KUBIG 25-S
여름방학 BASIC STUDY SESSION

NLP SESSION
WEEK1

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CONTENTS

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Session 중에는 모두 캠을 켜주시기 바랍니다 :)

01 NLP SESSION 소개

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1-1. 분반장 소개

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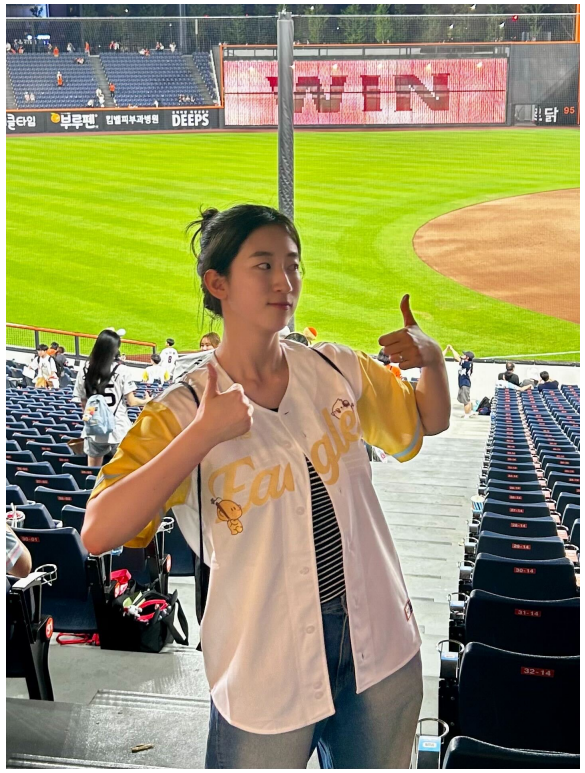
잘 부탁 드립니다 ! !



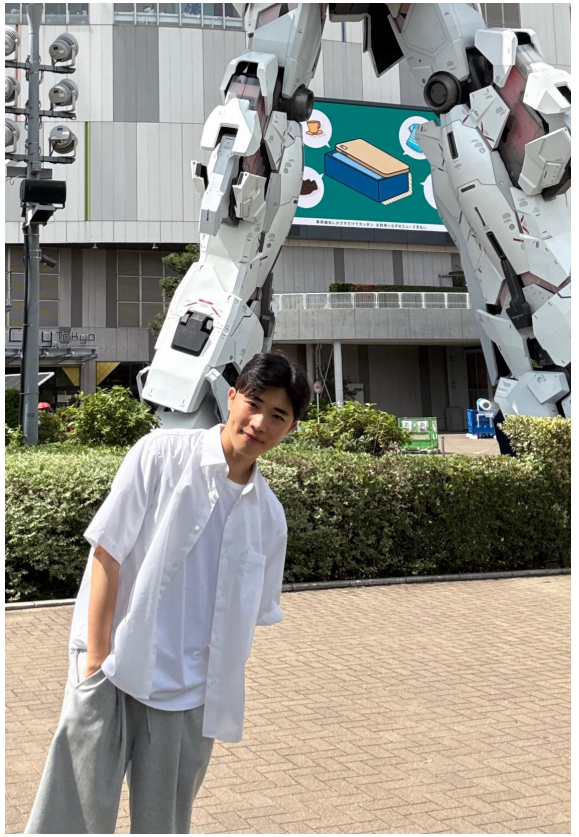
분반장 19기 최주희

분반장 19기 최주희

- 관심 분야: 미디어/커뮤니케이션 & AI/데이터
- 대전에서 석사과정 훈련중 ...
- 문과 베이스로 AI, 데이터 연구하고 싶다면 상담 대환영입니다 ..^^ (잡아가는 거 아니에요 그냥 그렇다고요 ...ㅎ)

분반장 20기 기광민

- 관심 분야: LLM & BioNLP
- 마곡에서 인턴 하고 있어요!
- 인턴십 관련해서 물어볼거 있으시면 언제든지 오세요~



분반장 20기 기광민

1-2. 진행방식

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주차	복습과제	학습내용	예습과제
1주차	- 해당 주차에 배운 내용에 대한 코드 실습 과제 부여 - ex) week1 복습과제: deep learning reminder(pytorch basic) - session 시작 초반부에 우수 코드 선정자가 5분 가량 코드 구현 과정 발표(별도 발표자료 없이 코드를 화면공유하여 발표) - 마감기한: 수요일 오후 6시	OT & DL Preview	- 다음 주차에 배울 내용에 대한 코드 실습 과제 부여 - ex) week1 예습과제: 텍스트 전처리 pipeline 구현 코드 - week1 예습과제라 함은, week1 session이 끝나고 부여되는, week2 내용에 대한 예습과제를 의미합니다! - 마감기한: 수요일 오후 6시
2주차		텍스트 전처리, 워드 임베딩 (Word2Vec, GloVe)	
3주차		순환신경망: RNN, LSTM, GRU, ELMo	
4주차		Attention, Transformer	
5주차		BERT/GPT	
6주차		LLM 기초 (Fine-tuning, 프롬프트, 경량화)	
7주차		RAG, 최신 논문 흐름 (에이전트, RL, 앙상블)	

1-2. 진행방식

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매주 목 19:00~21:00 총 2시간 진행

* 모든 문의(과제, 강의, 출결 등)는 분반장 최주희/기광민에게 슬랙 디엠 부탁드립니다

1-3. 타임라인

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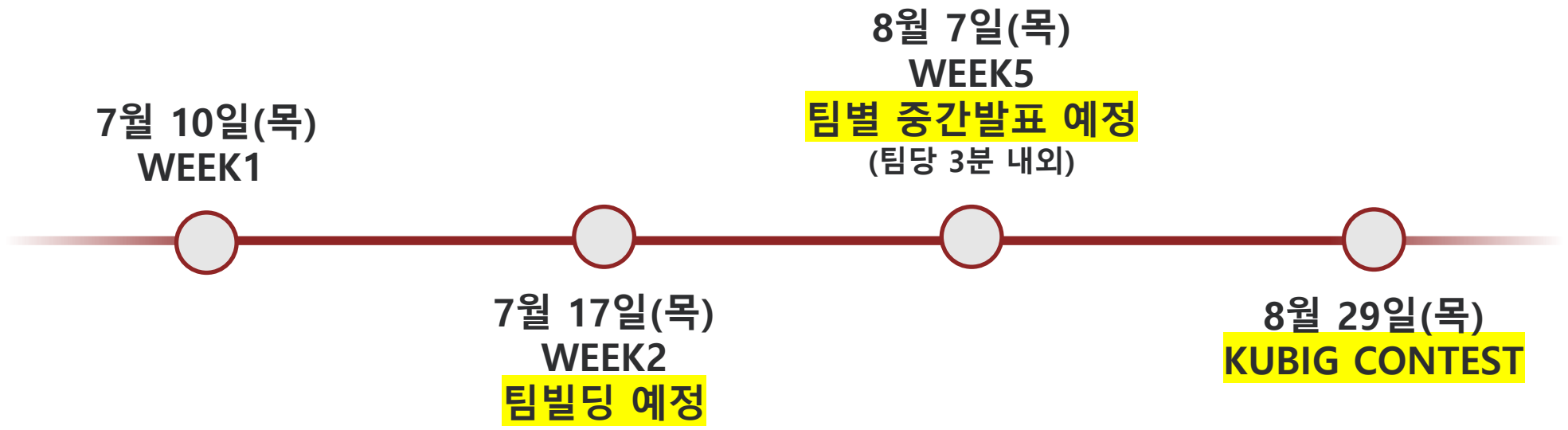
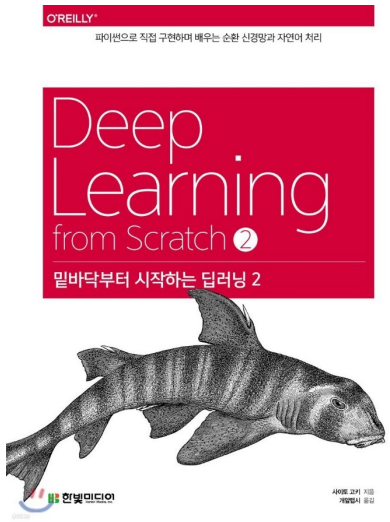


1-4. 참고 교재



밑바닥부터 시작하는 딥러닝2

딥러닝을 이용한 자연어 처리 입문
위키독스에서 무료 이용 가능(부분 유료)

고려대학교 DSBA 연구실
유튜브 채널에서 paper review 영상 참고

1-5. 자기 소개

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방학동안 함께 하실 분들 !

