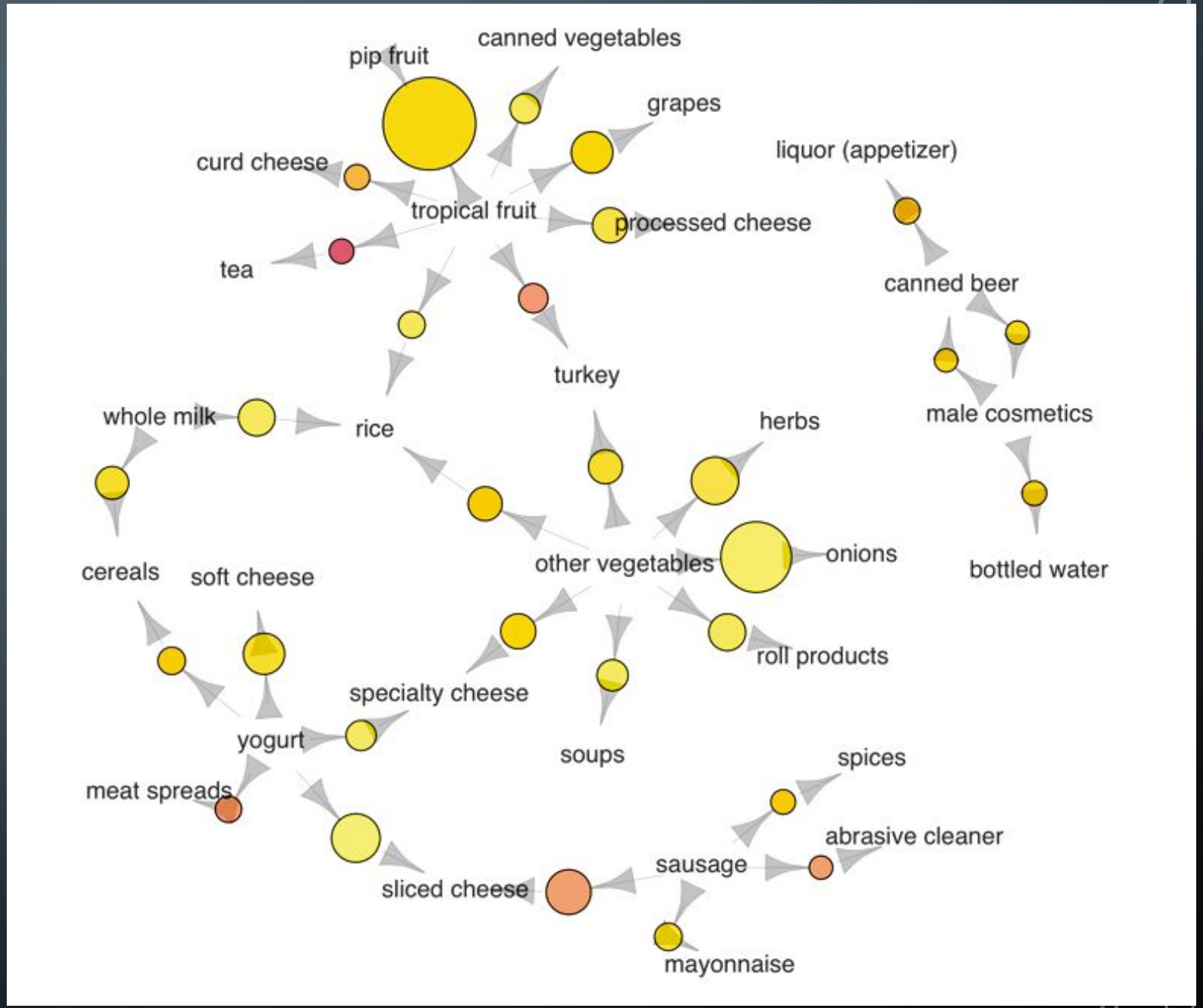


	Longitude	Latitude	Landmark
0	2.328729	48.846361	French Alliance Paris Ile-De-France
1	2.289282	48.861596	Trocadéro Gardens
2	2.294483	48.858370	Eiffel Tower
3	2.340802	48.886503	Place du Tertre
4	2.343023	48.886706	The Basilica of the Sacred Heart of Paris
5	2.300375	48.871669	Louis Vuitton Maison Champs Élysées
6	2.330479	48.873820	Galeries Lafayette

