

Part. 01

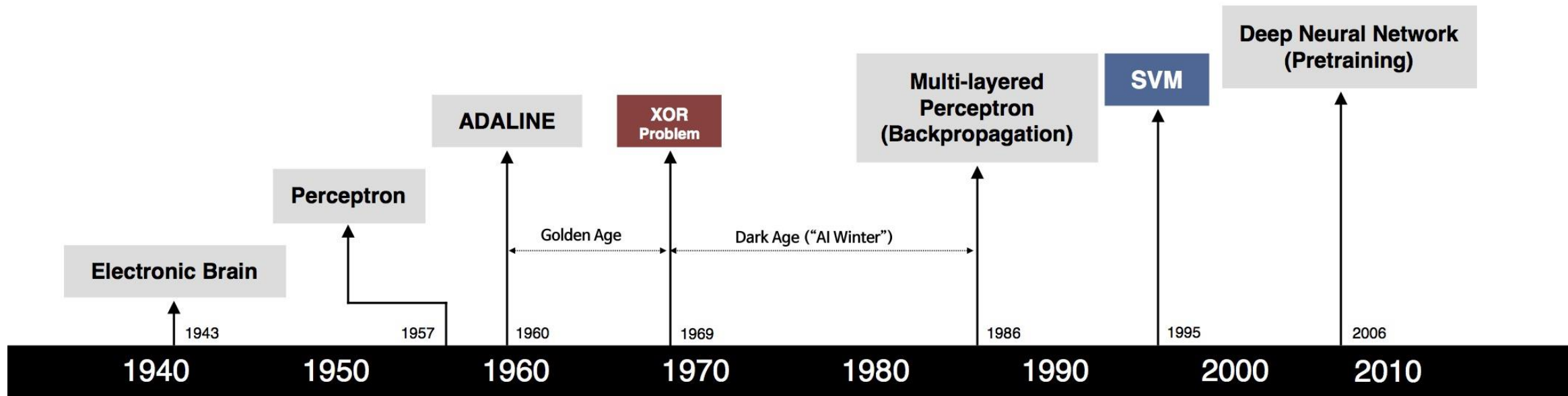
Deep Learning

| Deep Learning의 시작과 현재

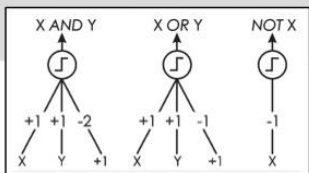
FASTCAMPUS
ONLINE

강사. 신제용

I 딥러닝의 역사



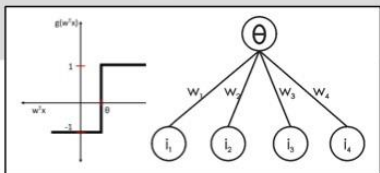
S. McCulloch – W. Pitts



- Adjustable Weights
- Weights are not Learned



F. Rosenblatt



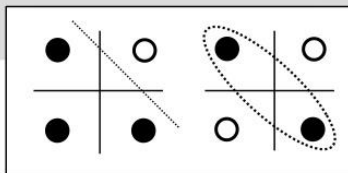
- Learnable Weights and Threshold



B. Widrow – M. Hoff



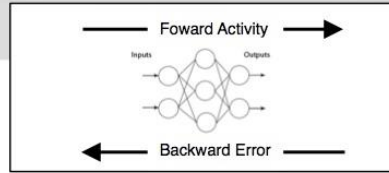
M. Minsky – S. Papert



- XOR Problem



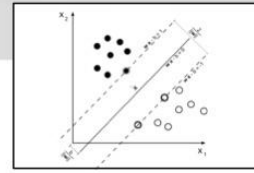
D. Rumelhart – G. Hinton – R. Williams



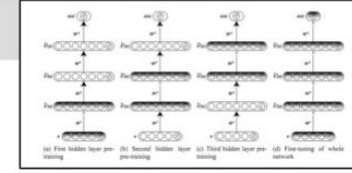
- Solution to nonlinearly separable problems
- Big computation, local optima and overfitting
- Limitations of learning prior knowledge
- Kernel function: Human Intervention