강서연

강준석

김동욱

김수환

김종현

백서현

신지민

원아현

윤채영

은지현

여러분을 소개해주세요!

기수, 이름, 학과, 나이, 취미

NLP 경험, NLP 선택 이유, 원하는 방향성

02 Theoretical Background of Deep Learning

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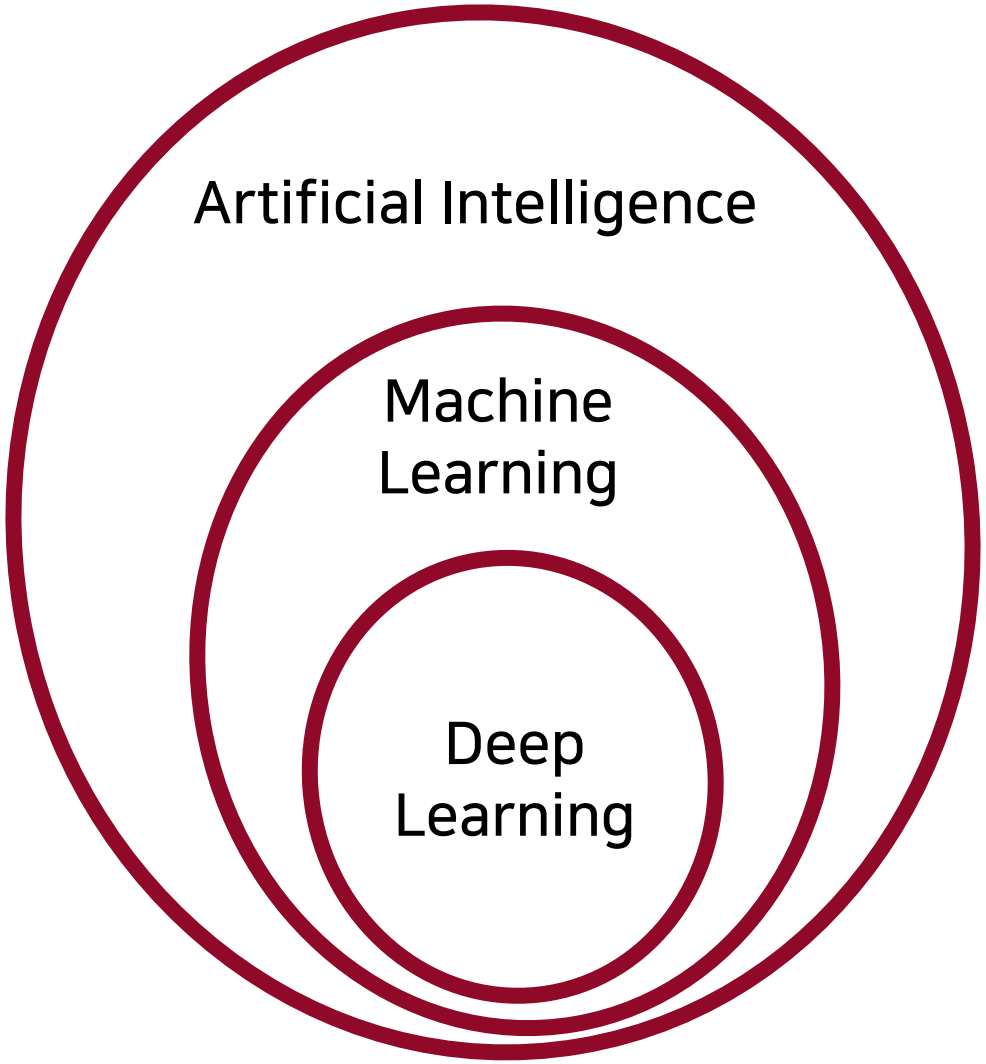
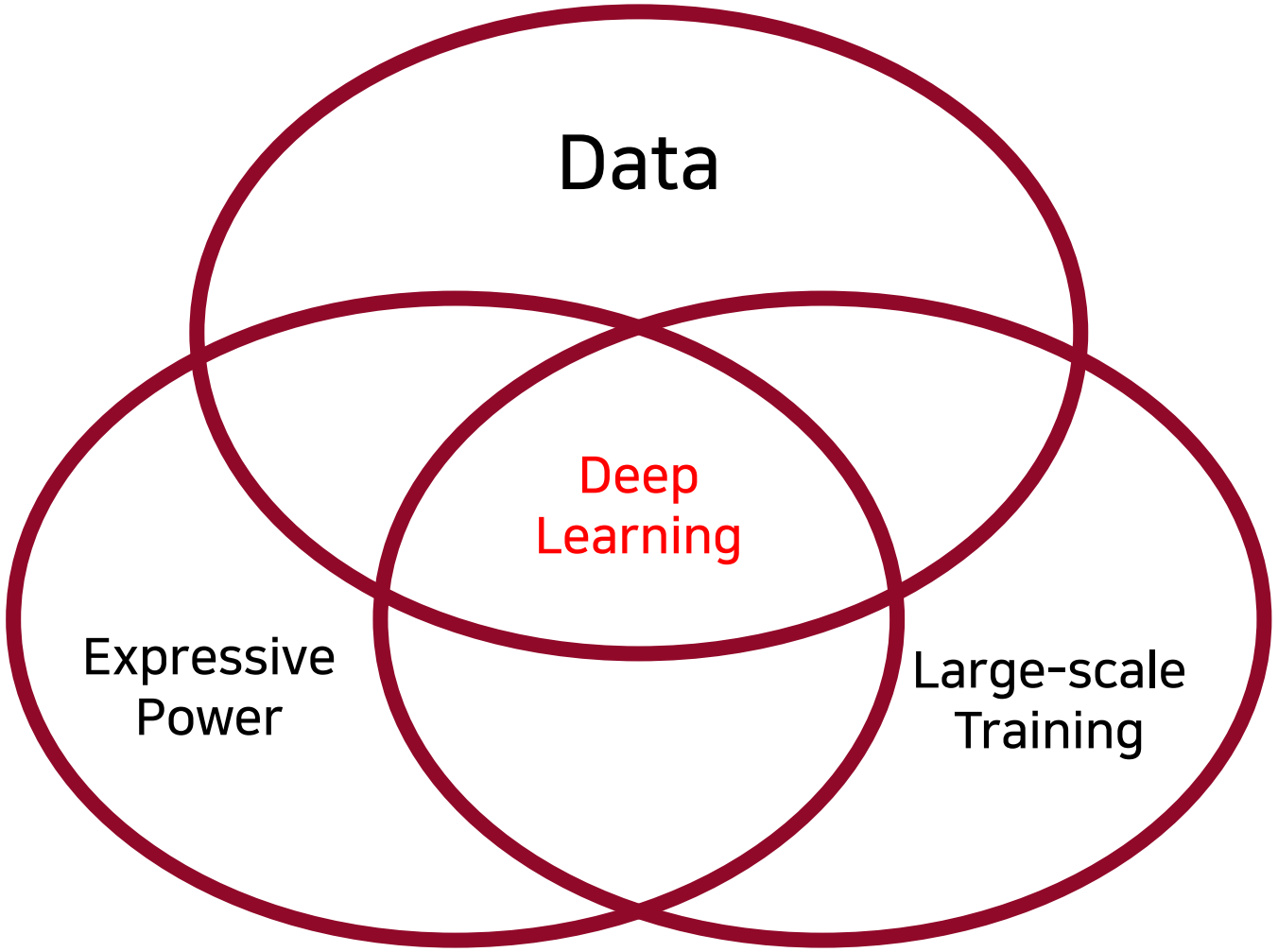
2-0. What is Deep Learning?



출처: 딥러닝을 위한 통계적 모델링(STAT433)

2-0. What is Deep Learning?



출처: 딥러닝을 위한 통계적 모델링(STAT433)

2-0. What is Deep Learning?

