
딥러닝 올인원

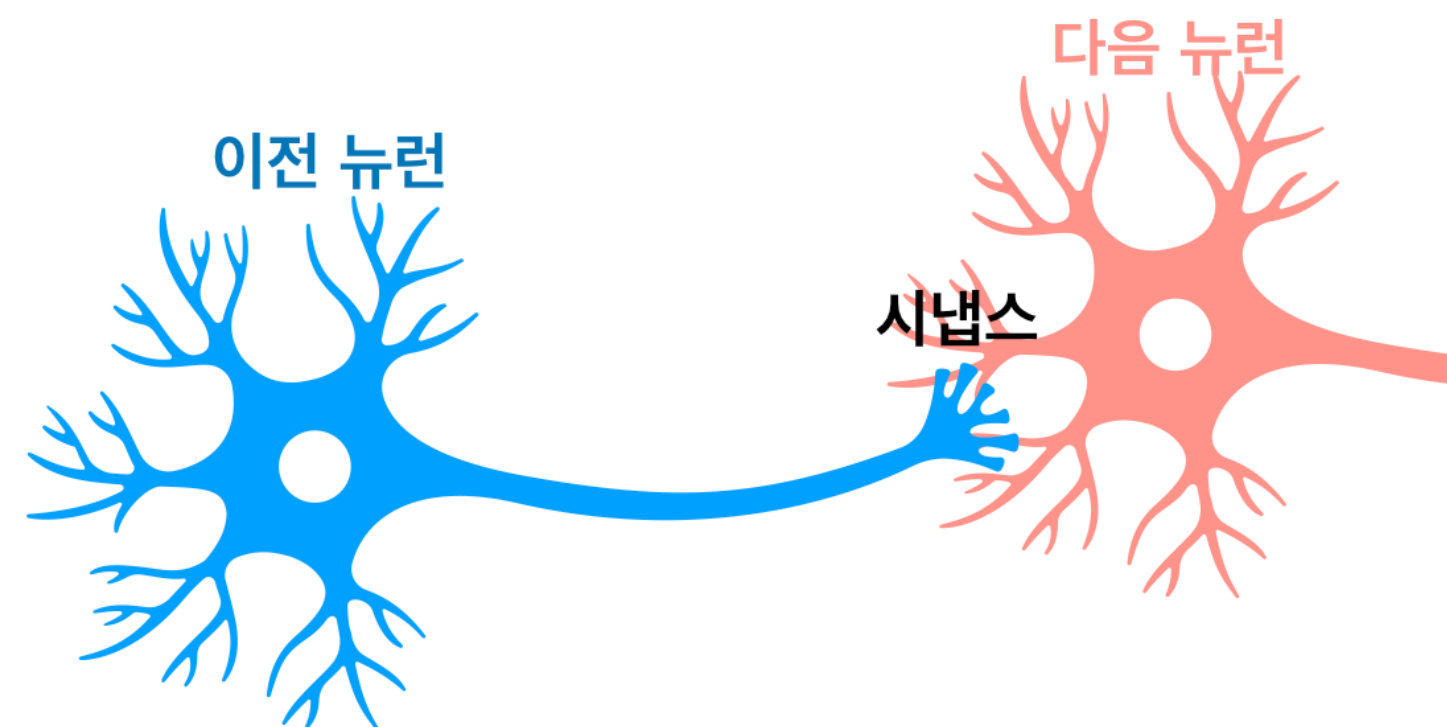
인공 신경망
3강

딥러닝호형

인공 신경망 (Artificial Neural Network)