V. Vapnik – C. Cortes



G. Hinton – S. Ruslan



- Hierarchical feature Learning

I 딥러닝의 뿌리를 찾아서

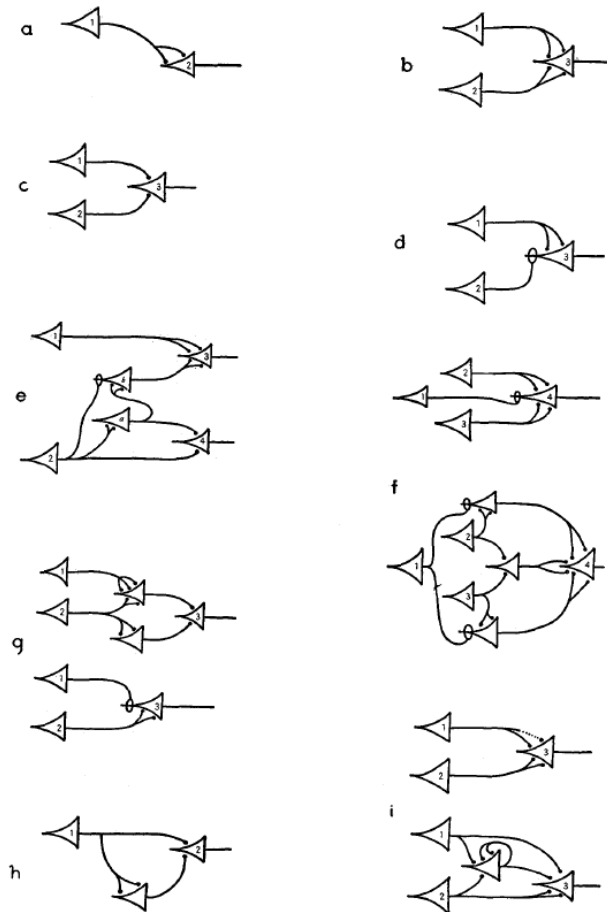
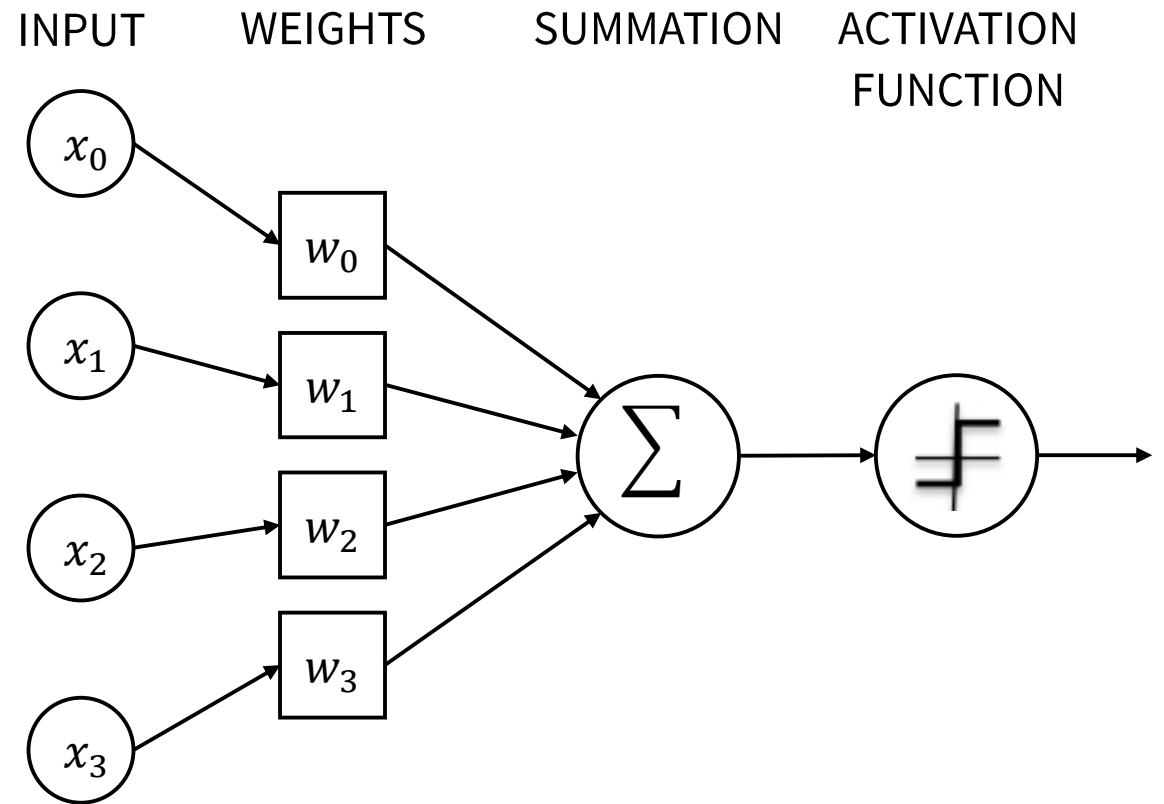


