

Introduction to Machine Learning

LÊ ANH CƯỜNG
Ton Duc Thang University

Outline

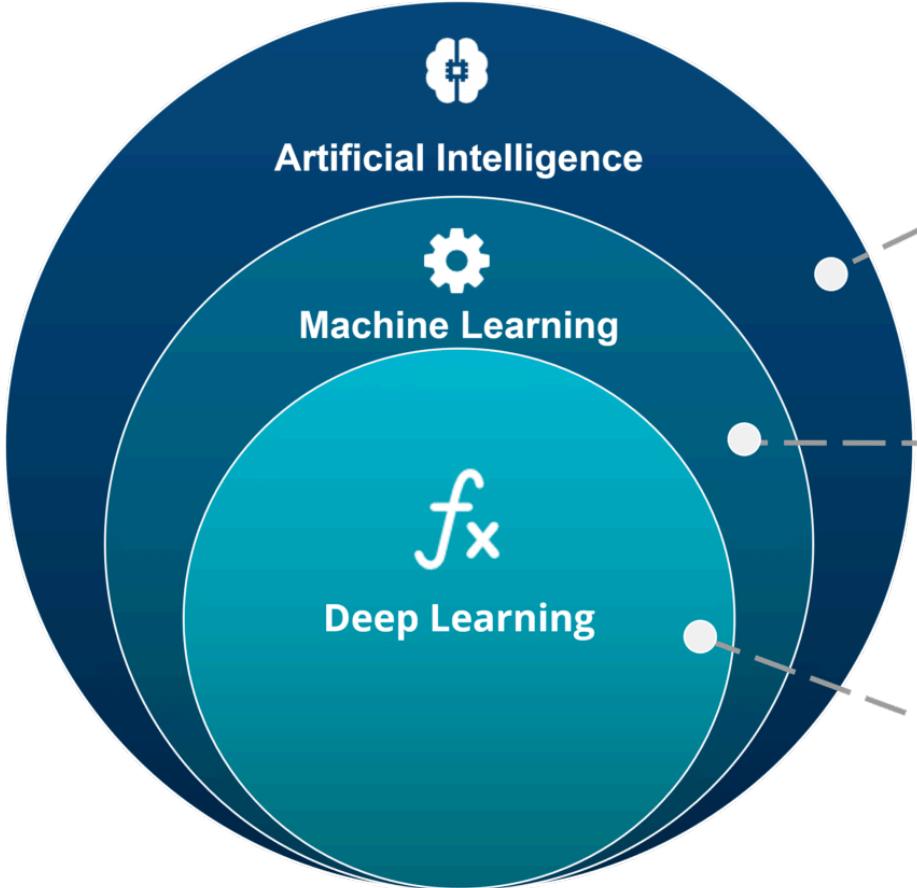
1. What are AI systems?
2. A general paradigm for AI systems and the ML component
3. Examples of ML models
4. The tasks of Machine Learning
5. History of ML
6. Topics of this course

AI and ML

- Machine learning is a subset of AI which allows a machine to automatically learn from past data without programming explicitly. The goal of AI is to make a smart computer system like humans to solve complex problems. The goal of ML is to allow machines to learn from data so that they can give accurate output.
- AI is a bigger concept to create intelligent machines that can simulate human thinking capability and behavior, whereas, machine learning is an application or subset of AI that allows machines to learn from data without being programmed explicitly.

<https://www.analyticsinsight.net/the-difference-between-artificial-intelligence-and-machine-learning>

<https://www.javatpoint.com/difference-between-artificial-intelligence-and-machine-learning>



ARTIFICIAL INTELLIGENCE

A technique which enables machines to mimic human behaviour

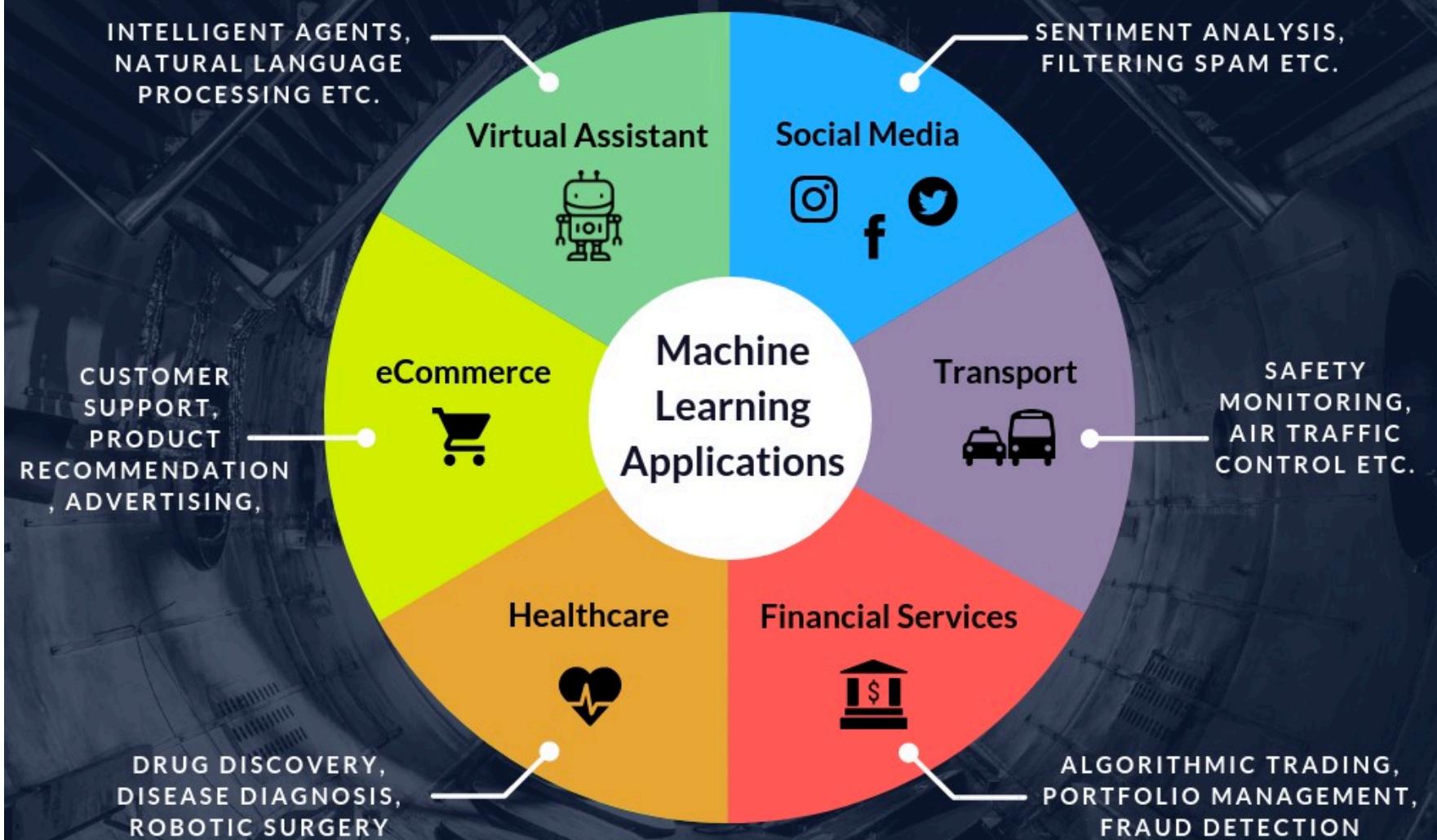
MACHINE LEARNING

Subset of AI technique which use statistical methods to enable machines to improve with experience

