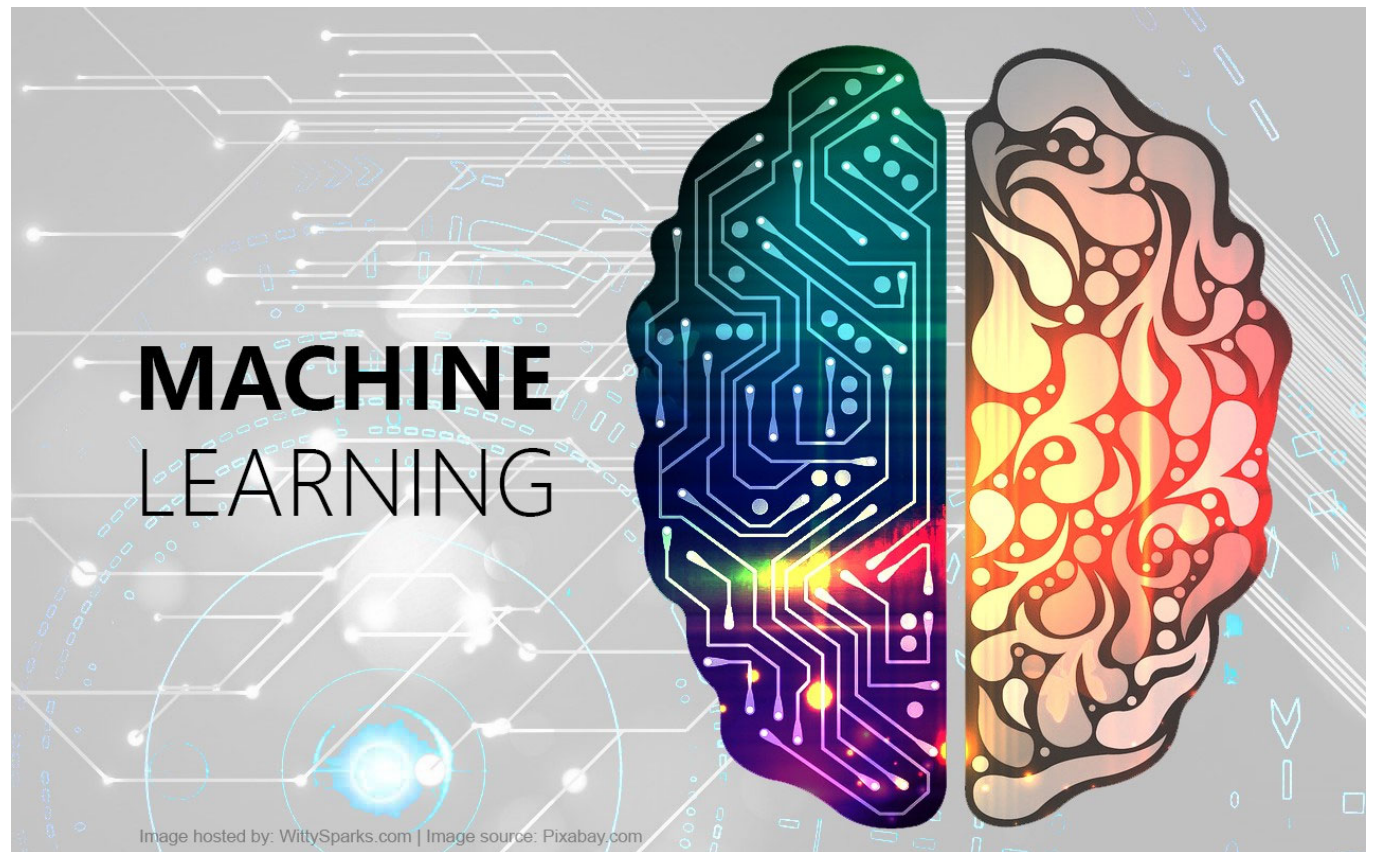# Machine Learning

Introduction

Jian Liu
Penglin Dai

j.liu9@leeds.ac.uk
penglindai@swjtu.edu.cn

What is Machine Learning?

Machine Learning (ML):

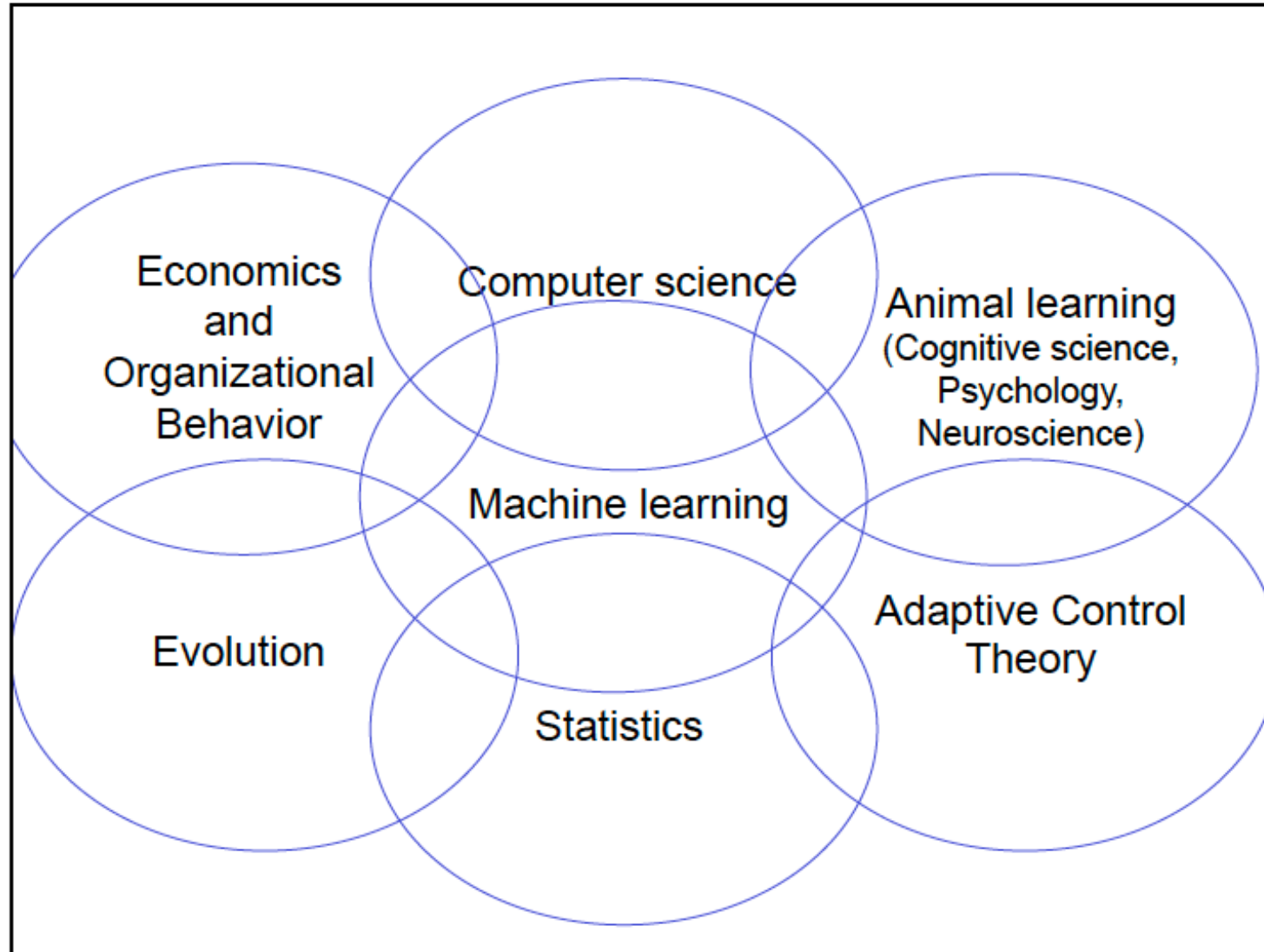**The field of study that gives computers the ability to learn without being explicitly programmed.**