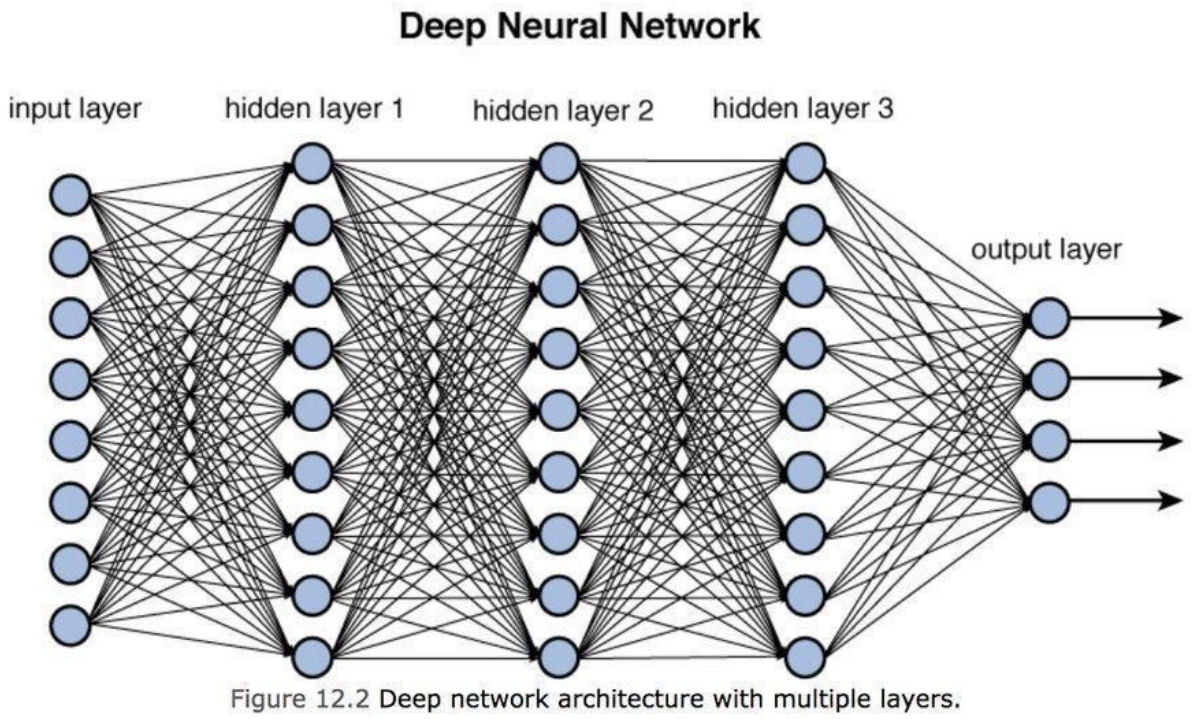
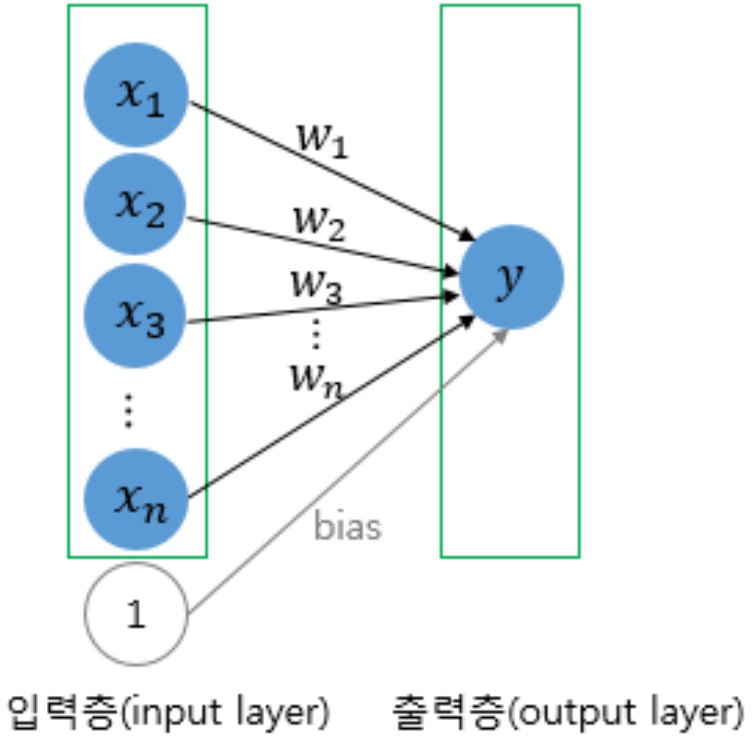


Figure 12.2 Deep network architecture with multiple layers.

Deep Learning = Deep Neural Network

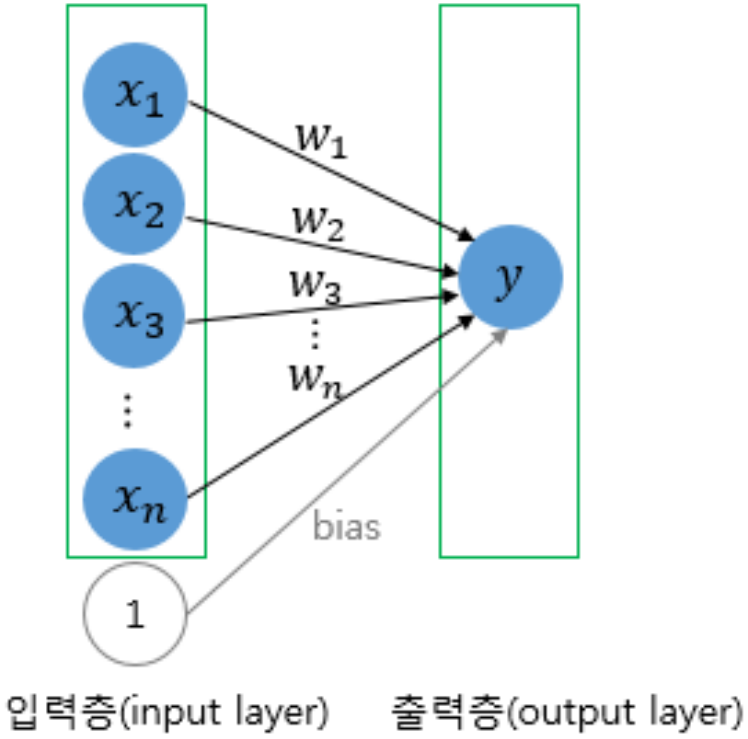
2-1. Single-Layer Perceptron

single-layer perceptron



출처: https://wikidocs.net/24958

2-1. Single-Layer Perceptron



When activation function is step function..

$$if \sum_{i}^{n} w_i x_i + b \geq 0 \rightarrow y = 1$$

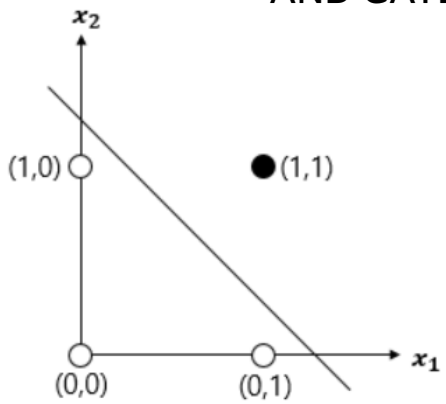
$$if \sum_{i}^{n} w_i x_i + b < 0 \rightarrow y = 0$$

출처: https://wikidocs.net/24958

2-2. The XOR Gate Problem

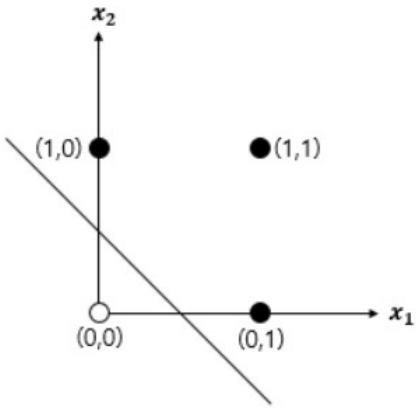
Separate B/W by a single line *(in 2-dimension space)*

