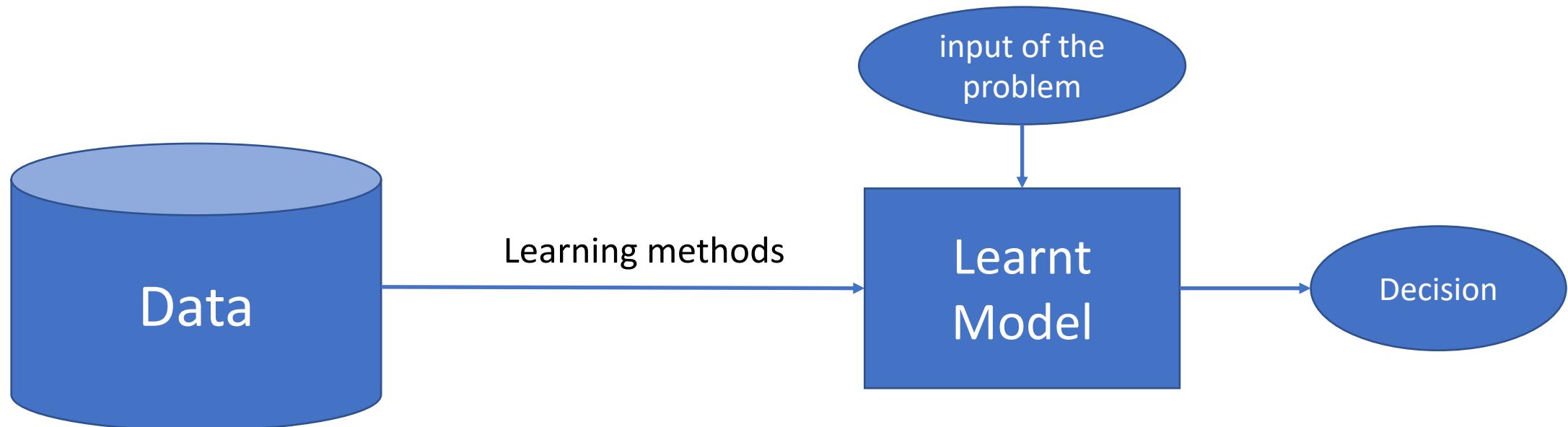


Introduction to Machine Learning and Deep Learning

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What is machine learning?

- Machine learning is a method of data analysis that automates analytical model building and allows computers to **learn and make decisions** on their own, without explicit programming.



What is Machine Learning

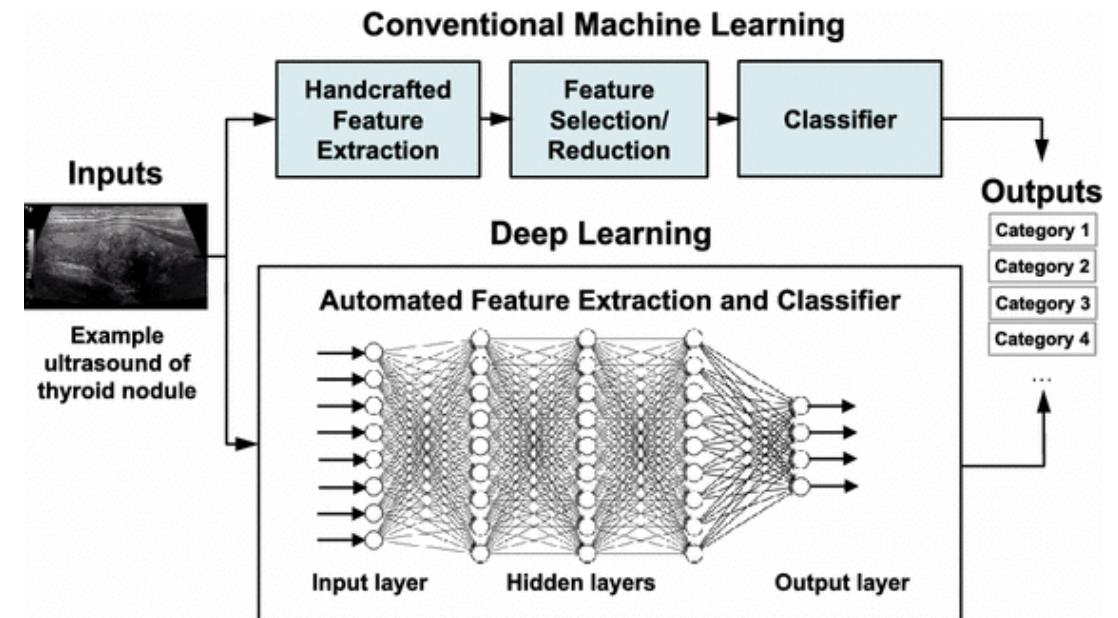
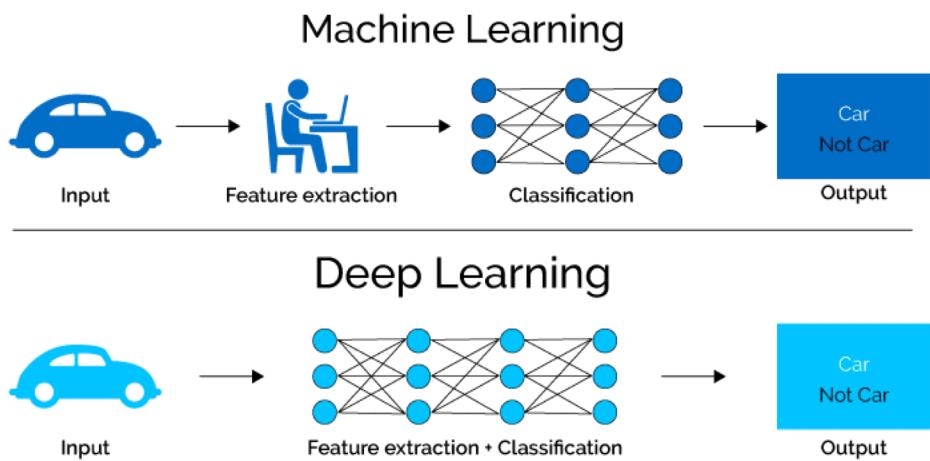
- Machine learning is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention.
- There are many different types of machine learning, including supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning.