DEEP LEARNING

Subset of ML which make the computation of multi-layer neural network feasible

APPLICATIONS OF MACHINE LEARNING



Domains of applying AI

- Retail
 - AI provides virtual shopping capabilities that offer personalized recommendations and discuss purchase options with the consumer.
- Banking
 - Artificial Intelligence enhances the speed, precision and effectiveness of human efforts. In financial institutions, AI techniques can be used to identify which transactions are likely to be fraudulent, adopt fast and accurate credit scoring, as well as automate manually intense data management tasks.
- Games
 - AI in games is about planning. The artificial agent must decide on the next best action(s) to perform depending on the state of the game.

Domains of applying AI

- Transportation
 - autonomous cars; navigation system; monitoring traffic lights;
- Logistics and Warehouse Management
 - Logistics and warehouses management are two very complex problems. They depends on many parameters difficult to model, some of them even time-dependent.
- Machine Translation
- Virtual Assistant
- Computer Vision
- Healthcare
- ...

Why AI?

- AI is as capable as an expert, acts as smart as humans
- AI offers optimal solutions to problems
- AI solves predictive problems

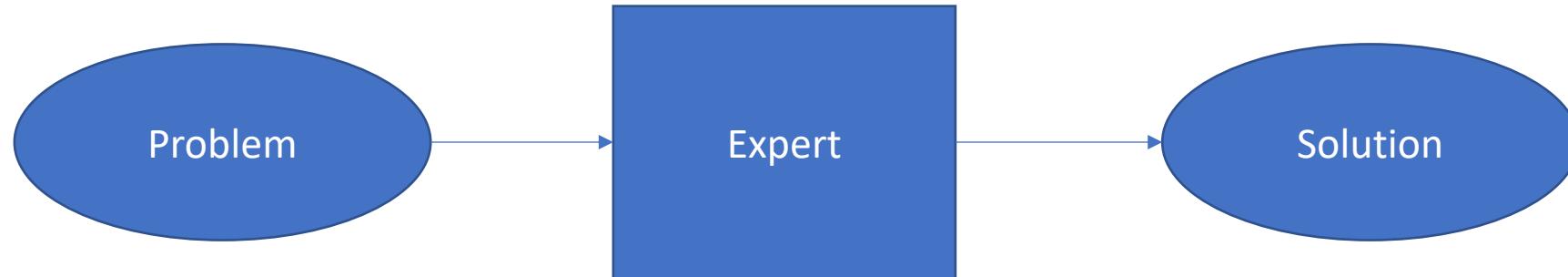
Why AI?

AI capabilities

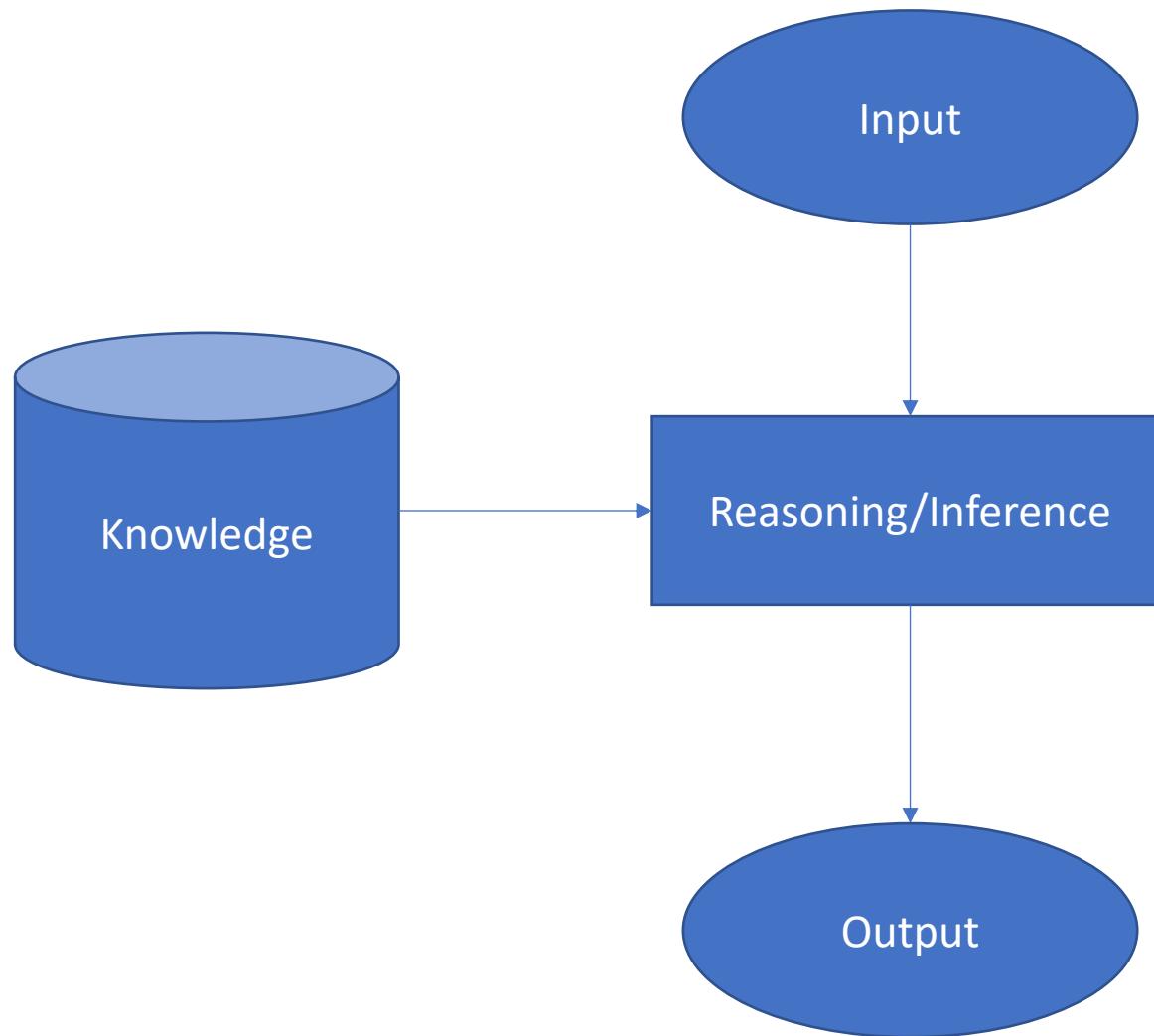
- AI adds intelligence to existing products.
- AI achieves incredible accuracy
- AI analyzes more and deeper data -> new knowledge