AND GATE



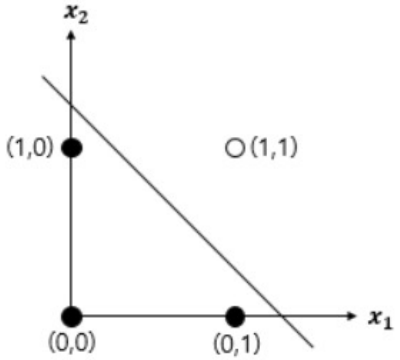
x_1	x_2	y
0	0	0
0	1	0
1	0	0
1	1	1

OR GATE



x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	1

NAND GATE



x_1	x_2	y
0	0	1
0	1	1
1	0	1
1	1	0

출처: https://wikidocs.net/24958

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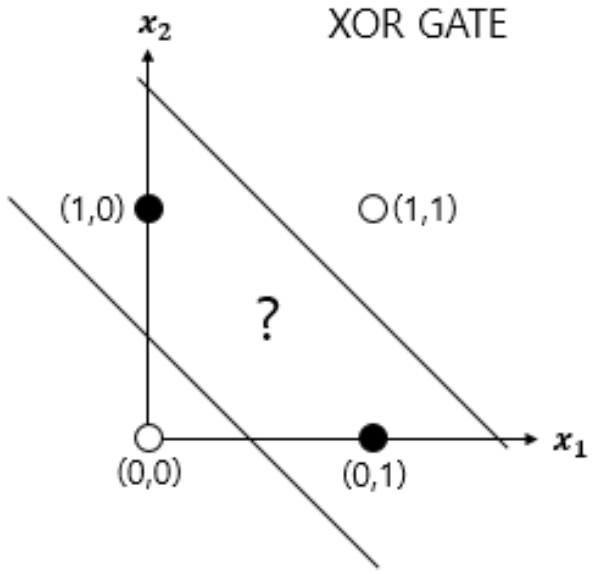
XOR problem

Can you separate B/W by a single line *(in 2-dimension space)*?



x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	0

출처: https://wikidocs.net/24958

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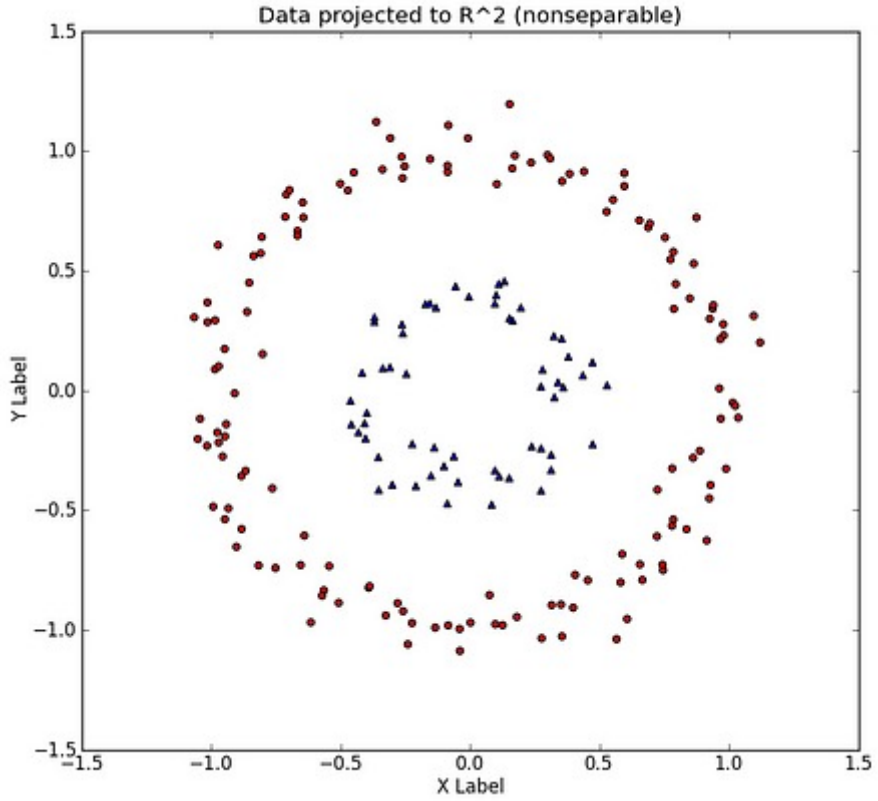
Linearly Non-Separable

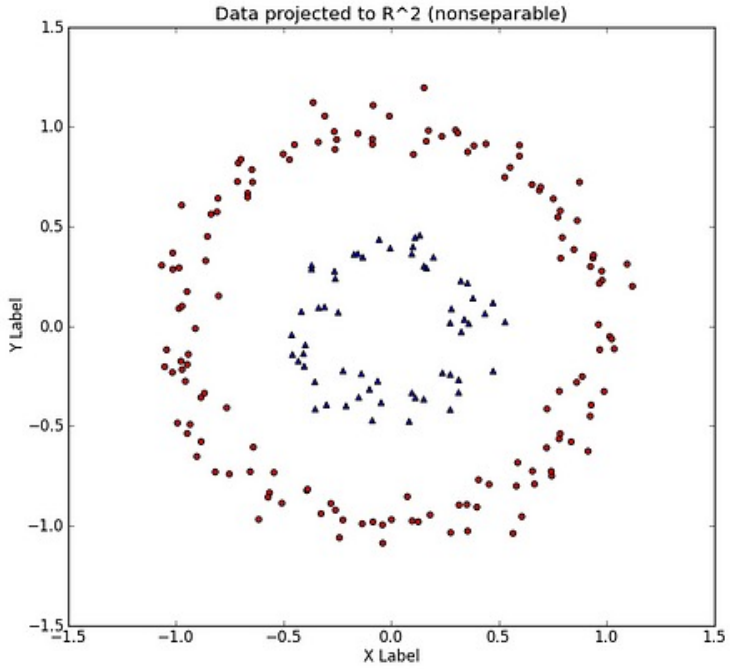
(in 2-dimension space)



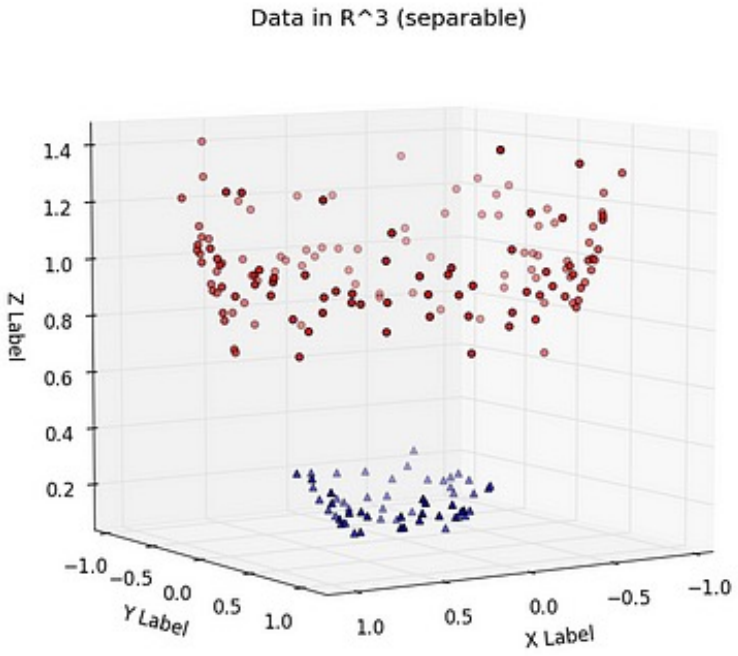
출처: https://vivek-yadav.medium.com/

Linearly Non-Separable

(in 2-dimension space)