Arthur Lee Samuel was an American pioneer in the field of computer gaming and artificial intelligence. He popularized the term "machine learning" in 1959.

Further resources on defintion:
https://www.youtube.com/watch?v=ukzFI9rgwfU

What is Machine Learning?

A Quick History of Machine Learning

Since an early flush of optimism in the 1950's, smaller subsets of artificial intelligence - first machine learning, then deep learning, a subset of machine learning - have created ever larger disruptions.
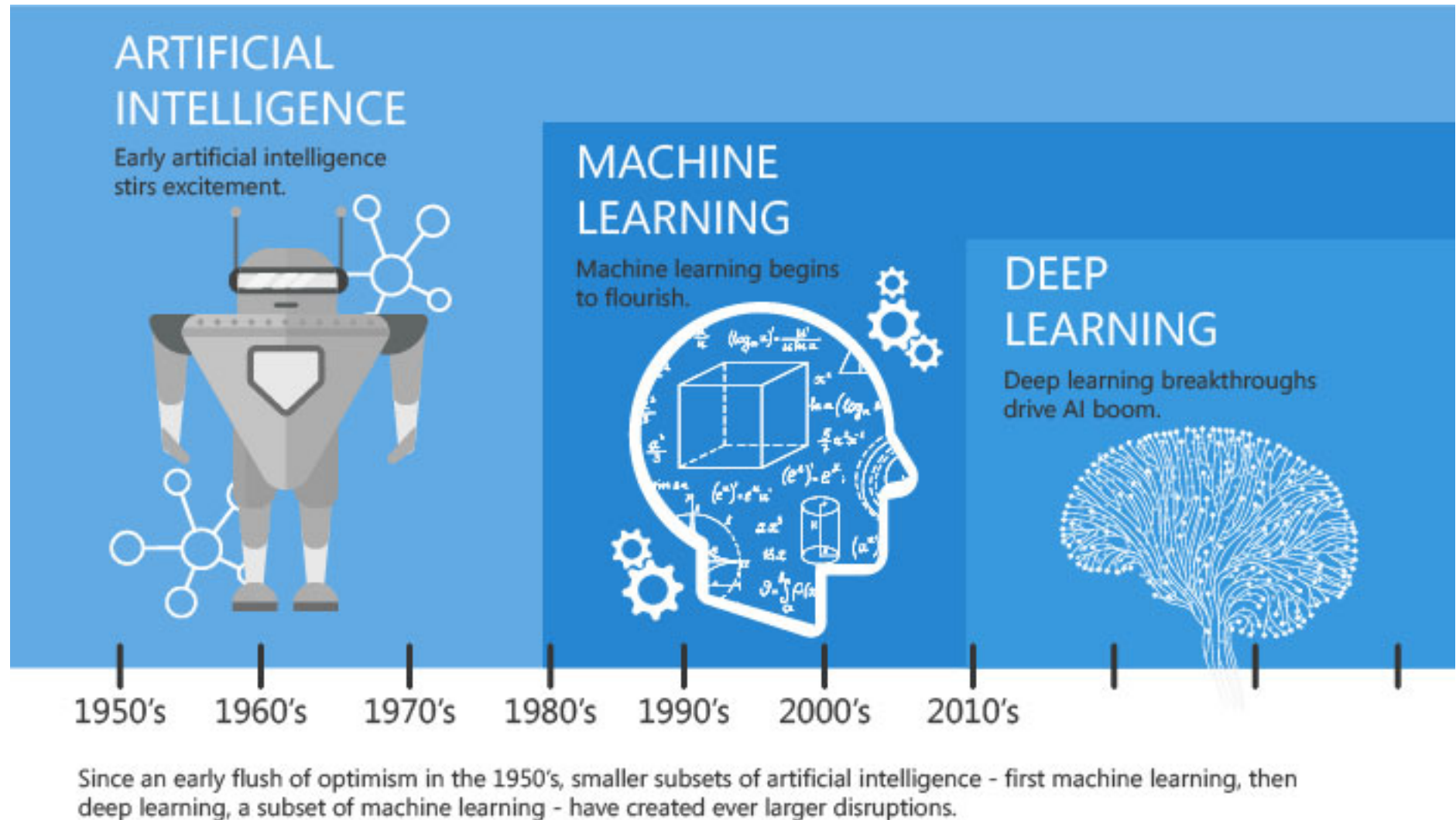
Image: Linked In | Machine Learning vs Deep learning

A Quick History of Machine Learning

1940s EIMC — Electronic Numerical Integrator and Computer
Image: www.computerhistory.org

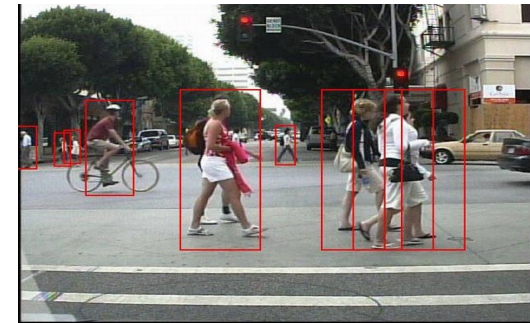How do you use Machine Learning
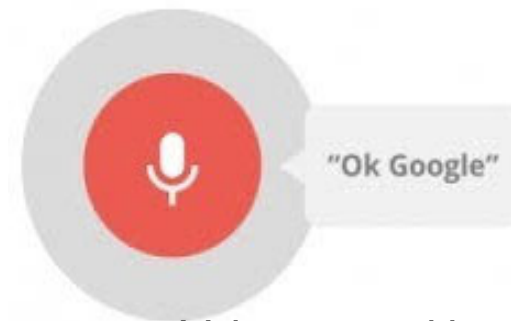in your everyday life?