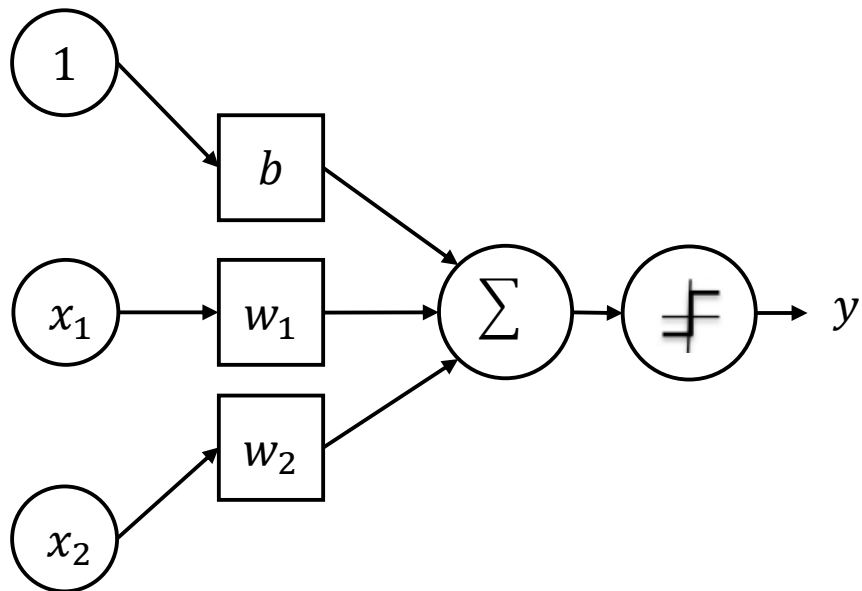
FIGURE 1

최초의 인공신경망 개념
(McCulloch and Pitts, 1943)

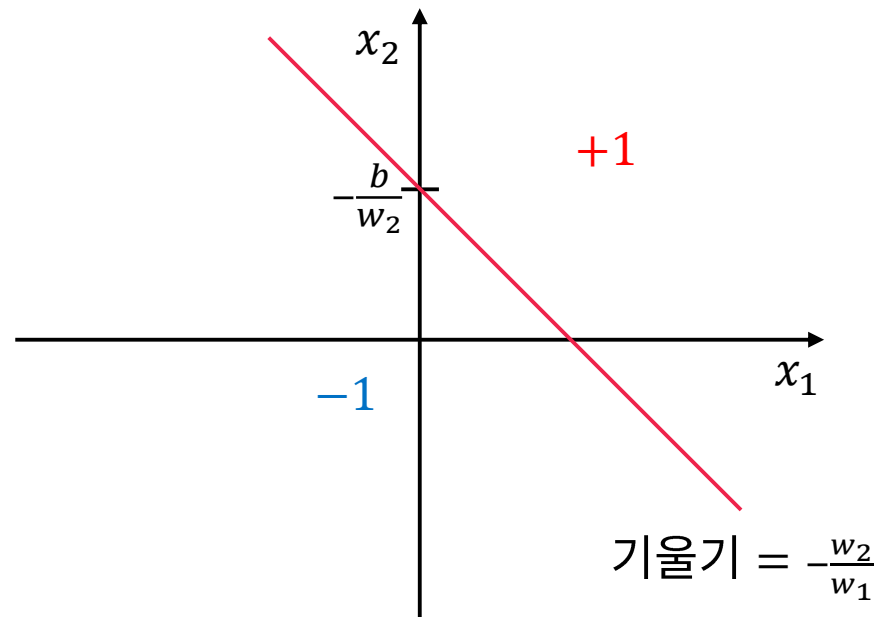


Rosenblatt의 퍼셉트론 구조
(Rosenblatt, 1958)

