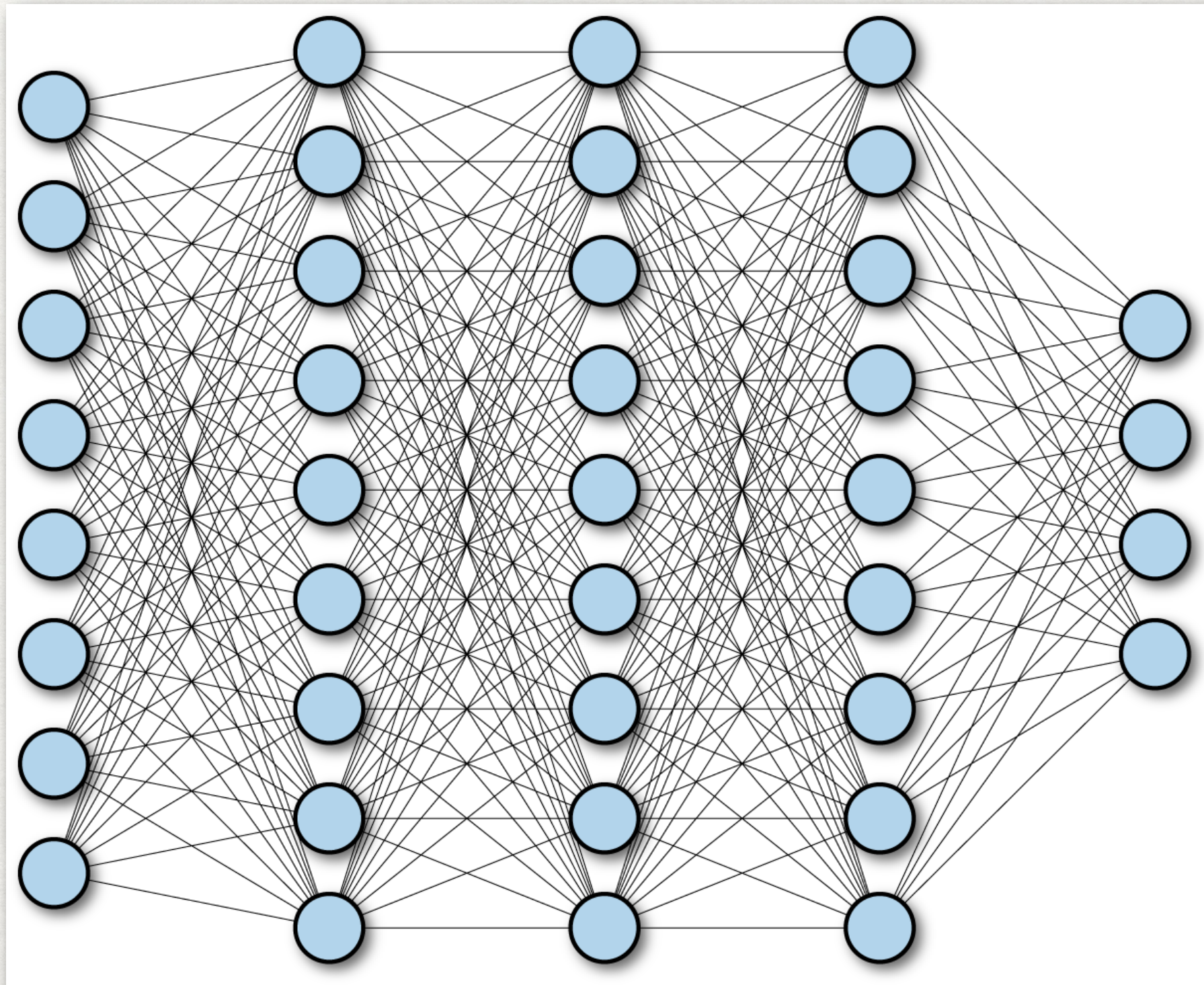


# 완전 연결 신경망

Fully Connected Neural Network

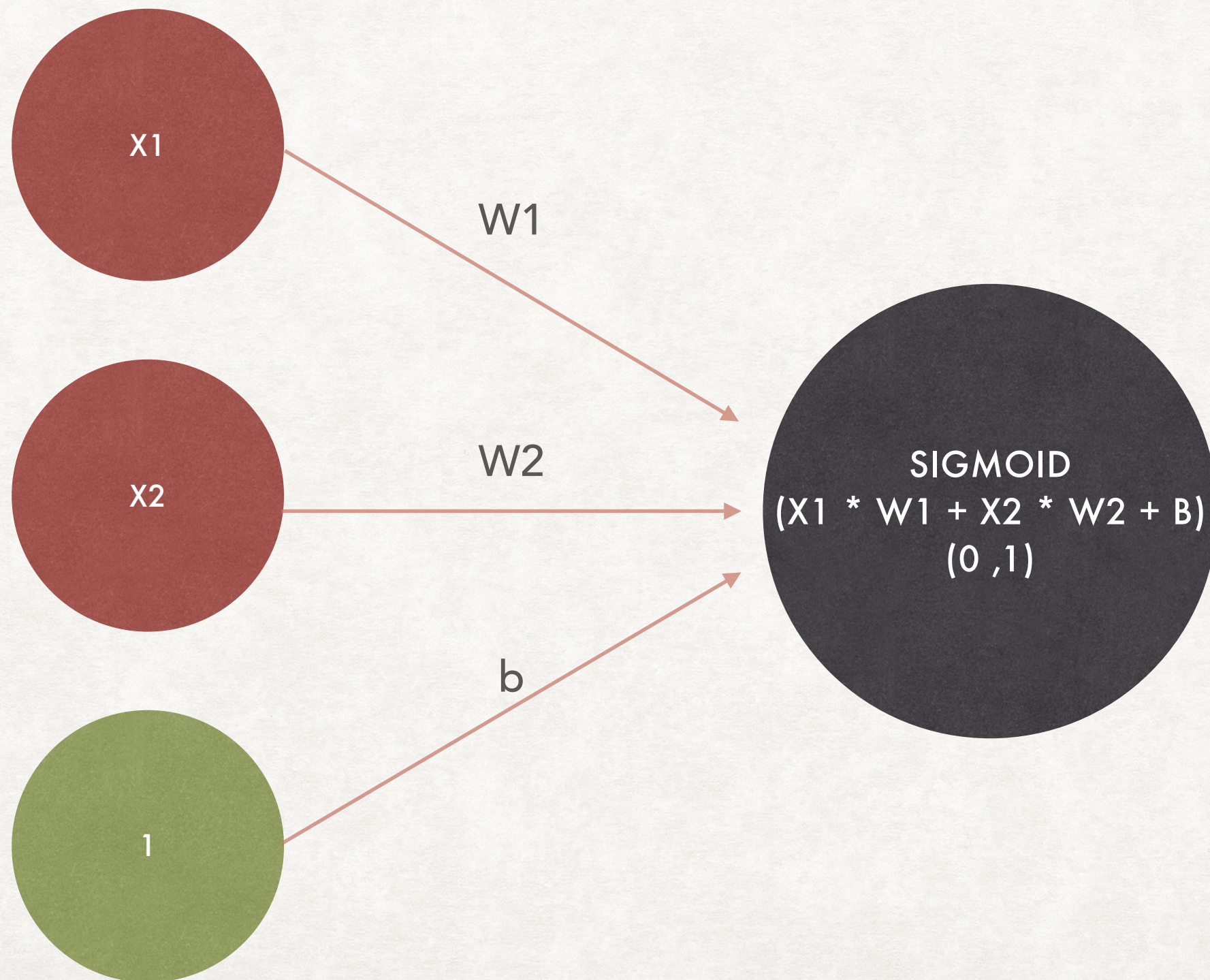


# 완전 연결 신경망(다층 퍼셉트론)





# 로지스틱 모델(단층 퍼셉트론)





로지스틱 모델으로