Objective of Machine Learning

Developing data-based models for:

- Prediction (classification, regression)
- Pattern discovery (periodic and abnormal patterns)
- Optimal decision (decision making, recommendation)
- Representation (useful features of data, data representation)
- Generation (images, texts, video,...)

Conventional Machine learning vs Deep Learning



ARTIFICIAL INTELLIGENCE VS MACHINE LEARNING VS DEEP LEARNING

1 Artificial Intelligence

Development of smart systems and machines that can carry out tasks that typically require human intelligence

2 Machine Learning

Creates algorithms that can learn from data and make decisions based on patterns observed

Require human intervention when decision is incorrect

3 Deep Learning

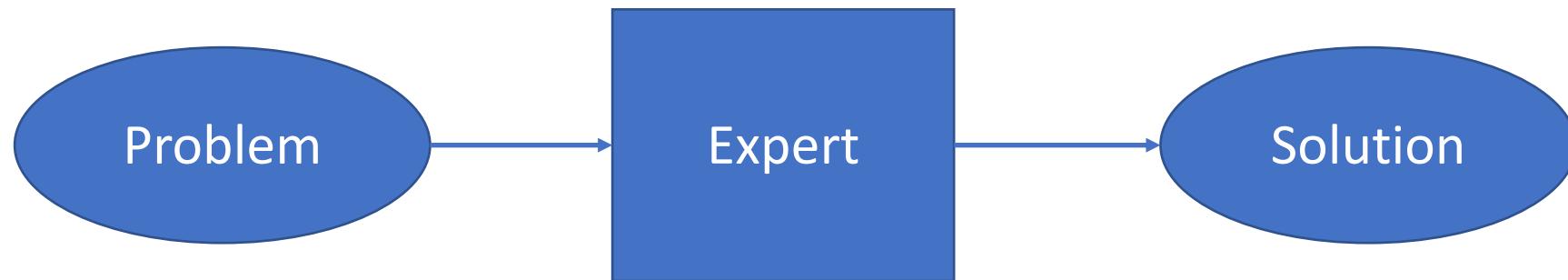
Uses an artificial neural network to reach accurate conclusions without human intervention

Topics of this course

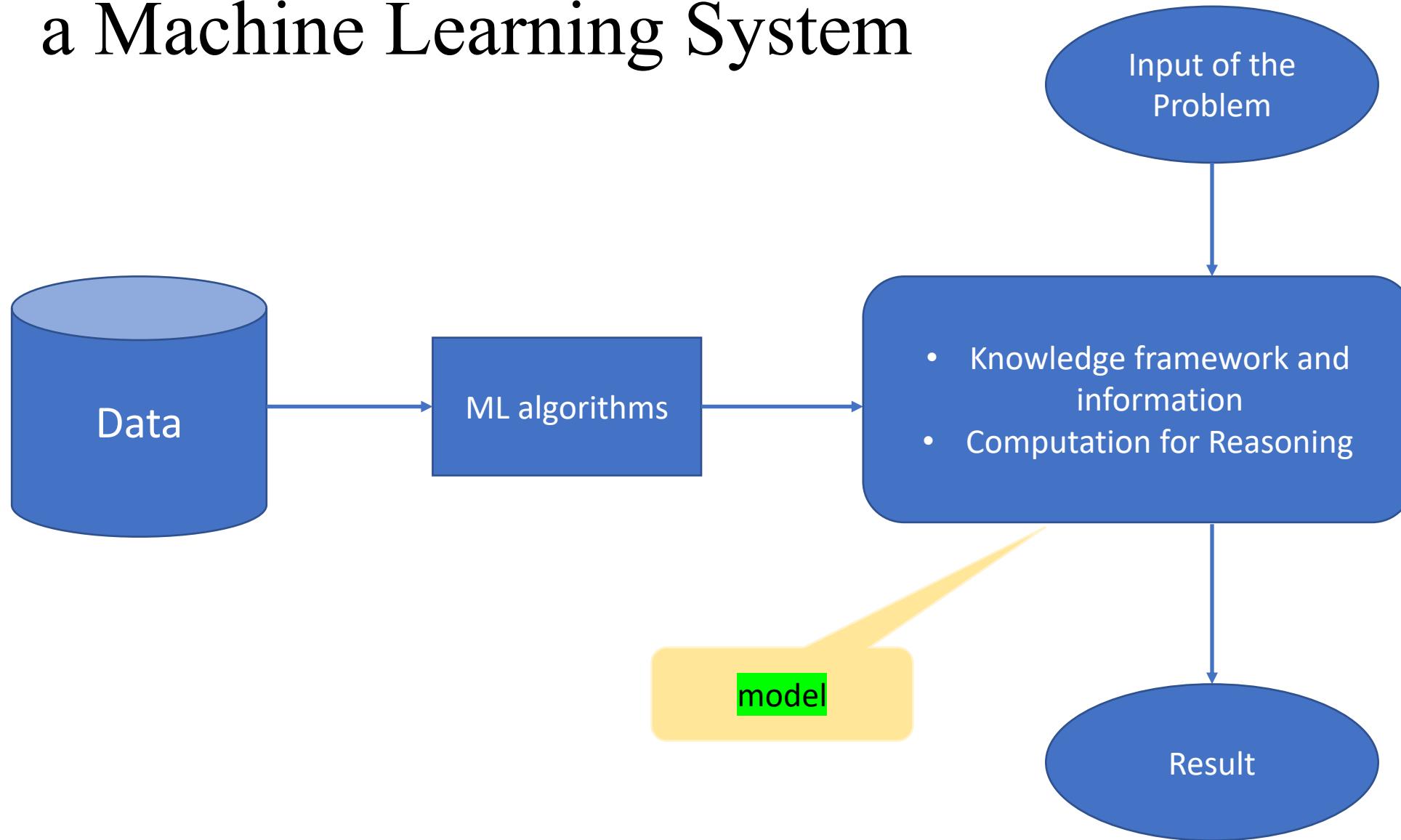
- Basic Neural Networks
- Deep Belief Network
- Convolutional Neural Networks
- Recurrent Neural Networks and Long Short Term Memory
- Transformer Models
- Generative Adversarial Networks
- Reinforcement Learning and Deep RL

General Diagram of A Machine Learning

- How does an Expert solve problems?