Some Examples

Spam filtering

Face detection

Pedestrian detection

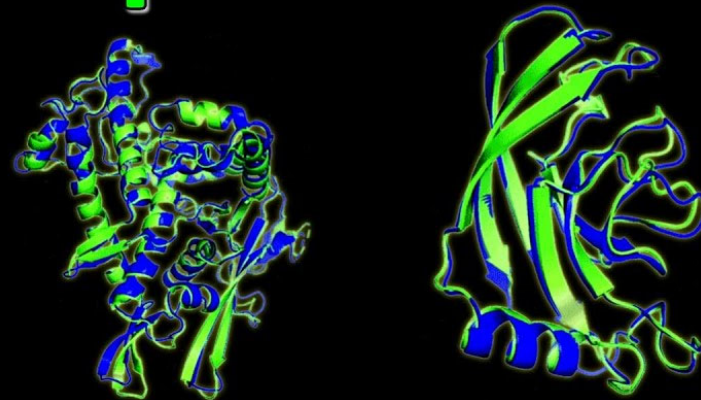
Movie recommendation

Voice recognition

Some Examples

Some Examples
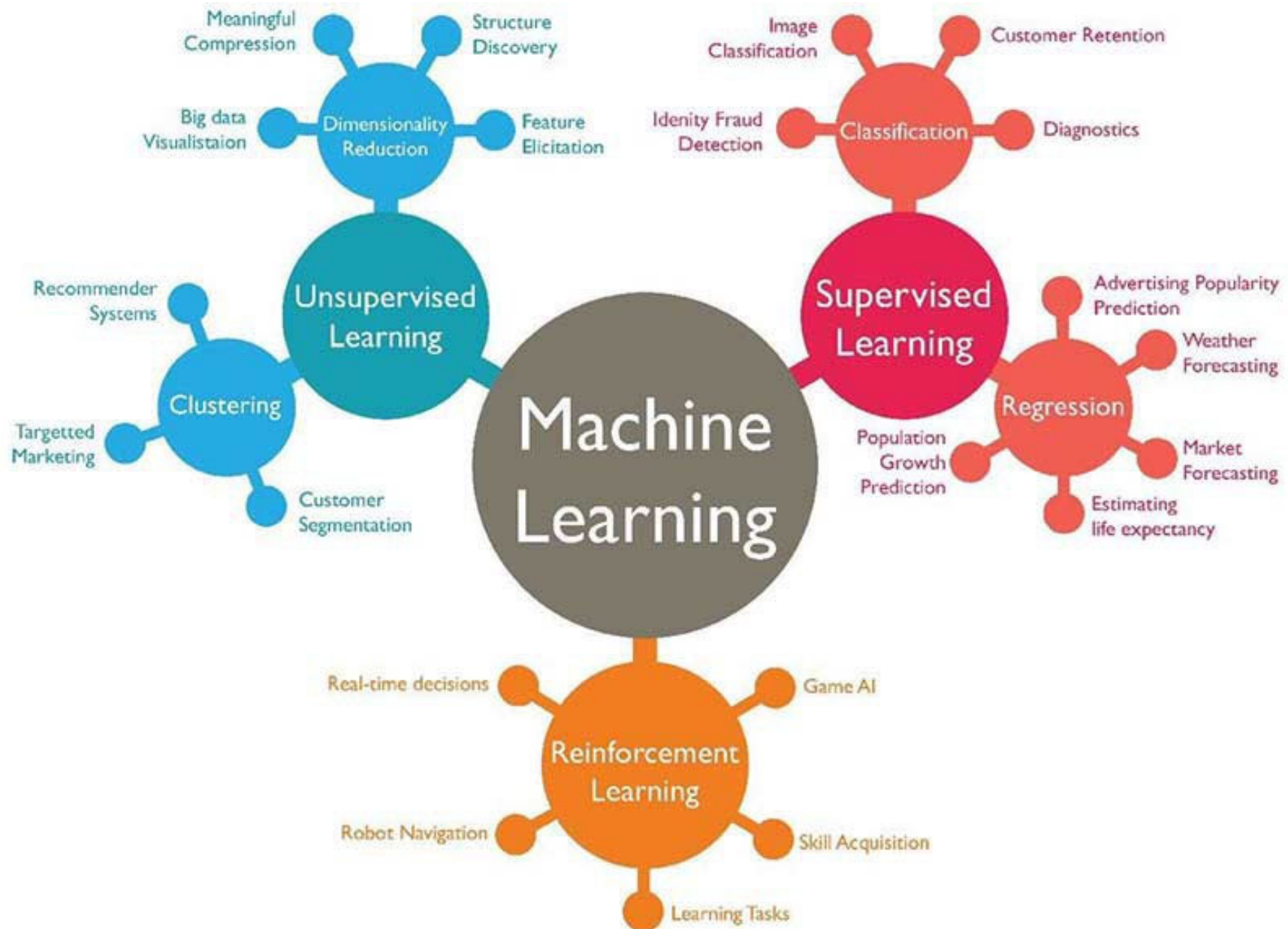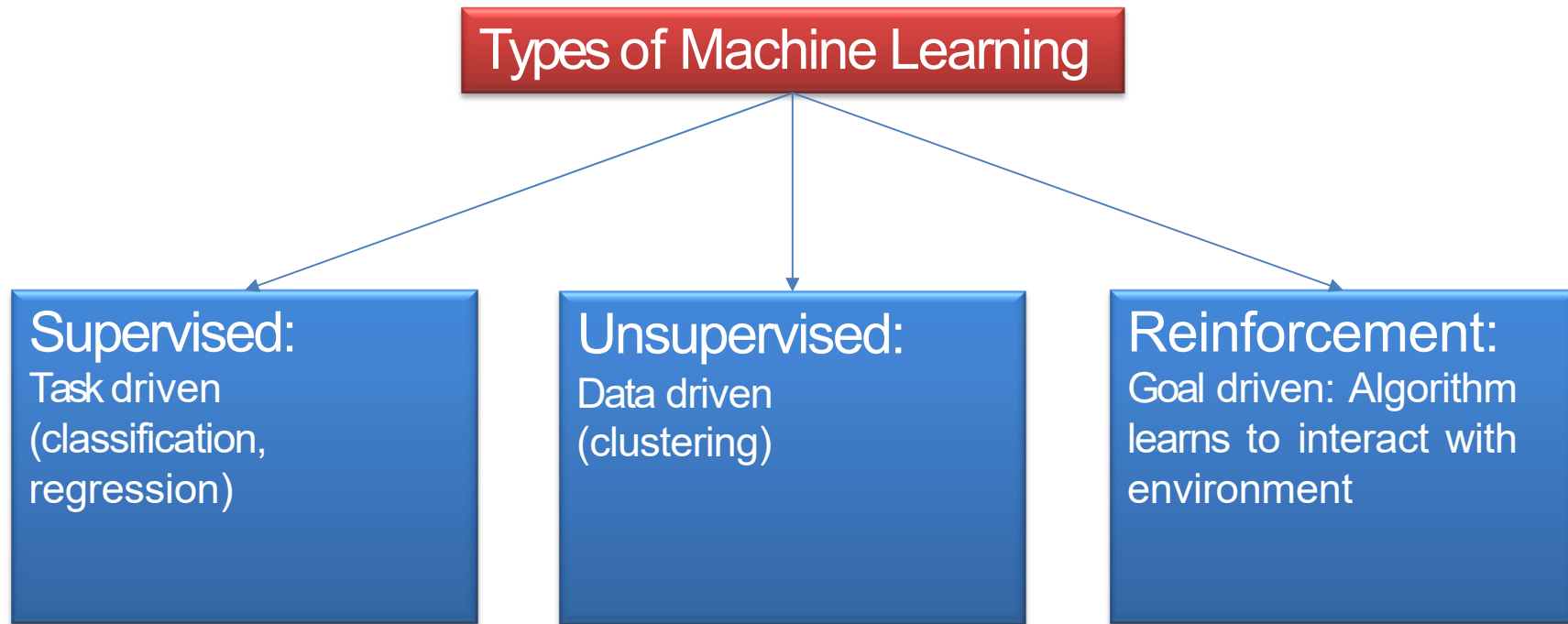