# AND 게이트 학습해보기

X1	X2	Y
0	0	0
0	1	0
1	0	0
1	1	1

AND 게이트 진리표



로지스틱 모델으로

# OR 게이트 학습해보기

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	1

OR 게이트 진리표



로지스틱 모델으로

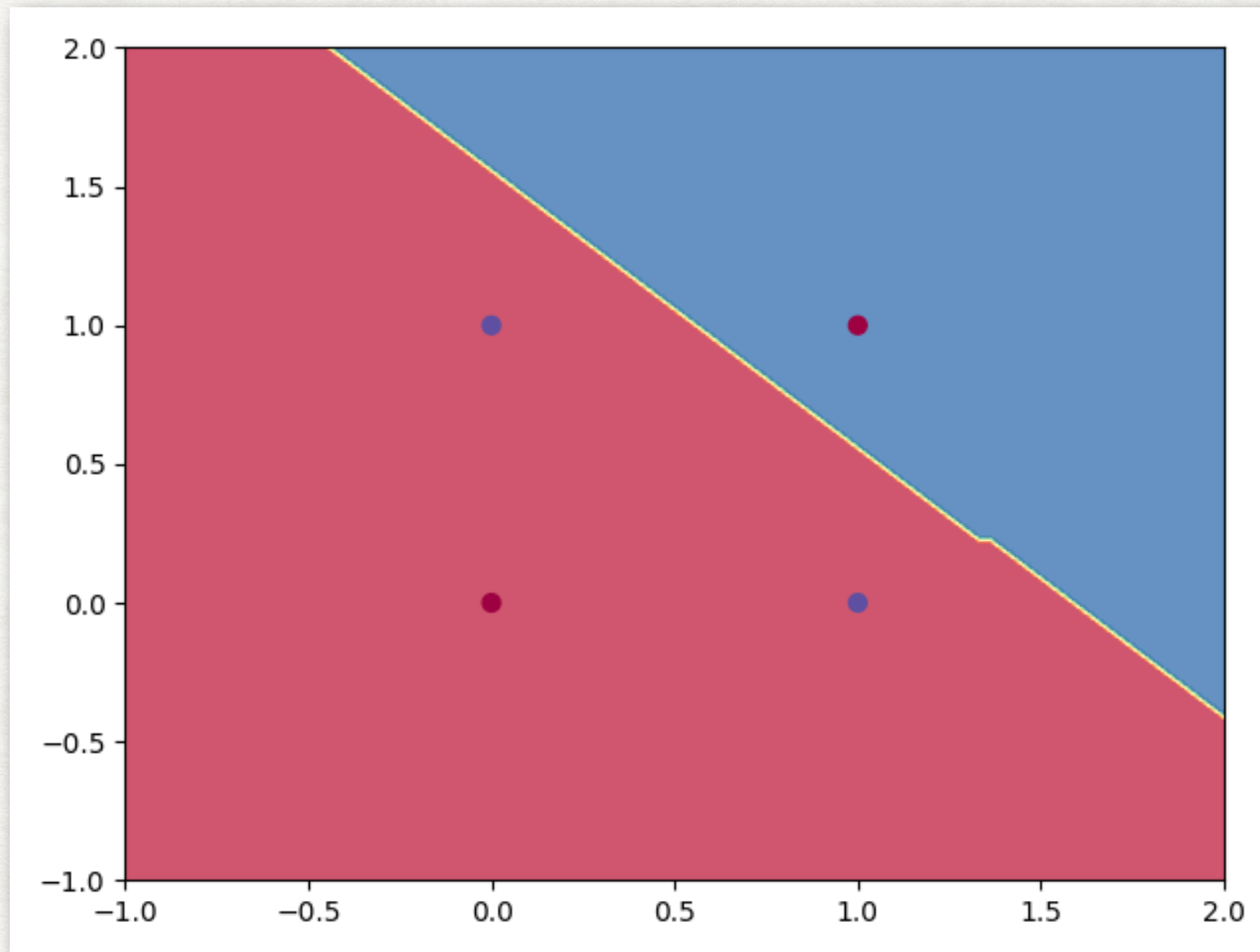
# XOR 함수 학습해보기

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	0

XOR 게이트 진리표



