뉴런의 모습과 데이터가 상상이 될까

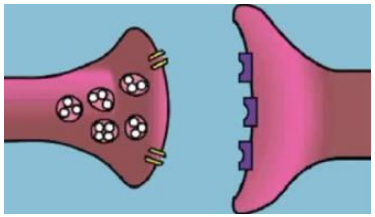
x_1, x_2, x_2, x_2 $\quad w \quad$ h $\quad y$

$$\begin{pmatrix} 1,1,1,1 \\ 2,2,2,2 \\ 3,3,3,3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 1 \\ 3 \end{pmatrix} \rightarrow \begin{pmatrix} 7 \\ 14 \\ 21 \end{pmatrix} \quad \begin{pmatrix} 4 \\ 8 \\ 12 \end{pmatrix}$$

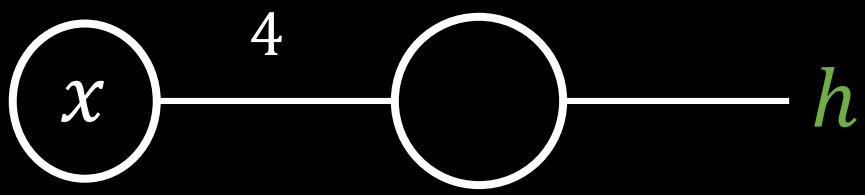
(Q) Draw a neuron

Representing the following equation:

