

Introduction to Deep Learning

Woo-Jeoung Nam

College of IT Engineering, School of Computer Science and Engineering

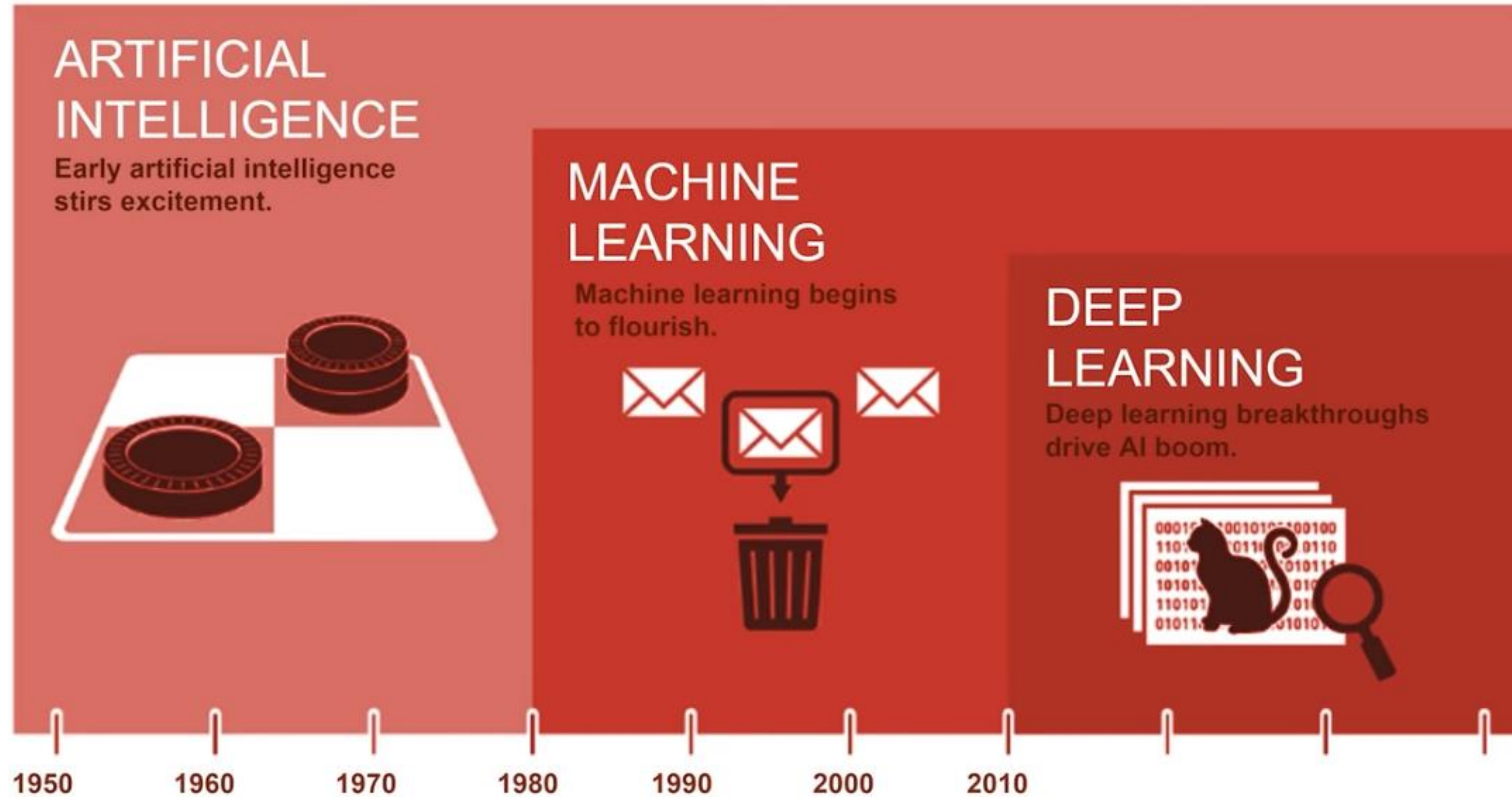


Agenda

- Machine Learning & Deep Learning
- Algorithm compared with machine learning
- Definition of an algorithm by example
- Algorithm categories
 - Problem
 - Design



AI, ML, DL



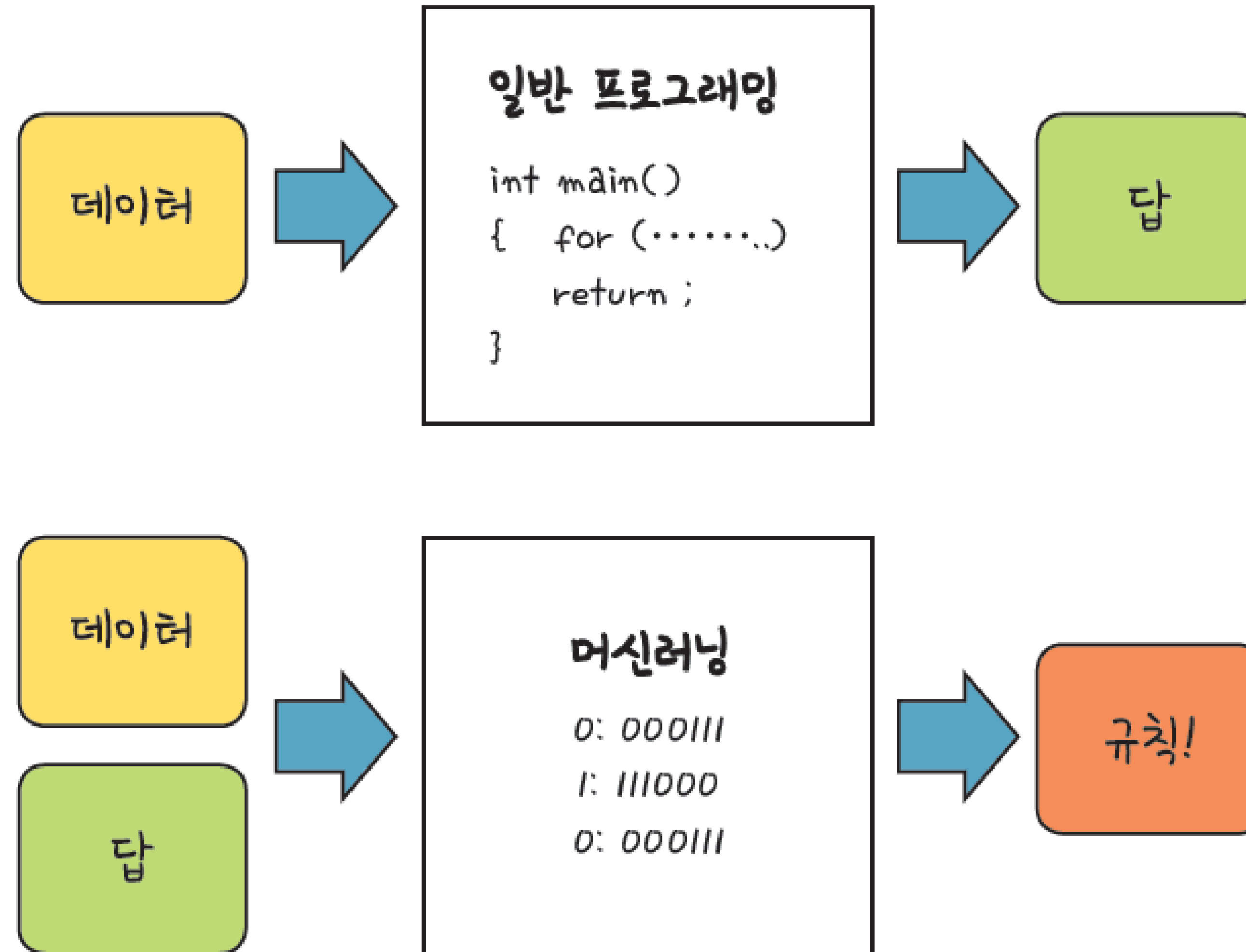
Machine Learning

- Machine learned
- Machine learning (ML) is a field of study in artificial intelligence concerned with the development and study of statistical algorithms that can learn from data and generalize to unseen data, and thus perform tasks without explicit instructions. [Wikipedia]
- Computer languages, algorithm, created by human