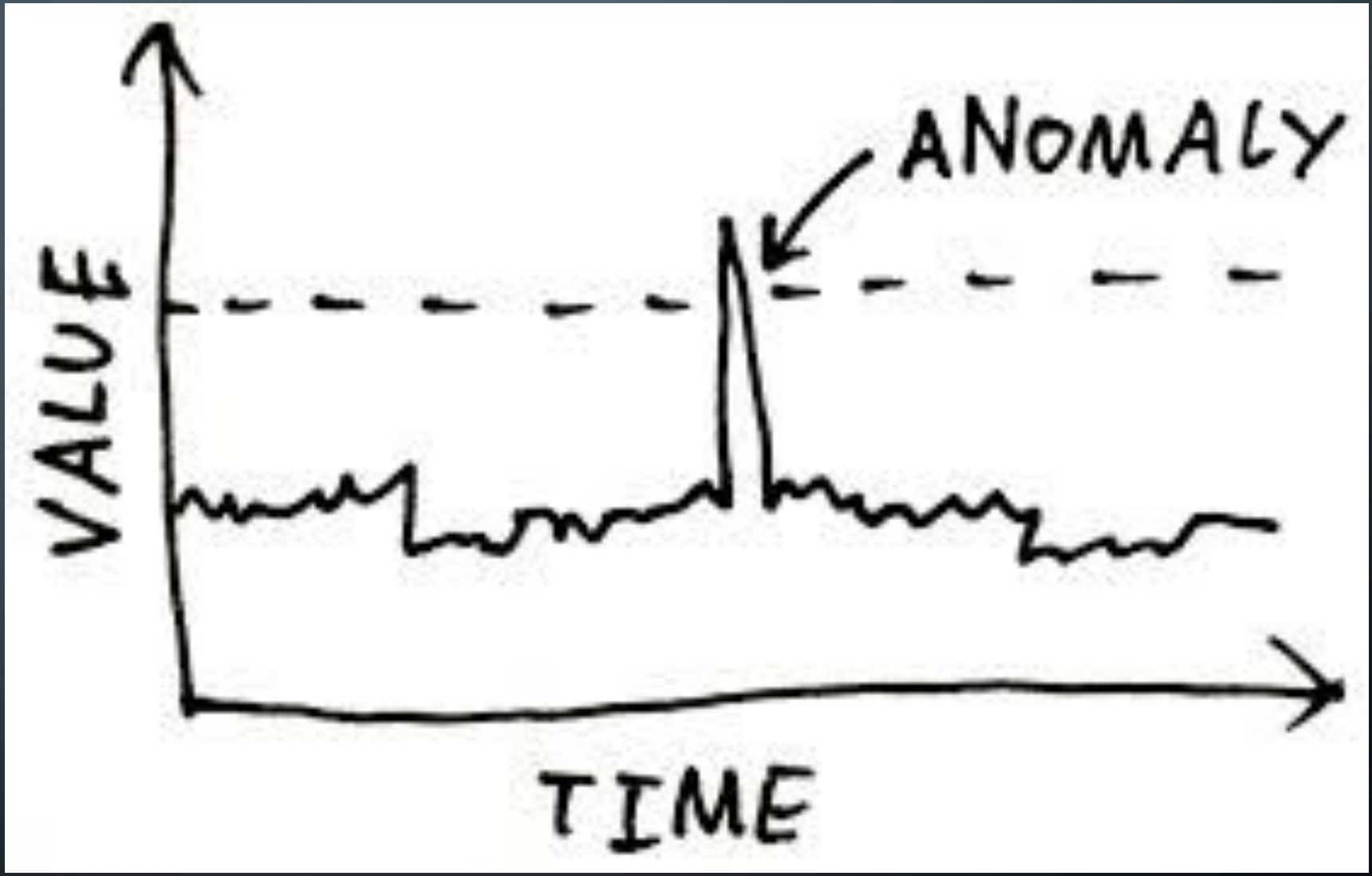
	Longitude	Latitude	Landmark	Cluster	Vacation Day
1	2.289282	48.861596	Trocadéro Gardens	0	Monday
2	2.294483	48.858370	Eiffel Tower	0	Monday
12	2.775808	48.872234	Disneyland Paris	1	Tuesday
17	2.784017	48.853465	La Vallée Village	1	Tuesday
22	2.358804	48.858703	Le Marais	2	Wednesday
13	2.352245	48.860642	The Centre Pompidou	2	Wednesday
14	2.349902	48.852968	Cathédrale Notre-Dame de Paris	2	Wednesday