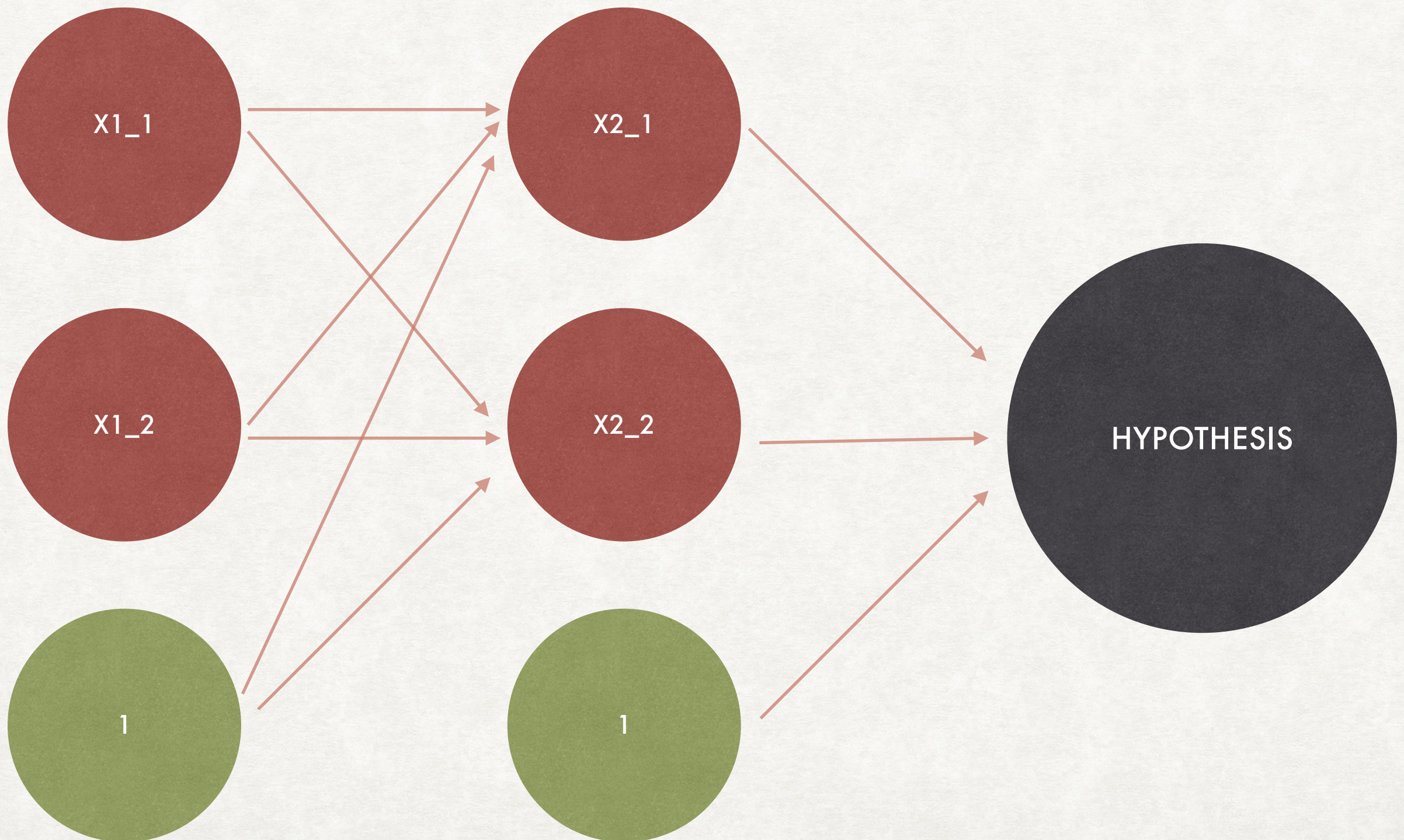
# 단층 퍼셉트론의 한계



**XOR 함수를 100% 학습할 수 없다**



# 완전 연결 신경망(다층 퍼셉트론)





다층 퍼셉트론으로

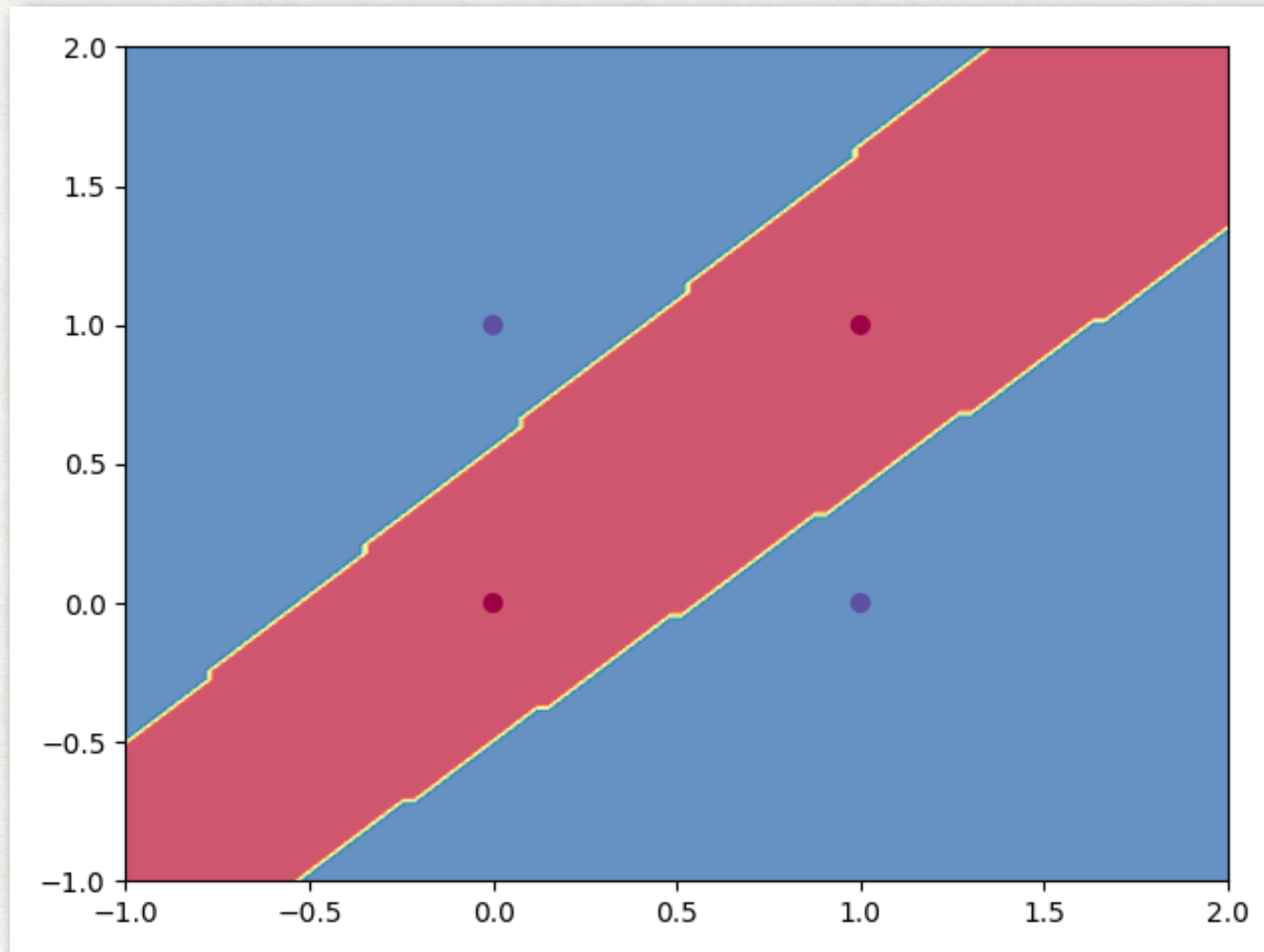