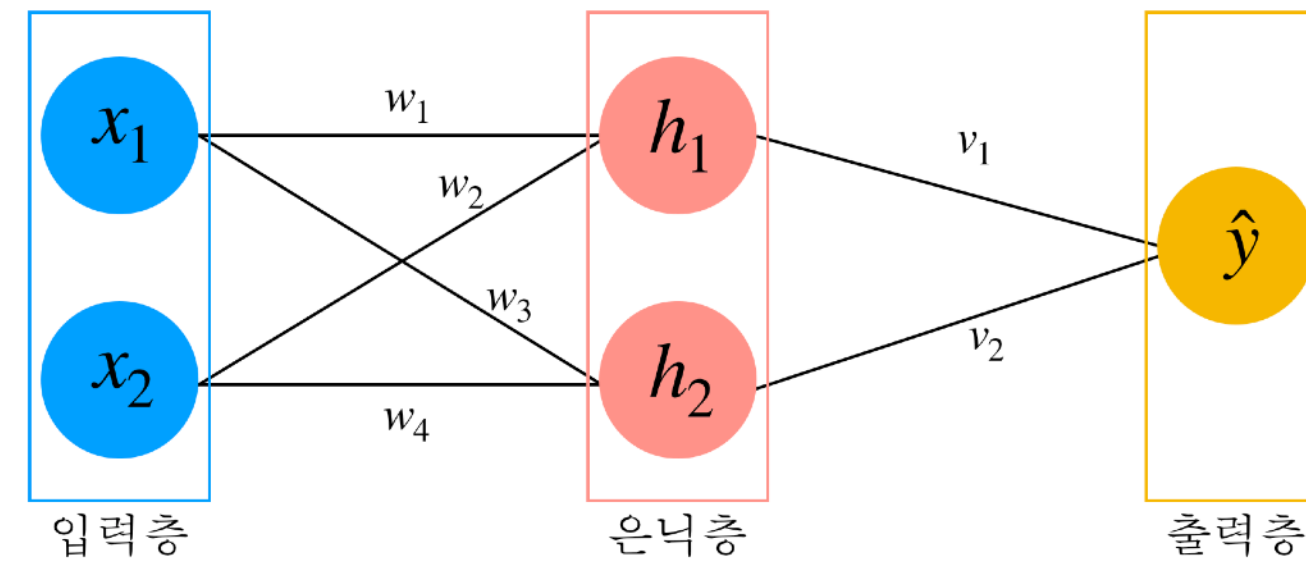
인간의 신경망



인공 신경망(Artificial Neural Network)



인공 신경망



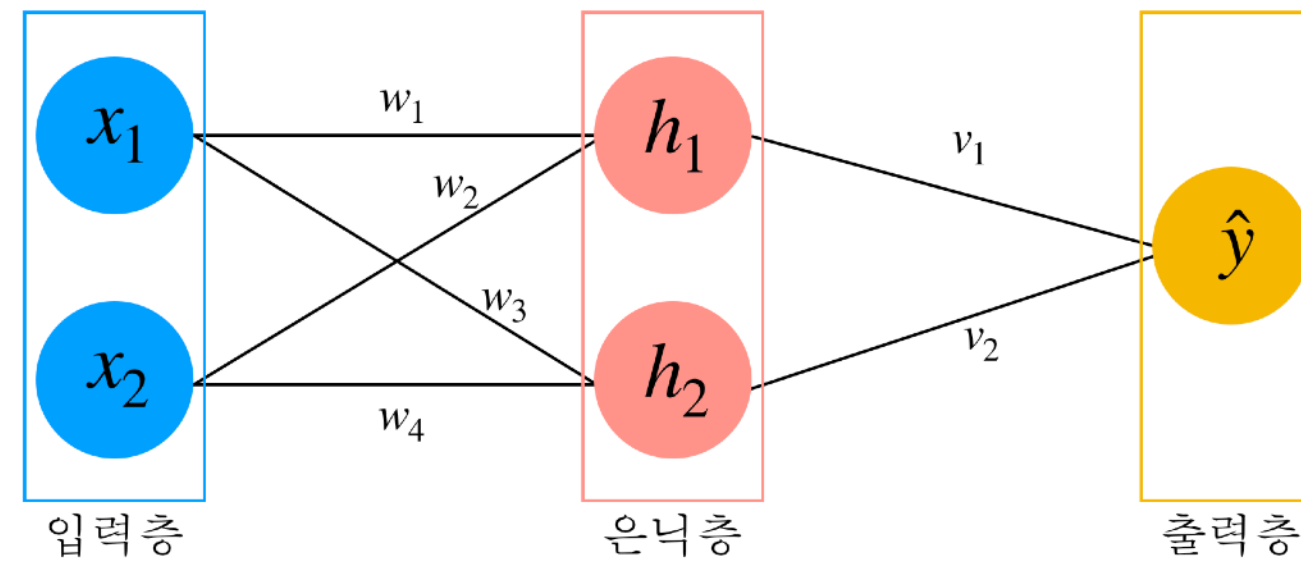
$$h_1 = w_1x_1 + w_2x_2, h_2 = w_3x_1 + w_4x_2$$

$$\hat{y} = v_1h_1 + v_2h_2$$

인공 신경망(Artificial Neural Network)