Association mining

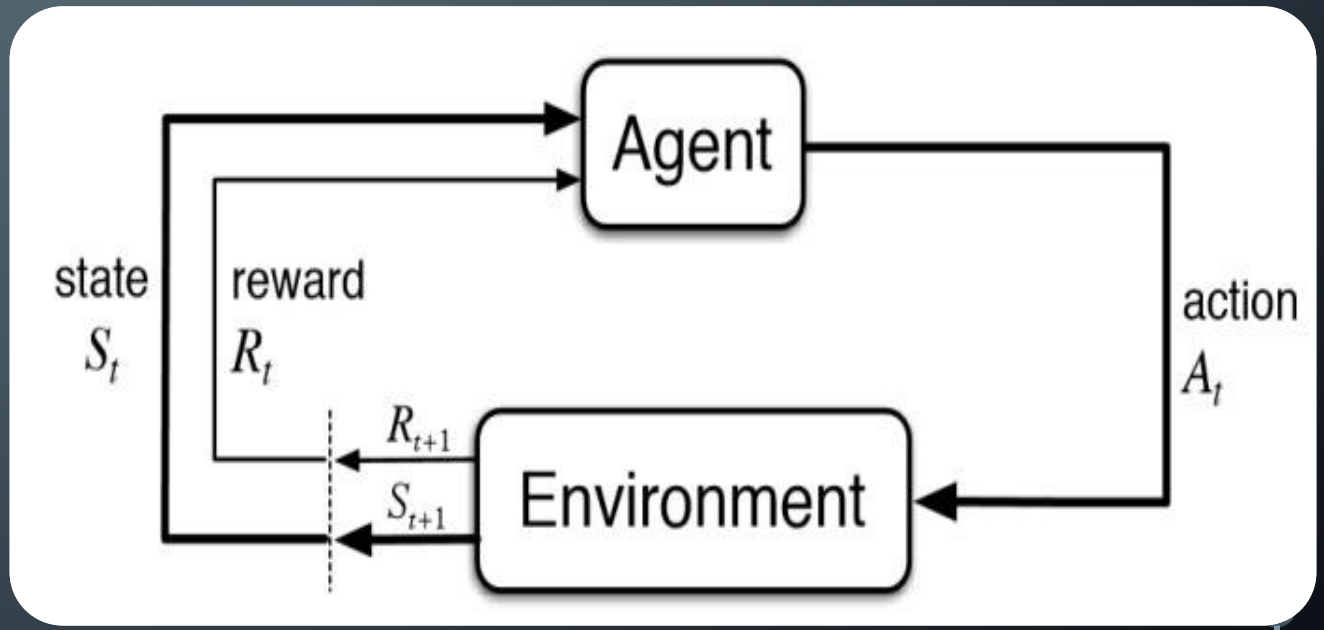


Anomaly detection



REINFORCEMENT LEARNING

- Sequential decision making
- employs a system of rewards and penalties to compel the computer to solve a problem by itself.
- Human involvement is limited to changing the environment and tweaking the system of rewards and penalties.