https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html

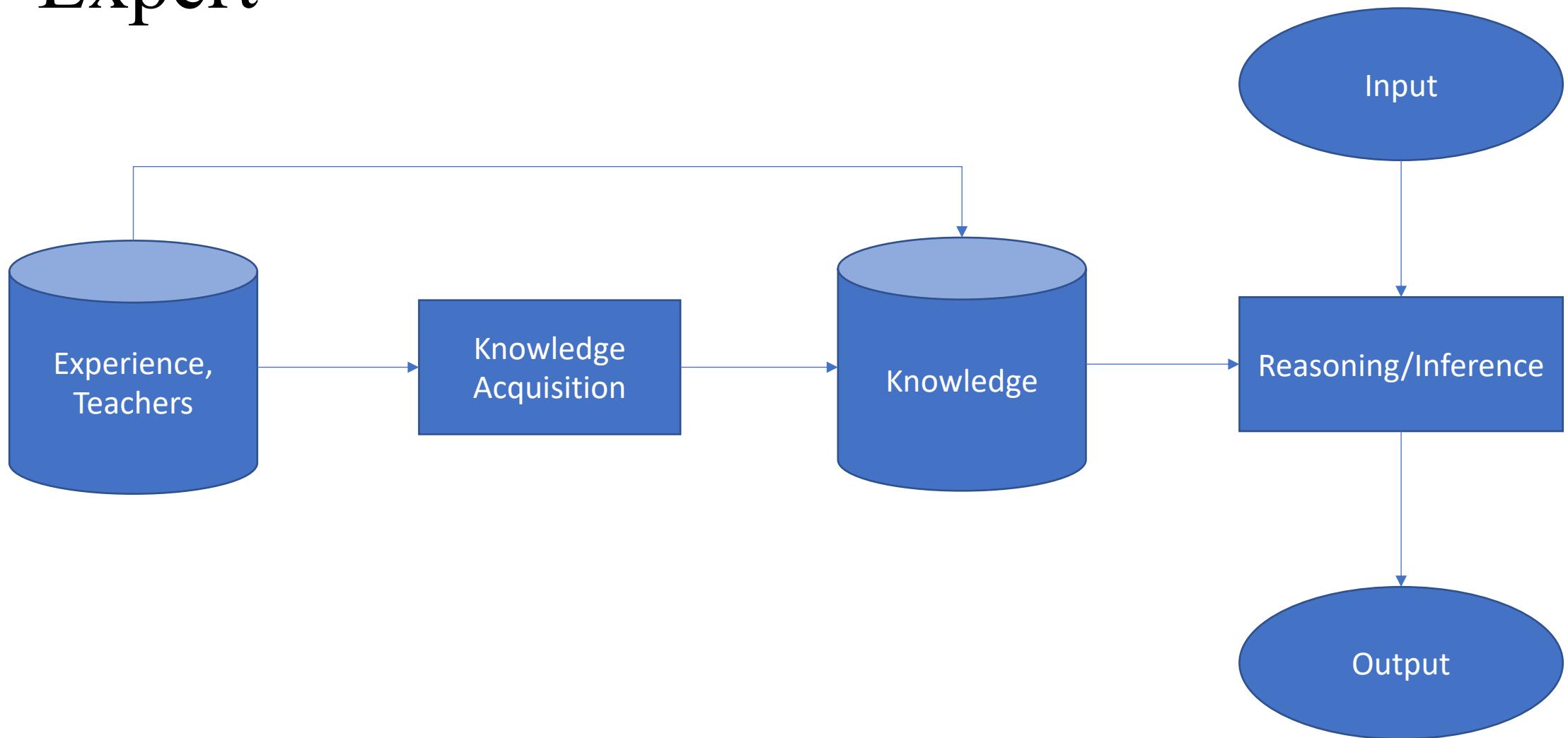
How does a person solve problems?



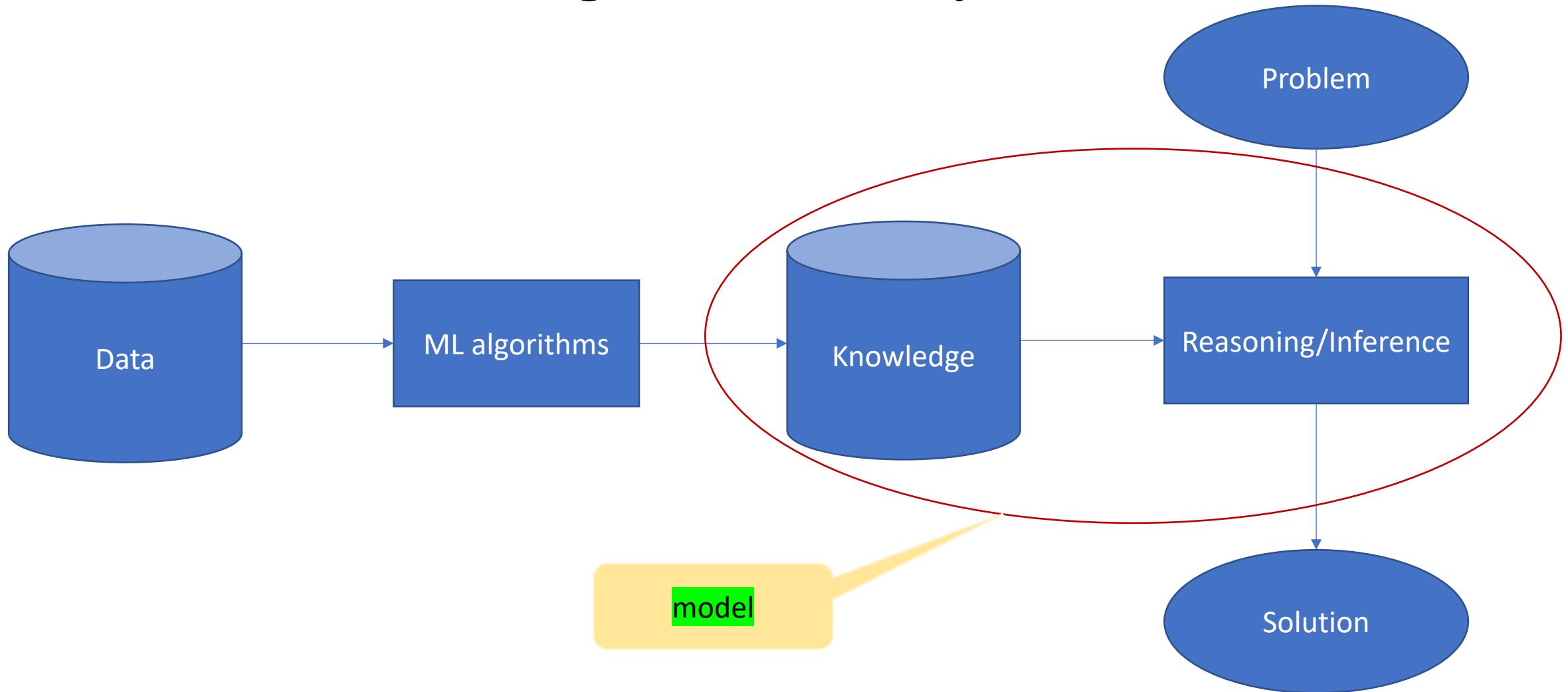
Expert



Expert



A General Paradigm of ML Systems



What are ML components in AI systems?