Google DeepMind's
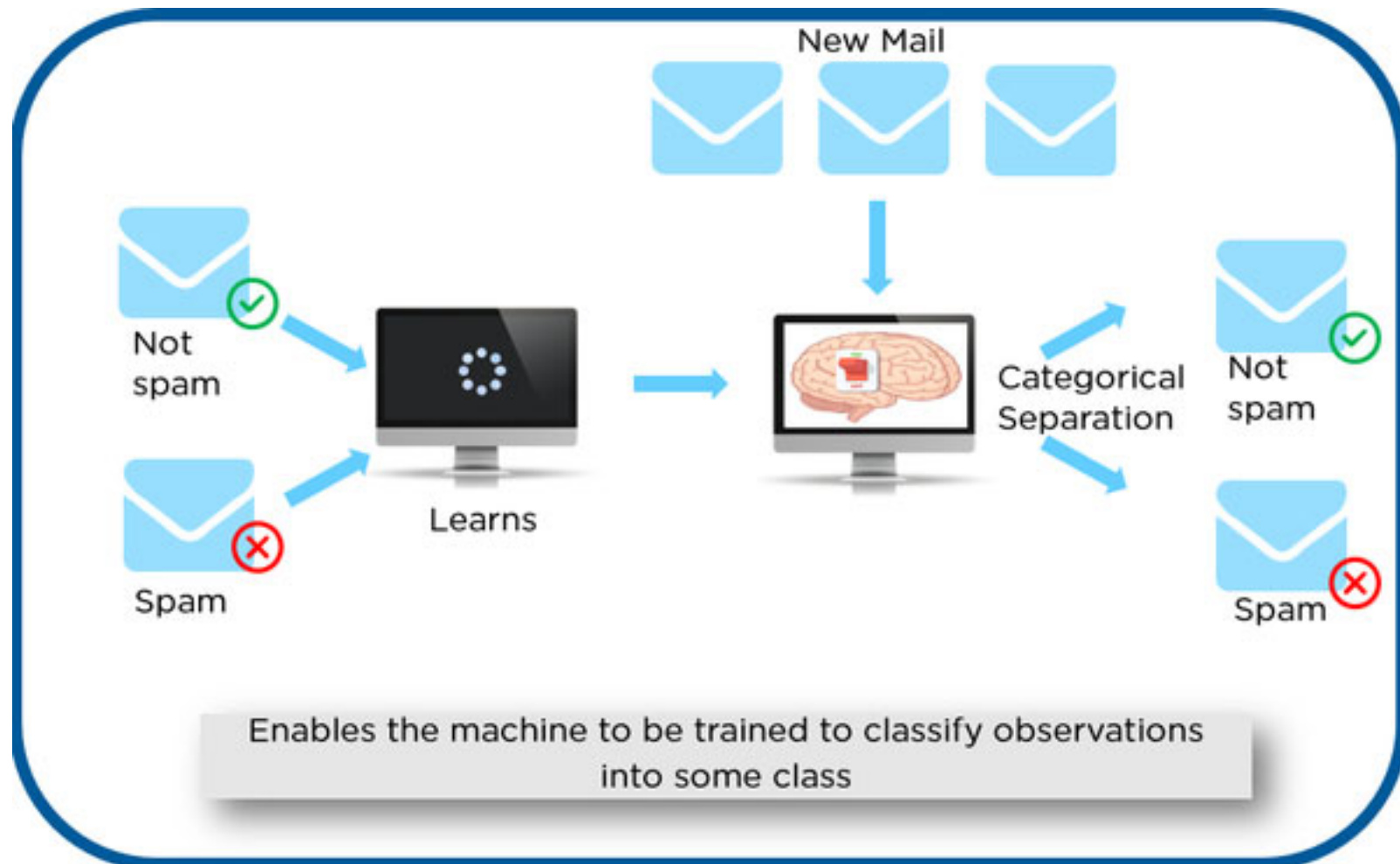**AlphaFold 2**
AI Breakthrough in Biology

Types of Machine Learning

Types of Machine Learning

Types of Machine Learning

Supervised:
Task driven (classification, regression)

Unsupervised:
Data driven (clustering)

Reinforcement:
Goal driven: Algorithm learns to interact with environment

Supervised Learning

New Mail

Not spam

Spam

Learns

Categorical Separation

Not spam

Spam

Enables the machine to be trained to classify observations into some class

Classification

Task: determine the discrete variable y (chair/table) given x (image)
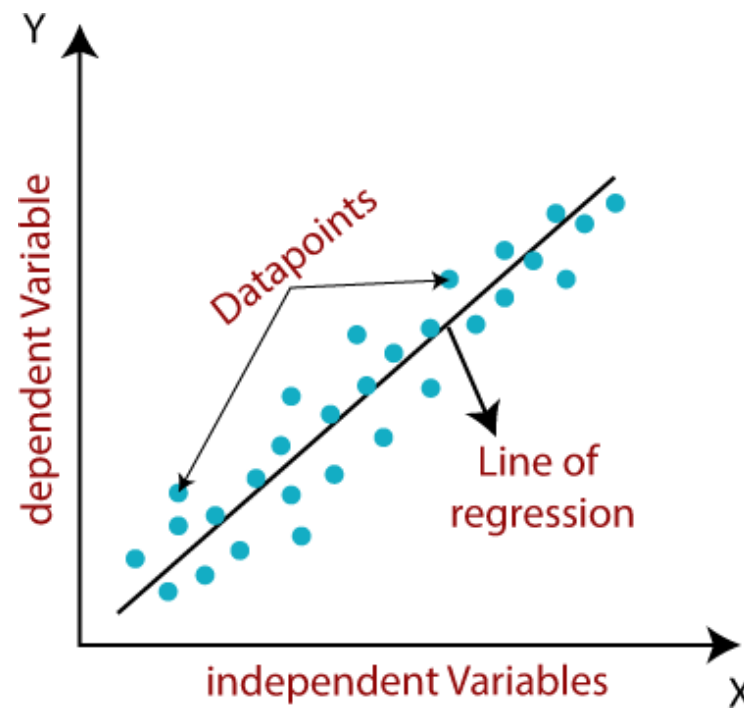
 Chair

 Chair

 Chair

 Table

 Table

 ?