인공 신경망



$$h_1 = w_1x_1 + w_2x_2 + b_1, h_2 = w_3x_1 + w_4x_2 + b_2$$

$$\hat{y} = v_1h_1 + v_2h_2 + b_3$$

인공 신경망

알아두기 2.1.1 — 행렬의 표현. 행렬(matrix)과 행(row), 열(column) 그리고 성분(element)

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ 와 같이 괄호의 한 묶음을 행렬이라고 하며 $()$ 나 $[]$ 을 사용하여 묶을 수 있다. 이 때

가로는 행이고 세로는 열이라고 한다. 즉, $\begin{pmatrix} a & b \end{pmatrix}$ 는 1행, $\begin{pmatrix} c & d \end{pmatrix}$ 는 2행이라고 하며 $\begin{pmatrix} a \\ c \end{pmatrix}$ 는

1열, $\begin{pmatrix} b \\ d \end{pmatrix}$ 는 2열이라고 한다. 또한 2개의 행, 2개의 열을 가지고 있는 행렬이므로 2×2(2 by 2) 행렬이라고 말하고 행렬 안의 값들을 성분이라고 한다. 예를 들어 a 는 1행 1열 성분이라고

하며 문자로는 a_{11} 이라고 표현한다.

$$A = \begin{matrix} & \begin{matrix} \text{1열} & \text{2열} & \text{3열} & \dots & \dots & \text{m-1열} & \text{m열} \end{matrix} \\ \begin{matrix} \text{행} \\ \left(\begin{matrix} a_{11} & a_{12} & a_{13} & \dots & \dots & a_{1(m-1)} & a_{1m} \\ a_{21} & a_{22} & a_{23} & \dots & \dots & a_{2(m-1)} & a_{2m} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{(n-1)1} & a_{(n-1)2} & a_{(n-1)3} & \dots & \dots & a_{(n-1)(m-1)} & a_{(n-1)m} \\ a_{n1} & a_{n2} & a_{n3} & \dots & \dots & a_{n(m-1)} & a_{nm} \end{matrix} \right) \end{matrix} & \begin{matrix} \text{1행} \\ \text{2행} \\ \vdots \\ \vdots \\ \vdots \\ \text{n-1행} \\ \text{n행} \end{matrix} \end{matrix}$$

↓ 열

인공 신경망

알아두기 2.1.2 — 행렬의 덧셈과 곱셈. 다음 2×2 행렬 A, B 가 주어졌다고 가정하자.

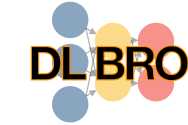
$$A + B = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} + \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \begin{pmatrix} a_{11} + b_{11} & a_{12} + b_{12} \\ a_{21} + b_{21} & a_{22} + b_{22} \end{pmatrix}$$

$$AB = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \begin{pmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} \end{pmatrix}$$

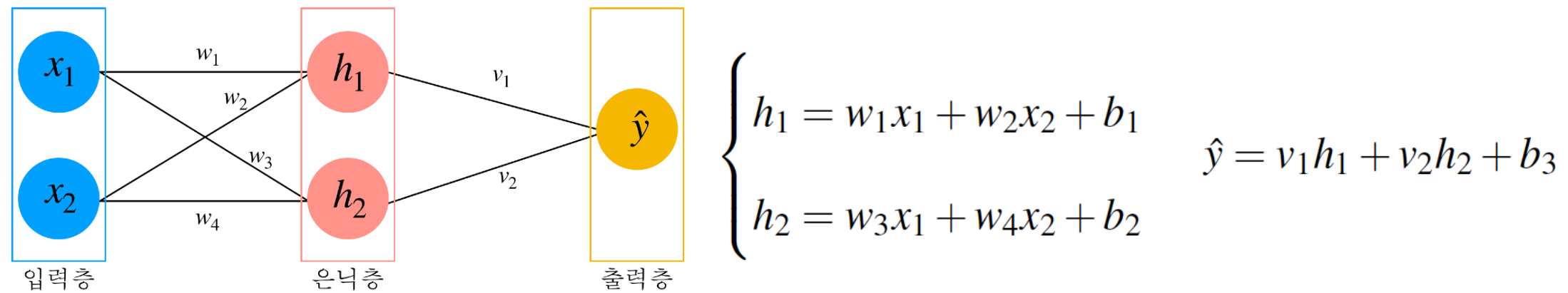
알아두기 2.1.3 — 연립 일차방정식과 행렬식. 다음 연립방정식과 행렬식은 같은 의미다.