Applications

- General Artificial Intelligence :- Many consider RL as a step to GAI
- AI in DOTA-2 action
- Games :- Beating the best of human race in game [leaderboard]

OpenAI Five

Competitive: 7,215–42 (99.4% winrate, 15,019 total players)

Note: During the live stream, the game count incorrectly omitted games abandoned by the human side.

Cooperative: 35,466 games (18,689 total players)

Leaderboard

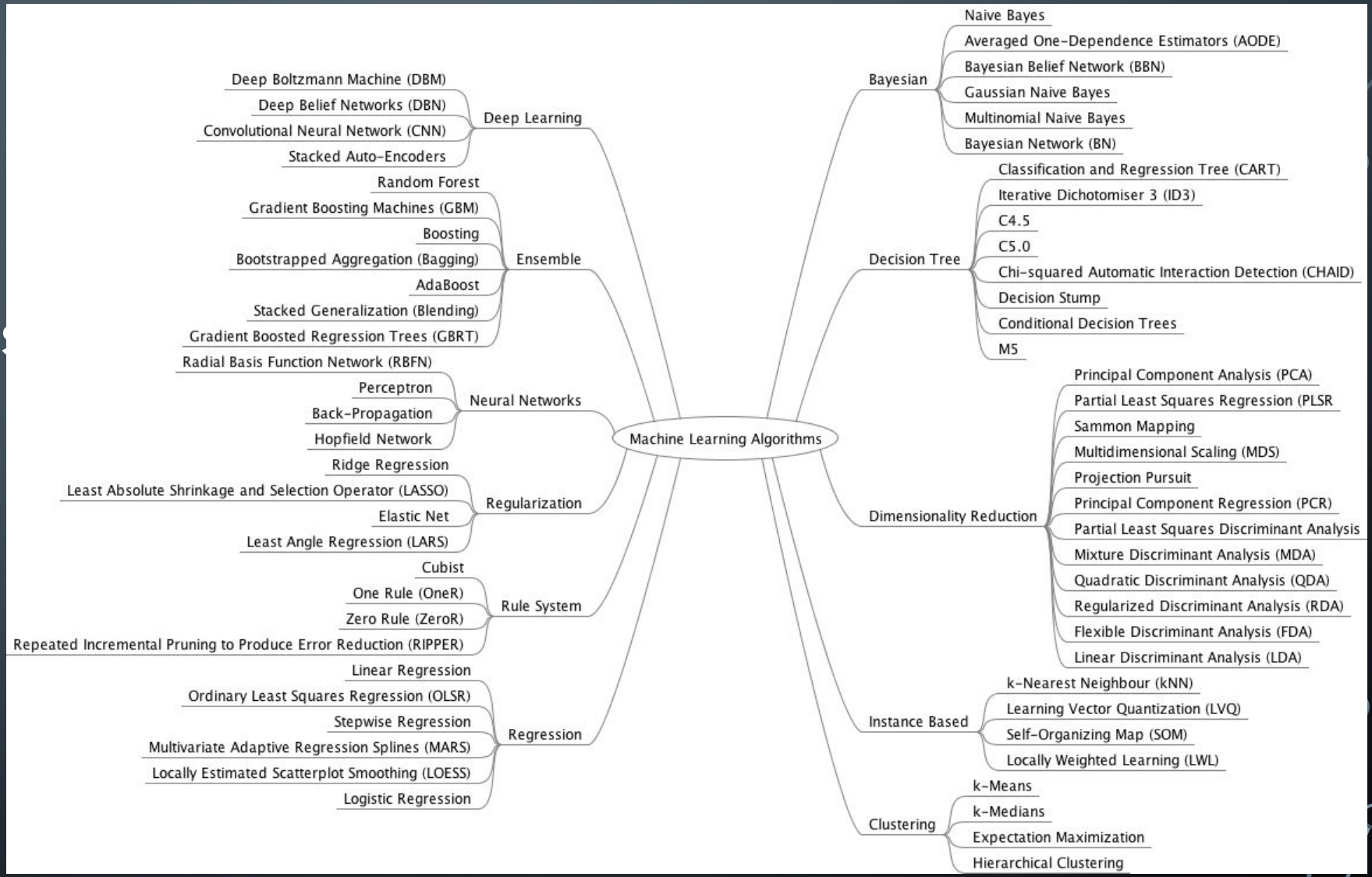
Win · Win streak 2 · Win streak 3+

#	ORGANIZER	GAME PLAYERS	WINNER	KILLS	DURATION
1	ainodehna 10	ainodehna, backtoashes, CANYGODXXX, .tv/juniorclanwar, gazeezy	Human Team (Radiant)	15–25	0:44:49
2	ainodehna 9	ainodehna, backtoashes, .tv/juniorclanwar, CANYGODXXX, gazeezy	Human Team (Radiant)	18–23	0:36:41