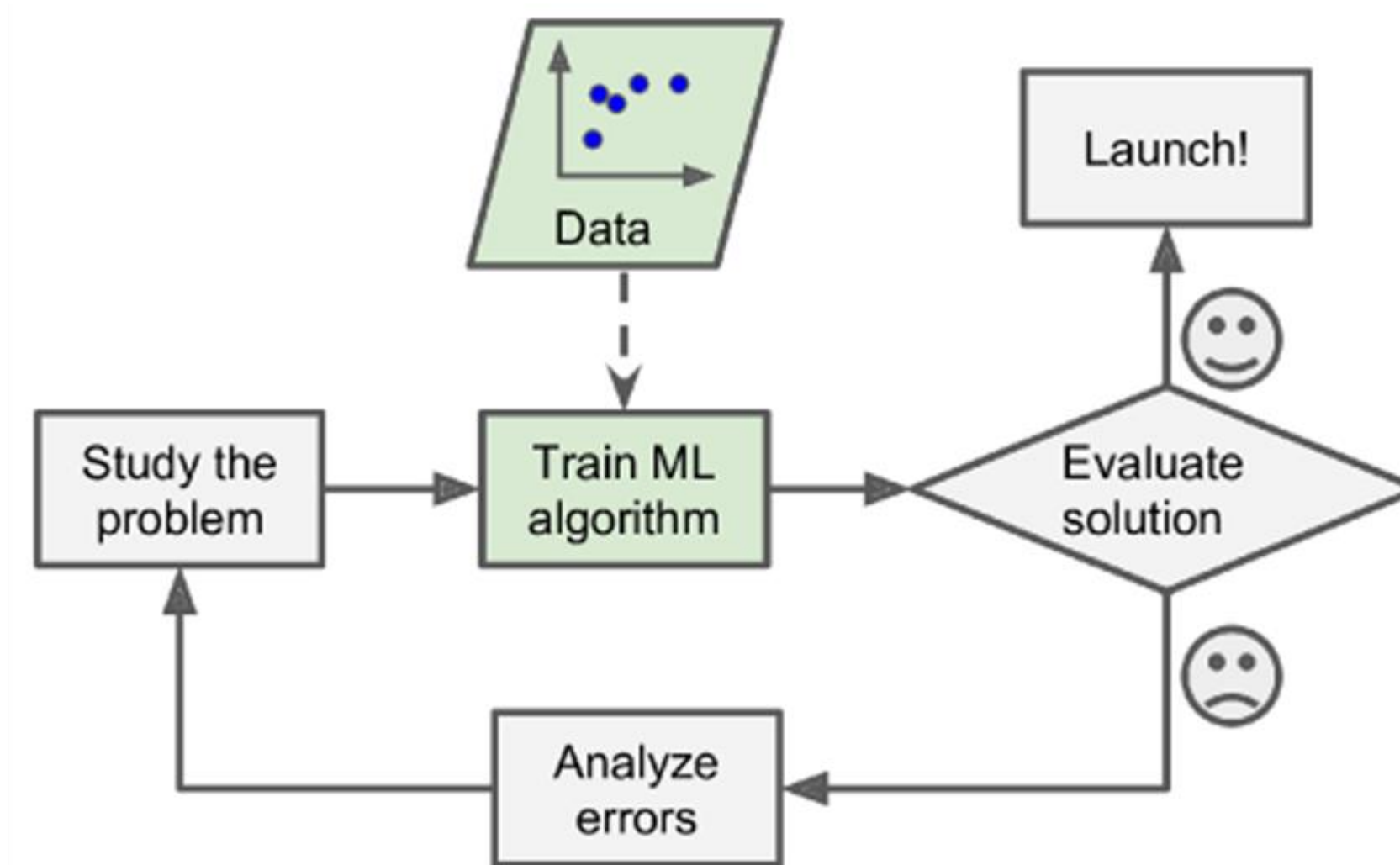
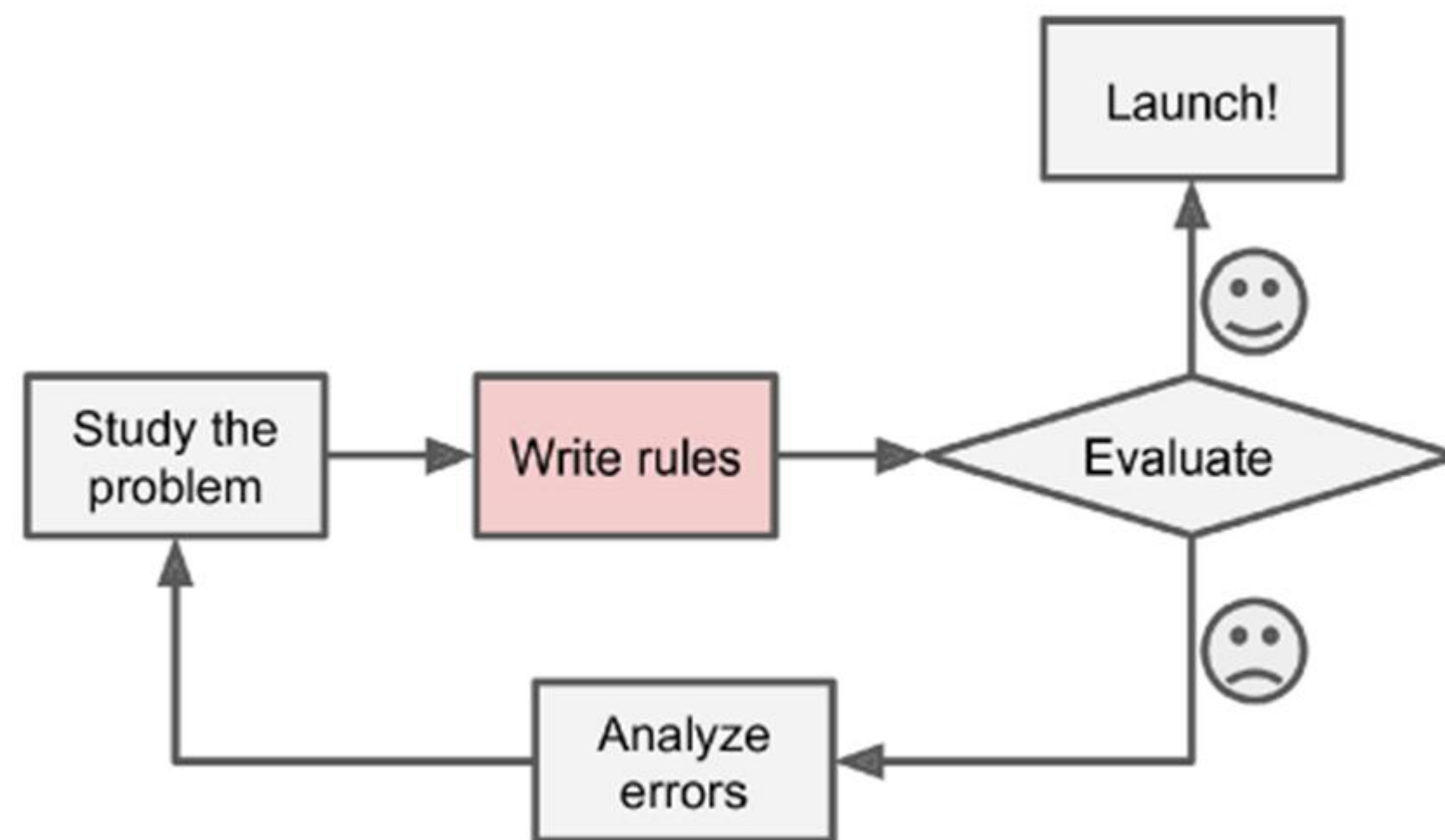
인간이 개발한 알고리즘을 컴퓨터 언어를 통해
기계에게 학습시키는 행위