$$\begin{cases} ax + by = e \\ cx + dy = f \end{cases} \iff \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} e \\ f \end{pmatrix}$$

인공 신경망 (Artificial Neural Network)



인공 신경망



입력층에서 은닉층으로 가는 계산

$$\begin{pmatrix} h_1 \\ h_2 \end{pmatrix} = \begin{pmatrix} w_1 & w_2 \\ w_3 & w_4 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} b_1 \\ b_2 \end{pmatrix}$$

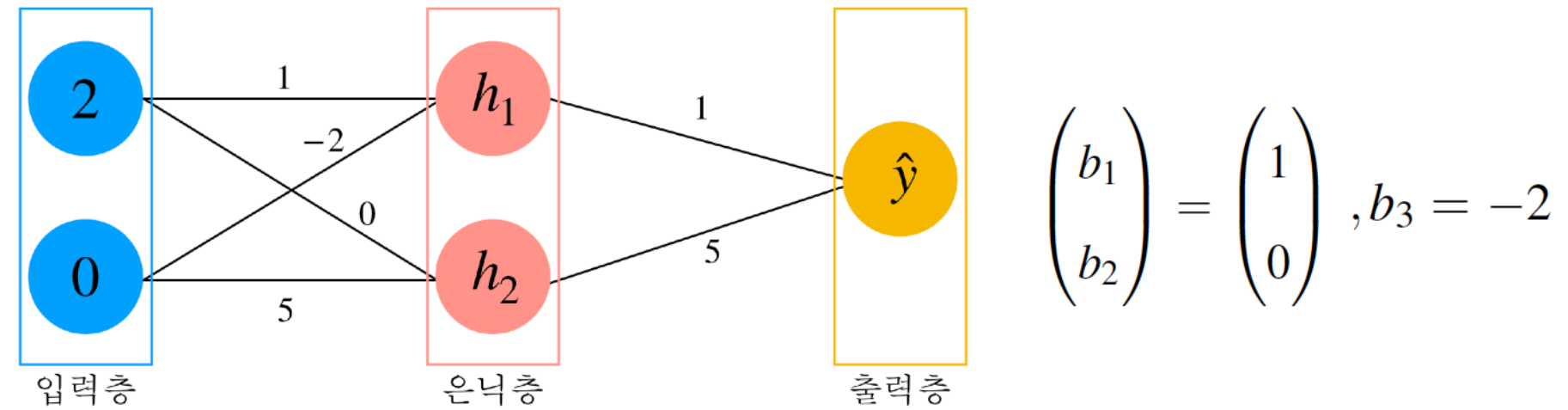
은닉층에서 출력층으로 가는 계산

$$\hat{y} = \begin{pmatrix} v_1 & v_2 \end{pmatrix} \begin{pmatrix} h_1 \\ h_2 \end{pmatrix} + b_3$$

인공 신경망(Artificial Neural Network)