3	ainodehna 8	ainodehna, .tv/juniorclanwar, CANYGODXXX, backtoashes, gazeezy	Human Team (Radiant)	15–14	0:36:01
4	ainodehna 7	backtoashes, ainodehna, gazeezy, CANYGODXXX, .tv/juniorclanwar	Human Team (Radiant)	9–8	0:36:06
5	ainodehna 6	ainodehna, CANYGODXXX, gazeezy, backtoashes, junior	Human Team (Radiant)	22–31	0:51:41
6	ainodehna 5	gazeezy, ainodehna, CANYGODXXX, backtoashes, junior	Human Team (Radiant)	17–21	0:44:34

Semi-supervised learning

- supervised learning → disadvantage → expensive to label data
- unsupervised learning → disadvantage → limited applications
- introduce semi-supervised learning :- some labelled data and lots of unlabelled data

Machine Learning as an umbrella of Algorithms

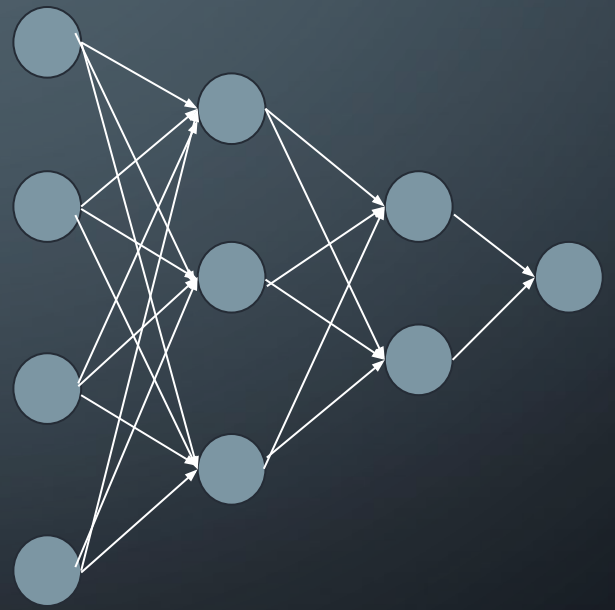


Inspirations

Deep learning

- Inspired by the human brain (the neuron)

