Machine Learning

- Learning represents the dynamic part of the intelligence
- Classical AI programs are constrained to solve problems inside the domain they have been designed for
- Real intelligence resides in the capacity to adapt to the environment and to solve new problems, solve them better, learn from errors, ...
- Machine learning studies the methods to give that capacity to AI programs

Basis/Influences

- Models of intelligence
  - Cognitive Psychology: The process of human learning
  - Neurobiology: The brain, the neuron
- Knowledge/concepts
  - Cognitive Psychology: What is a concept? How to represent them? Is there an explanation about how we represent them?
  - Mathematical Logic: How concepts can be combined and manipulated?
  - Statistics: What mathematical model represents them?
  - Information theory: How can we code them?

Goals

- The goal of ML is not to model human learning
- We need methods able to extend the capacity of programs (agents)
  - Methods that help agents to reach beyond their initial programming
  - Methods that allow agents to adapt to new environments
  - Methods that help to automatically create models for complex tasks
  - Methods that allow to discover patterns that can be used to solve new tasks

Does it work?

Does Machine Learning Really Work? Tom Mitchell. AI Magazine 1997

Where and what for can be machine learning applied?

- Tasks very difficult to program (face recognition, voice, ...)
- Adaptable applications (intelligent interfaces, spam filters, recommendation systems, ...)
- Data mining (intelligent data analysis)

Types of machine learning

Characteristics:

- Supervised vs unsupervised
- Basic Knowledge vs Structured Knowledge
- Inductive vs deductive
- Symbolic vs conexionist

Types of machine learning

- **Inductive Learning:** Models are built from the *generalization* of examples. We look for patterns that explain the common characteristics of the examples.

All objects thrown by Galileo from Pisa tower fell at the same speed

So, any object fall at the same speed thrown from anywhere

Types of machine learning

- **Deductive Learning:** Deduction is applied to obtain generalizations from a domain theory, a solved example and its explanation.

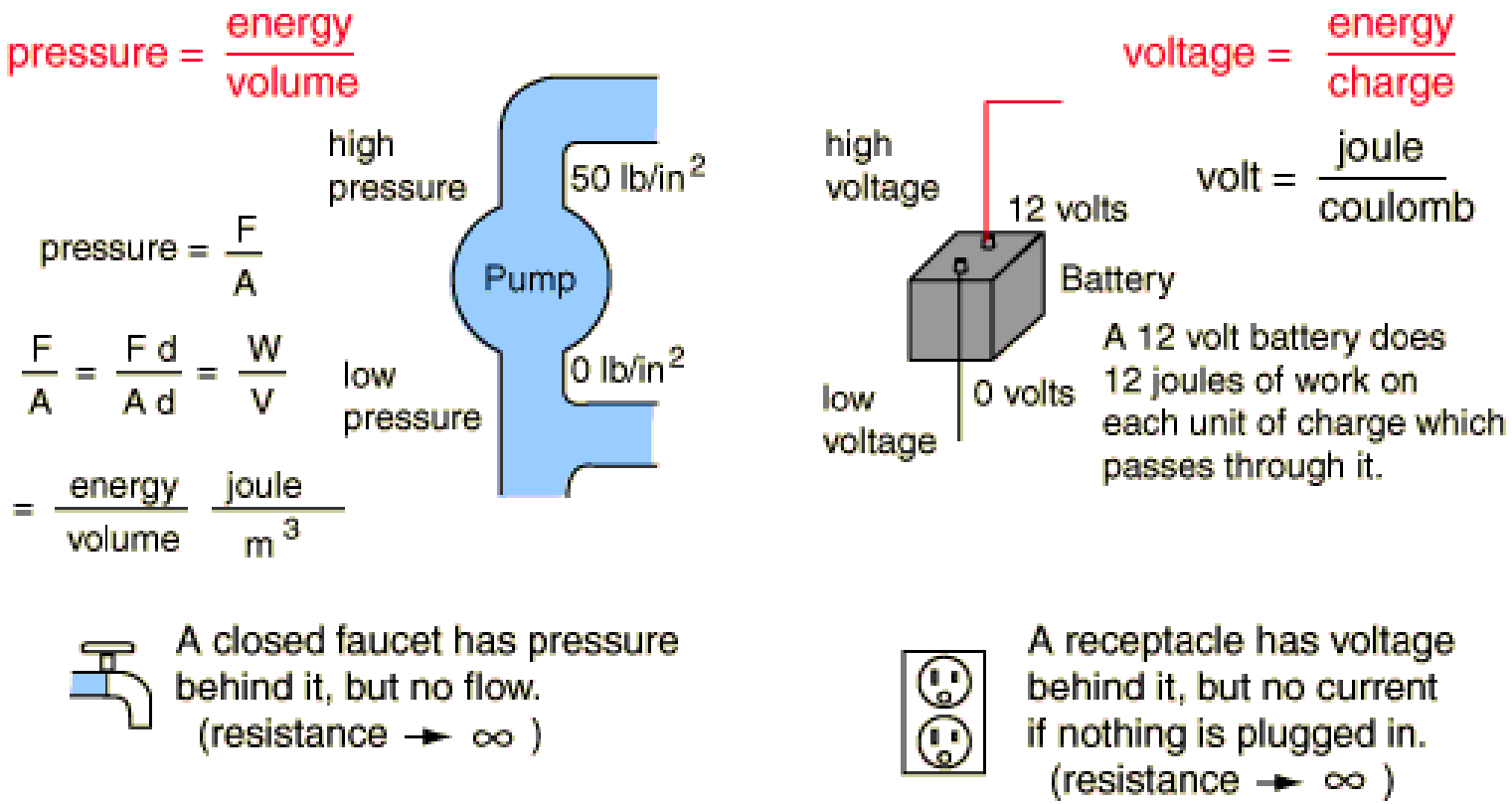
A Drink container is something that can hold liquid, the liquid can be hot or cold, it can be grasp because of its cillindrical or conical shape or because it has a handle, it can have one or two openings on the top end, and can be put on any horizontal surface