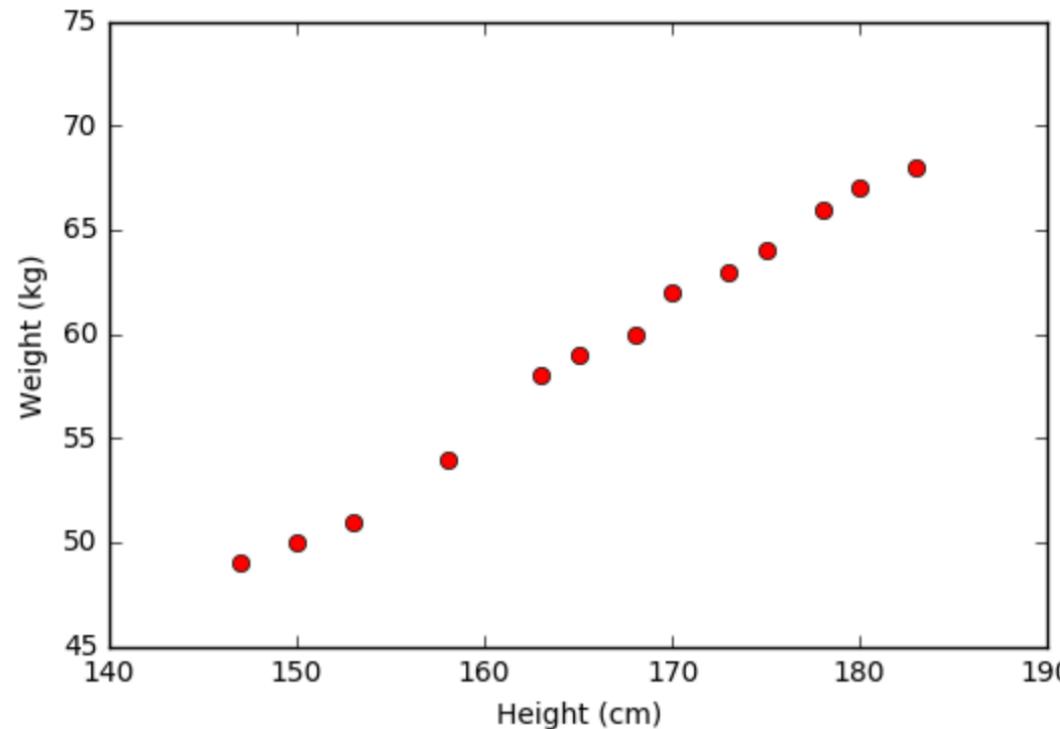
- Model
- Learning algorithms/methods

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ML model: example 1

Chiều cao (cm)	Cân nặng (kg)	Chiều cao (cm)	Cân nặng (kg)
147	49	168	60
150	50	170	72
153	51	173	63
155	52	175	64
158	54	178	66
160	56	180	67
163	58	183	68
165	59		



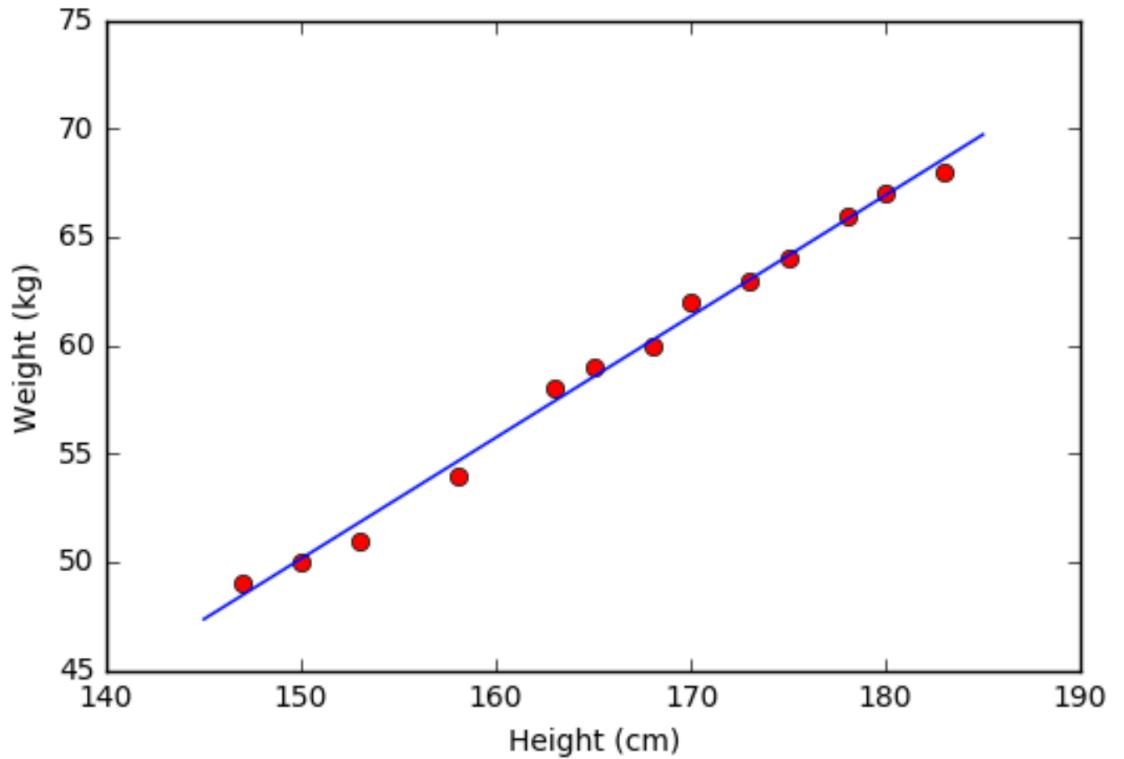
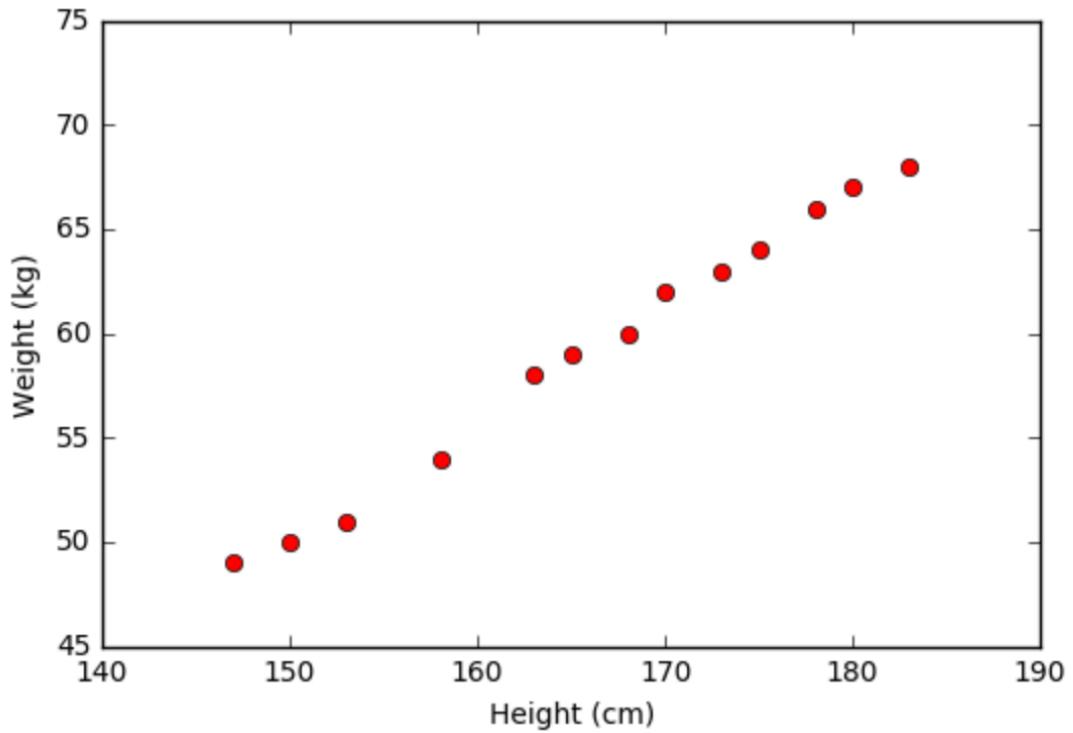
$$(\text{cân nặng}) = w_1 * (\text{chiều cao}) + w_0$$