Regression
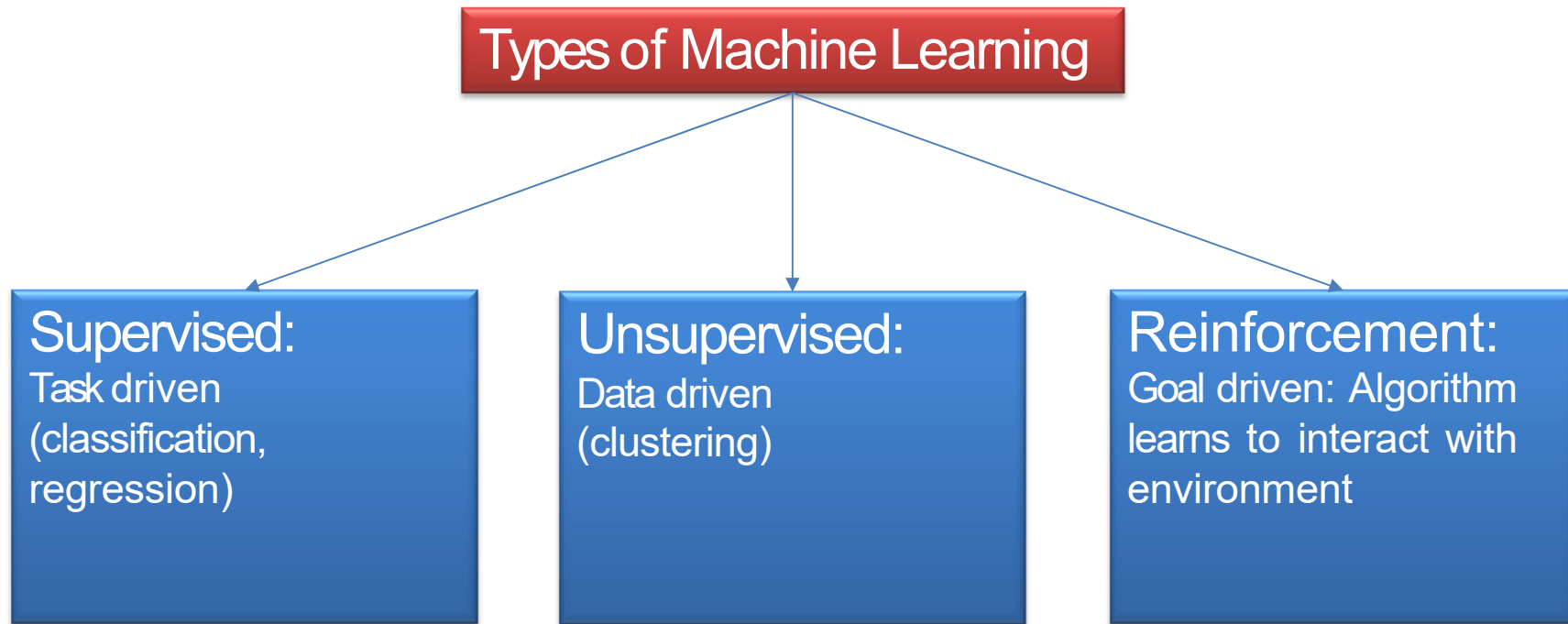
Task: predict a continuous dependent variable y (e.g. weight) given
an independent variable x (e.g. height)
Dependent variables are also called target variables.

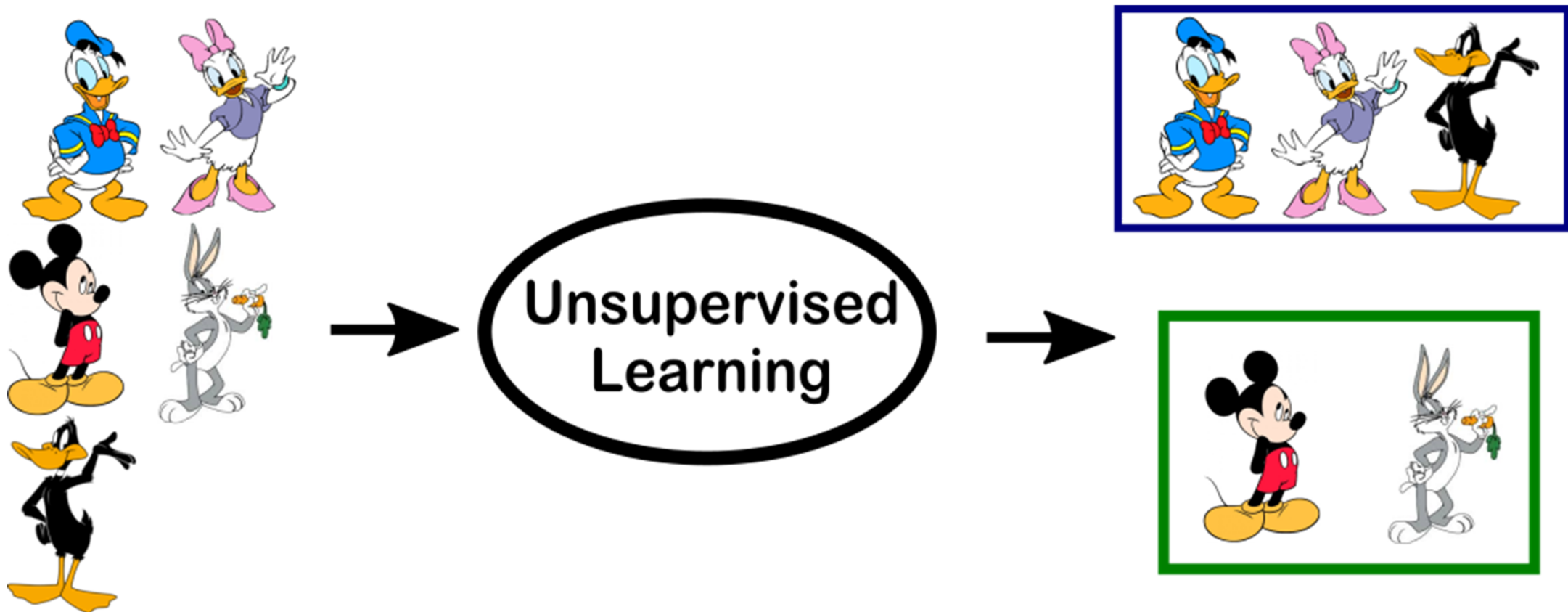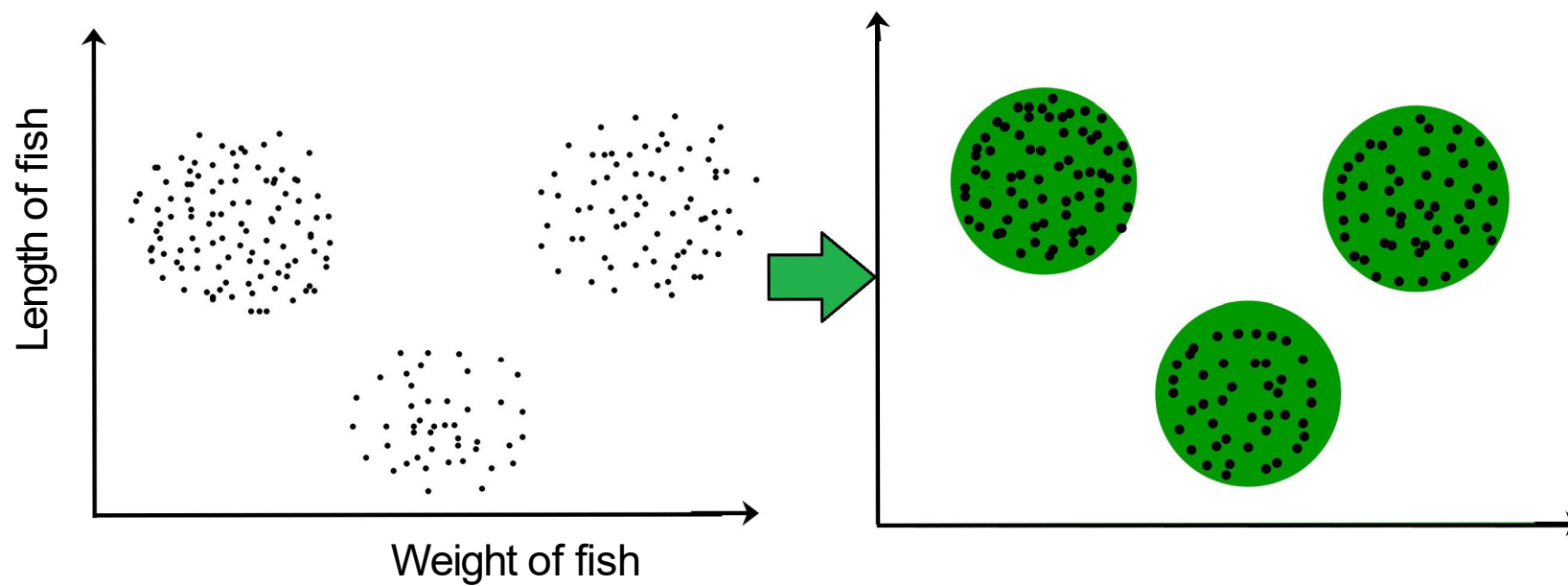| x	y
160	61
154	53
187	79
174	70
165	?