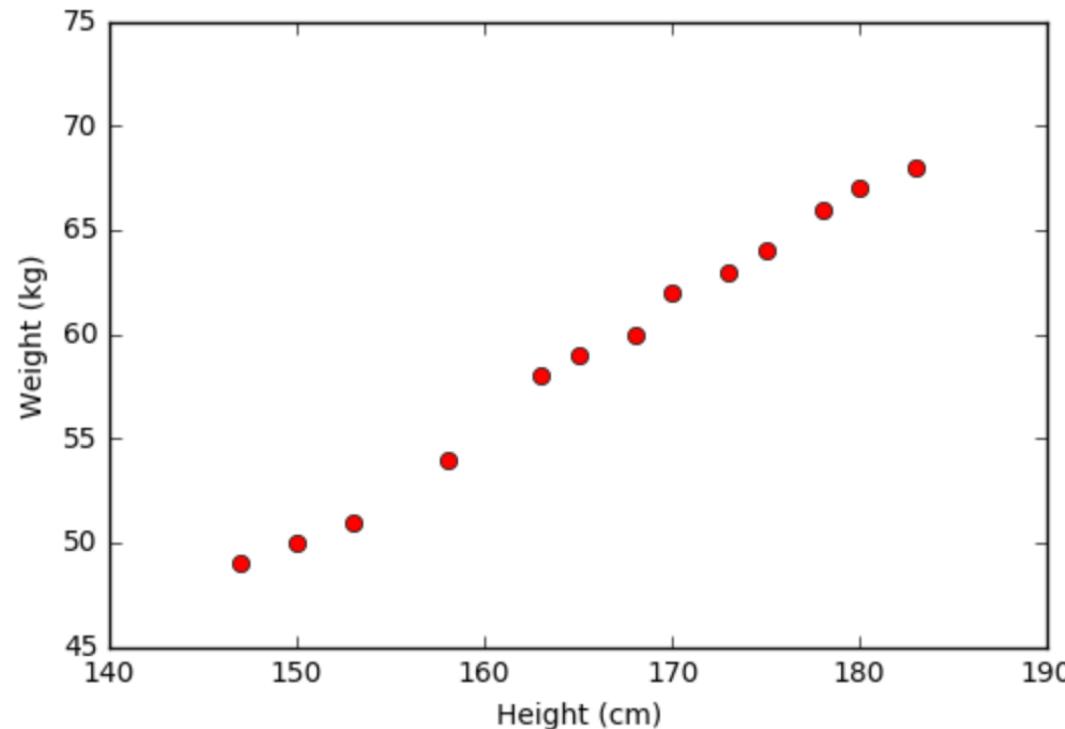


General Paradigm of a Machine Learning System



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		



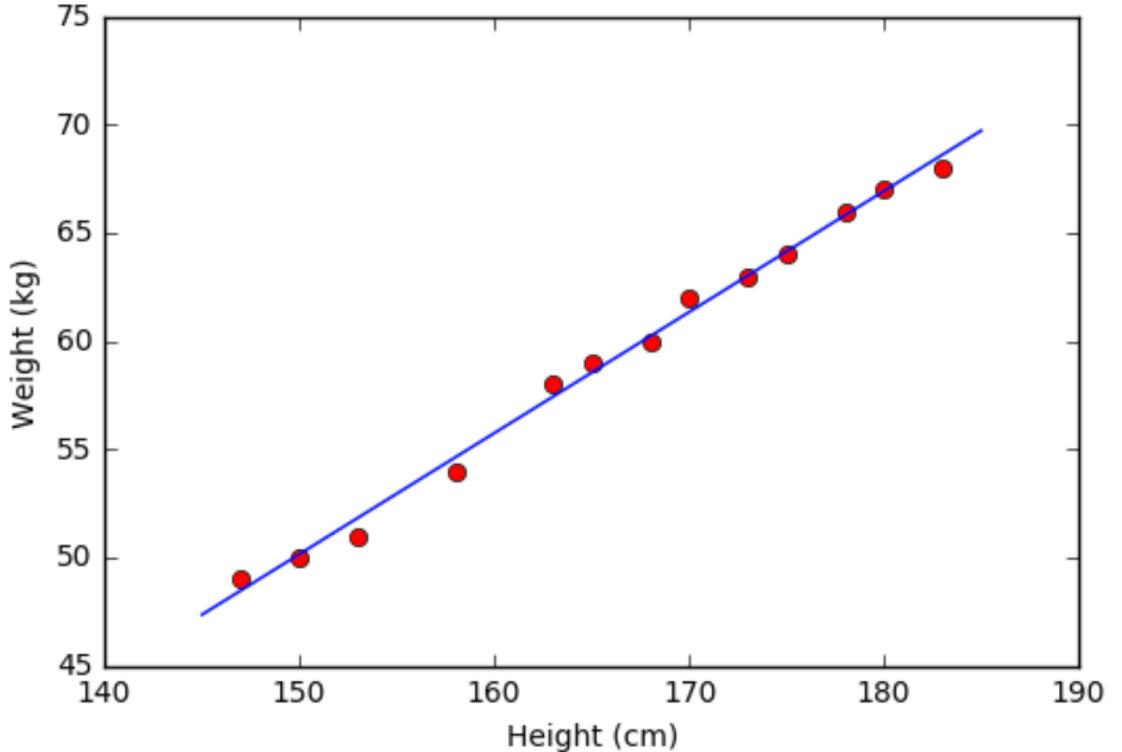
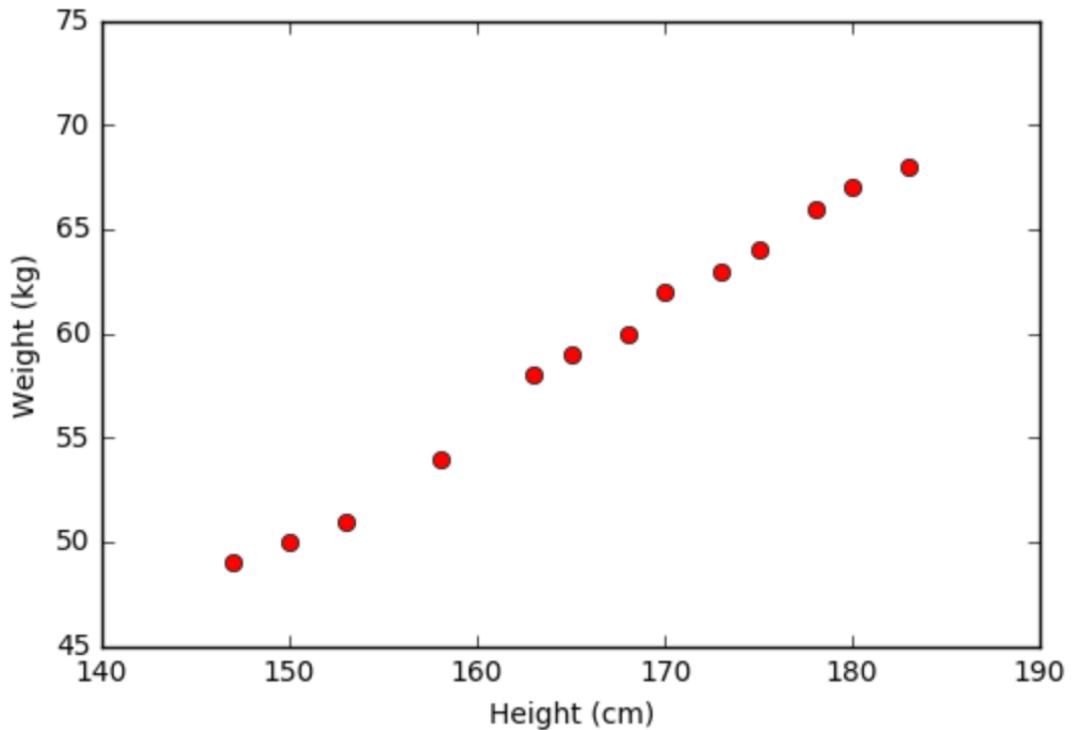
$$(\text{cân nặng}) = w_1 * (\text{chiều cao}) + w_0$$

