APR-421: Machine Learning

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Personal Introduction

René Gastón Armand Vilar Schlichter
Just call me René!

- Born in Sucre, Bolivia.
- Studied System Engineering in "Universidad del Valle Sucre", graduated 2014.
- Opened a start-up with colleagues which mainly focused on implementing and deploying custom software-based solutions for small to medium companies.
- 2016 I started superior studies at TU-Kaiserslautern in Germany, aiming at a Master's degree with main focus on "Intelligent Systems" - complemented with "Software Engineering" and "Data Science and Visualization". Got a perfect degree on the Thesis and graduated 2019.
- Started working at Jalasoft in 2021
  - First Role: Automation QA
  - Actual Role: ML Developer

Personal Introduction:

Class

- Personal introduction
- Hobbies?
- Grade Project?
- What you think is AI
- What is Intelligence?
- How do we learn?
- Experiences with AI?

Concepts

- What is Intelligence?
  The ability of an agent to comprehend, adapt and learn from their environment, so they can make coherent decisions

Concepts

- What you think is AI:

  It's the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings

Concepts

- How do we learn?
  You were all right!
  Experiences!

  That is the fundament behind 'Reinforcement Learning', we will see that soon.

APPs we use that have AI?

MOST OF THEM HAVE!

- Obviously ChatGPT, Bard, Midjourney, etc
- Spotify, Netflix, Amazon and much more.. (recommendations)
- Smartphone camera (better quality pictures)
- Tiktok (filters)
- Even MS Teams! (video recording transcriptions)

Machine Learning

Contents

- Intro (Today)
  - Personal Introductions
    - Basic Info
    - Why studying Software Engineering?
    - Favorite Programming Language?
    - What hobbies do you have?
    - Tell me about your grade project..
  - ML History
    - Past
    - Present
    - Near future
  - Python
- Math and Statistics: (Wednesday)
  - Quantitative vs Cualitative Data
  - Normalization and other common techniques
  - Recap: Linear regression
  - **Logistic regression**
  - Linear Classifiers

And the fun just begins!...

Grading

**Not strictly defined yet!**

60% exam / project

20% Homeworks

20% Participation

➤ Herbert A. Simon "Models of Man: Social and Rational", 1965

It is not my aim to surprise or shock you – but the simplest way I can summarize is to say that there are now in the world machines that think, that learn and that create.
Moreover, their ability to do these things is going to increase rapidly until – in a visible future – the range of problems they can handle will be coextensive with the range to which the human mind has been applied.
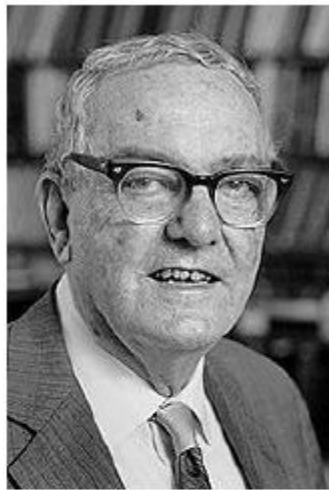
- ➤ 250 BC, Ctesibius from Alexeandria
  - ◼ Clepsydra (water clock) which regulates the water flow to a constant value –pressure
  - ◼ Earliest feedback system and complex gearing
  - ◼ Resulted in improved accuracy
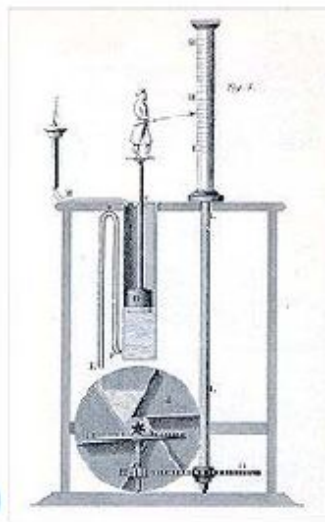
- ➤ Steam machine regulator (Watt, 18th century)
- ➤ Mathematical theory of self-regulating systems developed in 19th century
- ➤ Is that AI?
- ➤ Control-theory leading to cybernetics.

First AI application?

