DEEP LEARNING FOUNDATION & APPLICATION

WITH A FOCUS ON MEDICAL INFORMATICS

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AI and Deep Learning; What and Why?

OUTLINES

- What is AI?

- Sub-systems of AI?

- Rule-based versus Learning-based AI

- Deep learning; what and why?

LEARNING OBJECTIVES

- To get a big picture of AI and deep learning

- To learn the workflows of traditional machine learning methods versus deep learning algorithms

AI and Deep Learning; What and Why?

Photos and Content are from:
https://amturing.acm.org/

AI AND DEEP LEARNING; WHAT AND WHY?

- **What is AI? AI** is all about computerized models targeting at **Perception**, and **Action**.

- It **solves** a **problem, optimally**.

- It **figures out (alone)** what is the **best action to take**.
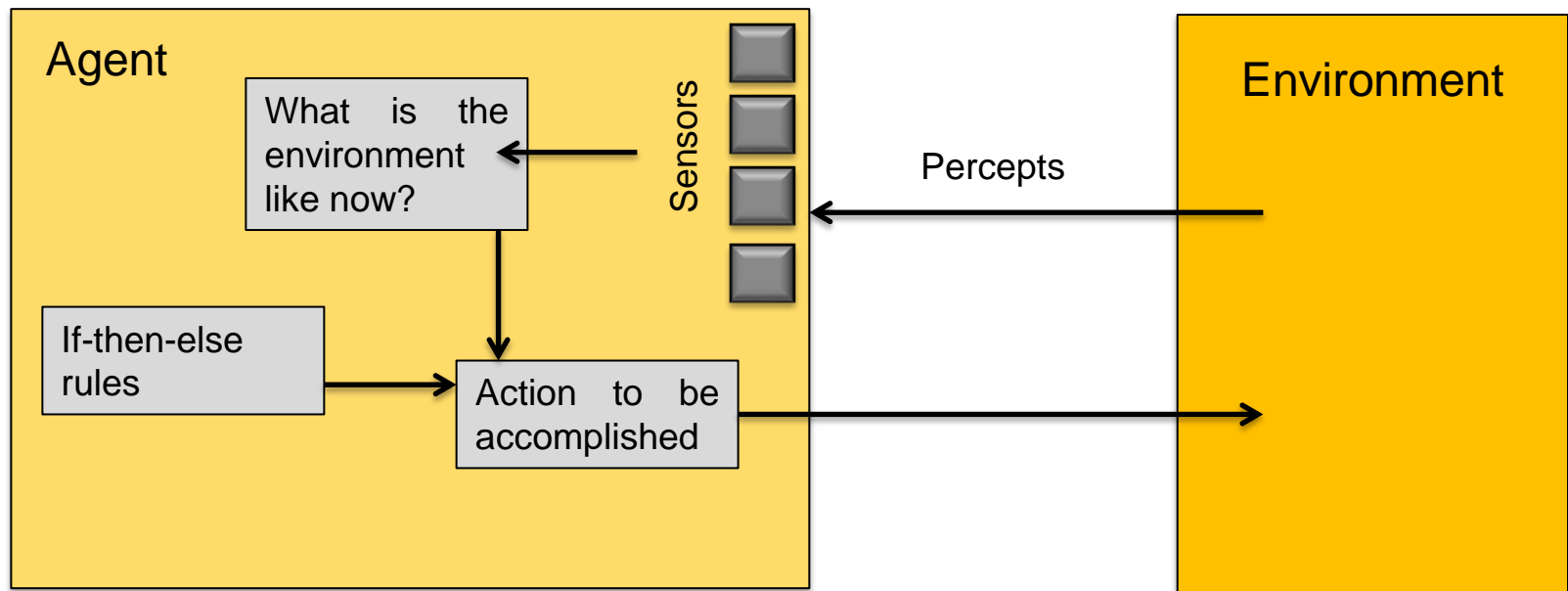
AI SUB-SYSTEMS

