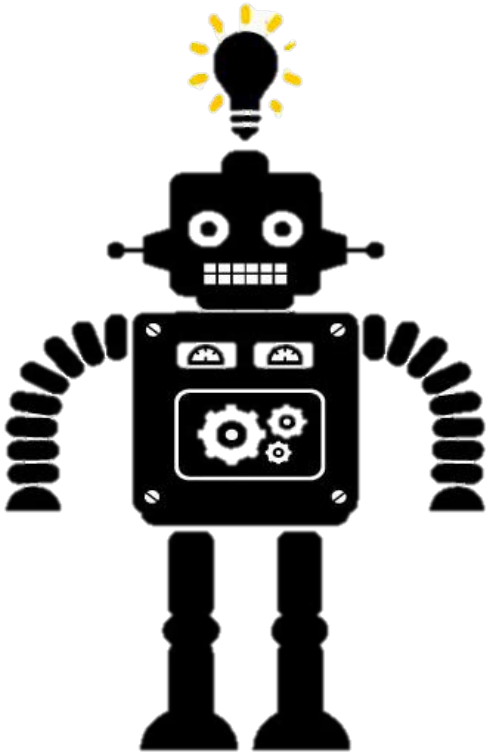
Deep Learning

Introduction to machine learning

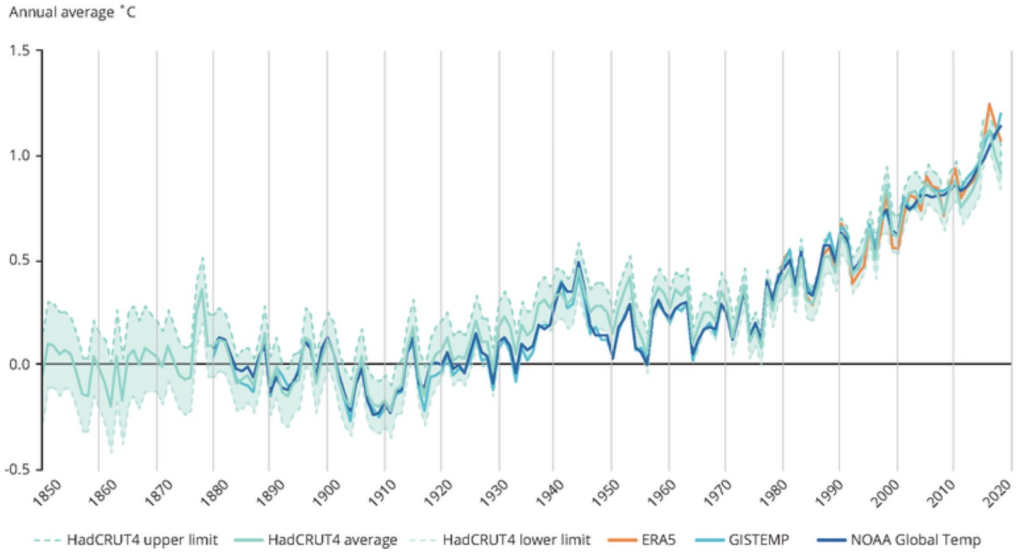


In this lecture

- What is machine learning?
- Why machine learning?
- Examples of machine learning applications
- History of machine learning

What is machine learning?

- Data are our measurements from a system so studying them helps us to make decisions about the system.
- ML is a tool that we use to study and learn from the data.
- Eg., data about the global mean surface shows a trend that enables computers to learn and infer from data that the global temperature is increasing.



Why machine learning works?

- The idea of machine learning works because data is not random – it has structure that can tell us about the underlying behavior of its generating system

- That is why we can use ML and train computers to understand the underlying process & make predictions/decisions for the future

Examples

- Media – Netflix to predict what individual viewers will likely enjoy based on the streaming history and habits of its millions of users.
- Web mining – search engines, Yelp to sort reviewers' photos to groups: menus, food, inside, outside and so on.
- Finance – credit scoring, fraud detection.
- Medicine – medical diagnosis, using electronic medical records, financial data and claims to predict sickness.
- Manufacturing – control, robotics, troubleshooting
- Transportation – self-driving cars.
- Bioinformatics – Motifs, alignments.