$$y = ax + b$$

$$(\text{cân nặng}) = w_1 * (\text{chiều cao}) + w_0$$

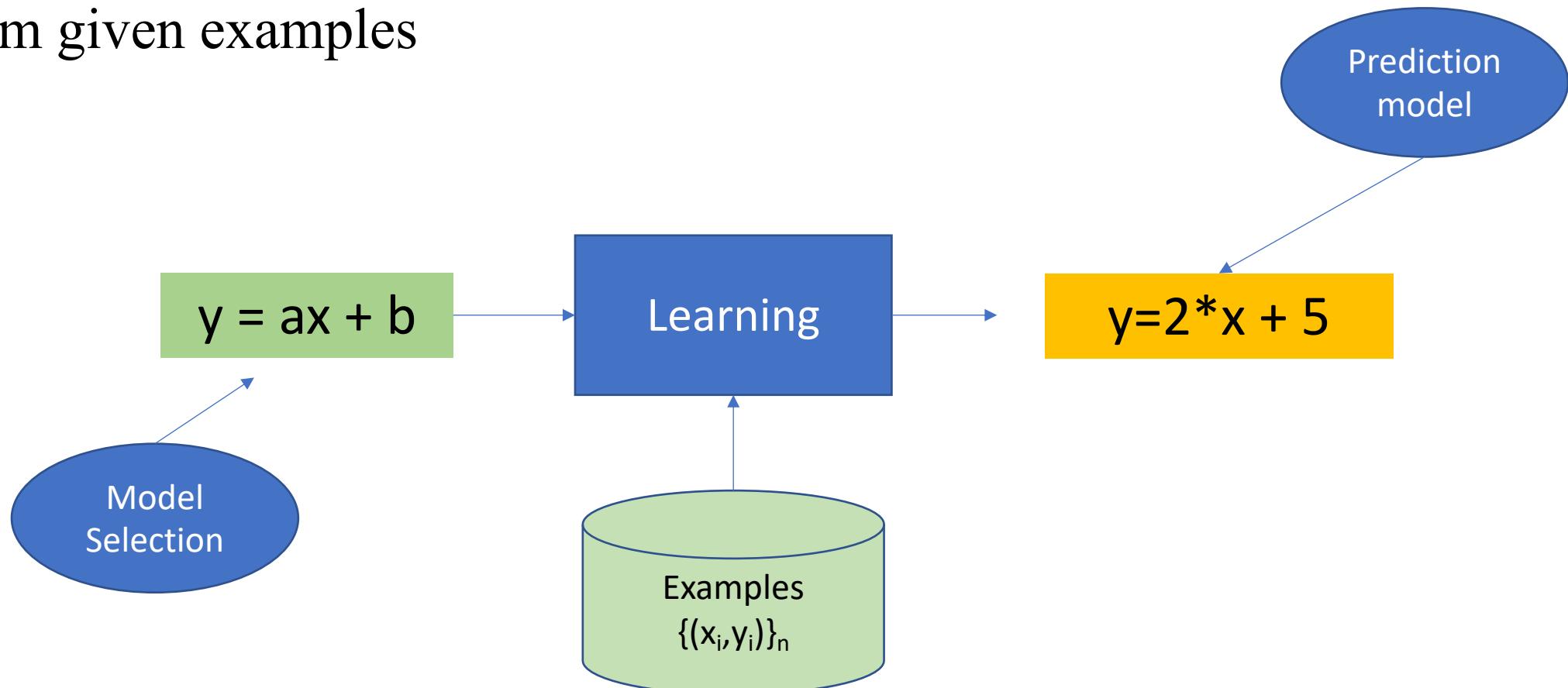
$$w = [[-33.73541021], [0.55920496]]$$

$$y = ax + b$$



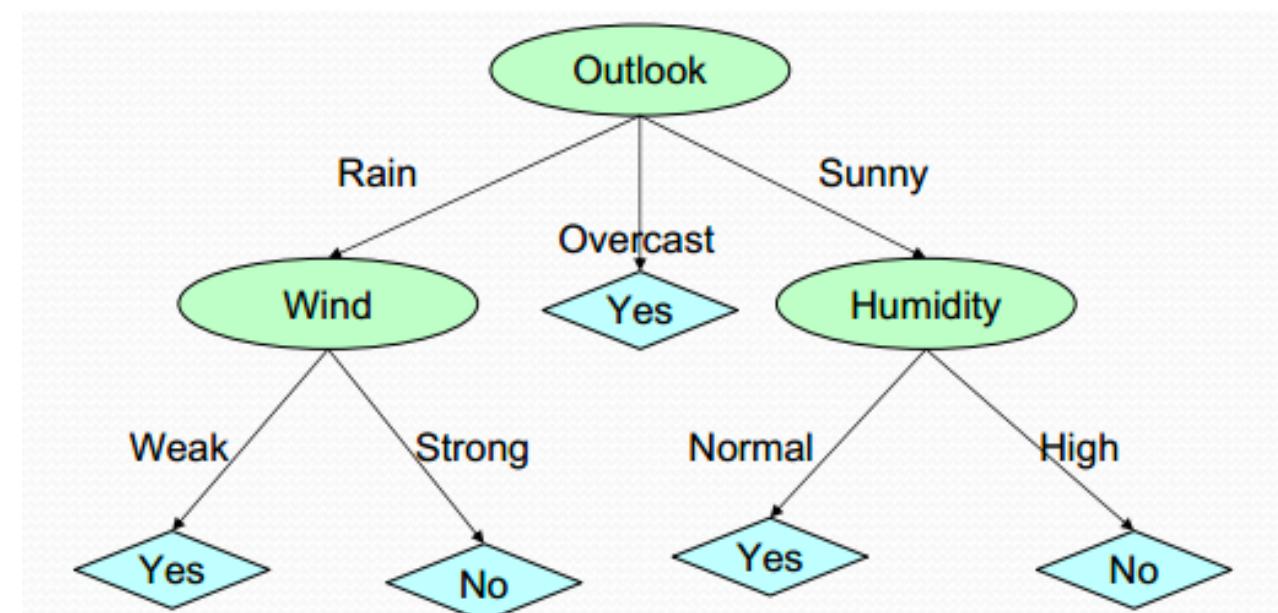
How to understand Learning?