$$y = ax + b$$

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

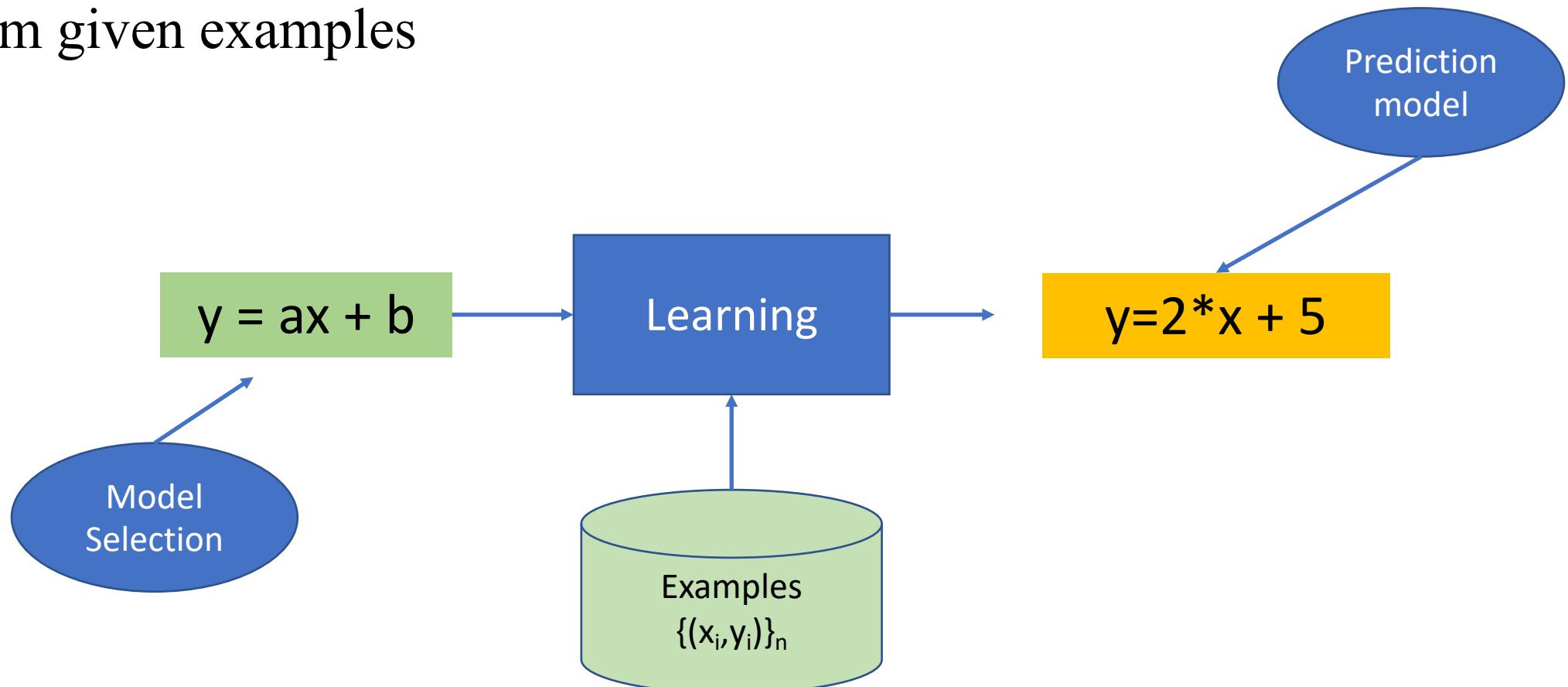
$$w = [[-33.73541021], [0.55920496]]$$

$$y = ax + b$$