> **Before computers existed**
>> - Frederick Winslow Taylor
>> - Midvale steel plant Philadelphia
>> - Break down process
>> - Evaluated different ways of performing the sub-tasks
>> - Created set of precise instructions
>> - Increased productivity
> **Is that AI?**
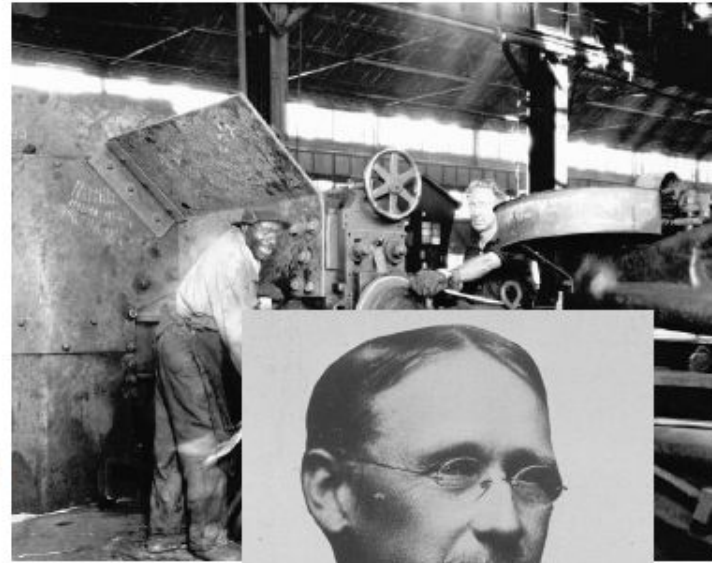
Also...

➤ Warren McCulloch and Walter Pitts. A logical calculus of the ideas immanent in nervous activity, 1943

- Generally agreed to be the first work on AI
- Combines three concepts
  - Function of neurons in the brain
  - Formal analysis of logic
  - Programming theory of Turing

➤ A couple of improvements

- Weights for the inputs (Perceptron)
- Multilayer perceptron networks

The Perceptron!
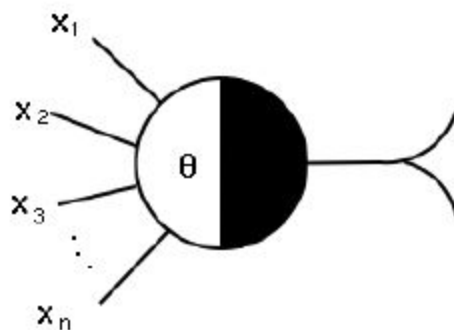
- **Marvin Minsky and Dean Edmonds – SNARC, 1951**
  - Neural network with 40 neurons
  - Stochastic Neural Analog Reinforcement Calculator
- **Alan Turing was the first who formulated the vision of AI**
  - 1950, Computing Machinery and Intelligence
  - Turing test

More Early works

- Aristotle formulates set of rules for the rational component of mind
- Later, the rules were compared to arithmetic calculations
  - Machines developed which implemented those ideas, 17th century
  - Results of those machines closer to human Mind than anything that animals could do (Pascal)
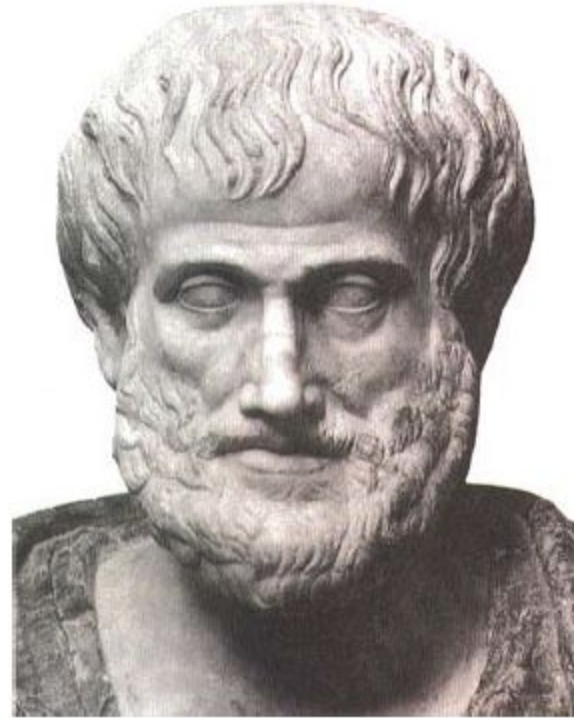
- Is human mind bound to physic rules?
- Dualism vs. Materialism
  - Dualism: Part of human mind is beyond nature
  - Materialism: The brain only works according to physical rules