I 퍼셉트론의 동작



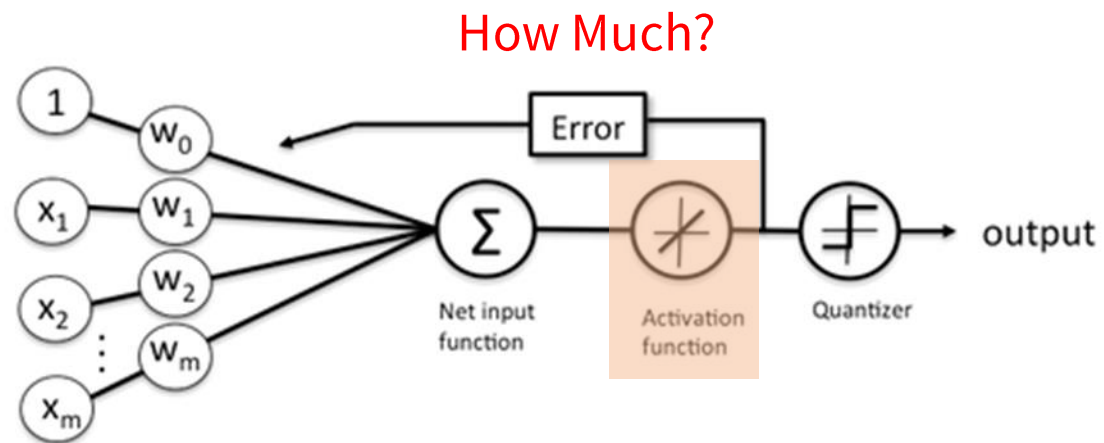
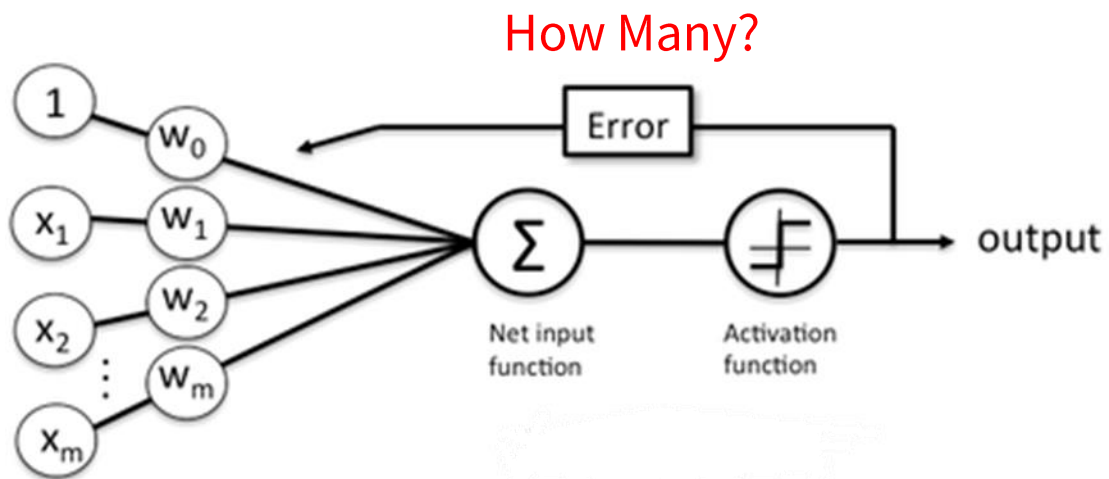
$$y = \begin{cases} +1, & b + w_1x_1 + w_2x_2 \geq 0 \\ -1, & b + w_1x_1 + w_2x_2 < 0 \end{cases}$$



$$x_2 = -\frac{w_1}{w_2}x_1 - \frac{b}{w_2}$$

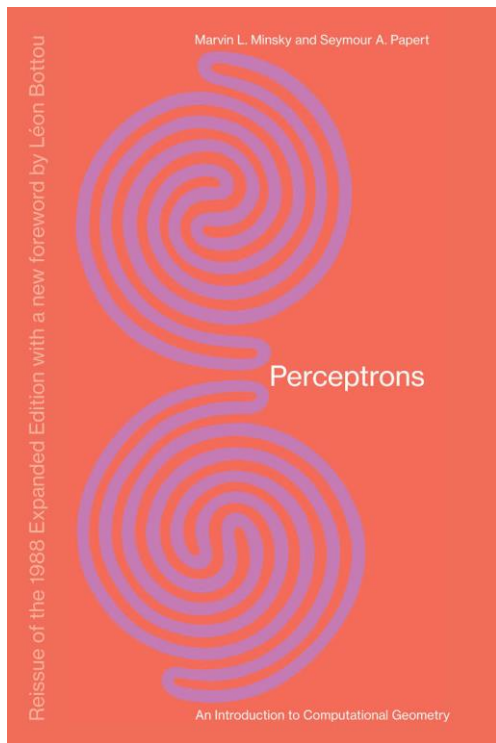
퍼셉트론의 수식과 시각적 표현

ADALINE (Adaptive Linear Element)