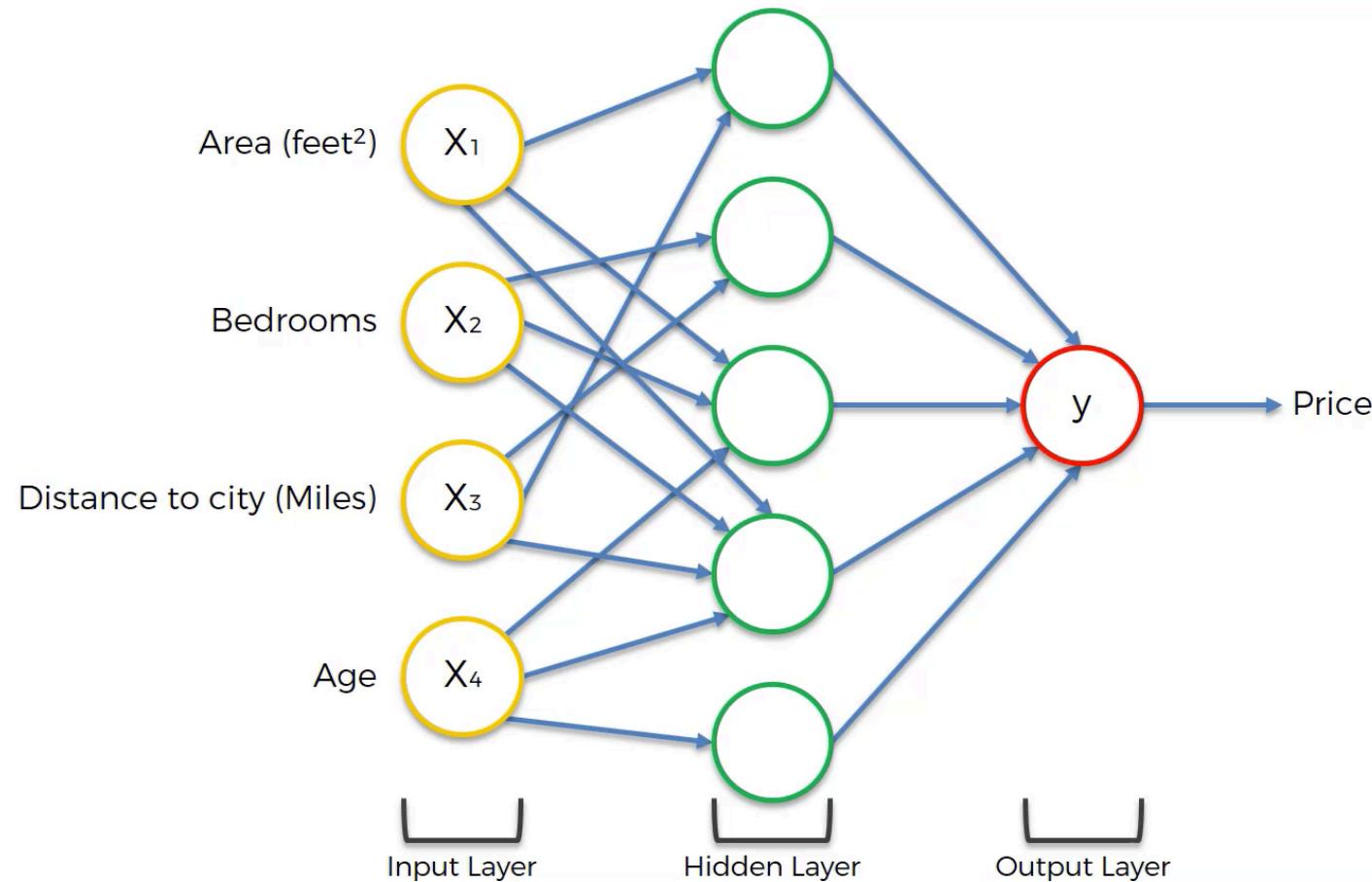


How to understand Learning?

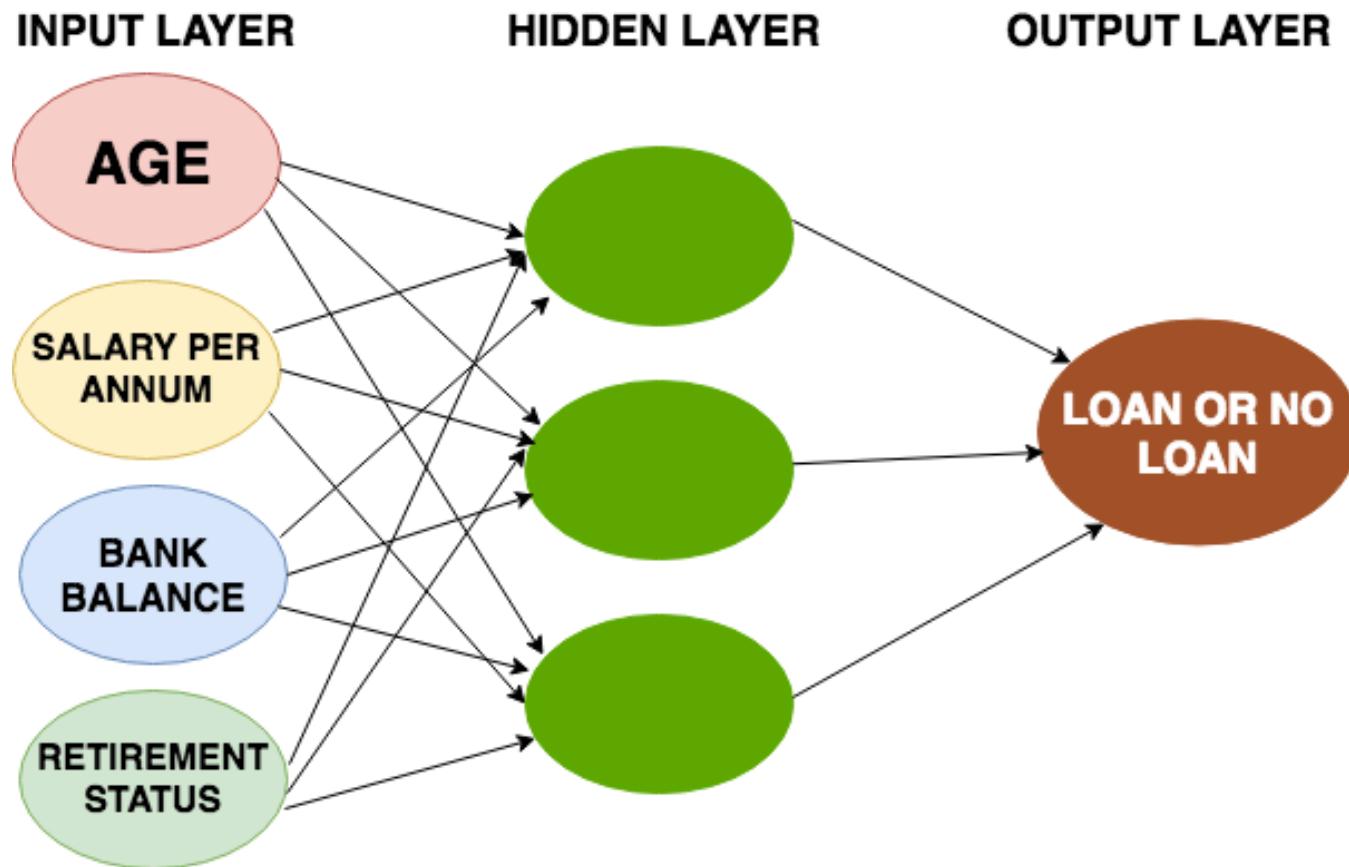
=> learn values for model's parameters by inferencing from given examples