- Speech Recognition

- Natural Language Processing

- Computer Vision

- Robotics

MAYO
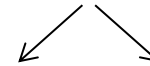CLINIC

RULE-BASED VERSUS LEARNING-BASED AI

Step

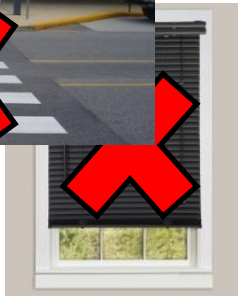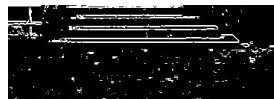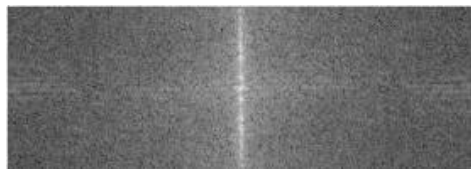Door

How to implement **singularities**???

Rule-based algorithms   Learning-based algorithms

Deep and machine learning strategies vs. **Traditional** (rule-based) methods
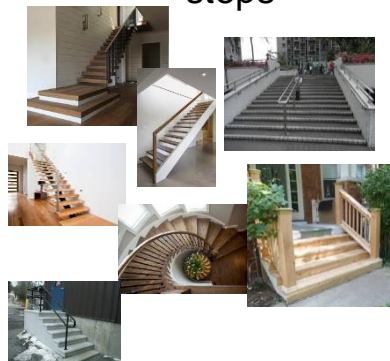
Traditional (there is no any learning technique)	Deep and machine learning techniques

We train computers at recognizing doors from steps by showing them a **large amount** of:
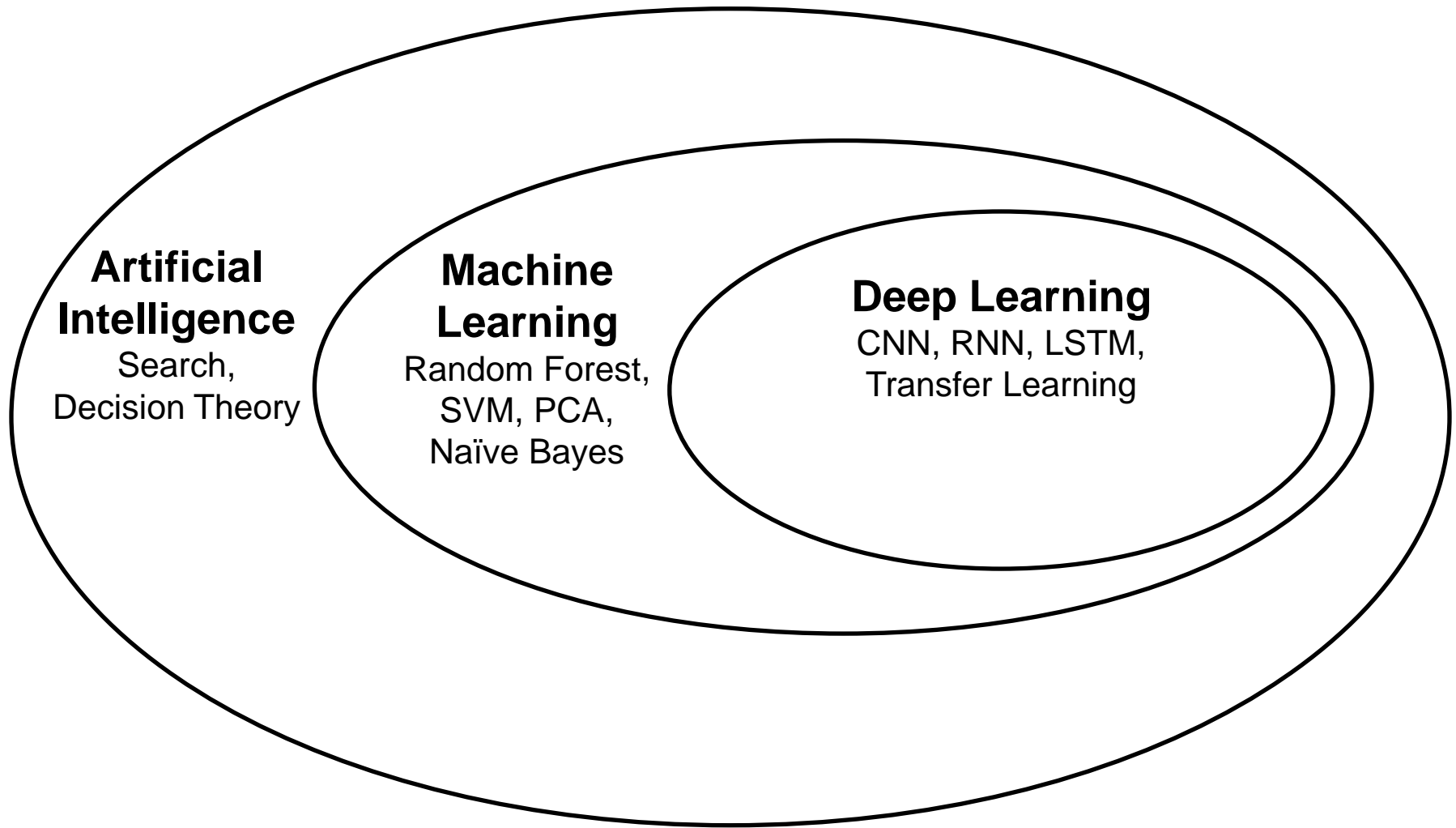
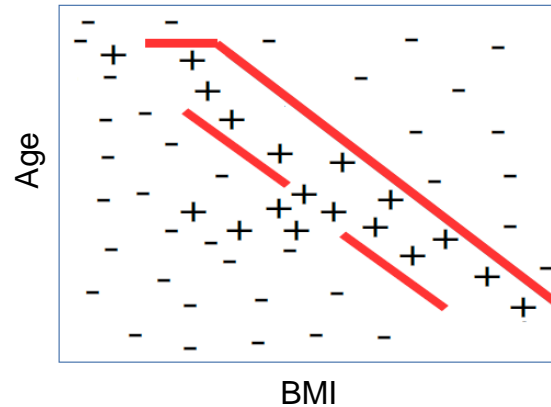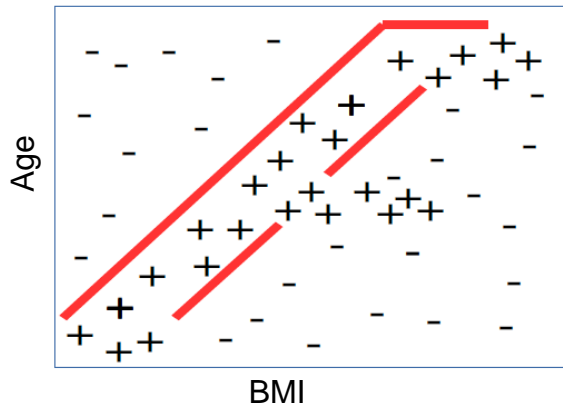**(object_type, picture)** pairs.