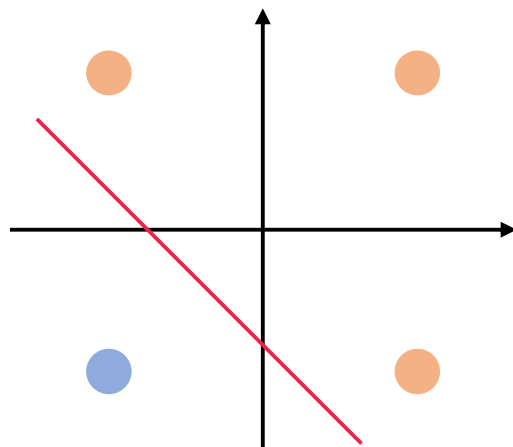


퍼셉트론과 ADALINE의 비교

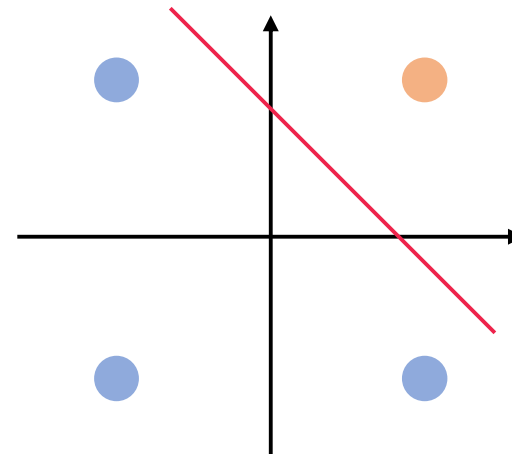
I XOR 문제와 AI Winter



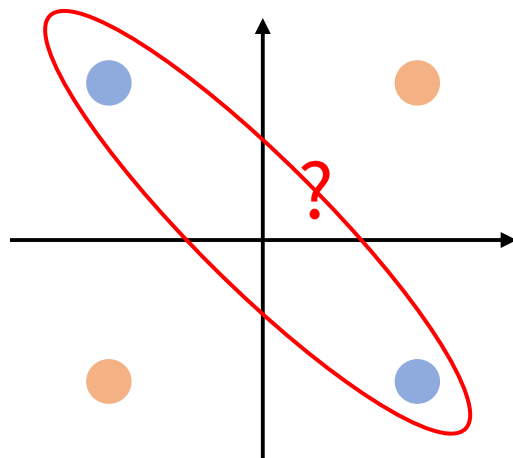
Perceptrons
(Minsky and Papert, 1969)



OR



AND

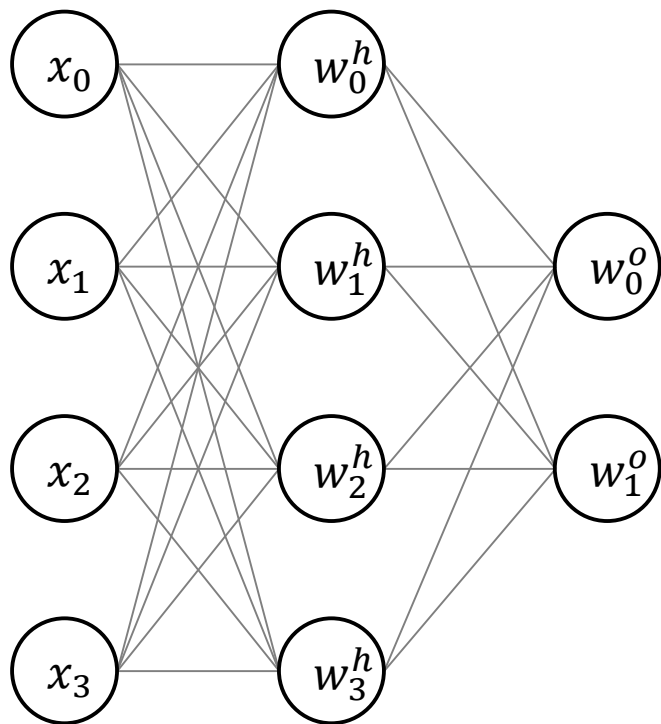


XOR

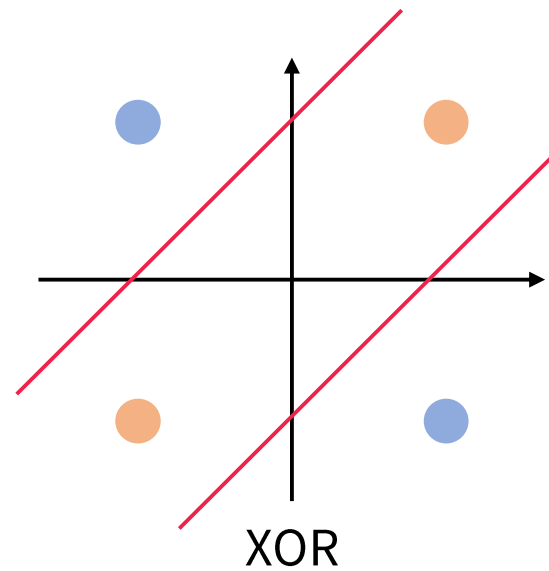


I 다층 퍼셉트론 (첫 번째 Breakthrough)

첫번째 계층 두번째 계층 세번째 계층
(입력 계층) (은닉 계층) (출력 계층)