we just float here
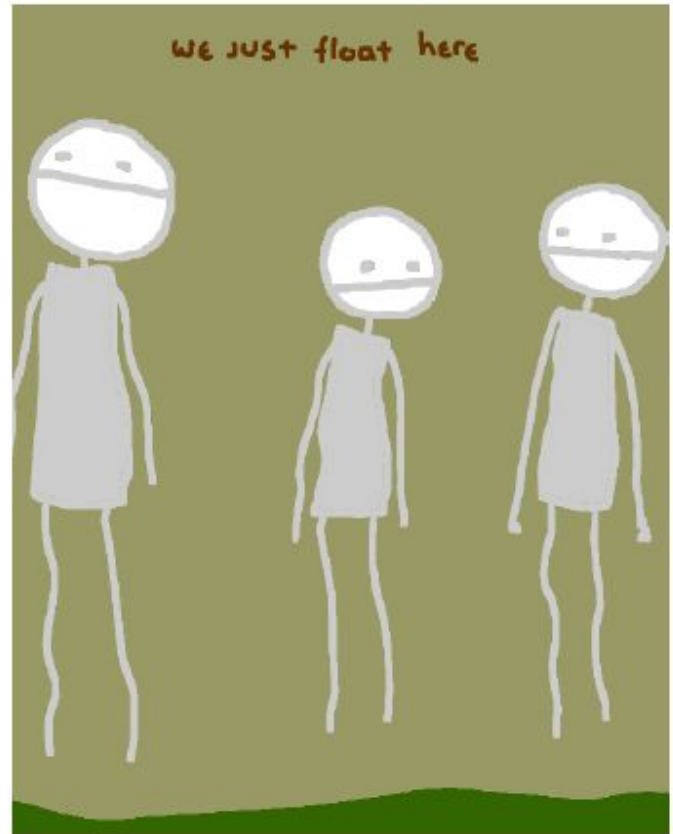
- Empiricism: We do not understand what we did not thought previously
- Induction: We build associations between known rules
- Confirmation theory: Knowledge gained from experience
  - Carl Hempel (1905-1997) formulated a procedure for extracting knowledge – can be seen as first theory of mind as process
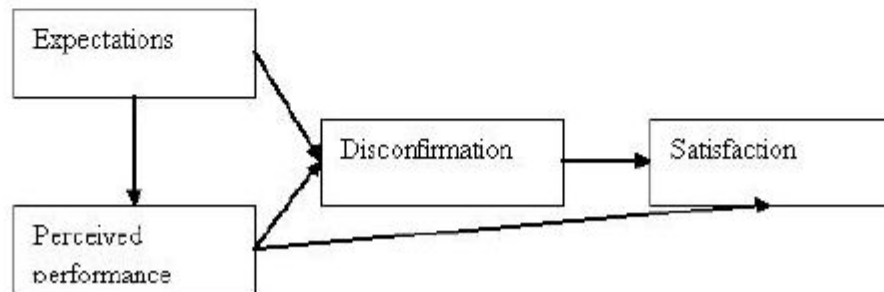
"You find, to your total amazement, that you are indeed losing control of your external behavior. You find, for example, that when doctors test your vision, you hear them say 'We are holding up a red object in front of you; please tell us what you see.' You want to cry out 'I can't see anything. I'm going totally blind.' But you hear your voice saying in a way that is completely out of your control, 'I see a red object in front of me.' ... [Y]our conscious experience slowly shrinks to nothing, while your externally observable behavior remains the same." (Searle, 1992)

PHILOSOPHICAL EXTRA SLIDES TO MAKE YOU THINK!

Homework:

Install Jupyter Notebooks on your PC:

https://jupyter.org/install

Clone/Copy files from this git repo:

https://github.com/philippbauch/simple-linear-regression-notebook

Try running the cells in order.

Tip: Once you've executed a cell, you can reference its variables and call its methods in other cells.