steps

doors

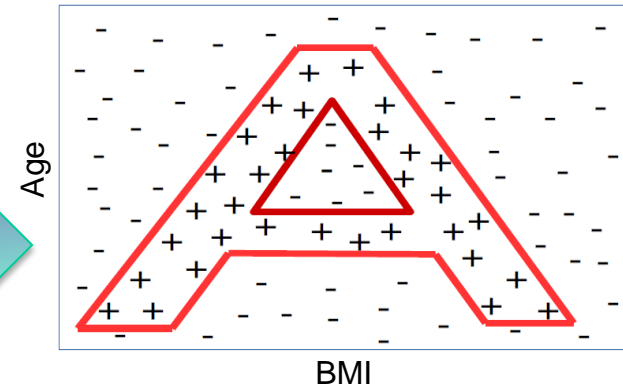# DEEP LEARNING; WHAT AND WHY?

Artificial Intelligence
Search, Decision Theory

Machine Learning
Random Forest, SVM, PCA, Naïve Bayes
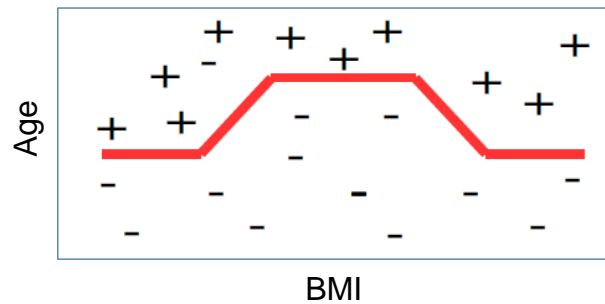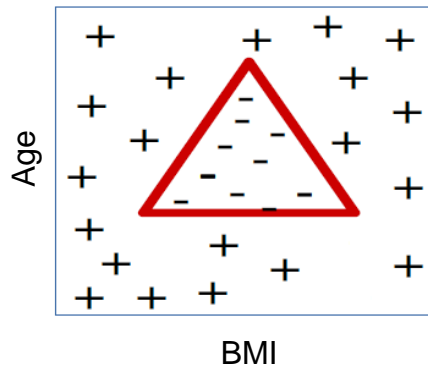
Deep Learning
CNN, RNN, LSTM, Transfer Learning
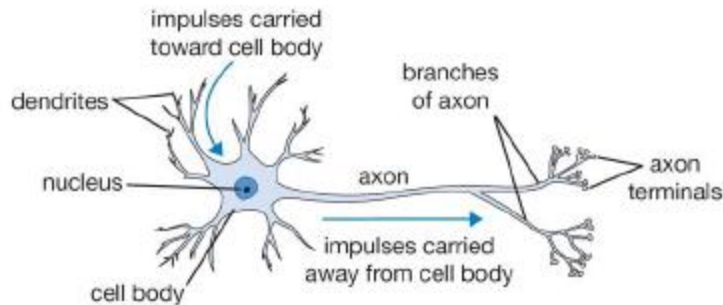
MAYO CLINIC

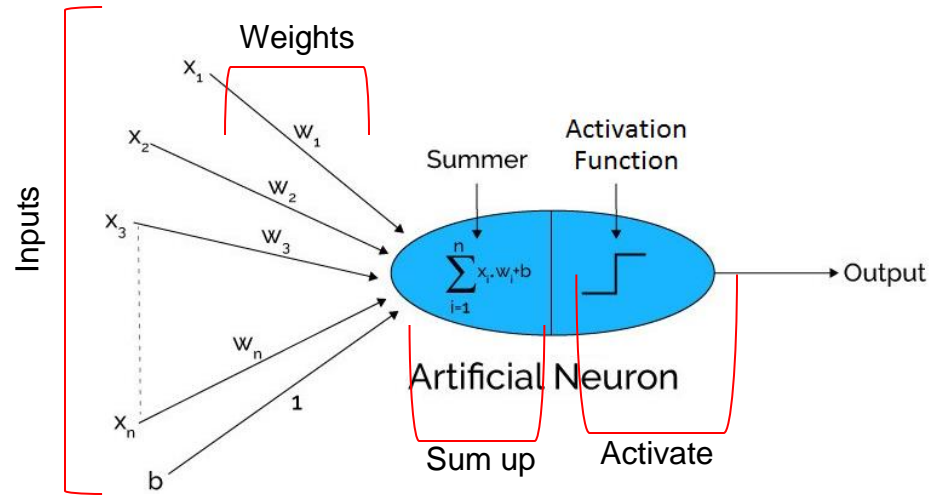# Deep learning; what and why?

Data amount is being increased, and the model tends to be a complex one

DEEP LEARNING; WHAT AND WHY?

Neuron: Computational building block for the "Brain"
Human Brain: ~100 to 1000 trillion synapses