# XOR 함수 학습해보기

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	0

XOR 게이트 진리표



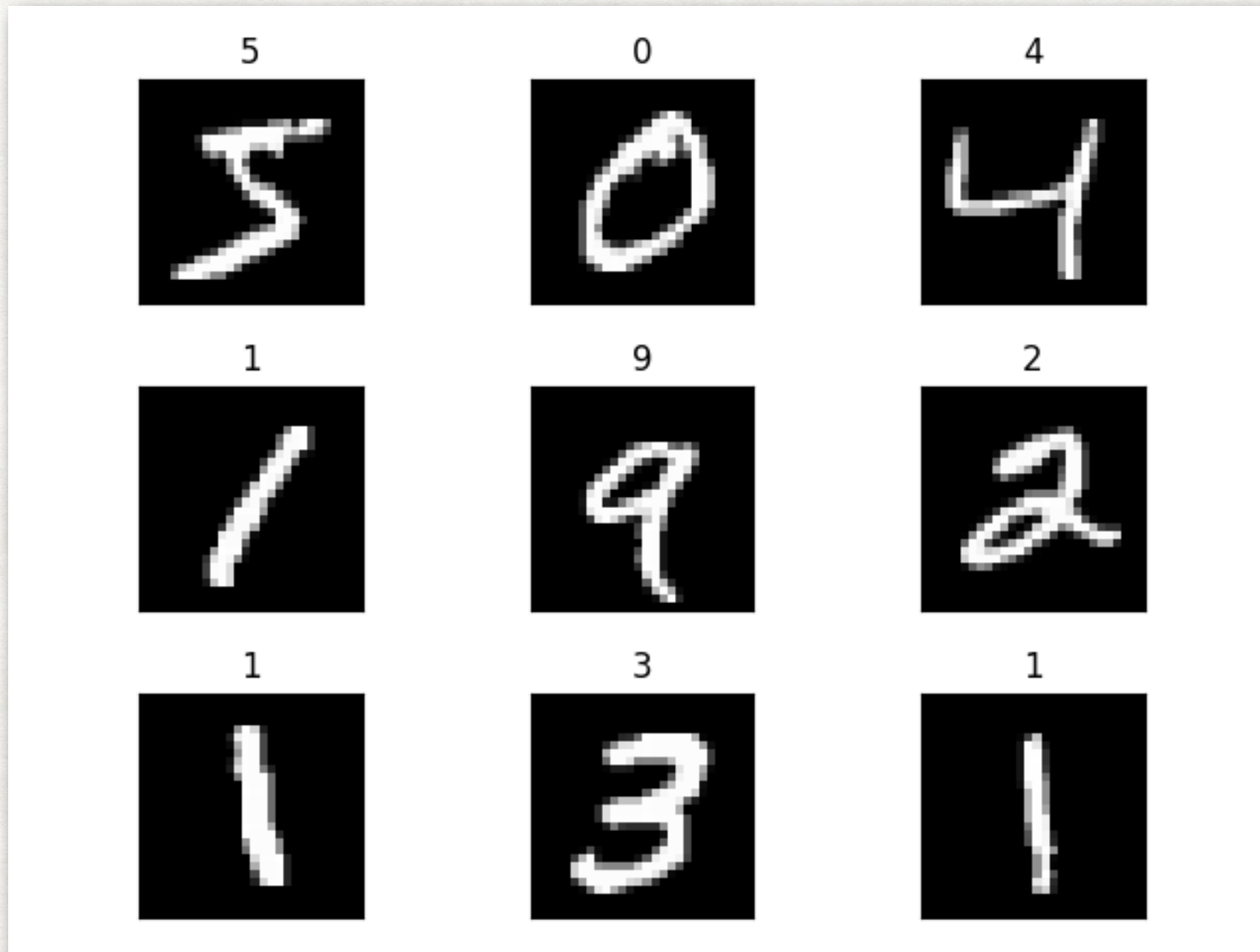
# 다층 퍼셉트론



**퍼셉트론 층을 하나만 늘려도 XOR 함수 학습 가능**



# MNIST

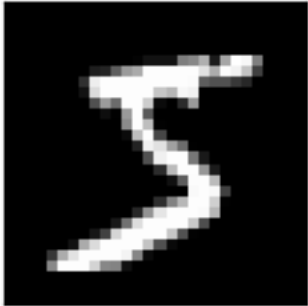
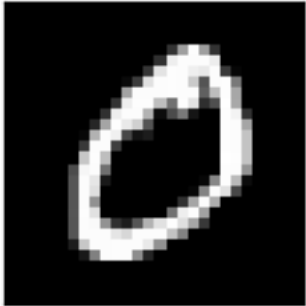
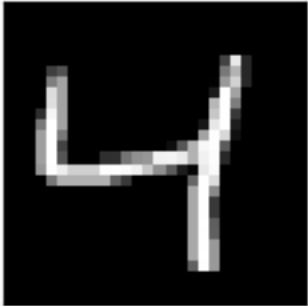
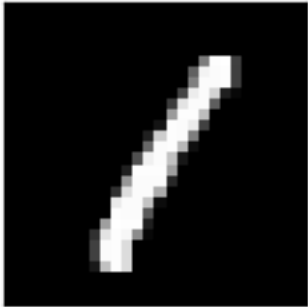