This is a tea cup, and is a drink container because can contain a hot liquid, has a handle. is on a table and has a top opening

So a drink container is anything that has a handle can contain hot liquid, can lie on a table and has a top opening

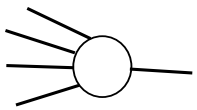
Types of machine learning

- **Analogical Learning:** Solutions to new problems are found by finding their similarities with known problems and adapting their solutions.

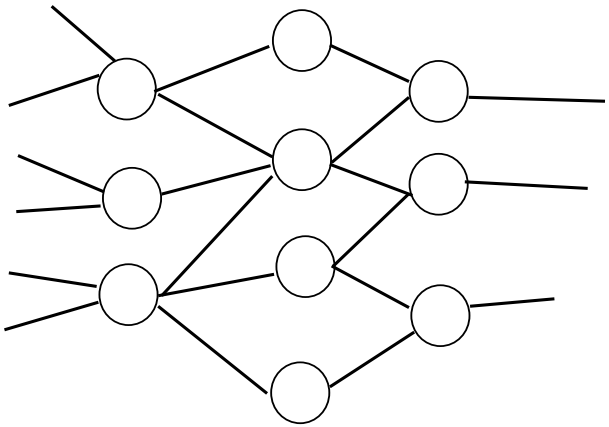


Types of machine learning

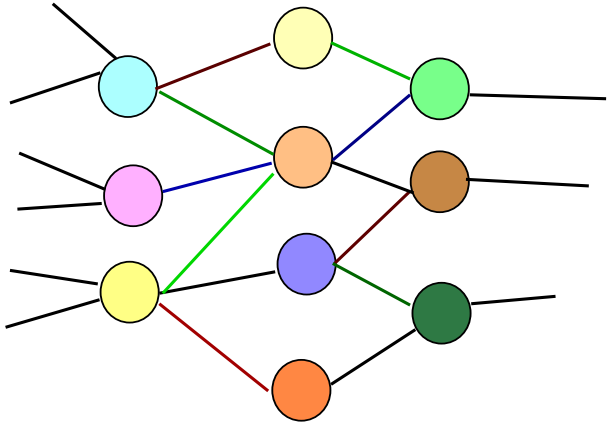
- **Conexionist learning:** Generalization is performed by the adaptation mechanisms of artificial neural networks.



I am a neuron



I am a neural network



I am a neural network trained to solve a problem