Machine Learning

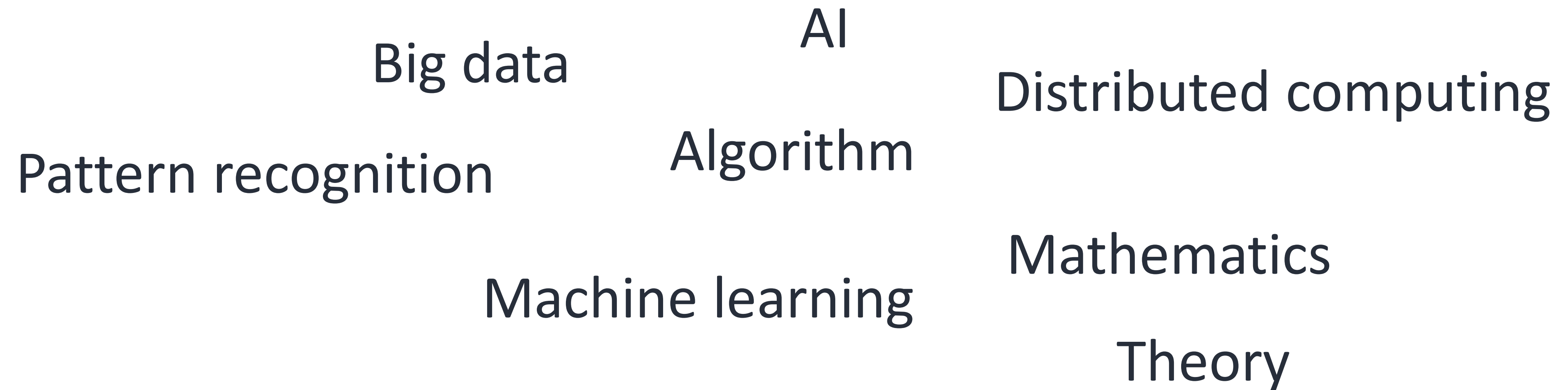


Machine Learning



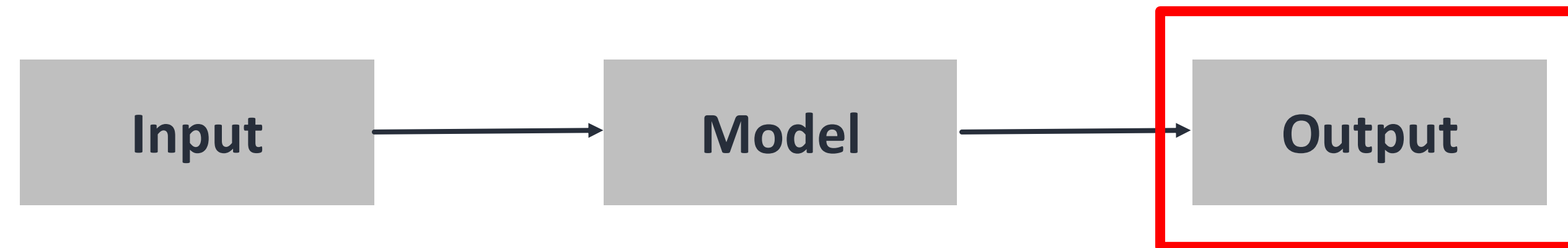
Algorithm & Computer language

- Sorting, Dynamic programming, Tree, Hashing, Backpropagation,...
- C++, Fortran, Java, Python, Matlab

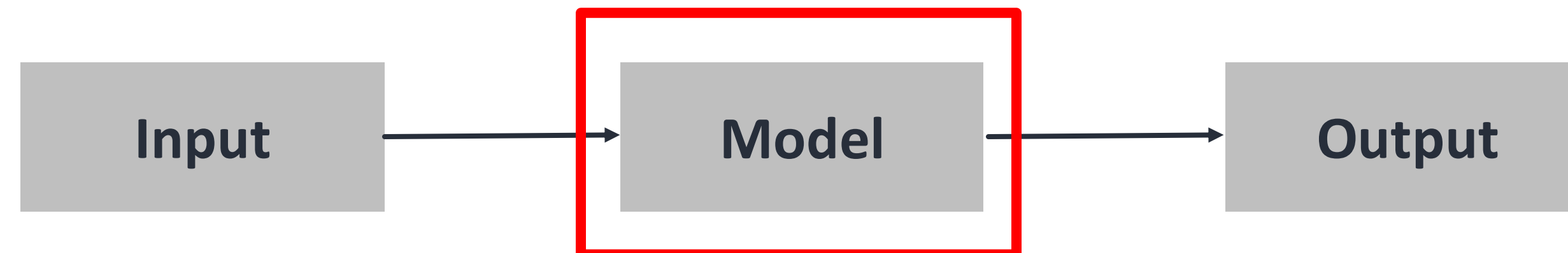


Back to the question | Algorithm = ML?

Algorithm



Machine learning



Back to the question | Algorithm = ML?