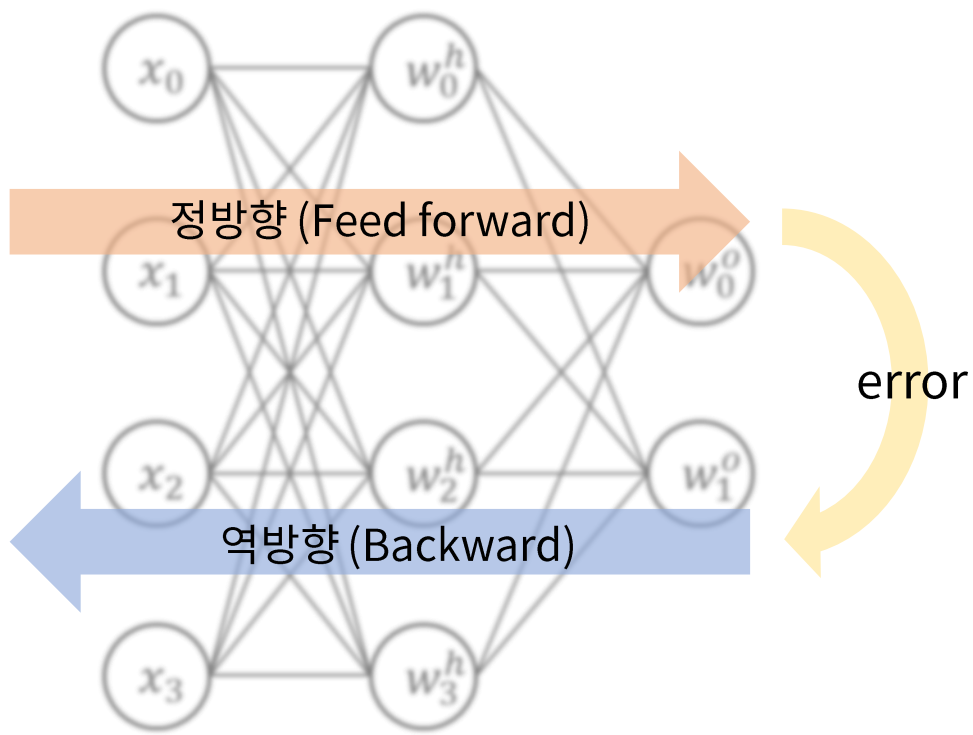


다층 퍼셉트론 (1986)
(Multi-Layered Perceptrons; MLP)



MLP로 XOR 문제를 해결한 예

I 역전파 알고리즘과 MNIST

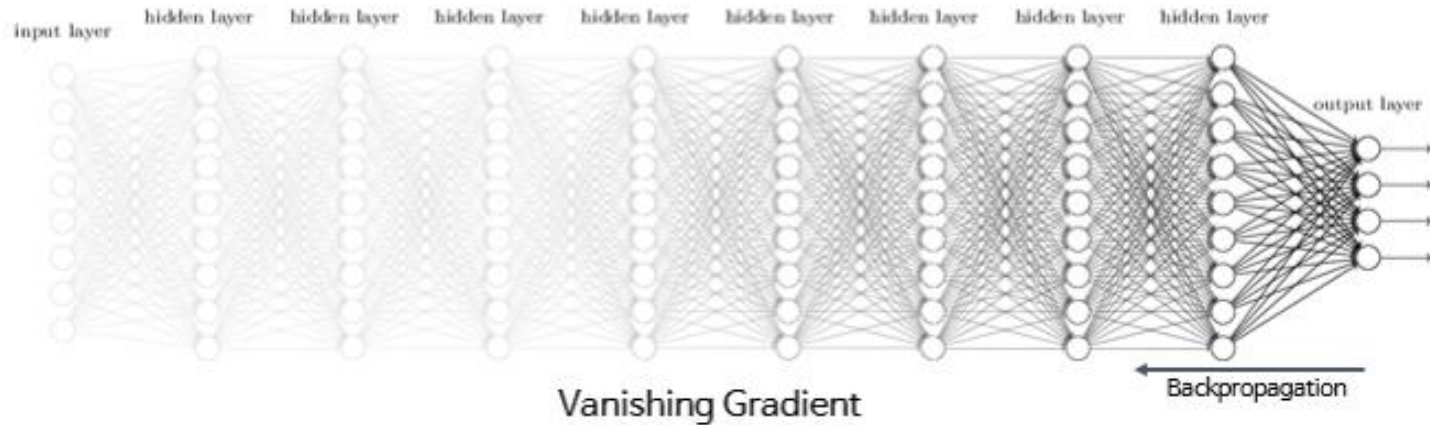
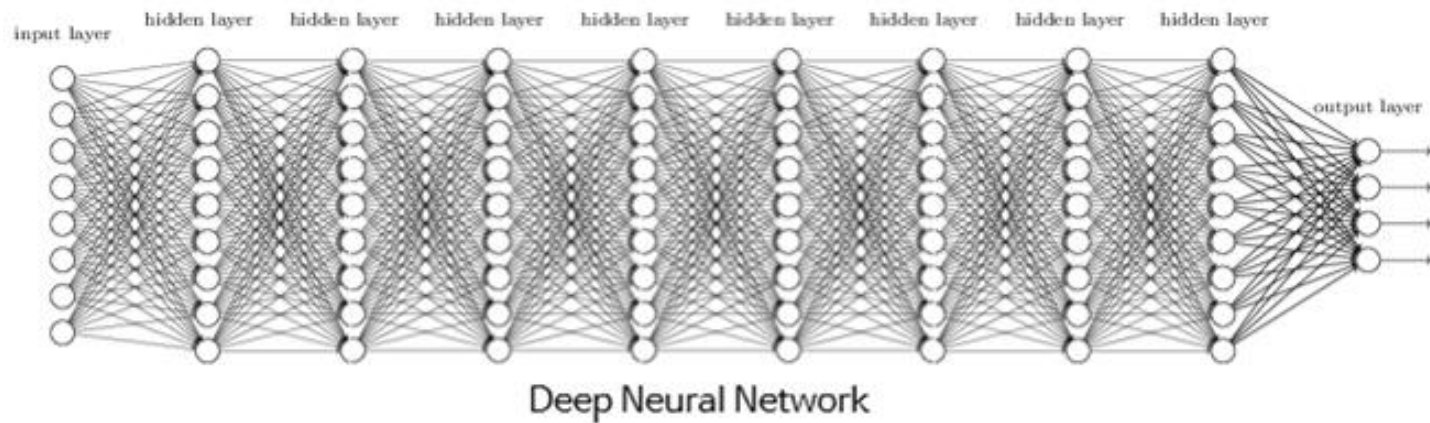