=> learn values for model's parameters by inferencing from given examples

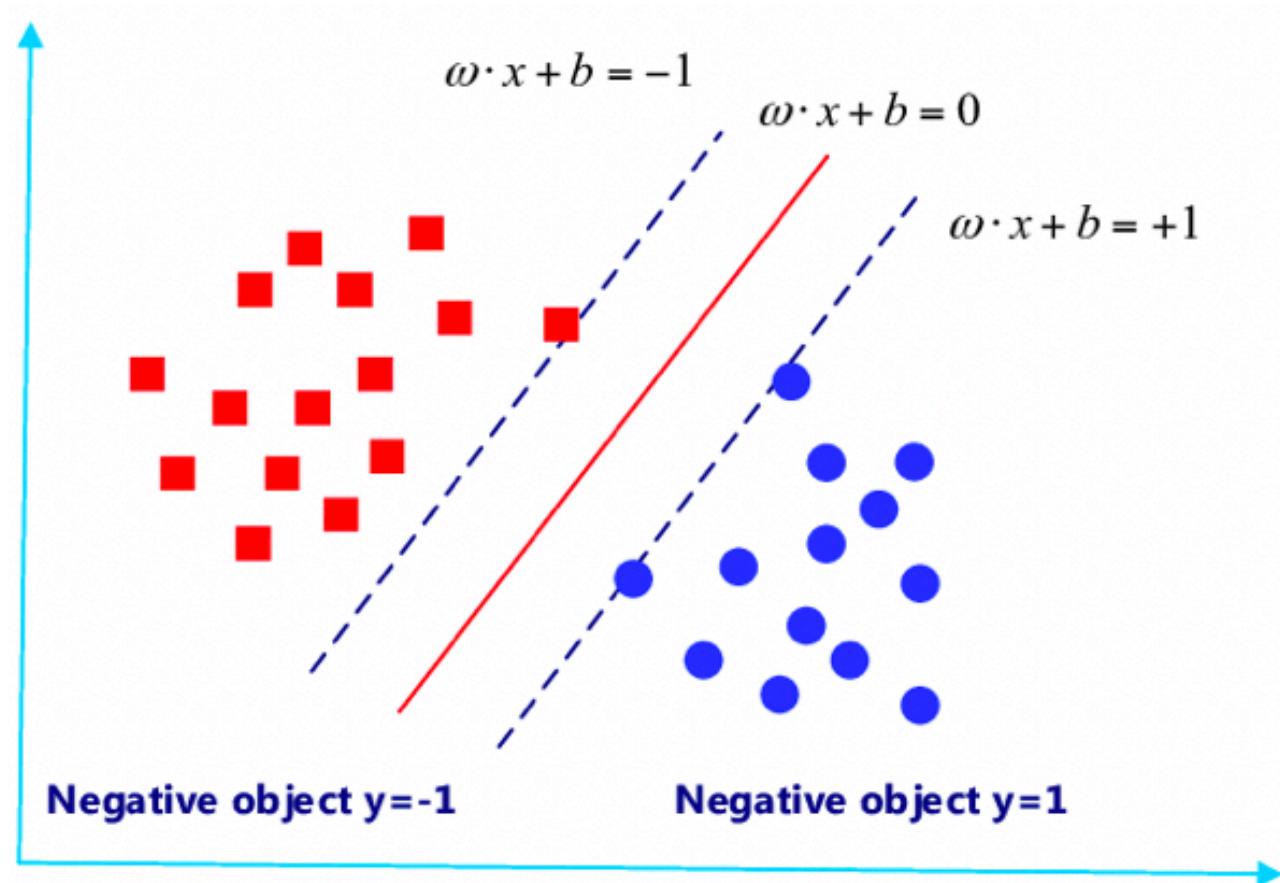


ML model: example 2

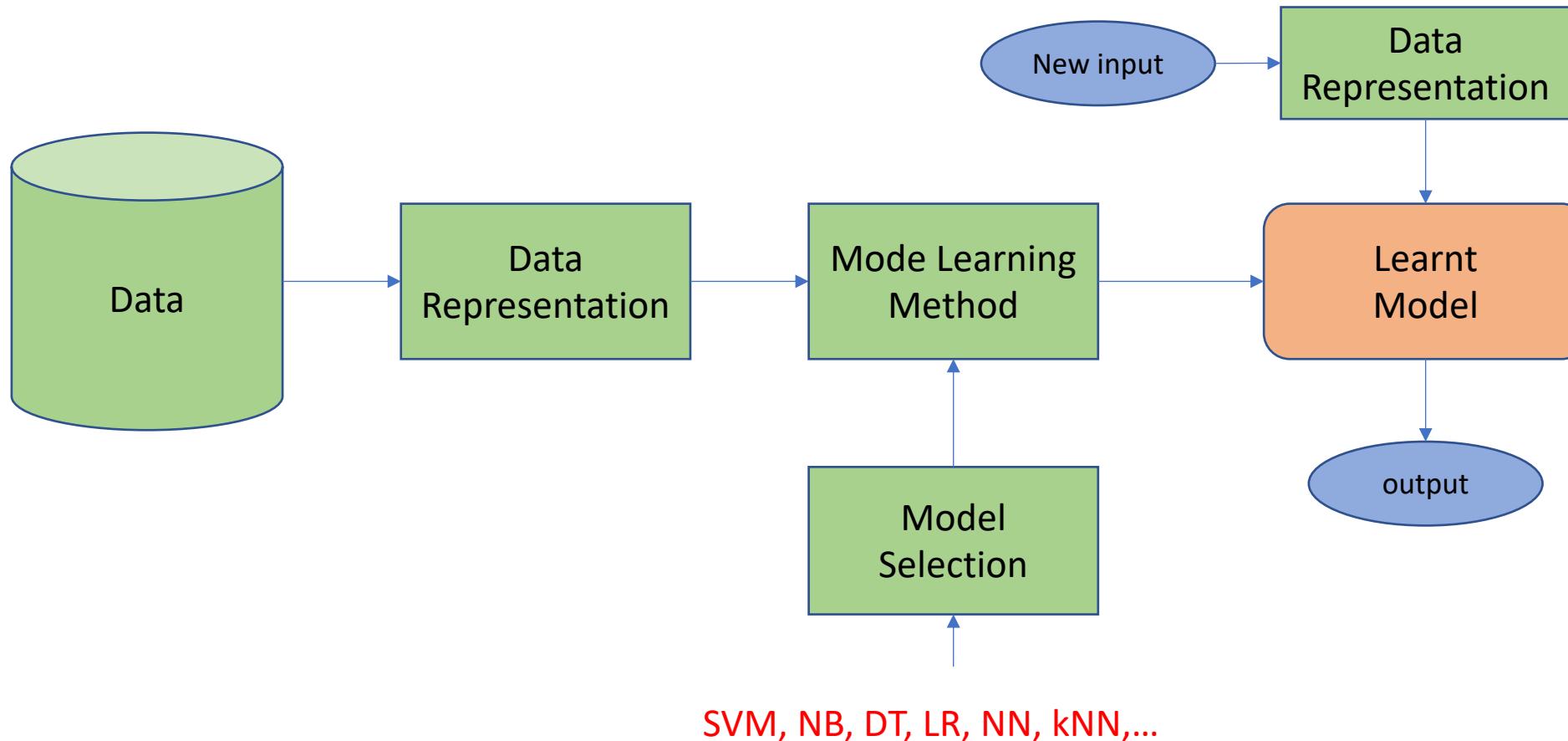
Outlook	Tempreature	Humidity	W indy	Class
sunny	hot	high	false	N
sunny	hot	high	true	N
overcast	hot	high	false	P
rain	mild	high	false	P
rain	cool	normal	false	P
rain	cool	normal	true	N
overcast	cool	normal	true	P
sunny	mild	high	false	N
sunny	cool	normal	false	P
rain	mild	normal	false	P
sunny	mild	normal	true	P
overcast	mild	high	true	P
overcast	hot	normal	false	P
rain	mild	high	true	N