- Neural Networks

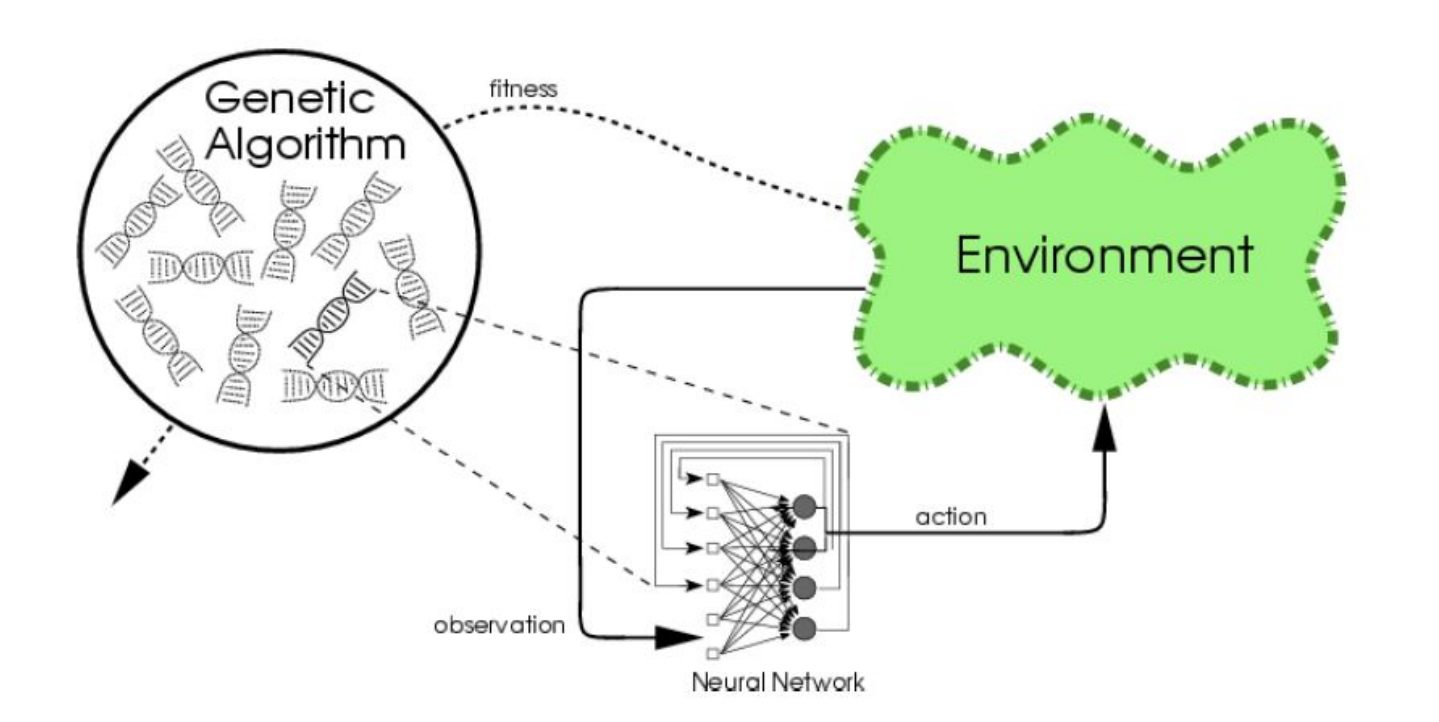


Deep learning

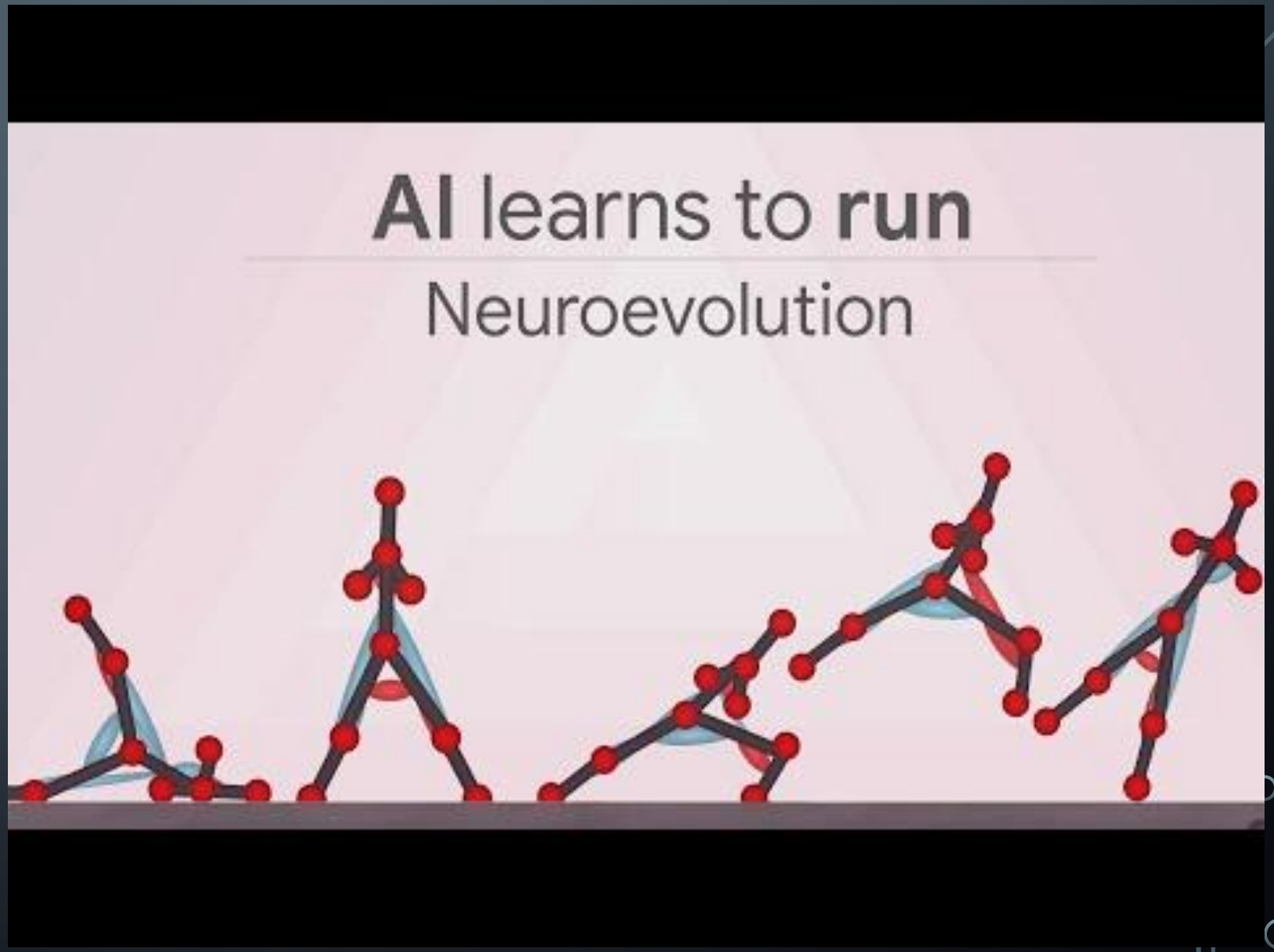
- In deep learning we learn to represent data in a nested hierarchy, more abstract concepts in terms of lesser one.
- In Traditional machine learning We model the function from input to output, if we want more complex relationship we will use more complex function.
- In deep learning we model the mapping as function of a functions. each one of these are simple functions but in function in next layer is applied to the output of previous layer. and we can model much more complex functions using this.
- in fact there is a theorem called Universal approximation theorem which says we can model any function using a Deep Neural Network of appropriate size.

Meta Learning

- Learning about learning (about hyper-parameters)
- example :- Neuroevolution (inspired by the darwinism)