예시

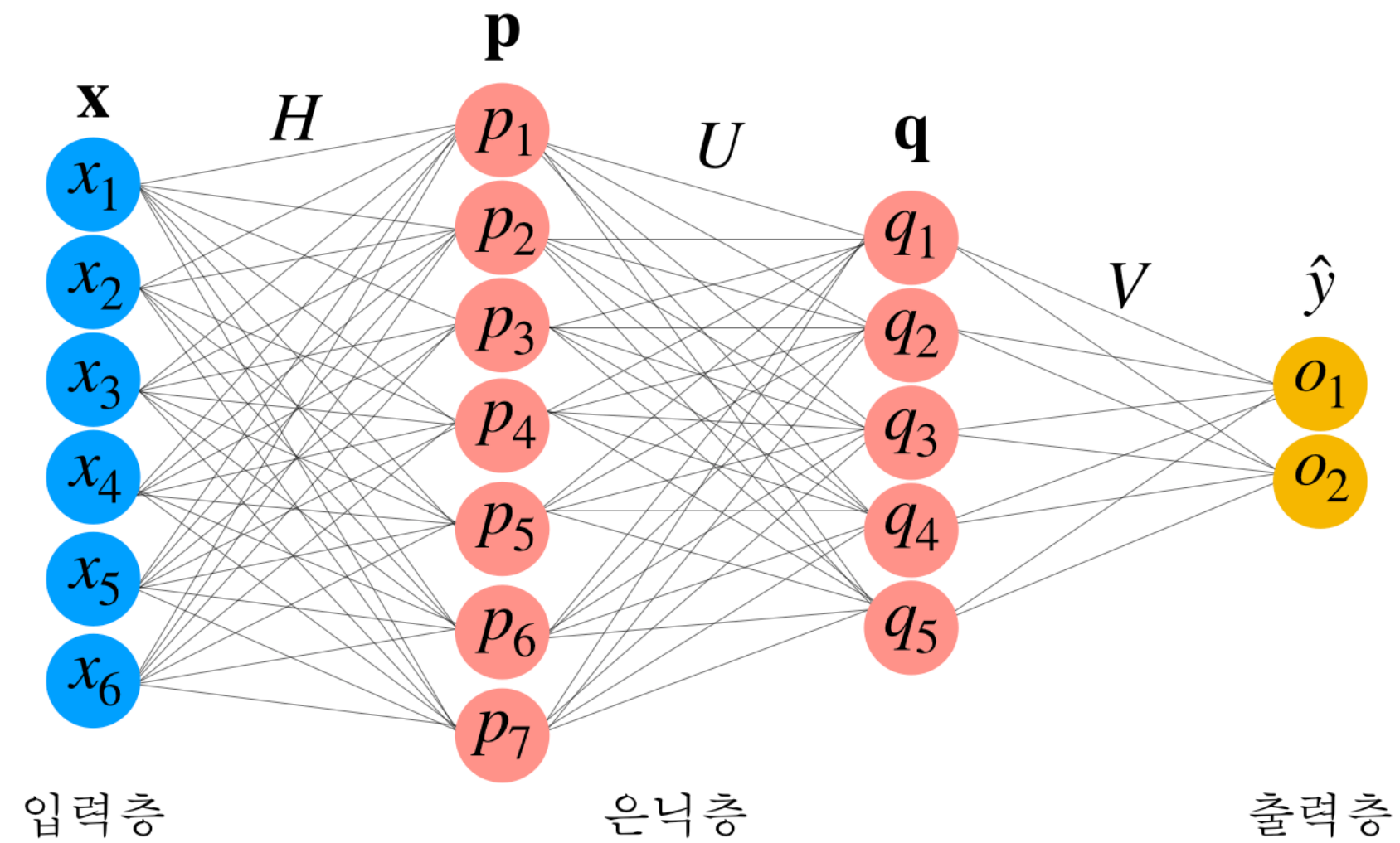


$$\begin{pmatrix} h_1 \\ h_2 \end{pmatrix} = \begin{pmatrix} 1 & -2 \\ 0 & 5 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \end{pmatrix} + \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \cdot 2 + (-2) \cdot 0 + 1 \\ 0 \cdot 2 + 5 \cdot 0 + 0 \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$$
$$\hat{y} = \begin{pmatrix} 1 & 5 \end{pmatrix} \begin{pmatrix} 3 \\ 0 \end{pmatrix} - 2 = 1 \cdot 3 + 5 \cdot 0 - 2 = 1$$

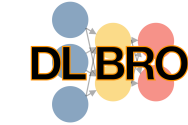
인공 신경망 (Artificial Neural Network)



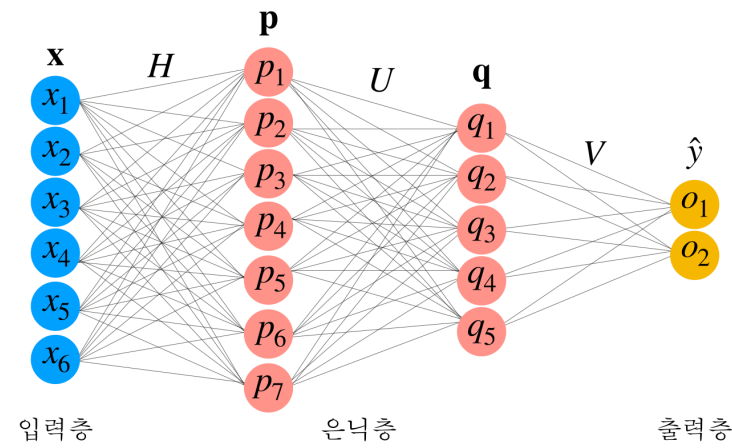
예시



인공 신경망(Artificial Neural Network)