오류 역전파 알고리즘
(Backpropagation Algorithm; BP)

8	9	0	1	2	3	4	7	8	9	0	1	2	3	4	5	6	7	8	6
4	2	6	4	7	5	5	4	7	8	9	2	9	3	9	3	8	2	0	5
0	1	0	4	2	6	5	3	5	3	8	0	0	3	4	1	5	3	0	8
3	0	6	2	7	1	1	8	1	7	1	3	8	9	7	6	7	4	1	6
7	5	1	7	1	9	8	0	6	9	4	9	9	3	7	1	9	2	2	5
3	7	8	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	0
1	2	3	4	5	6	7	8	9	8	1	0	5	5	1	9	0	4	1	9
3	8	4	7	7	8	5	0	6	5	5	3	3	3	9	8	1	4	0	6
1	0	0	6	2	1	1	3	2	8	8	7	8	4	6	0	2	0	3	6
8	7	1	5	9	9	3	2	4	9	4	6	5	3	2	5	5	9	4	1
6	5	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7
8	9	0	1	2	3	4	5	6	7	8	9	6	4	2	6	4	7	5	5
4	7	8	9	2	9	3	9	3	8	2	0	9	8	0	5	6	0	1	0
4	2	6	5	5	5	4	3	4	1	5	3	0	8	3	0	6	2	7	1
1	8	1	7	1	3	8	5	4	2	0	9	7	6	7	4	1	6	8	4
7	5	1	2	6	7	1	9	8	0	6	9	4	9	9	6	2	3	7	1
9	2	2	5	3	7	8	0	1	2	3	4	5	6	7	8	0	1	2	3
4	5	6	7	8	0	1	2	3	4	5	6	7	8	9	2	1	2	1	3
9	9	8	5	3	7	0	7	7	5	7	9	9	4	7	0	3	4	1	4
4	7	5	8	1	4	8	4	1	8	6	6	4	6	3	5	7	2	5	9

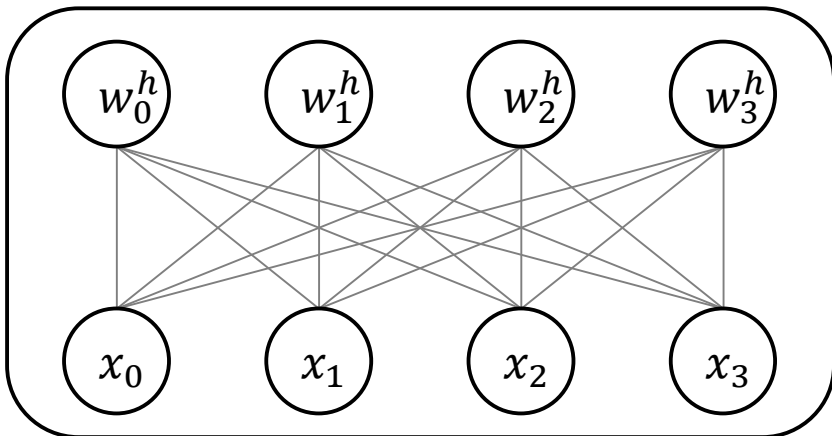
MLP와 BP 알고리즘으로 해결한 필기숫자 인식(MNIST) 문제
(LeCun, 1989)

I 기울기 소실 문제 (두 번째 AI Winter)