Algorithm



Model based

Machine learning



Data driven

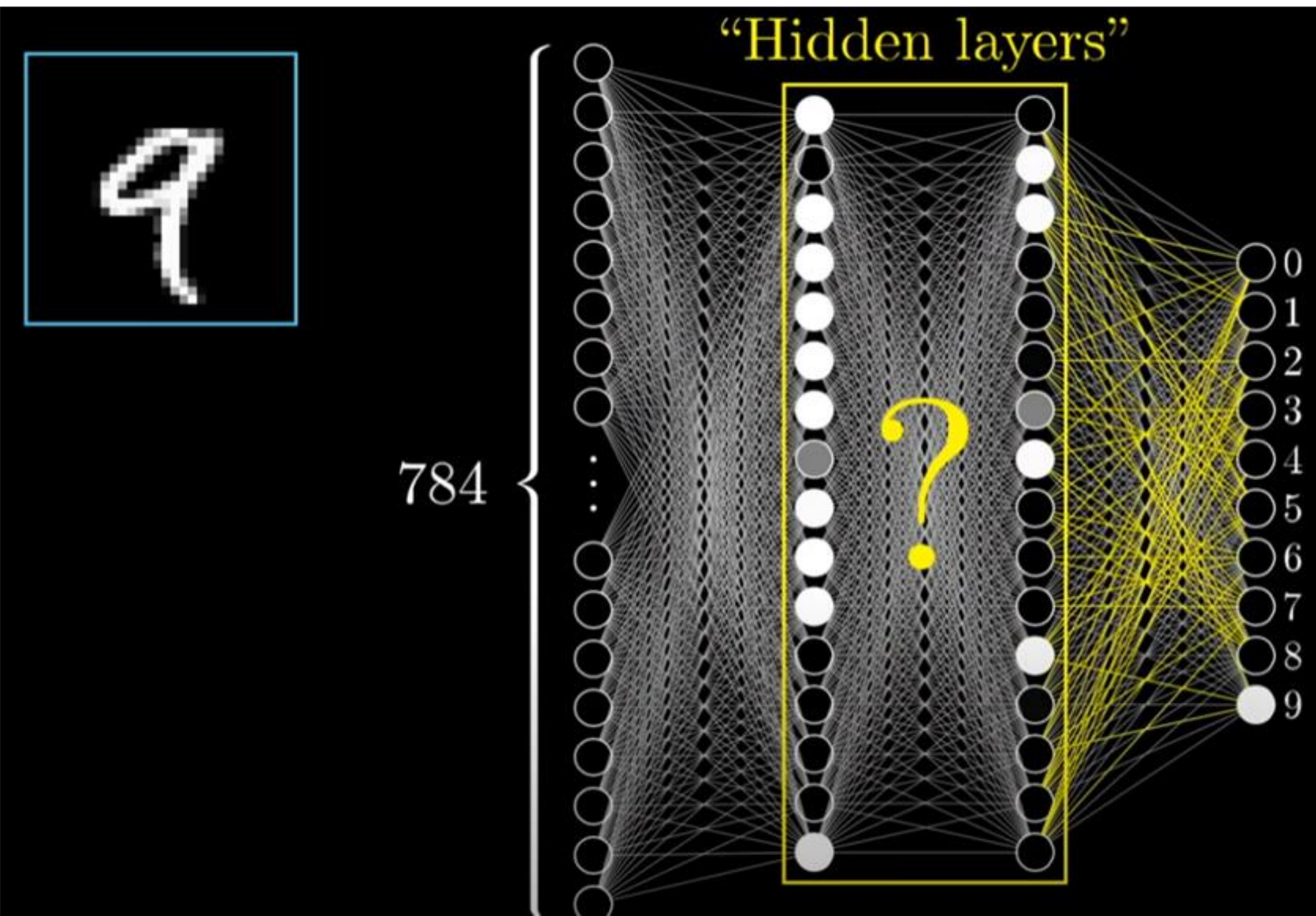
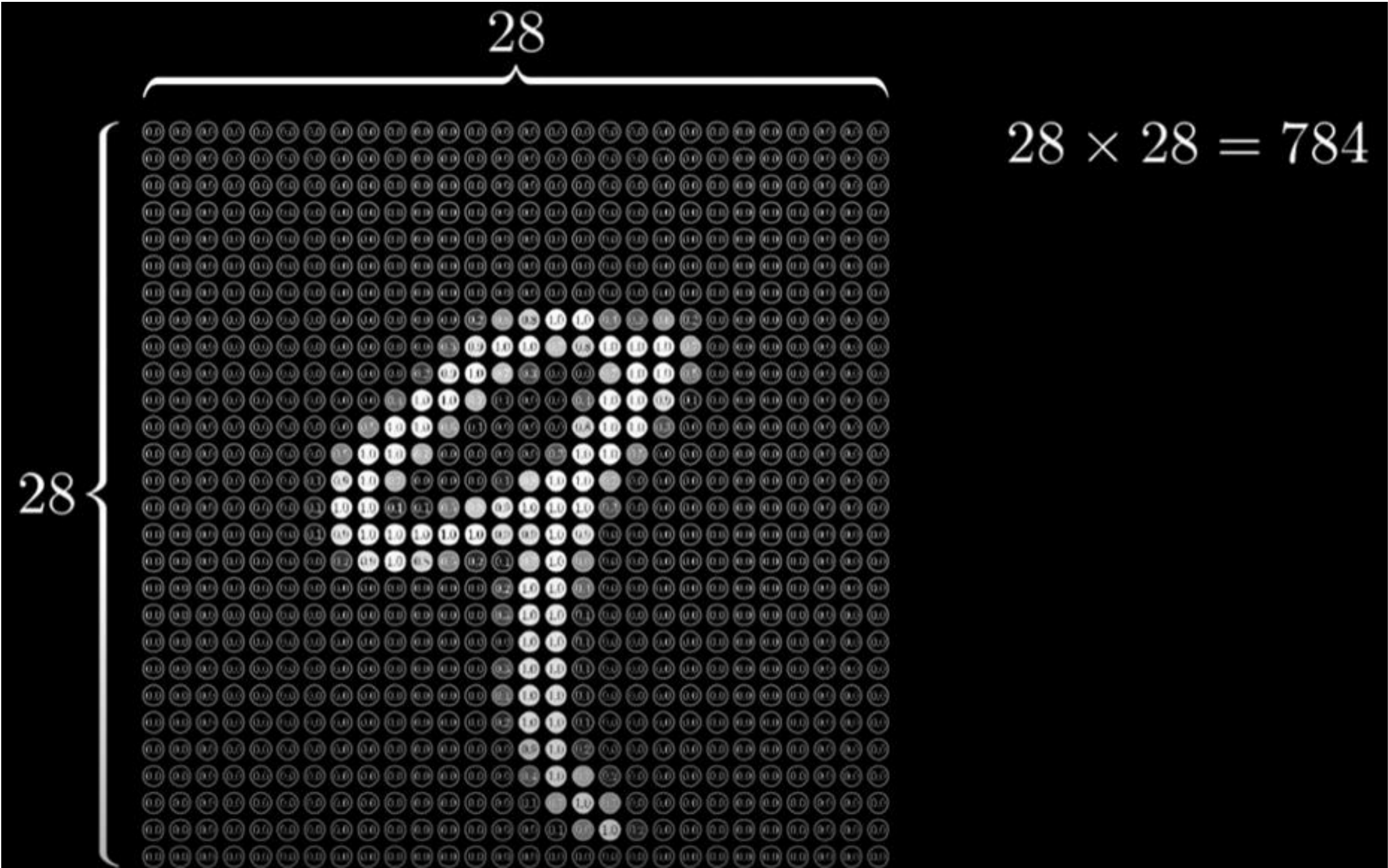


Where can ML be useful?