ML model: example 3



A General Machine Learning Diagram



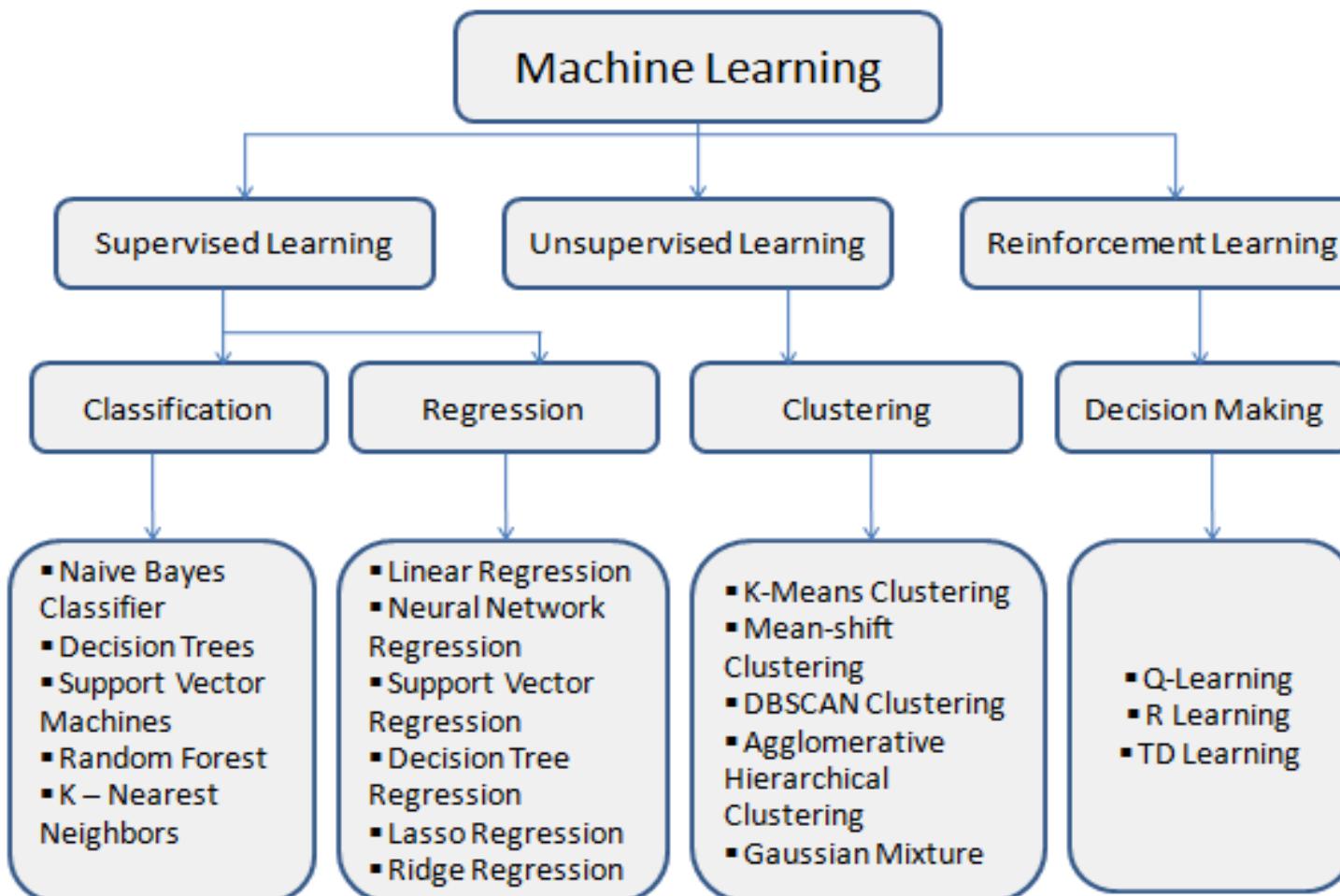
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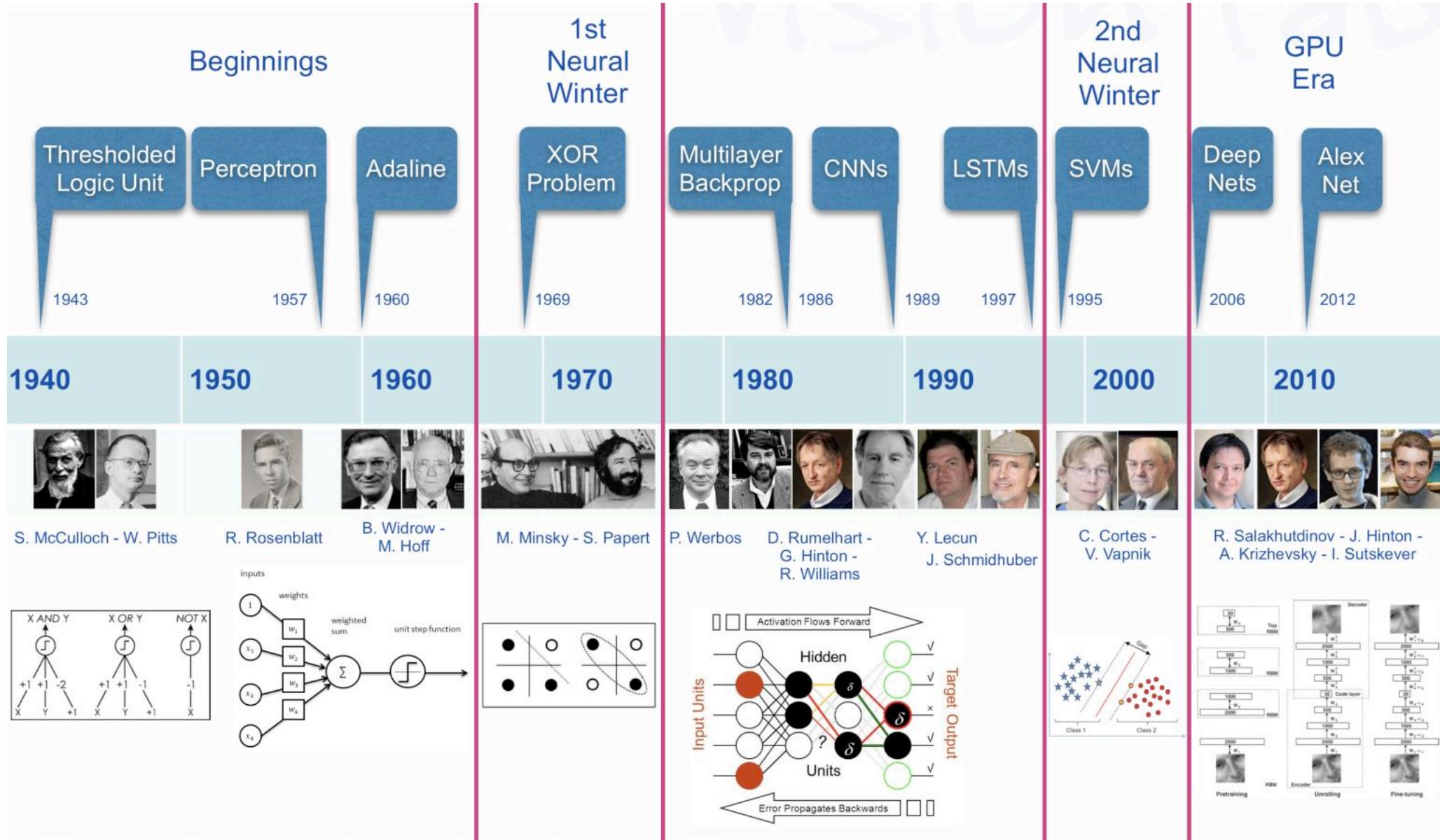
What should be learnt in Machine Learning?