Why we need machine learning?

- Humans need to go through lots of training and still are prone to making mistakes
- Human expertise aren’t readily available
- Solutions change in time (routing on a computer network)
- Solutions need to be adapted to particular cases
- Humans are unable to explain their expertise
- Human expertise doesn’t exist

History of machine learning

- The concept of “computing machinery intelligence” started in 1950s.
- It focused on
  - Human-level intelligence: abstract reasoning
  - Linguistic intelligence
  - Symbol using and knowledge representation
  - Rule-following and logic
- Games are popular because a metric exists to prove one algorithm is working better than another

History of machine learning (Cont.)

- In 1997, a milestone was reached: AI beats best human at chess!
- In 2011, IBM's Watson beats former human winners at the quiz game Jeopardy!
- In 2016, Google DeepMind beats world champions in Go game!

Garry Kasparov makes a move during his fourth game against the IBM Deep Blue chess computer. | Stan Honda/AFP/Getty Images

Why tremendous growth in machine learning?

- With recent technology, data has become cheap!
  - How many surveillance cameras are deployed in the US?
  - What is the size of the World Wide Web?
  - How many youtube videos are uploaded per day?

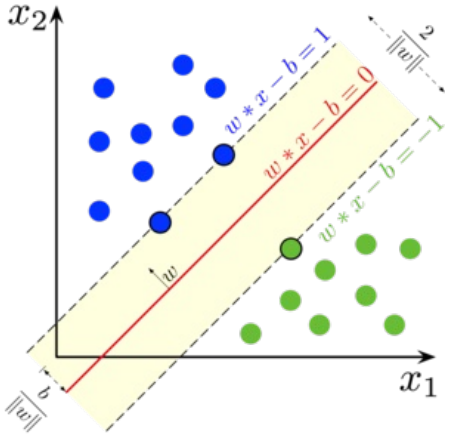
Example applications

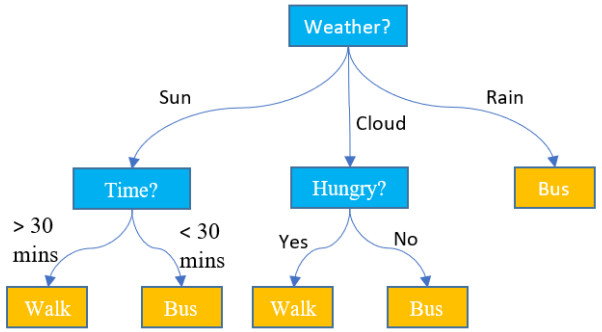
- https://www.youtube.com/watch?v=Bg_tJvCA8zw
- https://www.youtube.com/watch?v=cItRwEGThvo
- https://www.youtube.com/watch?v=kopoLzvh5jY
- https://www.youtube.com/watch?v=FOlzYBD4vxo
- https://www.youtube.com/watch?v=y1sxsye11xk
- https://www.youtube.com/watch?v=nAMSfmHuMOQ

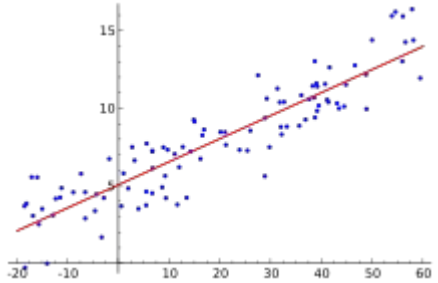
- https://experiments.withgoogle.com/experiments
- https://teachablemachine.withgoogle.com
- https://experiments.withgoogle.com/body-synth
- https://quickdraw.withgoogle.com/
- https://this-person-does-not-exist.com/

Different machine learning tools

- Traditional/classic machine learning methods
  - Regression
  - Logistic regression
  - Decision trees
  - Support vector machine







- Artificial Neural networks
- Deep learning

History of neural networks