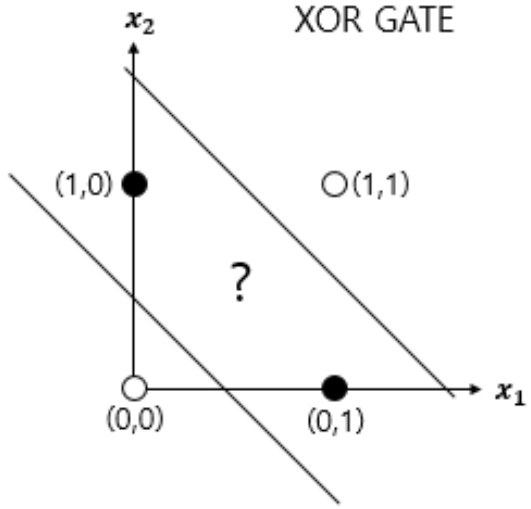


High-dimensional Space



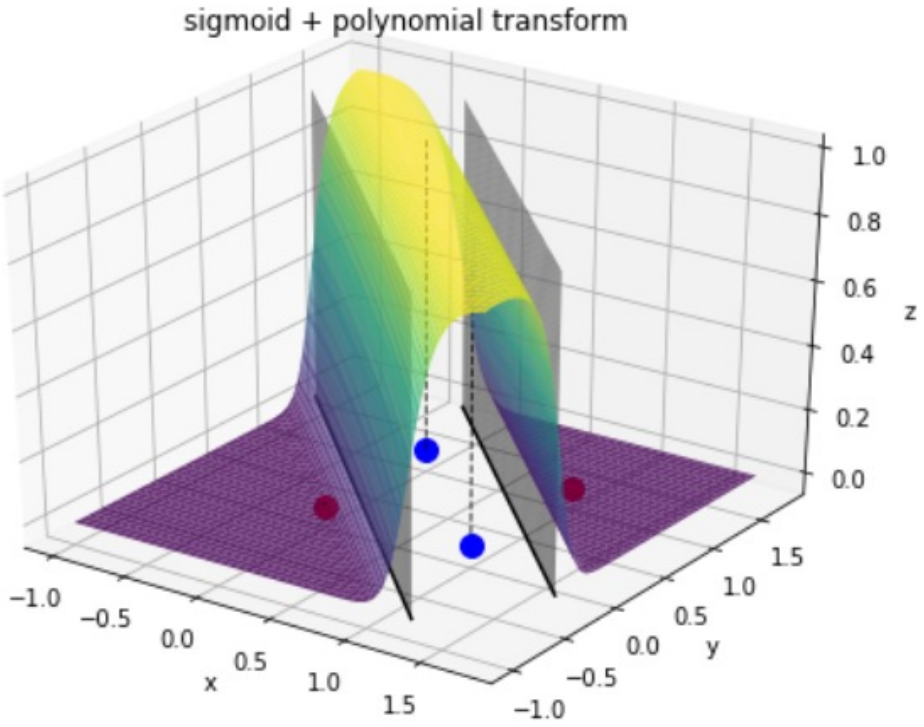
출처: https://vivek-yadav.medium.com/

2-3. Dimensional transform



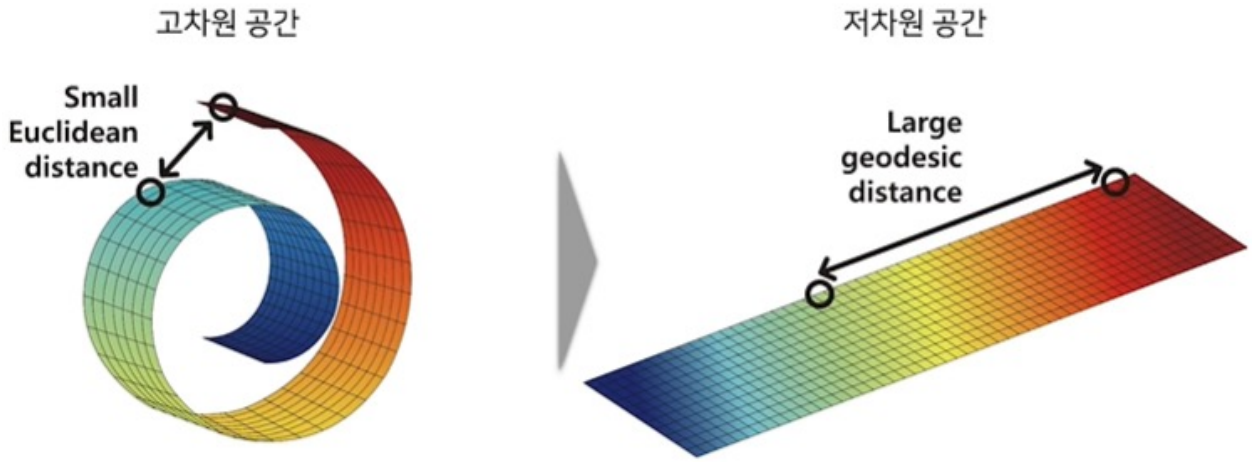
x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	0

High-dimensional Space



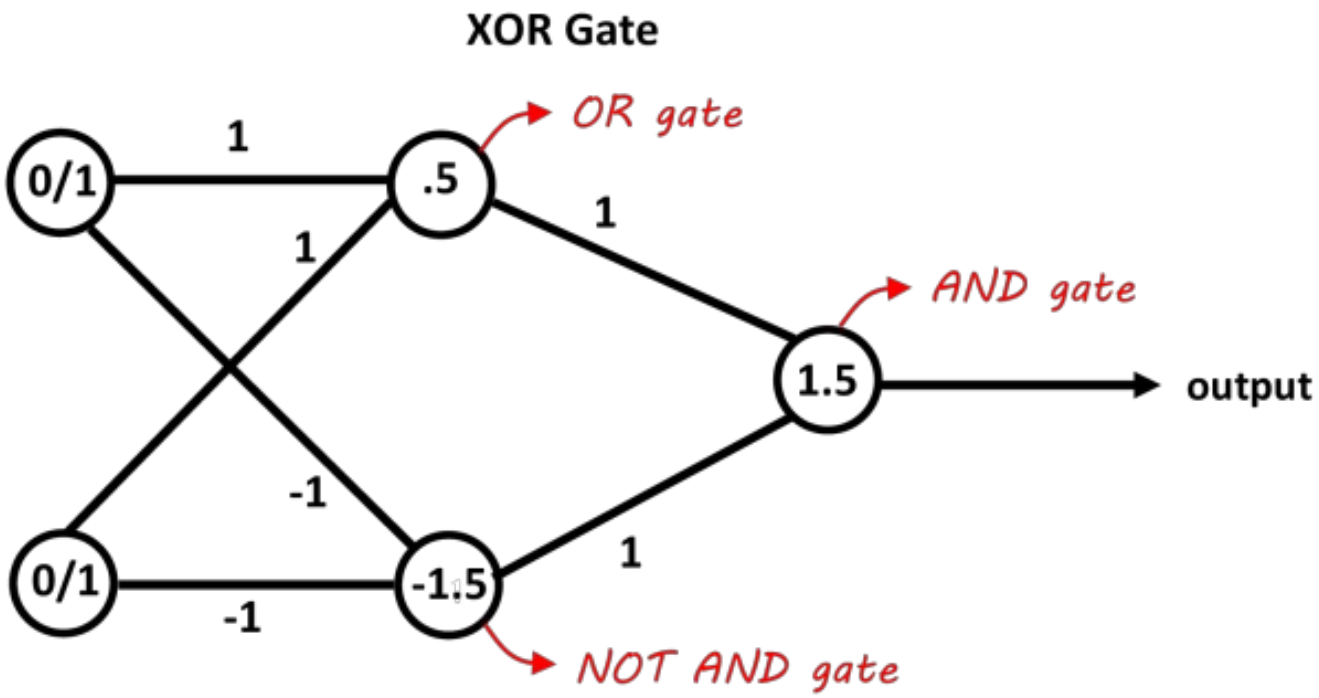
출처: https://datascience.stackexchange.com/questions/11589/creating-neural-net-for-xor-function

Manifold Hypothesis



- Hypothesis: High-dimensional data tend to lie in the vicinity of a low-dimensional manifold
- We can map data to a high-dimensional space through a smooth representation if the manifold hypothesis holds