- Virtually all applications for human
 - Image classification (고양이 or 강아지?)
 - Detecting tumors (종양) in brain scans
 - A chatbot or a personal assistant
 - Forecasting your company's revenue next year
 - App to react to voice commands (Siri, Alexa, etc.)
 - Detecting credit card fraud
 - Recommending a product/video based on past purchases
 - Building an intelligent bot for a game (AlphaGo, etc.)
 - ...



Deep Learning

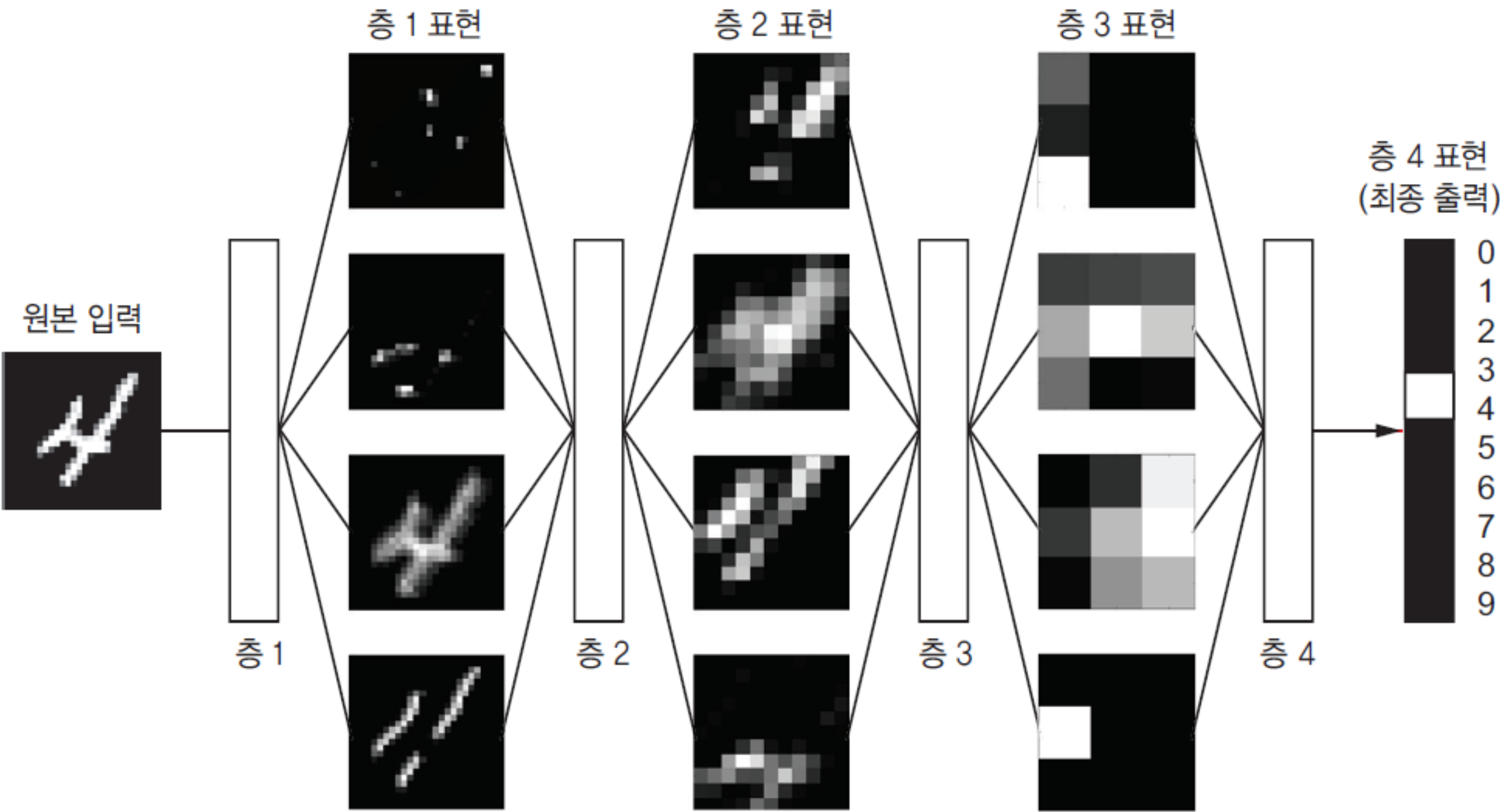


Deep Learning

- 연속된 ‘층’(layer)으로 ‘표현’을 학습한다는 개념. (**representation learning**).
 - Q. 데이터로부터 모델을 만드는 데 얼마나 많은 층을 사용했는가? \leftrightarrow 모델의 깊이가 얼마인가?
 - \rightarrow 층이 깊기 때문에 **deep learning**이라 부름.
 - \rightarrow 층 기반 표현 학습(**layered representations learning**) 또는 계층적 표현 학습(**hierarchical representations learning**)이라 부르기도 함



Deep Learning



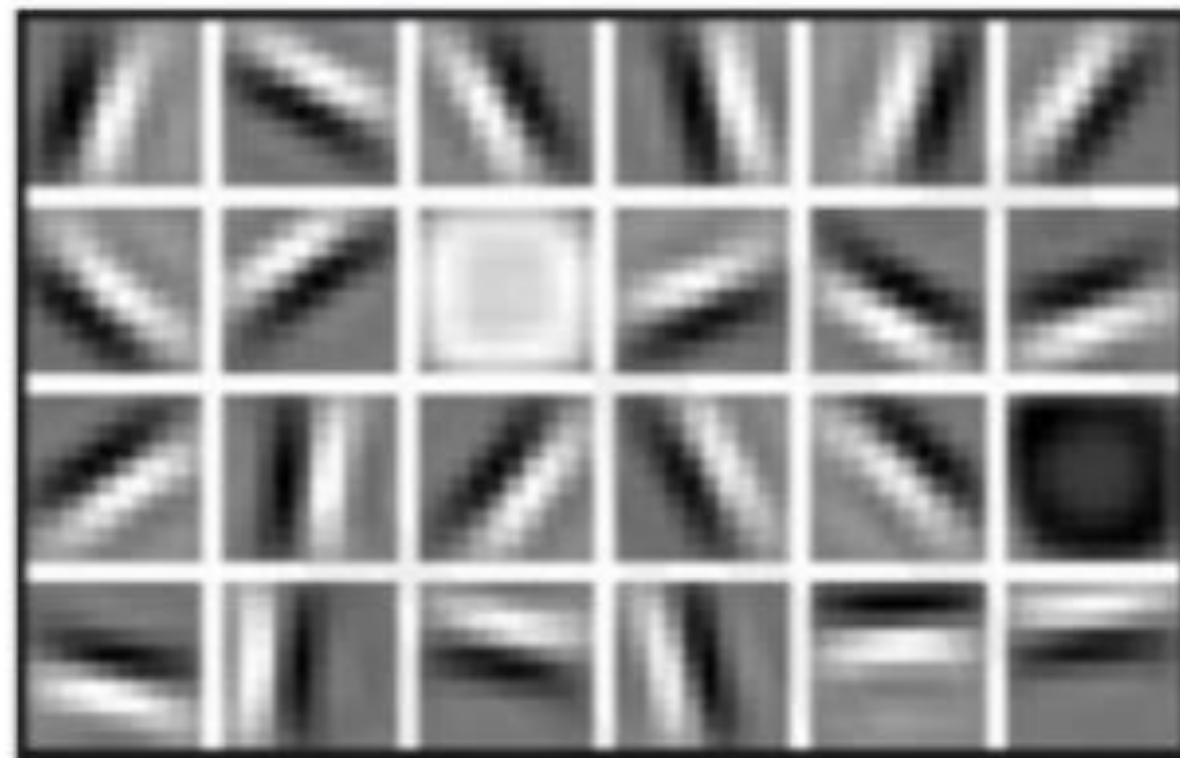
Deep Learning

Why Deep Learning?