Types of Machine Learning
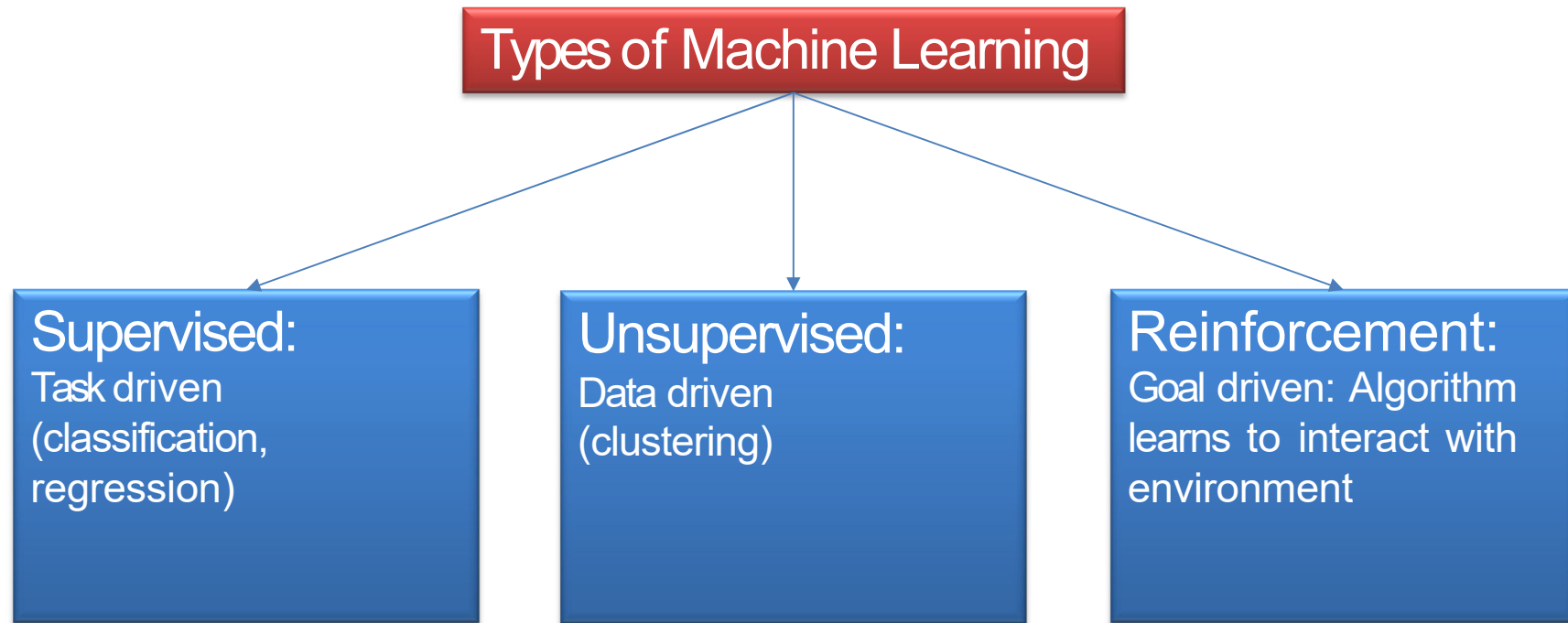
Unsupervised Learning

Clustering

Task: cluster the data (e.g. height/weight) into coherent groups.