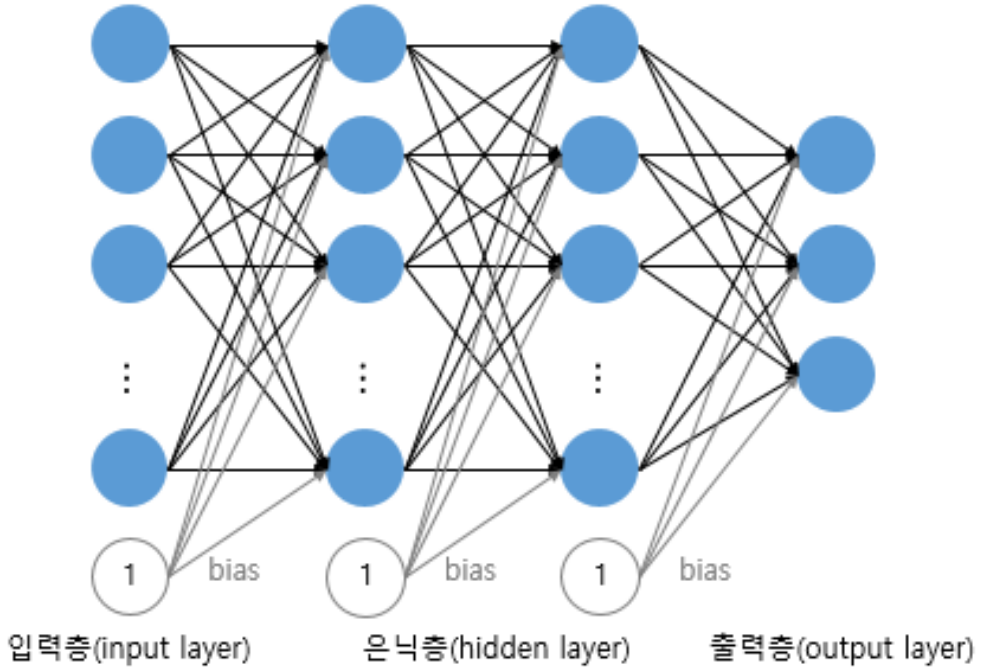
출처: https://velog.io/@sheoyonj/NN-Network-3



출처: https://datascience.stackexchange.com/questions/11589/creating-neural-net-for-xor-function

Multi-Layer Perceptron

(More Layers, much more parameters)



출처: https://wikidocs.net/24958

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Universal Approximation Theorem

Why deep learning is powerful

Universal approximation theorem — Let $C(X, \mathbb{R}^m)$ denote the set of continuous functions from a subset X of a Euclidean $\mathbb{R}^n$ space to a Euclidean space $\mathbb{R}^m$. Let $\sigma \in C(\mathbb{R}, \mathbb{R})$. Note that $(\sigma \circ x)_i = \sigma(x_i)$, so $\sigma \circ x$ denotes σ applied to each component of x.

Then σ is not polynomial if and only if for every $n \in \mathbb{N}$, $m \in \mathbb{N}$, compact $K \subseteq \mathbb{R}^n$, $f \in C(K, \mathbb{R}^m), \varepsilon > 0$ there exist $k \in \mathbb{N}$, $A \in \mathbb{R}^{k \times n}$, $b \in \mathbb{R}^k$, $C \in \mathbb{R}^{m \times k}$ such that

$$\sup_{x \in K} \|f(x) - g(x)\| < \varepsilon$$

where $g(x) = C \cdot (\sigma \circ (A \cdot x + b))$

(Universal Approximation Theorem) For a given arbitrary continuous function on a bounded domain and an error bound, there always exists a one-hidden-layer neural network that can approximate the given continuous function within the error bound.

출처: https://en.wikipedia.org/wiki/Universal_approximation_theorem

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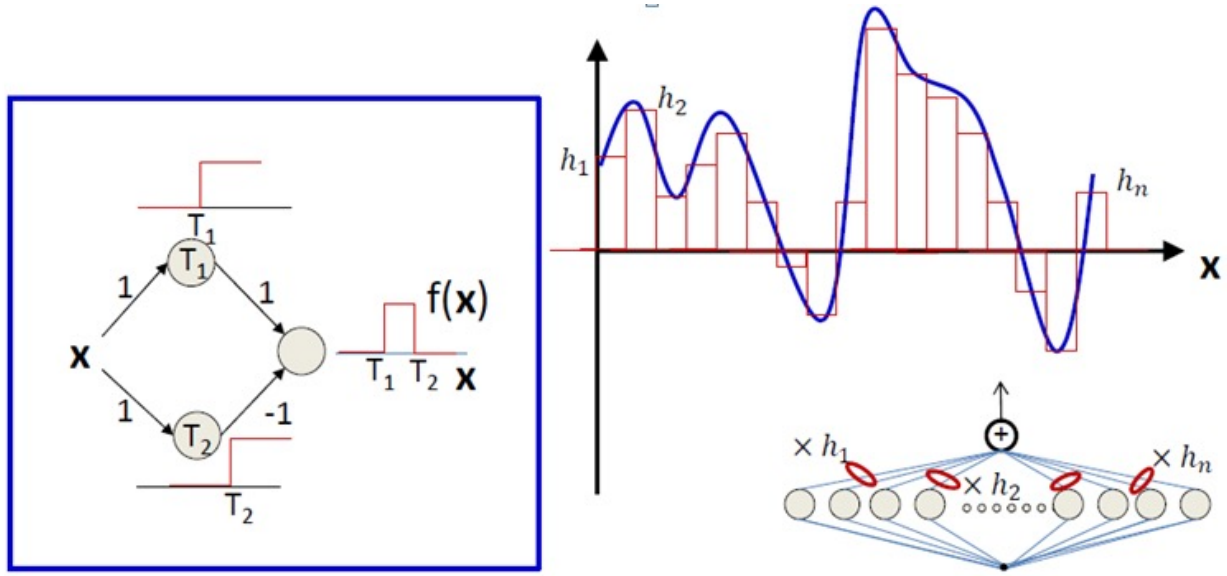
Universal Approximation Theorem

Why deep learning is powerful



Increase in # of hidden units -> increase in # of parameters
-> increase in # of regions -> increase in # of patterns a function can represent

출처: https://medium.com/analytics-vidhya/

03 Factors of Deep Learning

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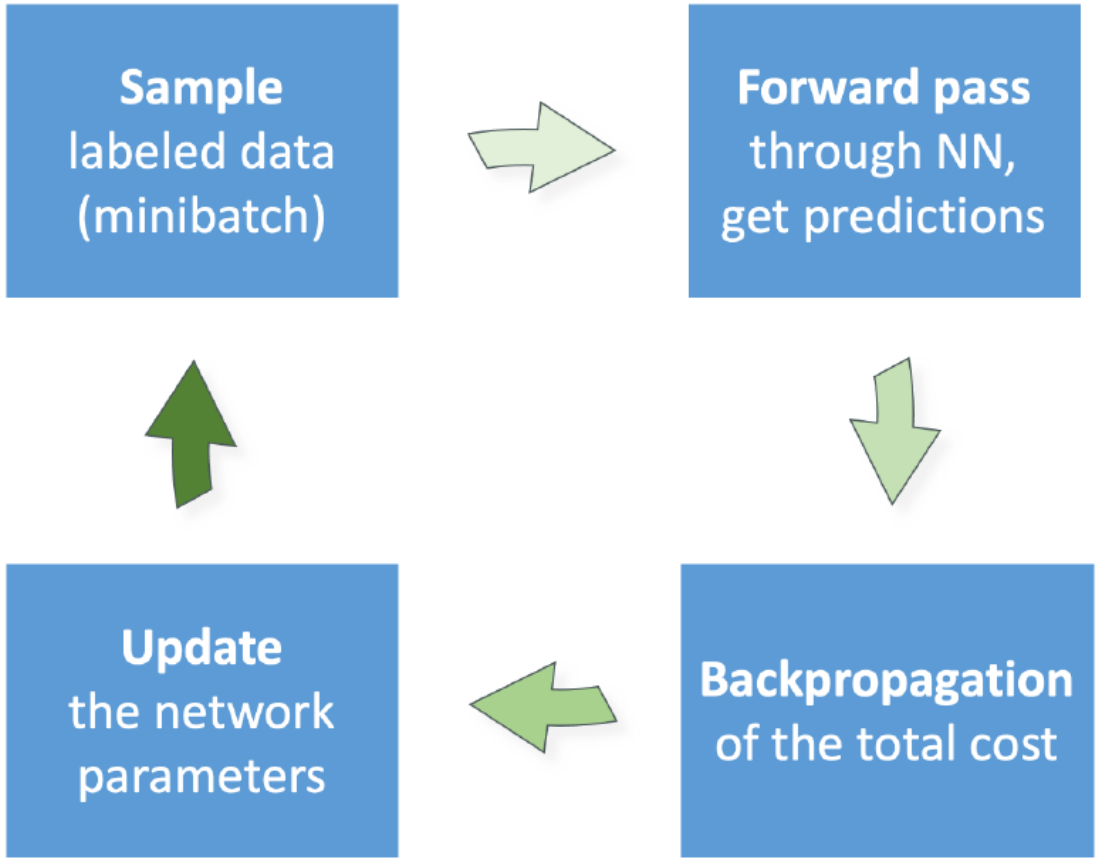
3-1. Deep Learning Training Cycle