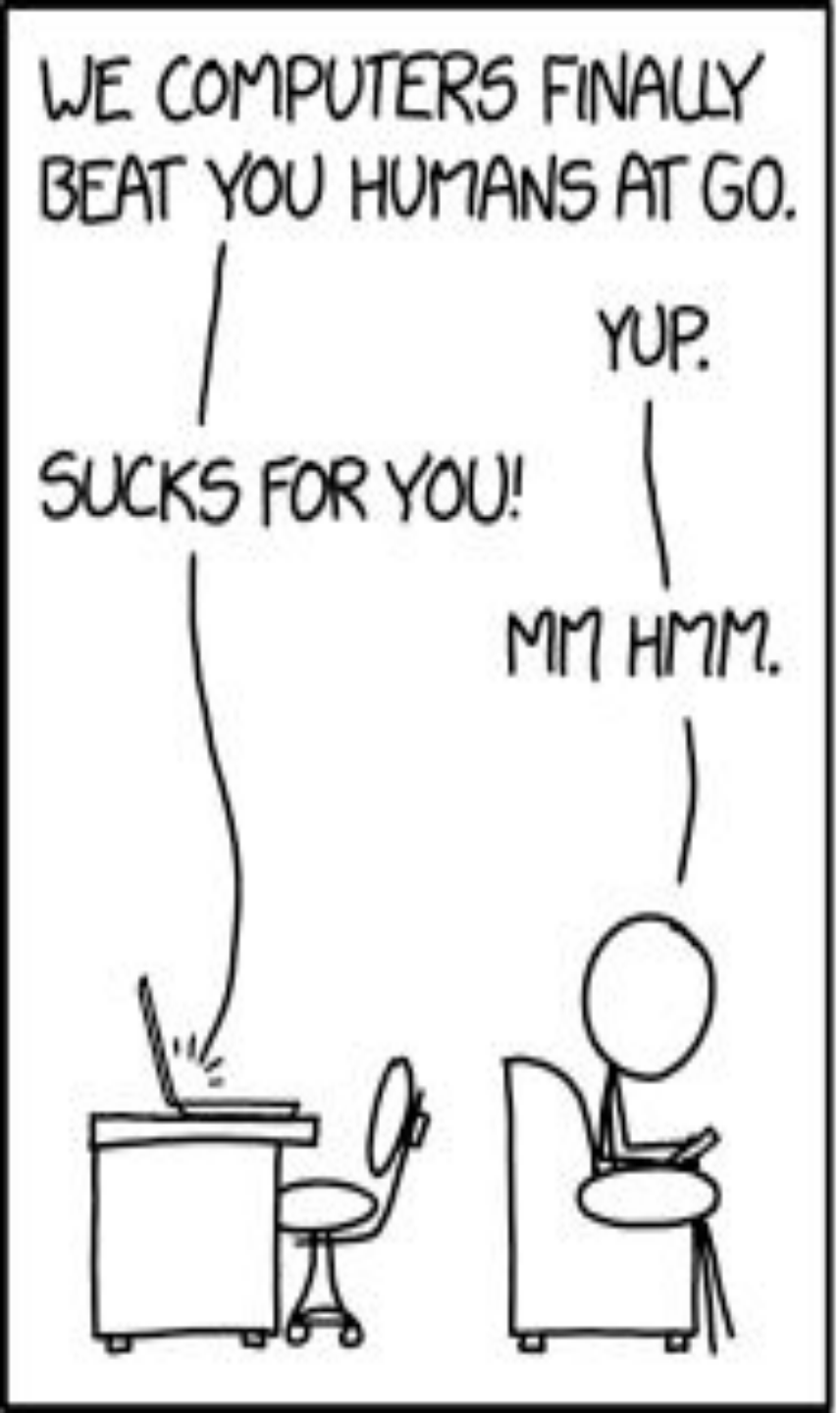


The bigger picture of AI :- a practical application of neuroevolution (Deep learning and meta-learning)



Then What is Data Science ?

- Data Science is a multidisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge , insights from data.
- Data scientists is been called the sexiest job of 21st century.
- What does data Scientists do?
  - Use statistics, machine learning, Data mining to generate useful insights
  - help organizations in data driven decision making.
  - Modeling is just only a part of it
    - Data visualization , data cleaning, data managing.
    - a data scientist must be a good storyteller.
  - Data scientist term is vague the actual task needed to be done varies a lot.


WE COMPUTERS FINALLY BEAT YOU HUMANS AT GO.
SUCKS FOR YOU!
YUP.
MM HMM.


WHAT'S NEXT? WHICH QUINTESSENTIALLY HUMAN THING SHOULD WE LEARN TO DO BETTER THAN YOU?
BEING TOO COOL TO CARE ABOUT STUFF.


OKAY, I'LL APPLY 10,000 YEARS OF CPU TIME TO THE INITIAL—
SOUNDS LIKE YOU'VE ALREADY LOST.
DAMN. THIS IS HARD.
IS IT? NEVER NOTICED.