Types of Machine Learning

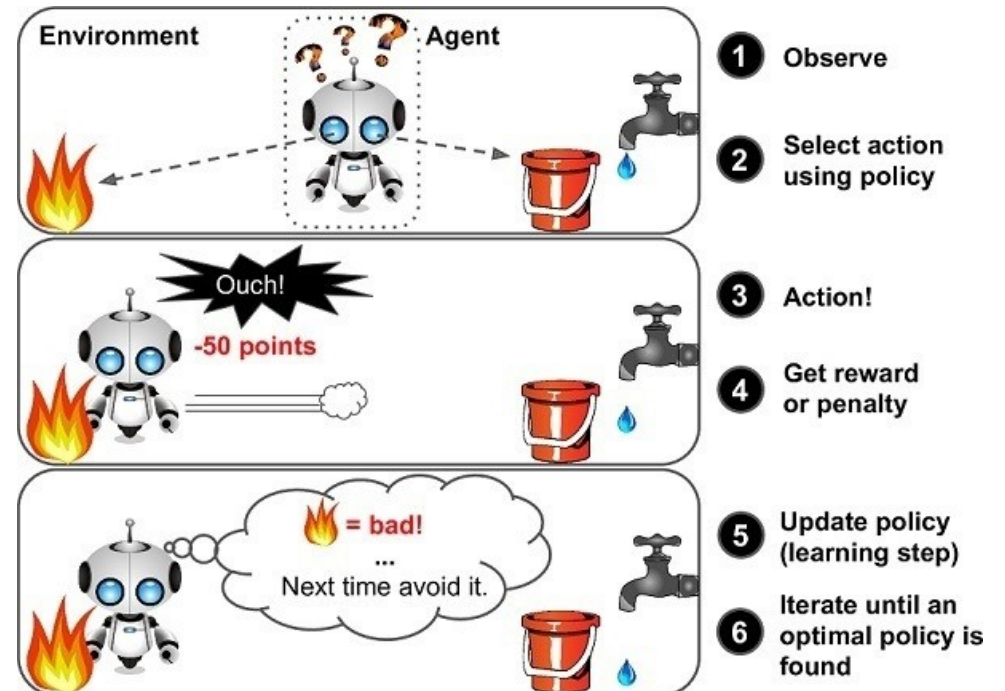Types of Machine Learning

Supervised:
Task driven (classification, regression)

Unsupervised:
Data driven (clustering)

Reinforcement:
Goal driven: Algorithm learns to interact with environment

Reinforcement Learning
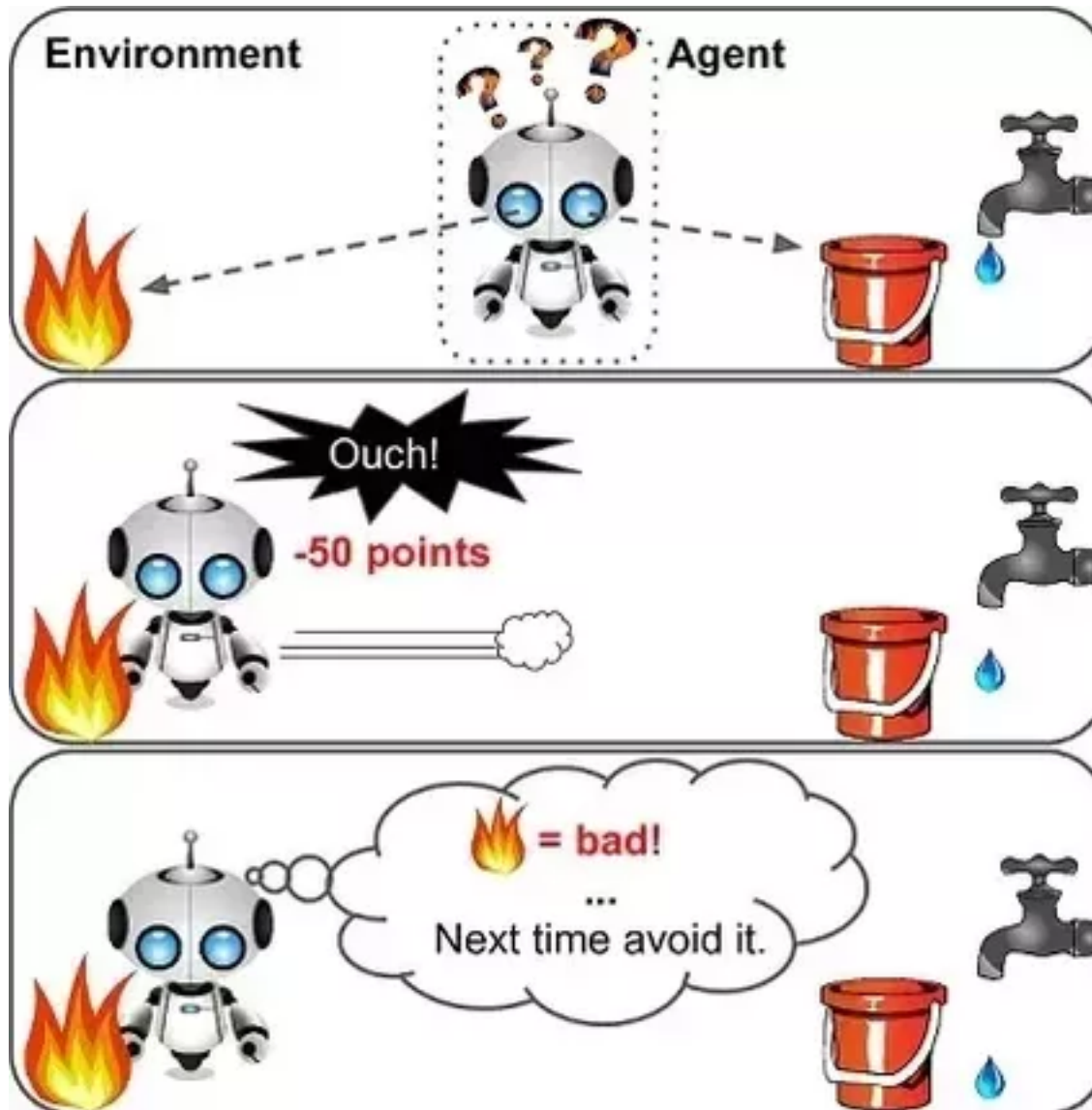
Reinforcement learning

Goal: At any state S_t, the agent learns to take the best action a_t to maximize the reward r_t.
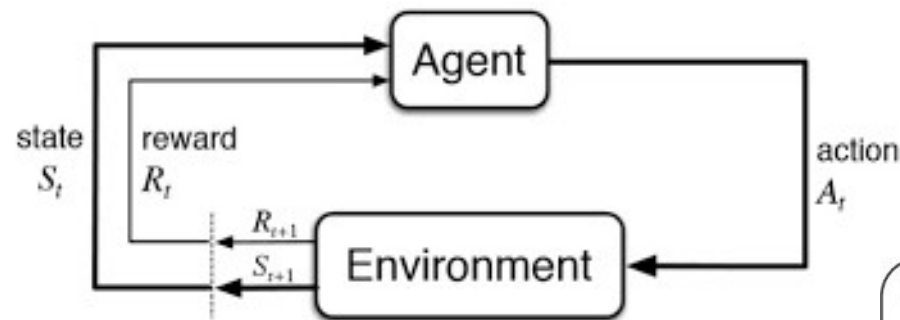
Goals

- Know the theory behind the most popular learning algorithms for <u>classification, clustering, and regression.</u>

- Code and apply those algorithms to datasets.