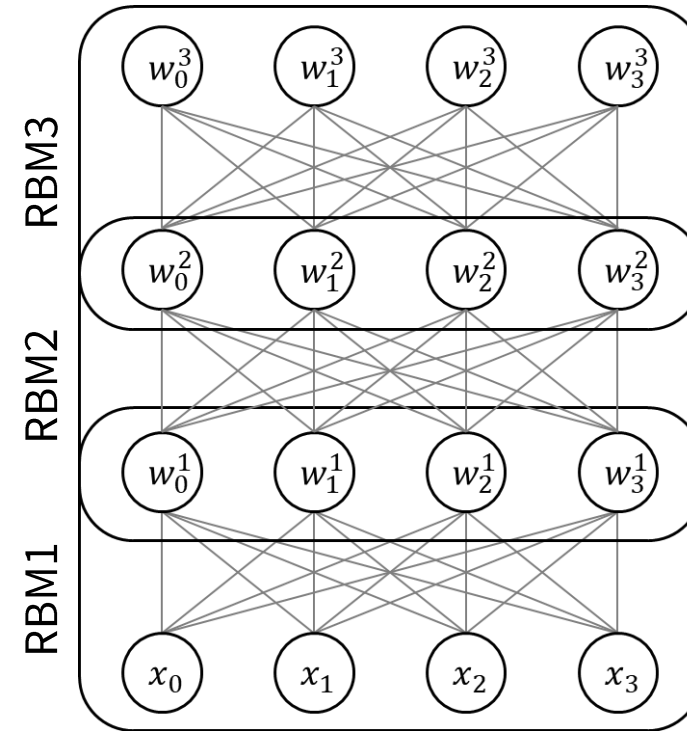


계층이 깊어질 수록 학습이 어려운 기울기 소실 (Vanishing Gradient) 문제

I 심층 믿음 신경망의 등장 (두 번째 Breakthrough)



RBM (Restricted Boltzmann Machine) 비지도 학습법



RBM을 쌓아 올린 DBN (Deep Belief Network)
(Hinton, 2006)

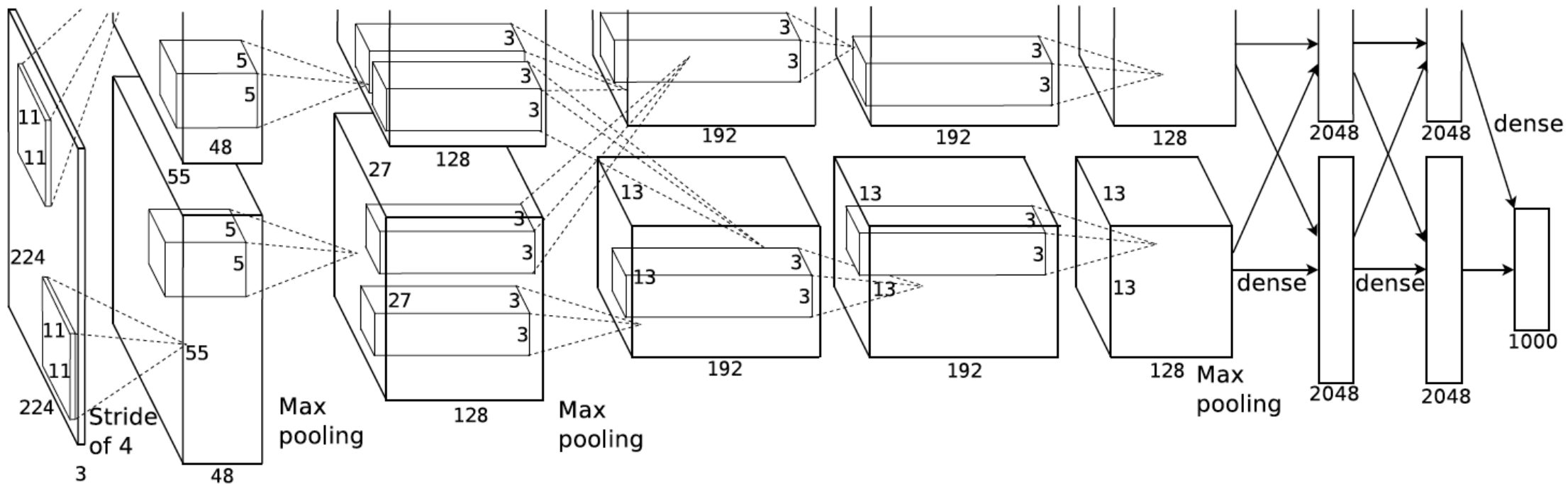
I ImageNet Large Scale Visual Recognition Challenges



Fei-Fei Li 교수의 대규모 영상 분류 데이터셋 ImageNet과 경연대회 ILSVRC

I AlexNet과 딥러닝의 비상

2012 ILSVRC (ImageNet Large Scale Visual Recognition Competition) 우승과 함께 시작된 딥러닝의 급부상



AlexNet (Krizhevsky *et al.*, 2012)

AlexNet과 딥러닝의 비상