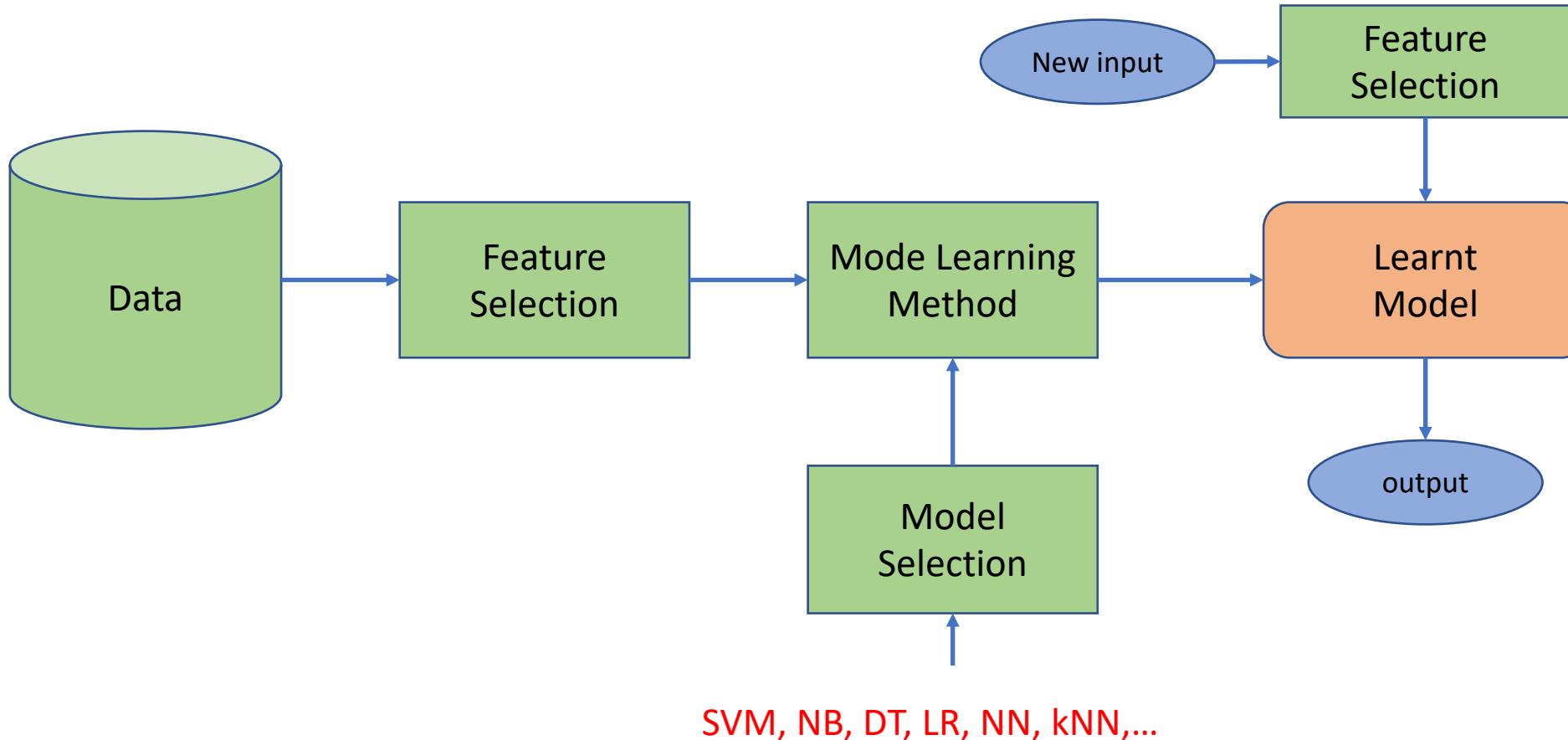
Example 2: House Price Prediction



Example 3:



A General Machine Learning Diagram



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,

How to develop a DL system?

- Understanding DL Models
- Implementation
- Tuning pre-trained models
- Running Environment
- Data Collection, Data Preprocessing, Data Labeling

AI is more than modeling.