Artificial Neuron: Computational building block for the "Neural Networks"
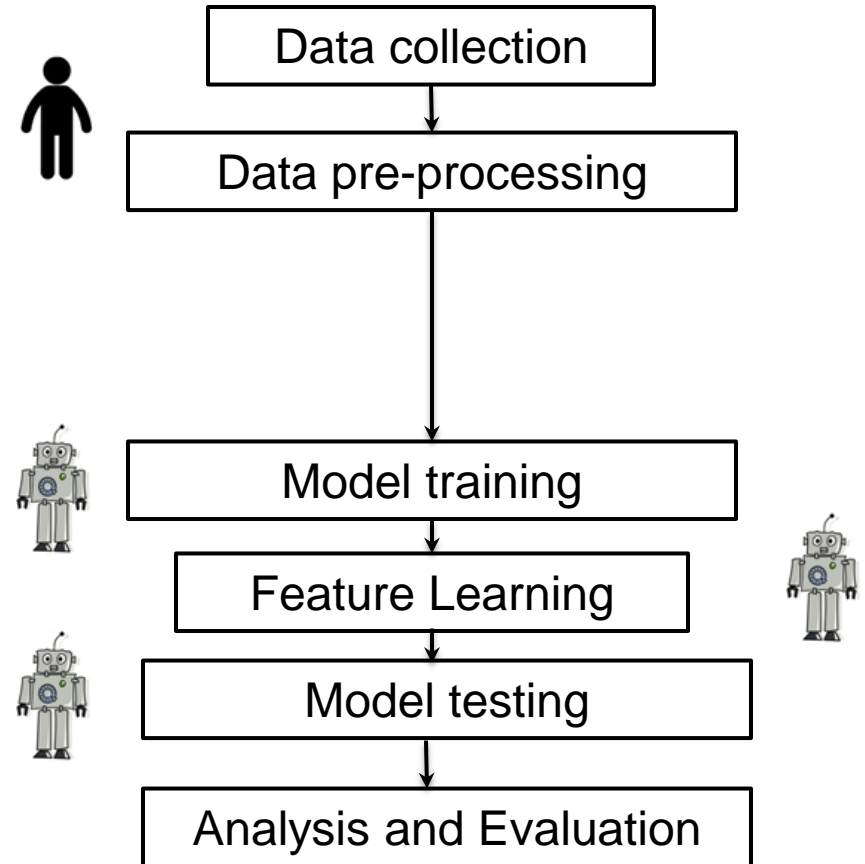**Neural Network:** ~1 to 10 billion synapses

Universality: for any arbitrary function f(x), there exists a neural network that closely approximates it for any input x.

MAYO CLINIC

DEEP LEARNING; WHAT AND WHY?

Machine Learning

Data collection
→
Data pre-processing
→
Feature Identification and Feature Extraction
→
Model training
→
Model testing
→
Analysis and Evaluation

Deep Learning

Data collection
→
Data pre-processing
→
Model training
→
Feature Learning
→
Model testing
→
Analysis and Evaluation

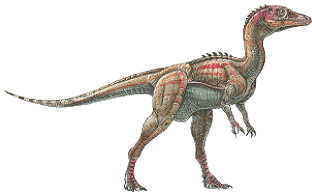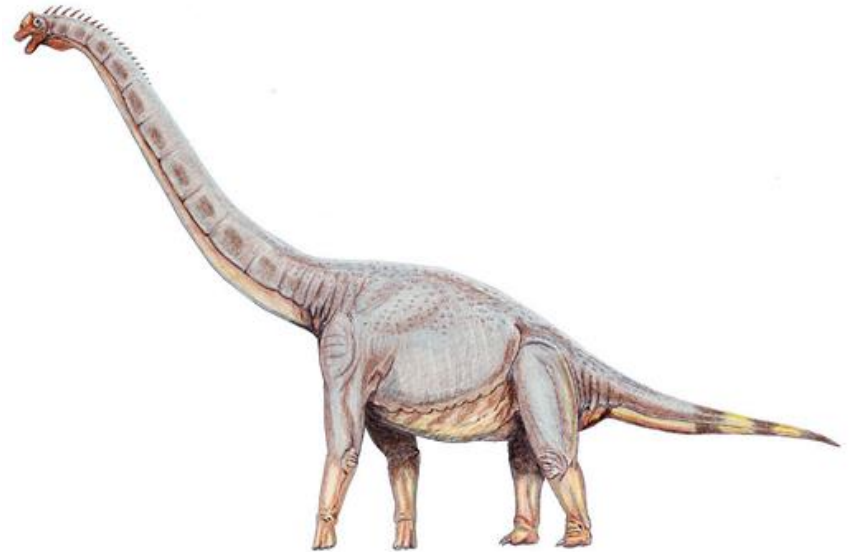# DEEP LEARNING; WHAT AND WHY?

Machine Learning

Deep Learning

REFERENCES