Hand engineered features are time consuming, brittle, and not scalable in practice

Can we learn the **underlying features** directly from data?

Low Level Features



Lines & Edges

Mid Level Features



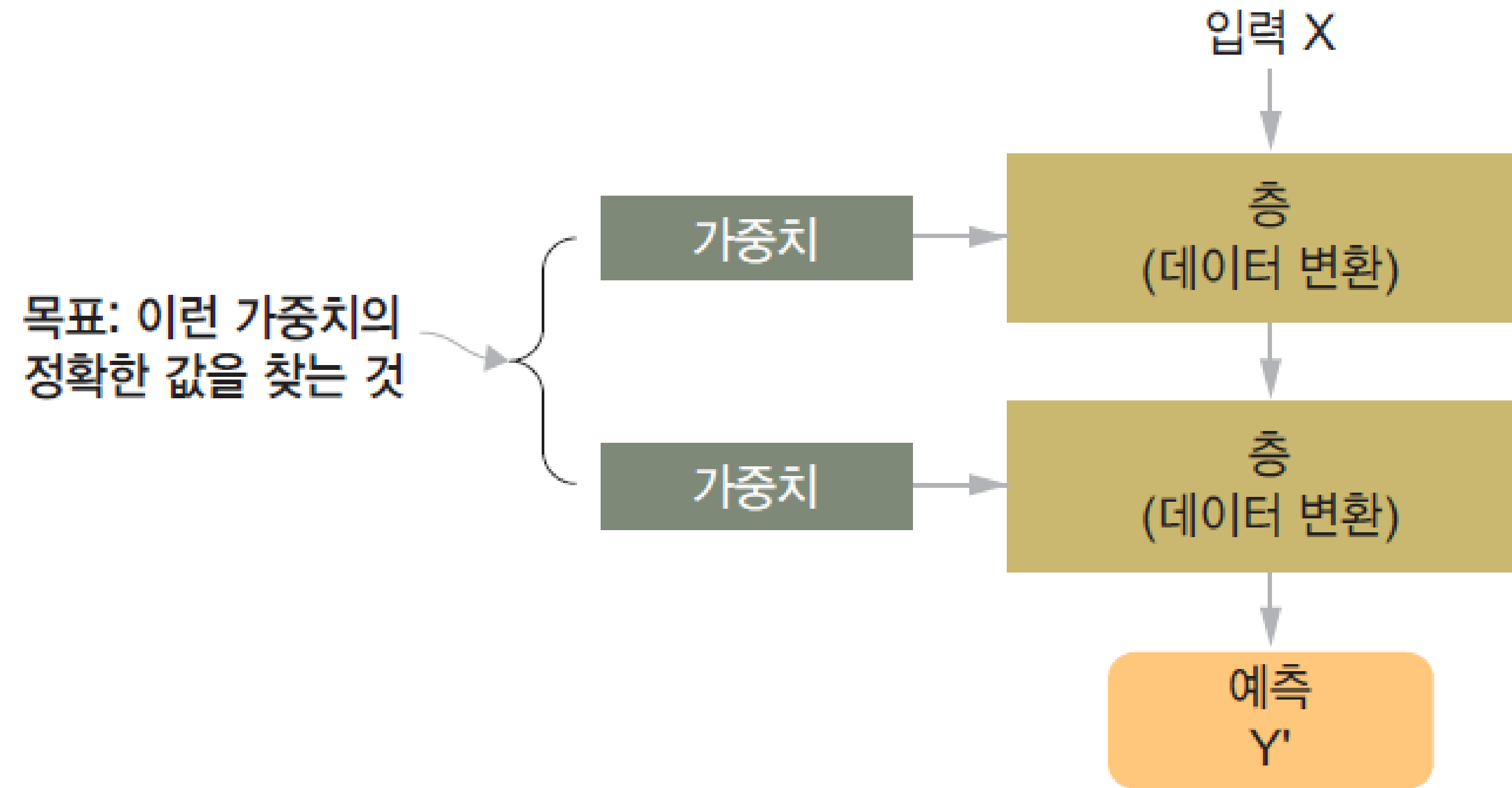