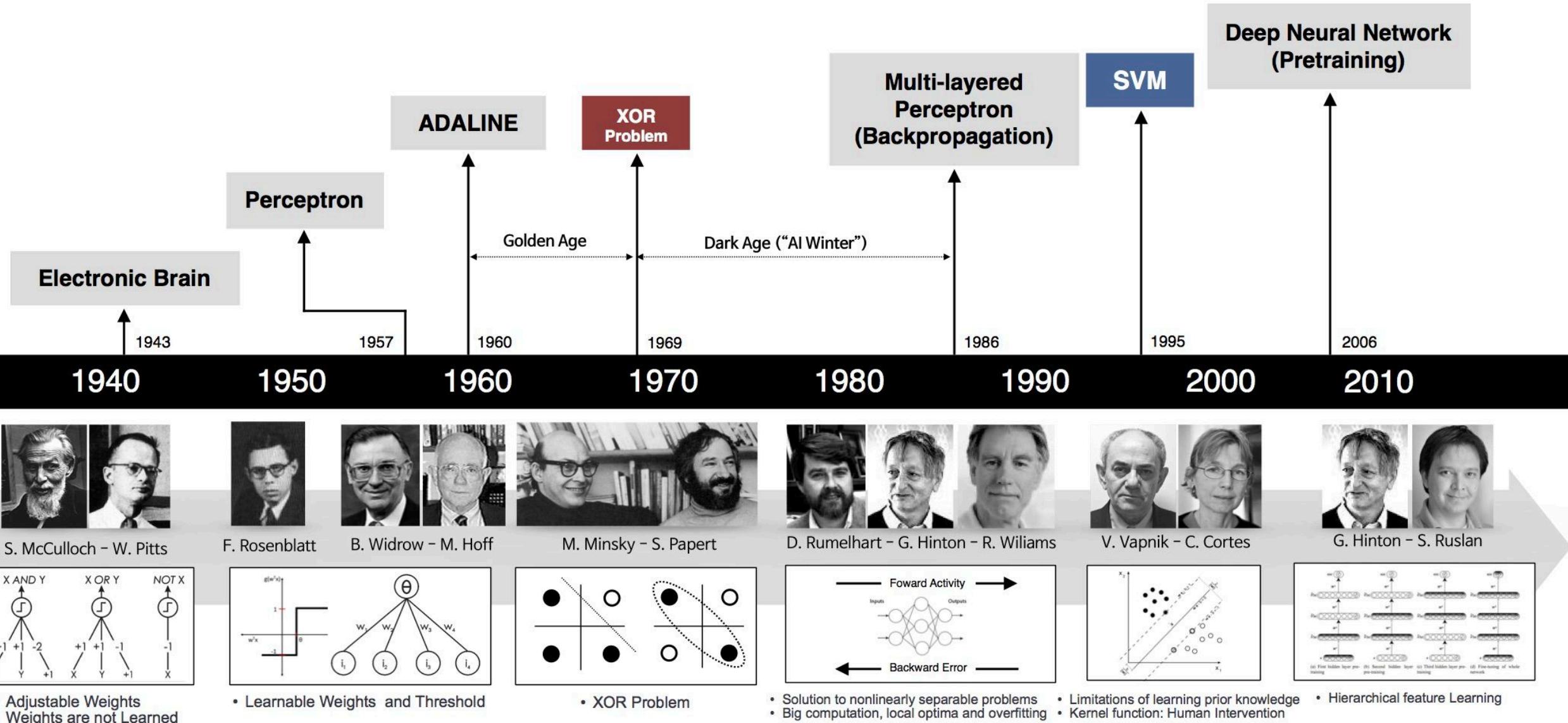
- Understanding ML models
 - Architecture, Structure, or form of the models
 - Computation, inference/reasoning
- Methods/Algorithms for learning models' parameters
- Model evaluation
- Data Processing: data collection; feature selection; dimensional reduction, noisy filtering,...
- Other issues: overfitting,

Types of Machine Learning



History of ML





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Topics of this course

1. Machine Learning: an Overview
2. Classification
 1. NB classifiers, Generative vs Discriminative models
 2. Decision Tree and Random Forest
 3. Support Vector Machine
 4. K-Nearest Neighbor
3. Regression
 1. Linear Regression and Gradient Descent Algorithm
 2. Logistic Regression for classification
4. Overfitting
5. Ensemble Learning
6. Unsupervised Learning
 1. Clustering
 2. Dimension Reduction
7. Neural Networks
8. Advanced Topics
 1. Deep Learning
 2. Reinforcement Learning

Course assessment

- Middle exam (20%)
 - Project and presentation
- Final exam (50%)
 - Project and presentation
- Progress exercises (30%)