출처: 딥러닝과수학 Seungsang Oh

3-2. Forward Pass

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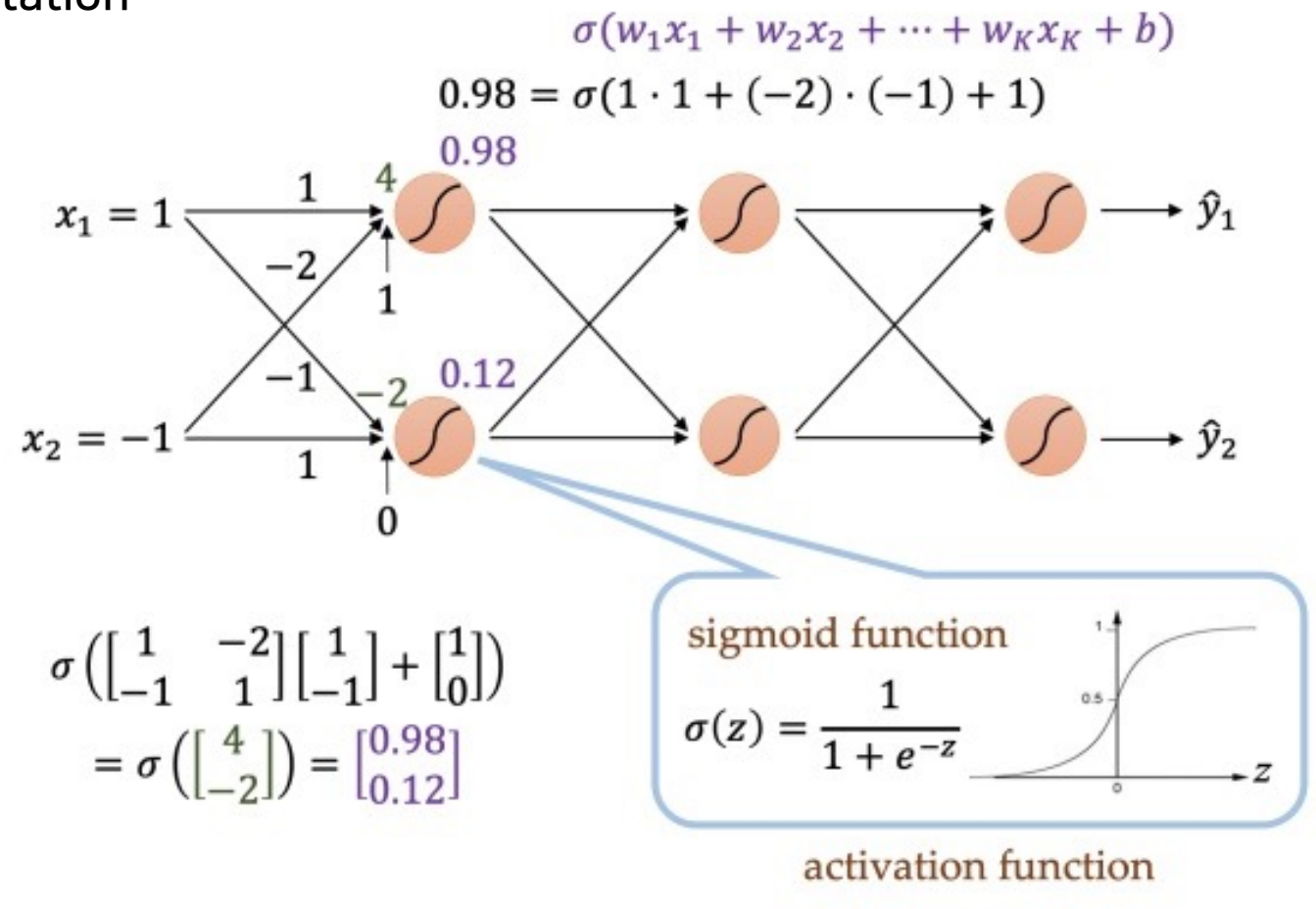
Forward Pass computation



출처: 딥러닝과수학 Seungsang Oh

3-3. Cost Function

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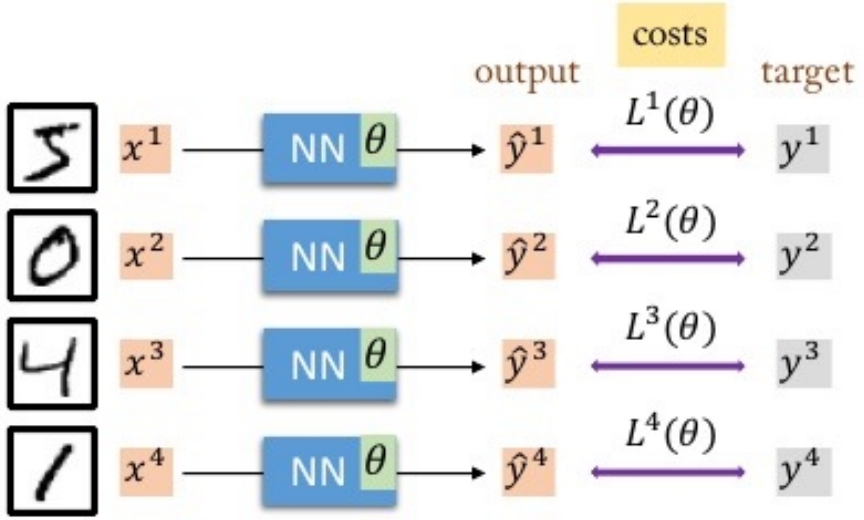
Total Cost