Eyes & Nose & Ears

High Level Features



Facial Structure

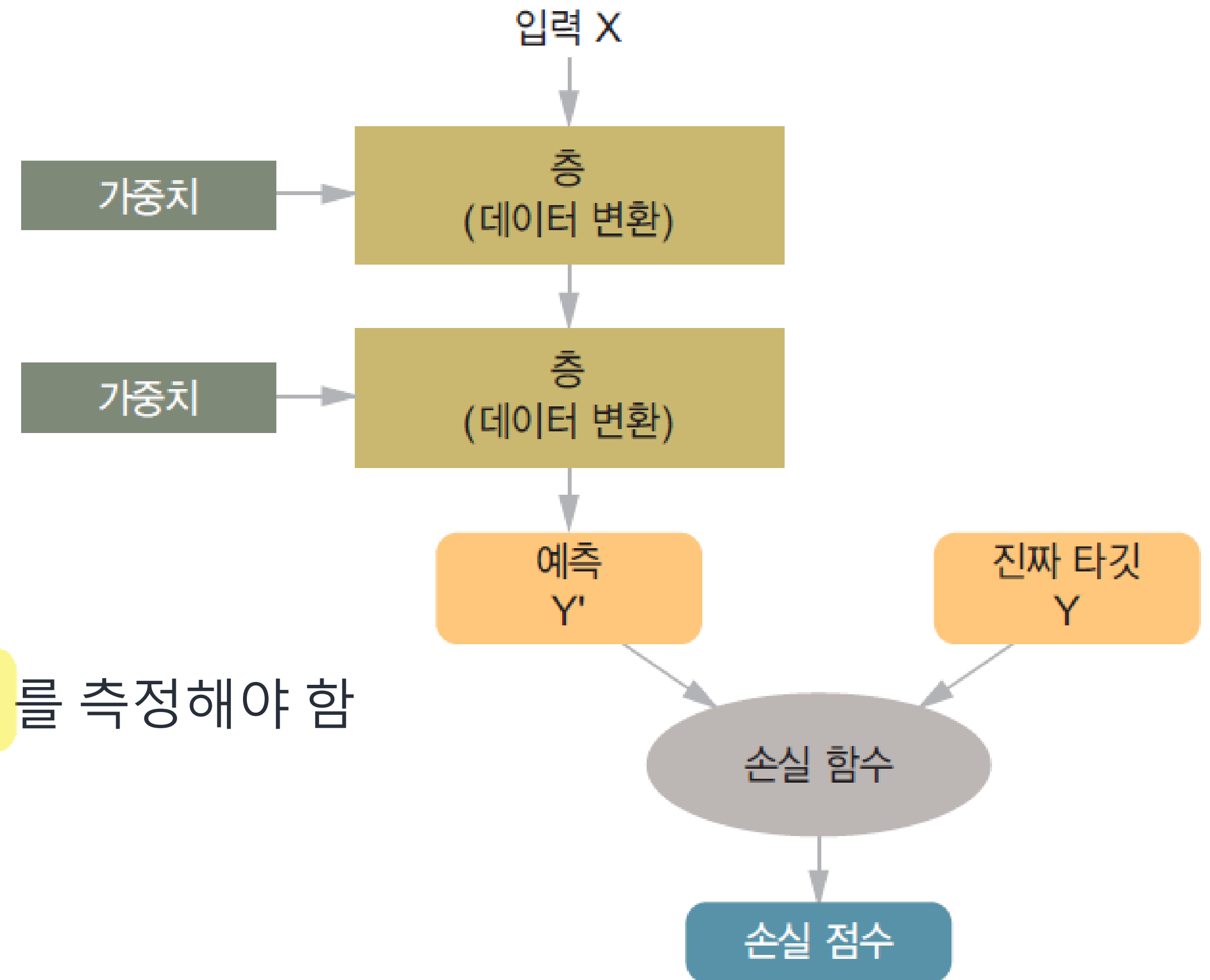
Deep Learning



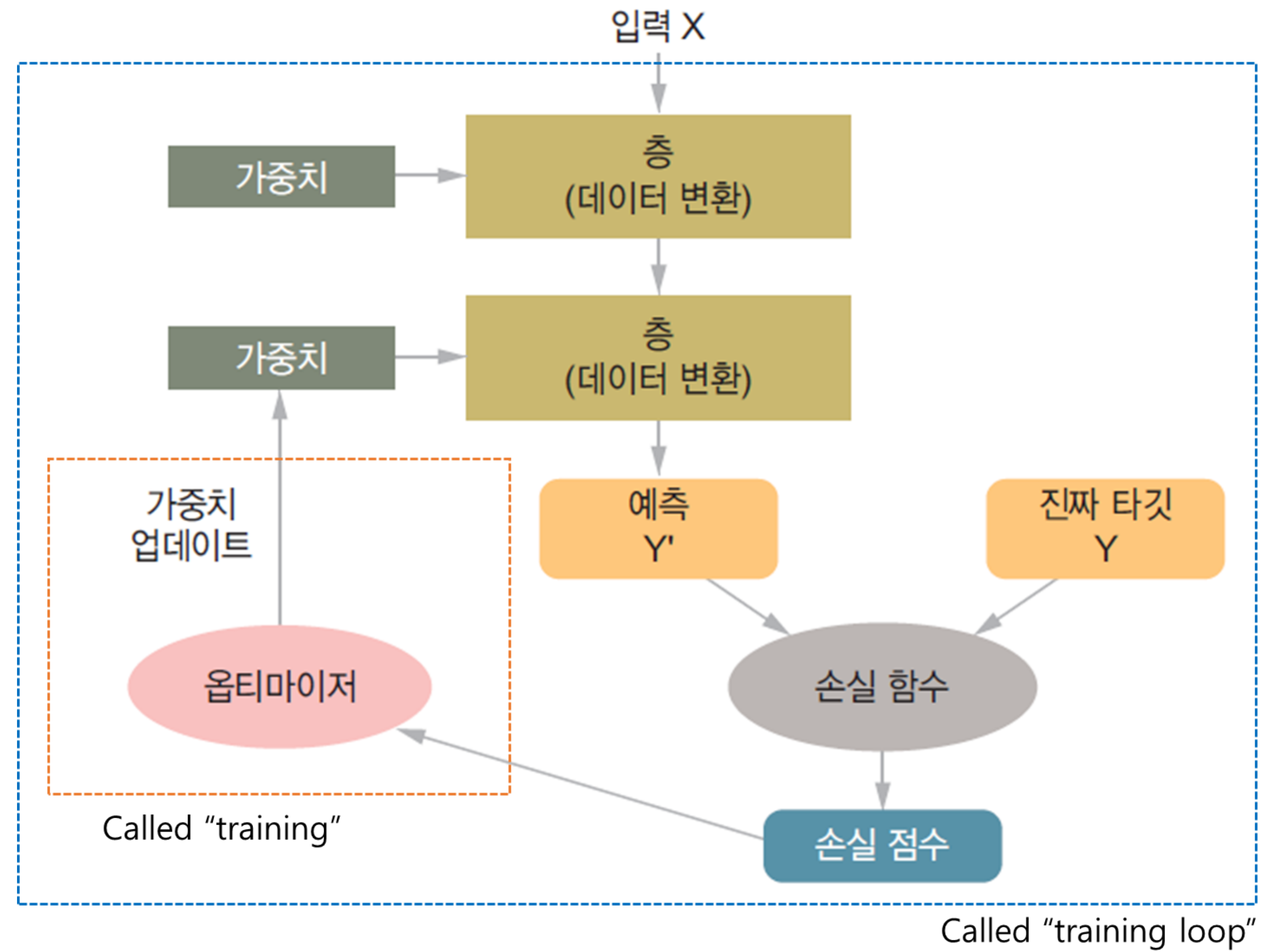
- 딥러닝 모델은 수천만개의 파라미터(가중치)를 갖기도 함.
 - 파라미터 조정은 어떻게?