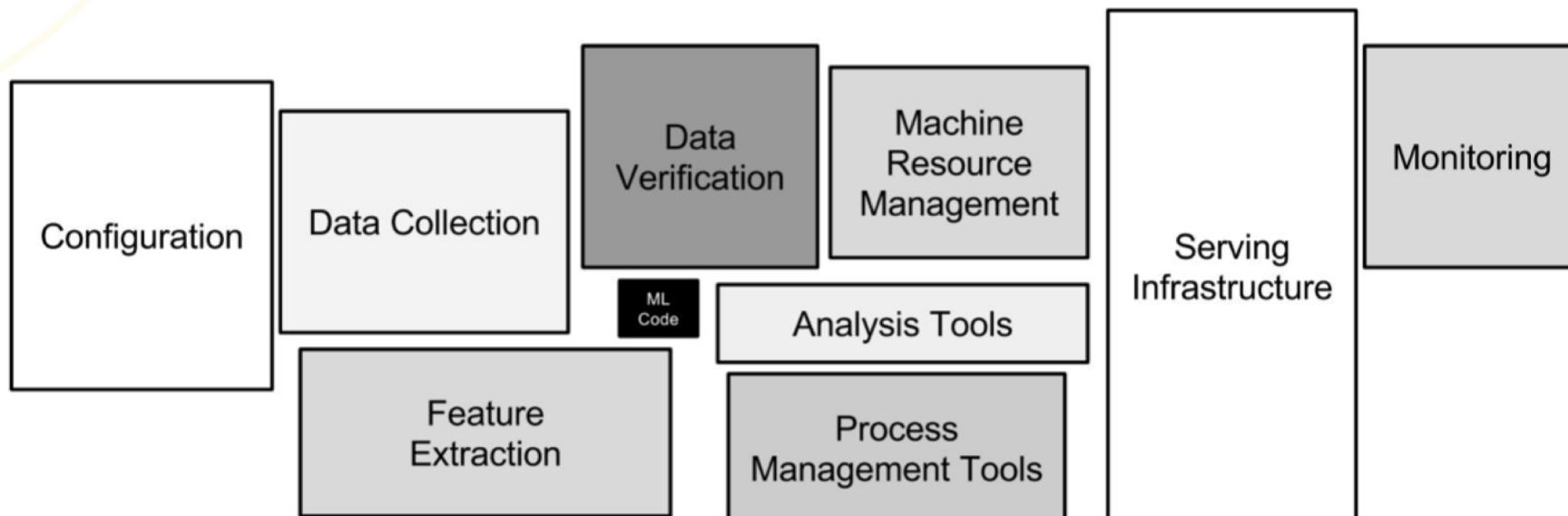
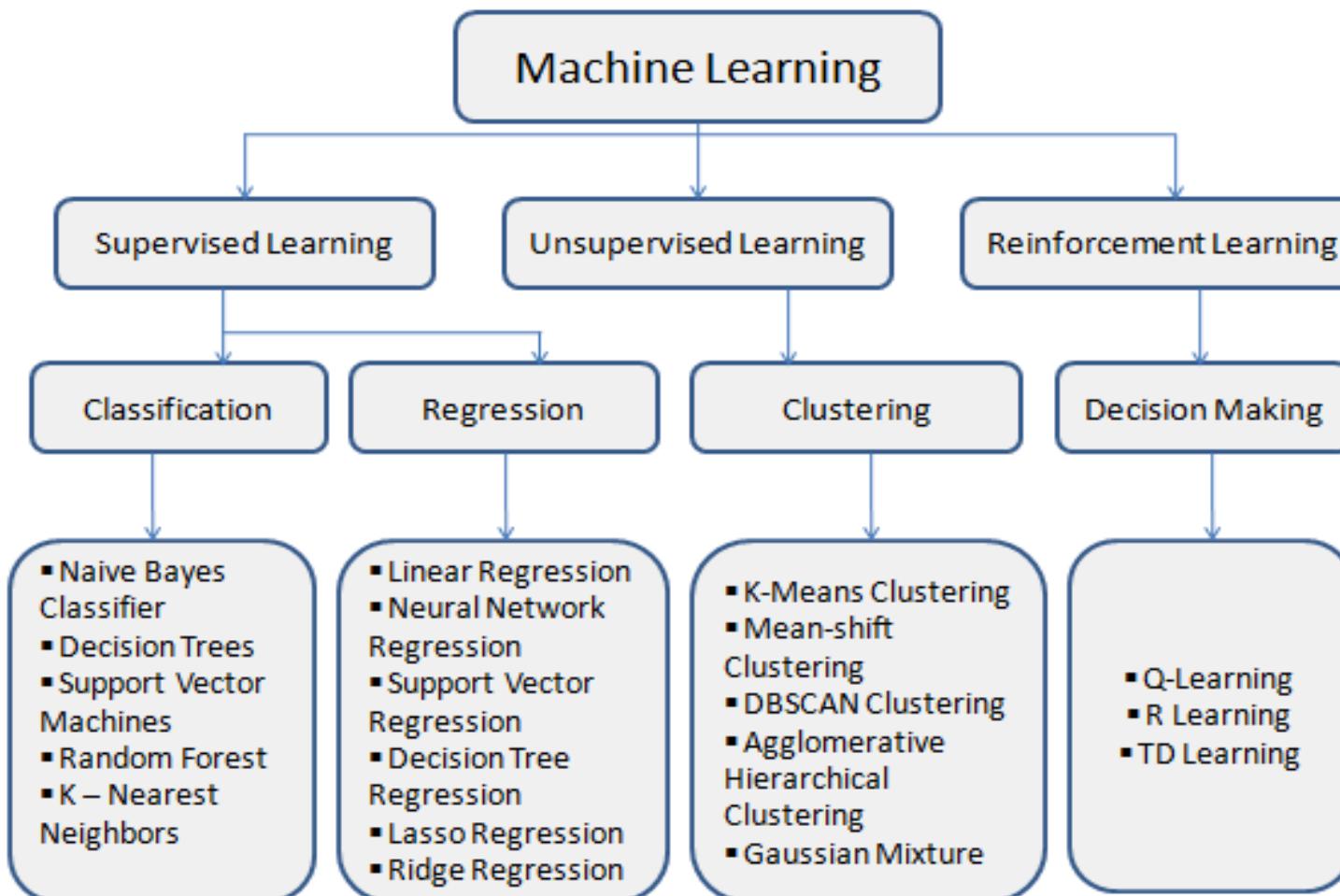
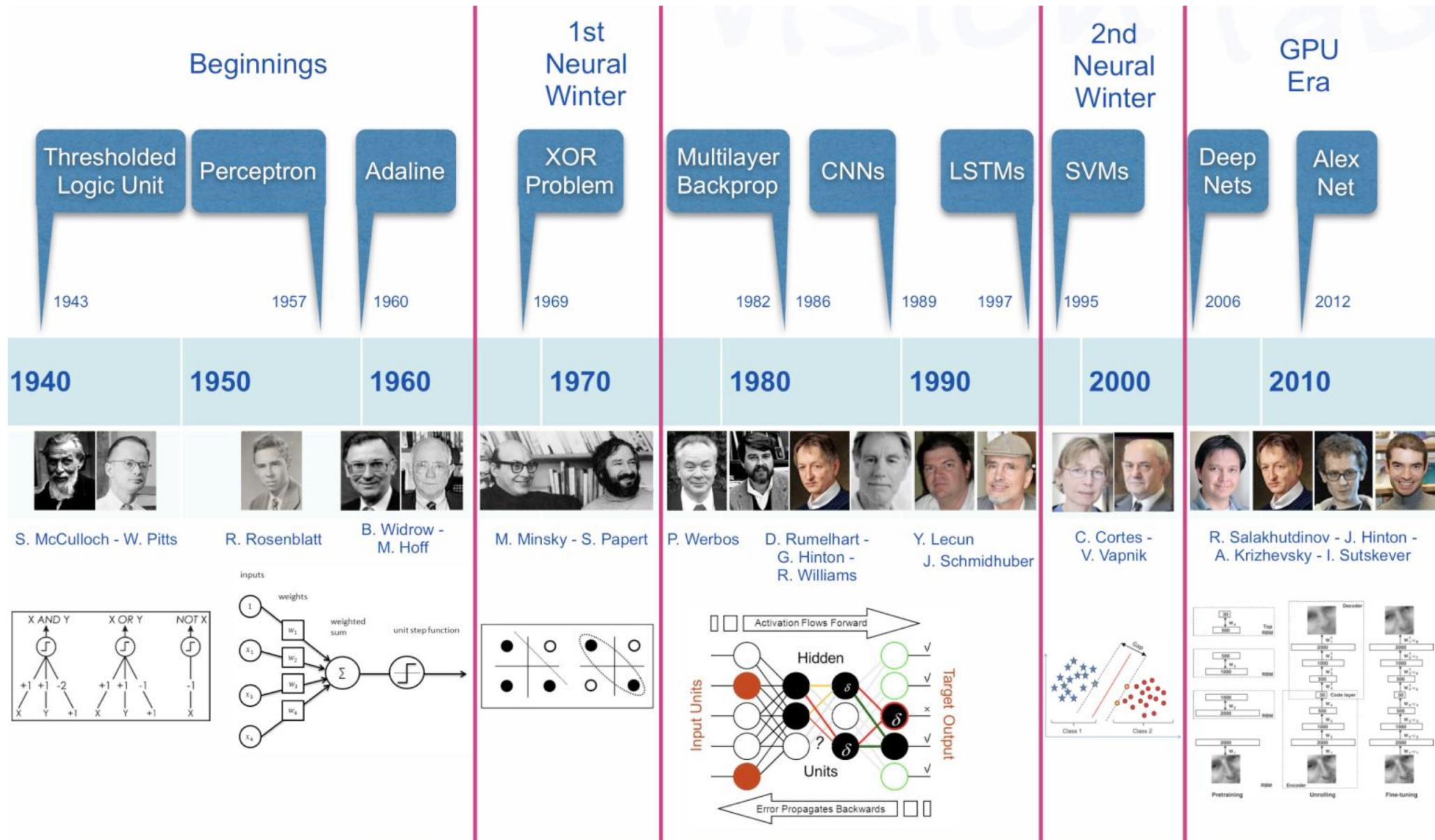


Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

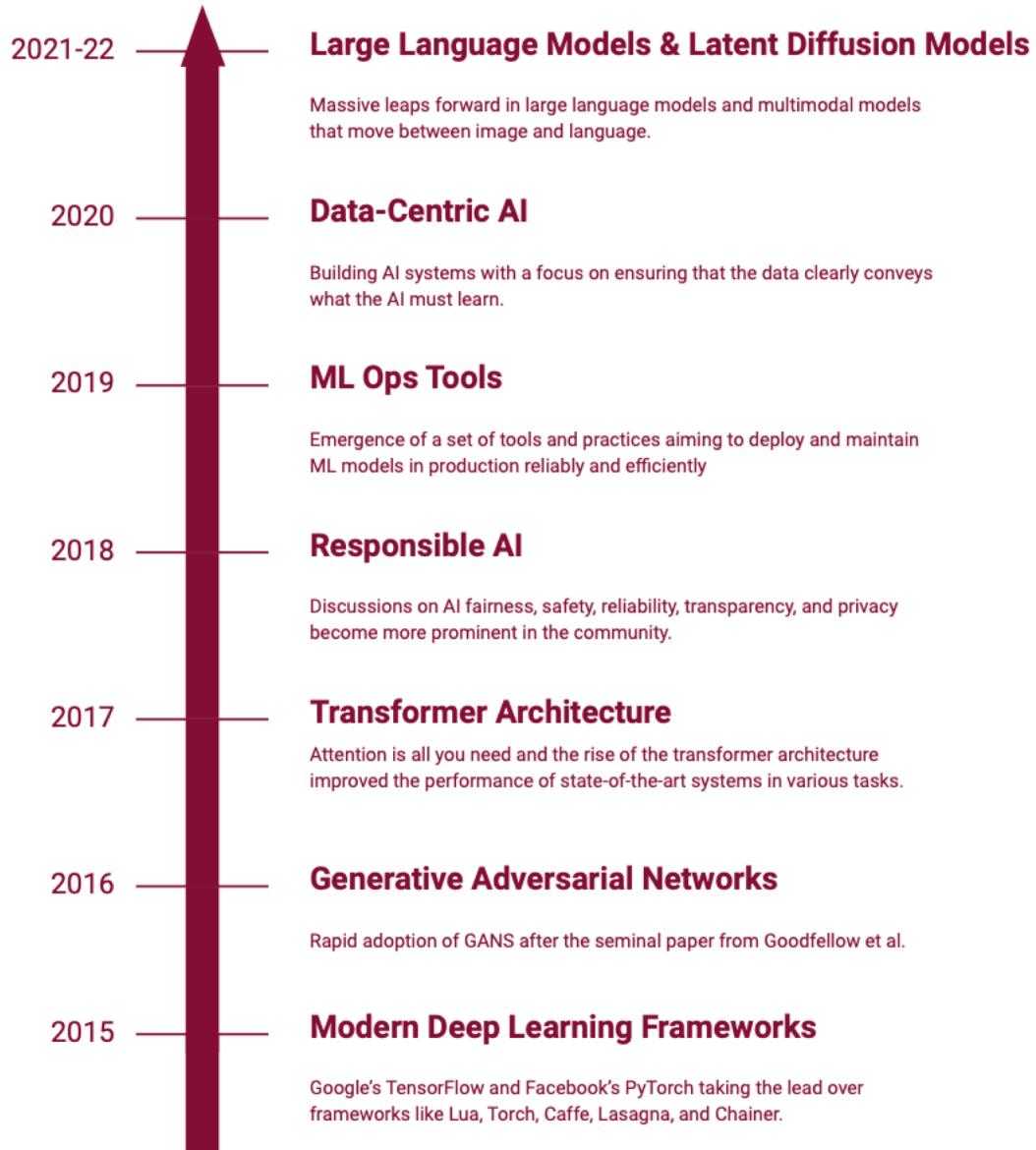
Types of Machine Learning



History of ML



Development of Deep Learning



Course assessment

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

Summary

- What is machine learning?
 - objective and characteristics
 - types of machine learning
- Distinguish between conventional machine learning and deep learning?
- What is the difference between developing a traditional ML system and a deep learning system?