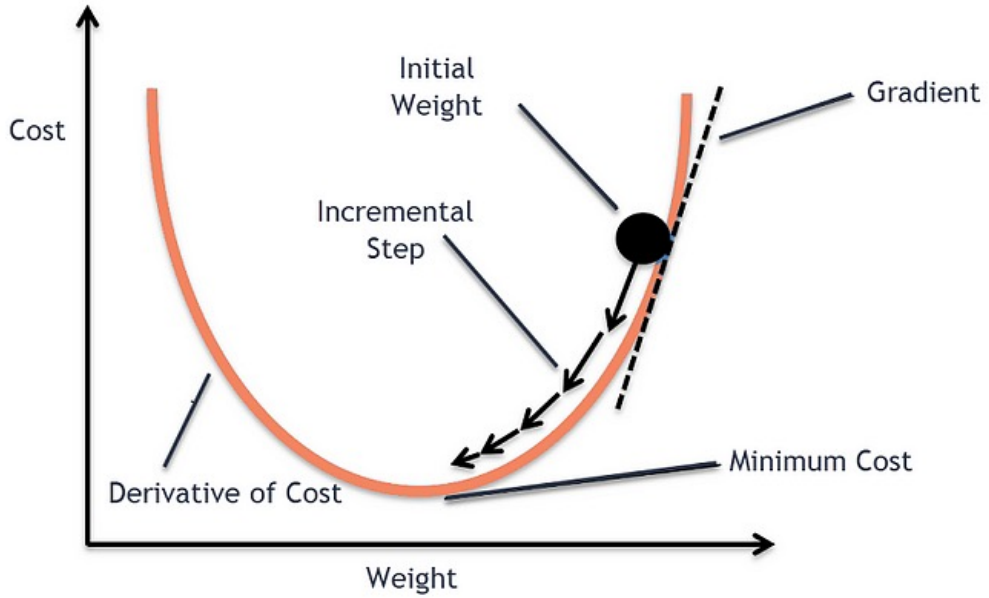
Total Cost

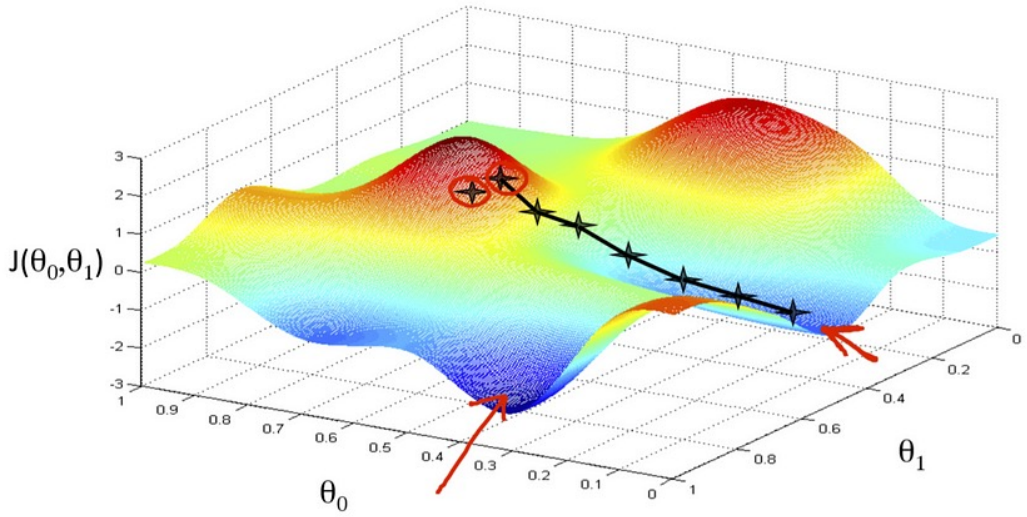
$$C(\theta) = \sum_{n=1}^{N} L^n(\theta)$$

Total cost를 minimize하는 network parameter 찾기

출처: 딥러닝과수학 Seungsang Oh

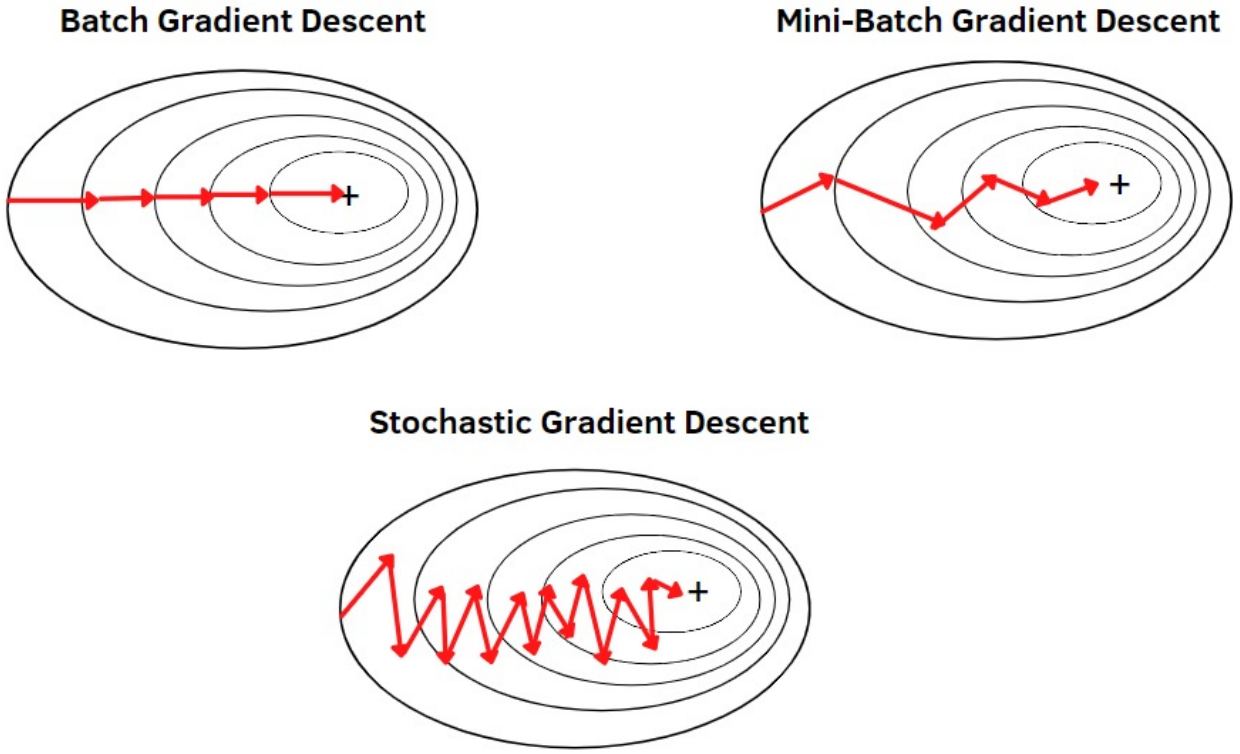
3-4. Gradient Descent





출처: https://towardsdatascience.com/an-intuitive-explanation-of-gradient-descent-83adf68c9c33
https://www.analyticsvidhya.com/blog/2022/07/gradient-descent-and-its-types/

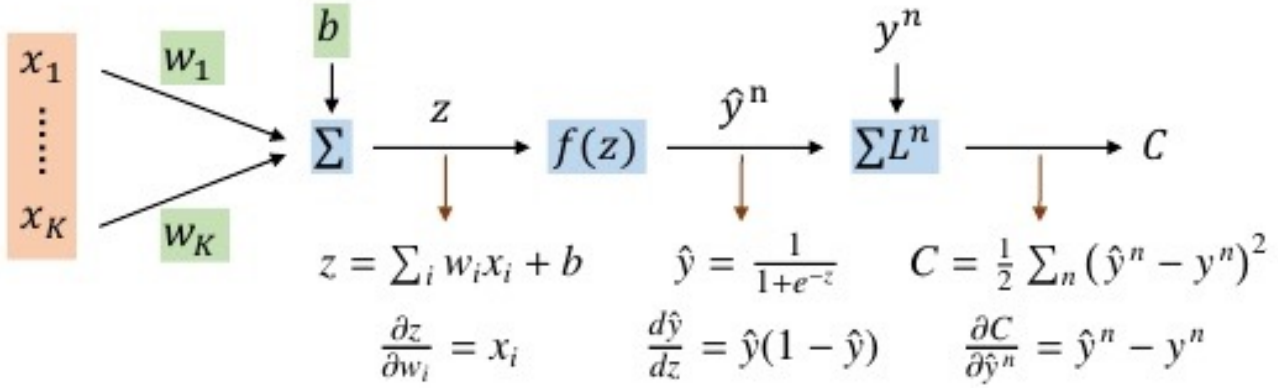
3-4. Gradient Descent



출처: https://towardsdatascience.com/an-intuitive-explanation-of-gradient-descent-83adf68c9c33
https://www.analyticsvidhya.com/blog/2022/07/gradient-descent-and-its-types/

3-5. Backpropagation

$$w_i(t+1) = w_i(t) - \eta \frac{\partial C}{\partial w_i}$$



$$\frac{\partial C}{\partial w_i} = \sum_{n=1}^{N} \frac{\partial z^n}{\partial w_i} \frac{d\hat{y}^n}{dz^n} \frac{\partial C}{\partial \hat{y}^n} = \sum_{n=1}^{N} x_i^n \hat{y}^n (1-\hat{y}^n)(\hat{y}^n - y^n)$$

Chain rule

출처: 딥러닝과수학 Seungsang Oh

04 과제 및 팀 빌딩 안내

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4-1. 예습과제, 복습과제

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1주차 복습과제1	1주차 복습과제2	1주차 예습과제1	1주차 예습과제2
Pytorch 기본 익히기 code	내용 복습 / 추론	텍스트 전처리 + 워드클라우드 code	Word2vec code

코드과제의 파일형식은 ipynb로, KUBIG 25-2 Github repo에 업로드 될 예정입니다!
Colab 환경에서 제작된 과제들이므로 google colab에서 실행하시는 것을 권장드립니다.

📣 KUBIG Contest Team Build

21기 강서연 강준석 김동욱 김수환 원아현 윤채영 은지현
22기 김종현 백서현 신지민

금일 세션이 종료된 후, 관심 분야 투표 공지 예정.
구글 폼으로 수요 조사 후 관심분야에 따라 팀 분할.

WEEK2 세션 시간에 팀 빌딩 결과 공지 예정.

수고하셨습니다 !