Deep Learning

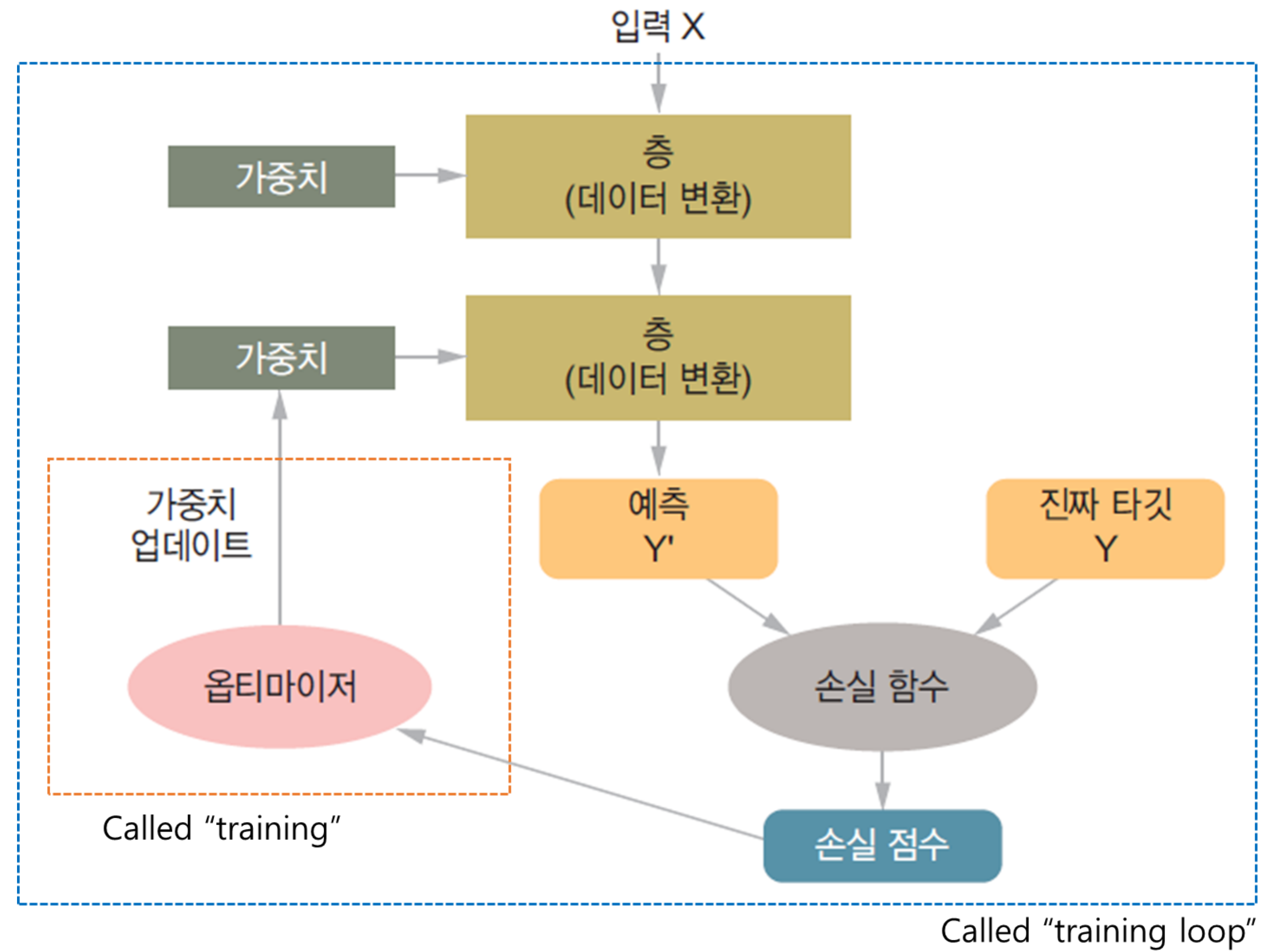
- 조정하려면?
 - 먼저 관찰해야 함
- 출력을 제어하려면?
 - 출력이 기대하는 것(목표)보다 얼마나 벗어났는지를 측정해야 함
 - 벗어난 정도 → 손실함수(loss function)



Deep Learning



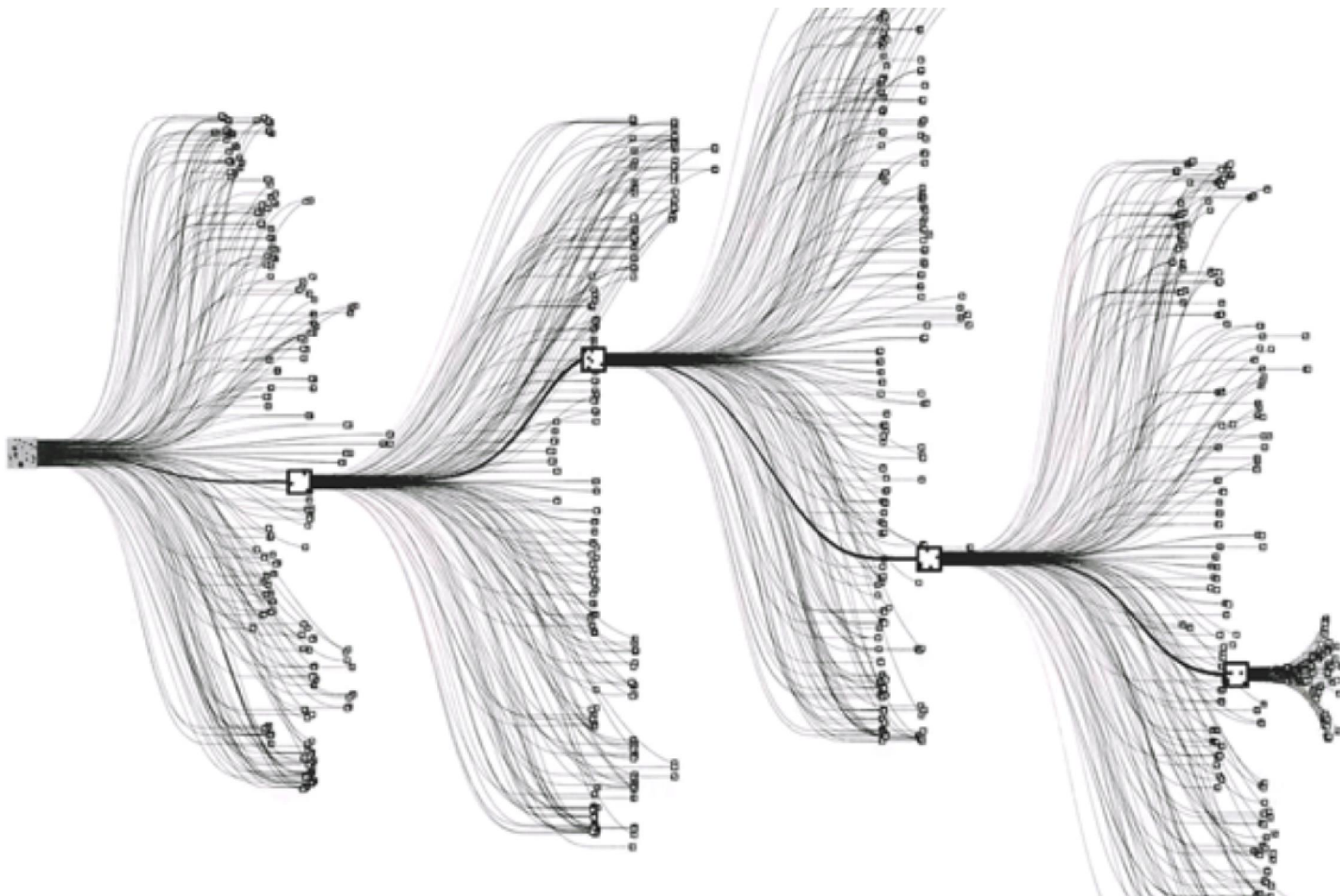
Deep Learning



DeepMind's AlphaGO










Game	Board size	State space	Game tree size
Go	19 x 19	10^{172}	10^{360}
Chess	8 x 8	10^{50}	10^{123}
Checkers	8 x 8	10^{18}	10^{54}



How to find and read paper?

- Research.com
- <https://openaccess.thecvf.com/CVPR2023>
- Google Scholar Search

Rank		Conference Details	Impact Score
1		Computer Vision and Pattern Recognition 18-06-2023 - 22-06-2023 - Vancouver	60.70
2		European Conference on Computer Vision 29-09-2024 - 04-10-2024 - Milan	38.70
3		Neural Information Processing Systems 12-12-2023 - 14-12-2023 - New Orleans	38.50
4		International Conference on Learning Representations 01-05-2023 - 05-05-2023 - Kigali	35.70
5		International Conference on Computer Vision 11-10-2021 - 11-10-2021 - Montreal	31.80
6		AAAI Conference on Artificial Intelligence 07-02-2023 - 14-02-2023 - Washington DC	31.10
7		International Conference on Machine Learning 17-07-2022 - 23-07-2022 - Baltimore	30.40