예시



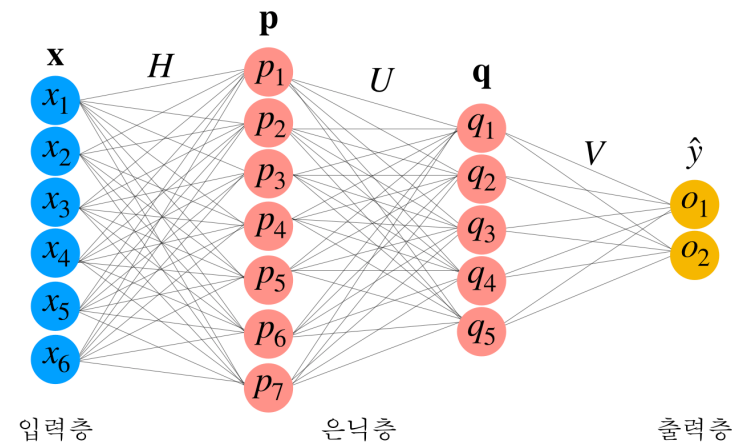
$$\mathbf{p} = H\mathbf{x} + \mathbf{a} \iff$$

$$\begin{pmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \\ p_6 \\ p_7 \end{pmatrix} = \begin{pmatrix} h_{11} & h_{12} & h_{13} & h_{14} & h_{15} & h_{16} \\ h_{21} & h_{22} & h_{23} & h_{24} & h_{25} & h_{26} \\ h_{31} & h_{32} & h_{33} & h_{34} & h_{35} & h_{36} \\ h_{41} & h_{42} & h_{43} & h_{44} & h_{45} & h_{46} \\ h_{51} & h_{52} & h_{53} & h_{54} & h_{55} & h_{56} \\ h_{61} & h_{62} & h_{63} & h_{64} & h_{65} & h_{66} \\ h_{71} & h_{72} & h_{73} & h_{74} & h_{75} & h_{76} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{pmatrix} + \begin{pmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \\ a_7 \end{pmatrix}$$

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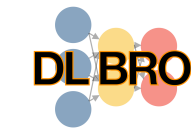


예시

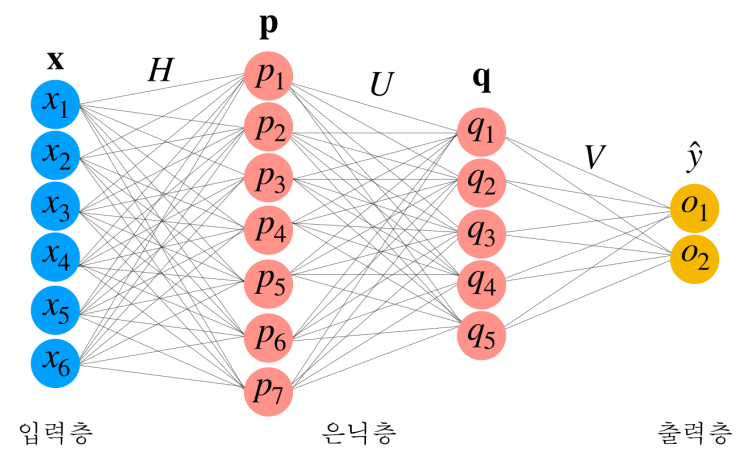


$$\mathbf{q} = U\mathbf{p} + \mathbf{b} \iff \begin{pmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \\ q_5 \end{pmatrix} = \begin{pmatrix} u_{11} & u_{12} & u_{13} & u_{14} & u_{15} & u_{16} & u_{17} \\ u_{21} & u_{22} & u_{23} & u_{24} & u_{25} & u_{26} & u_{27} \\ u_{31} & u_{32} & u_{33} & u_{34} & u_{35} & u_{36} & u_{37} \\ u_{41} & u_{42} & u_{43} & u_{44} & u_{45} & u_{46} & u_{47} \\ u_{51} & u_{52} & u_{53} & u_{54} & u_{55} & u_{56} & u_{57} \end{pmatrix} \begin{pmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \\ p_6 \\ p_7 \end{pmatrix} + \begin{pmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \end{pmatrix}$$

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예시



$$\hat{y} = V\mathbf{q} + \mathbf{c} \iff \begin{pmatrix} o_1 \\ o_2 \end{pmatrix} = \begin{pmatrix} v_{11} & v_{12} & v_{13} & v_{14} & v_{15} \\ v_{21} & v_{22} & v_{23} & v_{24} & v_{25} \end{pmatrix} \begin{pmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \\ q_5 \end{pmatrix} + \begin{pmatrix} c_1 \\ c_2 \end{pmatrix}$$