Machine Learning

Data Collection

Feature Selection

Model choice

Training

Evaluation
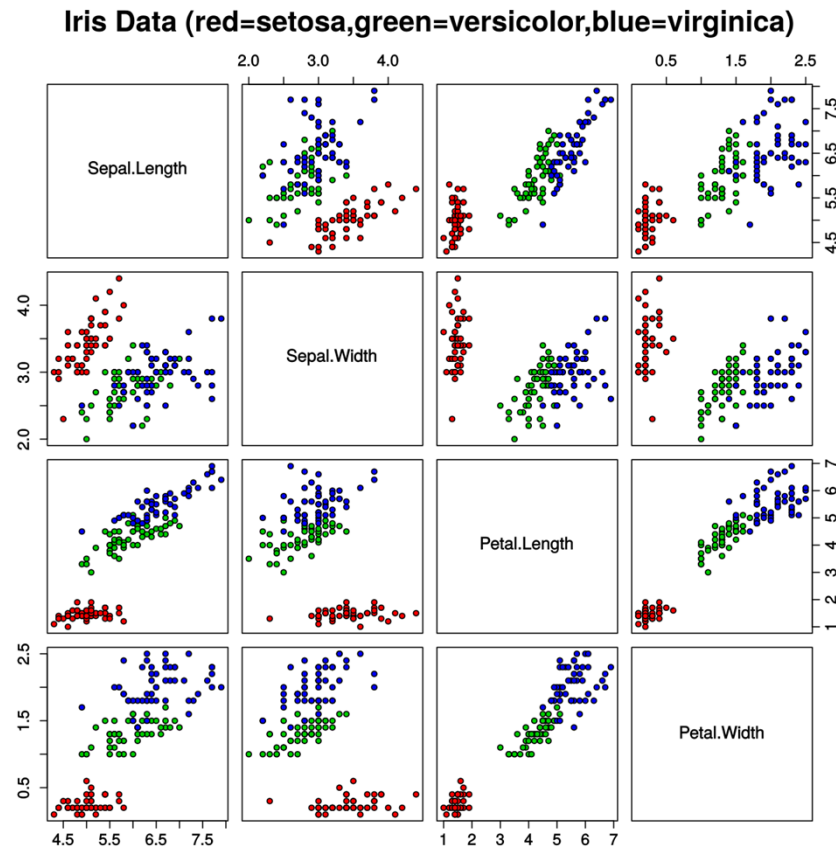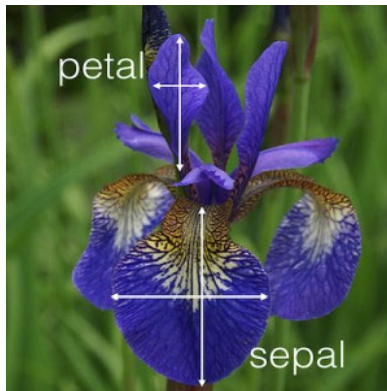
Machine Learning Process

Data Collection:
For example, many images
of various iris flowers
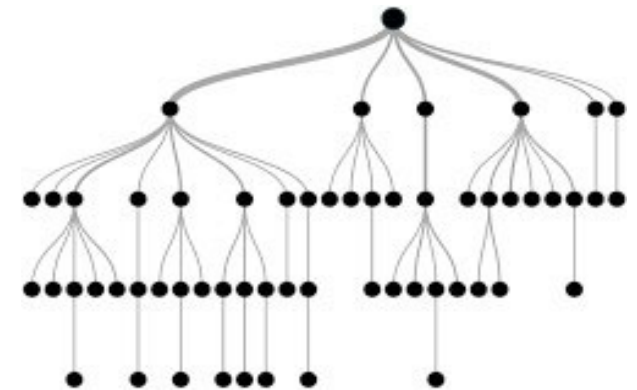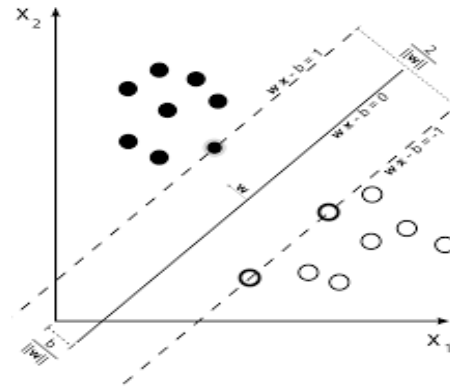
Machine Learning Process

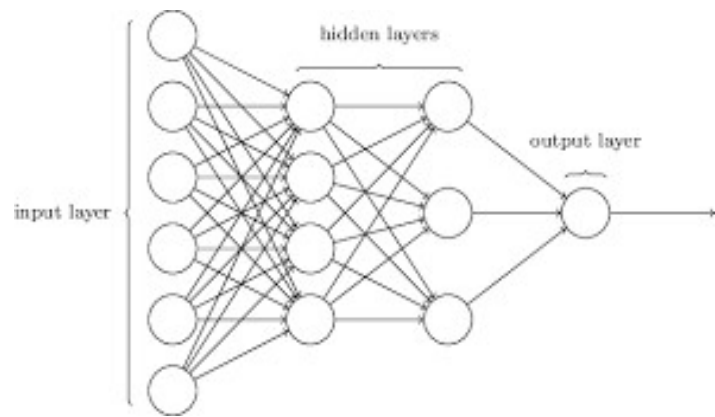Feature Selection:
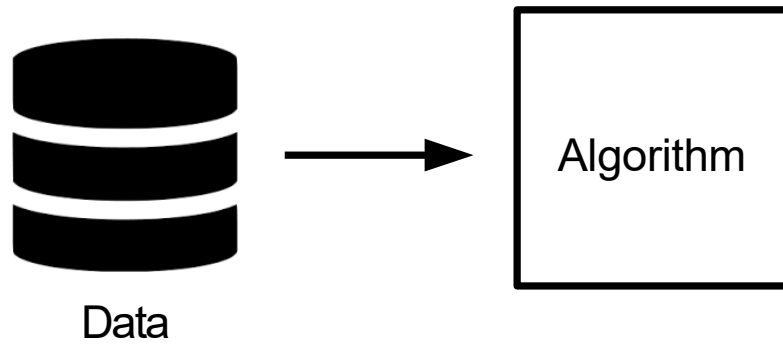E.g., length/widths of petal
and sepal in each flower

Iris Data (red=setosa,green=versicolor,blue=virginica)

Machine Learning Process

Model choice

Machine Learning Process

Training

Data

Algorithm

Machine Learning Process

Evaluation

		PredictedClass		
		Setosa	Versicolor	Virginica
	Setosa	**14**	1	1
Actual Class	Versicolor	1	**11**	3
	Verginica	1	3	**10**

Machine Learning

Data Collection

Feature Selection

Model choice

Training

Evaluation

Most of this class