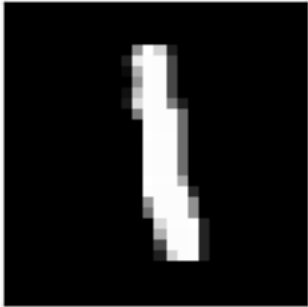

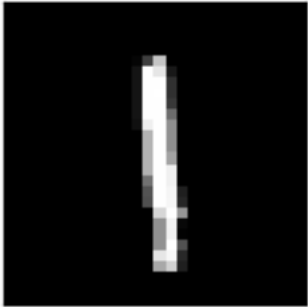


**손으로 쓴 숫자들로 이루어진 대형 데이터베이스  
약 1만개의 훈련 데이터와 2천개의 시험 데이터로 구성**



선형회귀 모델로

# MNIST 학습해보기

5 	0 	4 
1 	9 	2 
1 	3 	1 



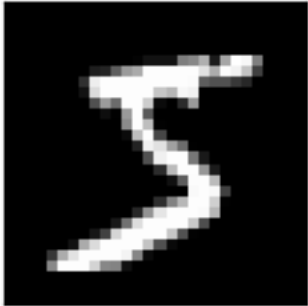
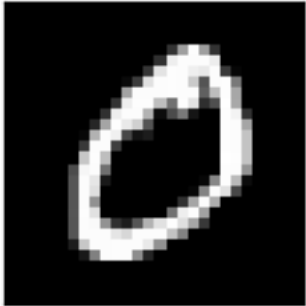
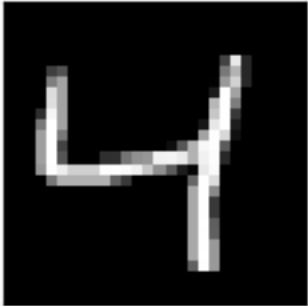
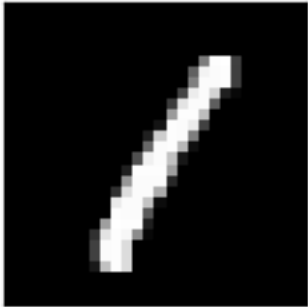


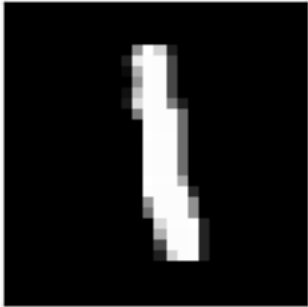

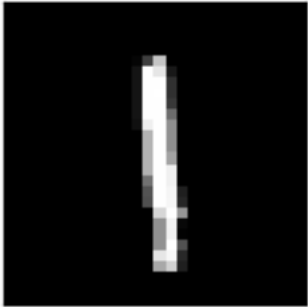
# MNIST 학습해보기

```
step 9100, loss: 0.000000
step 9200, loss: 0.000000
step 9300, loss: 0.000000
step 9400, loss: 0.000000
step 9500, loss: 0.000000
step 9600, loss: 0.000000
step 9700, loss: 0.000000
step 9800, loss: 0.000000
step 9900, loss: 0.000000
[[5.]
 [0.]
 [4.]
 [1.]
 [9.]
 [2.]
 [1.]
 [3.]
 [1.]]
accuracy 100.0%
```



로지스틱 모델로

# MNIST 학습해보기

5 	0 	4 
1 	9 	2 
1 	3 	1 



# MNIST 학습해보기

```
[8.80160660e-05 9.99516129e-01 2.60250545e-06 4.59207649e-06  
1.51171771e-04 1.16676256e-05 2.55140264e-09 9.55861709e-11  
2.13644876e-06 2.23617331e-04]  
[1.91968229e-05 2.88812764e-04 1.20486729e-04 4.73457767e-05  
5.69814656e-05 4.41171505e-05 1.25825795e-06 7.16236386e-08  
7.17135492e-07 9.99421000e-01]  
[3.70552264e-08 6.16918478e-05 9.99556243e-01 1.89154583e-04  
7.21382687e-09 1.90100548e-06 4.68105510e-09 8.27819449e-08  
1.56508939e-08 1.90917955e-04]  
[2.51402071e-06 9.99733865e-01 2.85621216e-08 1.20463206e-04  
2.91812455e-07 1.72611522e-06 1.51531003e-05 5.18832337e-08  
7.55436804e-06 1.18429678e-04]  
[3.62045976e-05 1.84917037e-04 1.72893706e-04 9.99445736e-01  
3.00571713e-07 1.54865978e-04 3.96312372e-10 1.59714673e-07  
3.33090822e-09 4.84401062e-06]  
[4.12890033e-09 9.99907732e-01 9.42164388e-06 5.44514592e-07  
4.72159822e-09 7.97798930e-05 2.57614925e-08 3.11907371e-08  
7.84384824e-08 2.47359390e-06]]  
[5 0 4 1 9 2 1 3 1]  
accuracy 100.0%
```