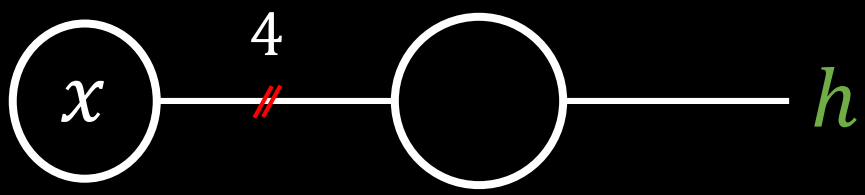
$$h = 4x$$

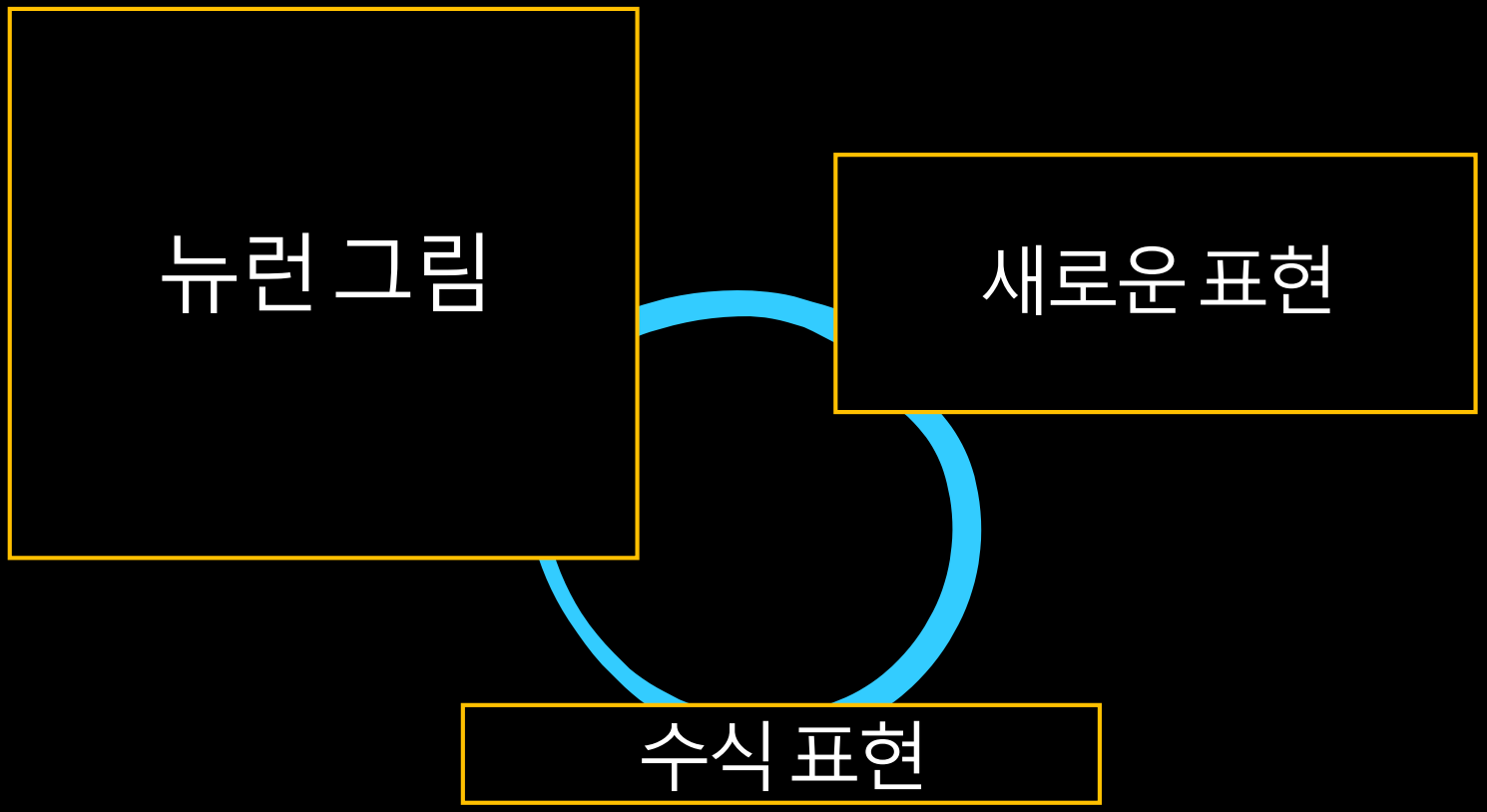


연결(시냅스)은 어디에 있을까?

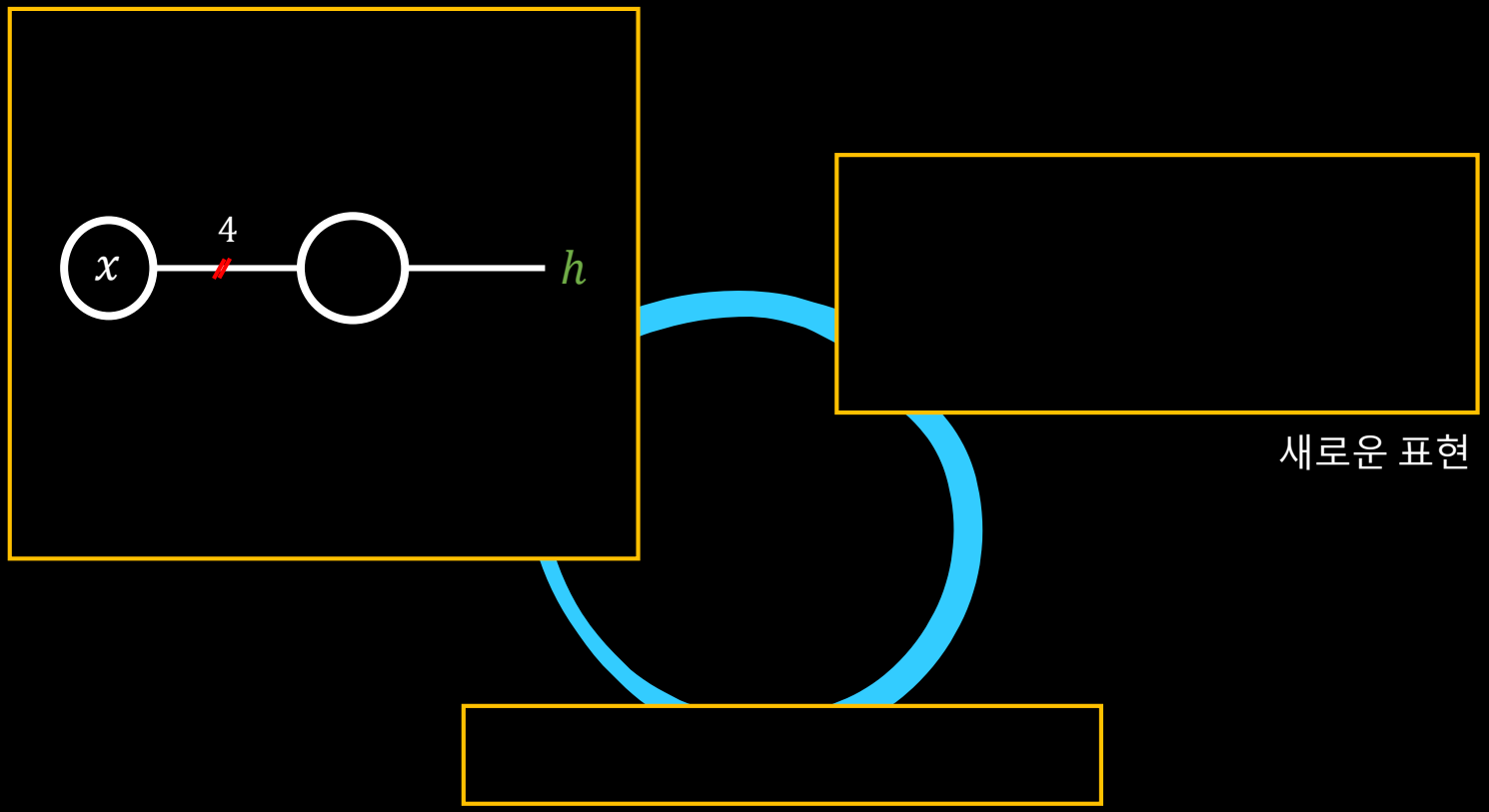


연결(시냅스)은 어디에 있을까?

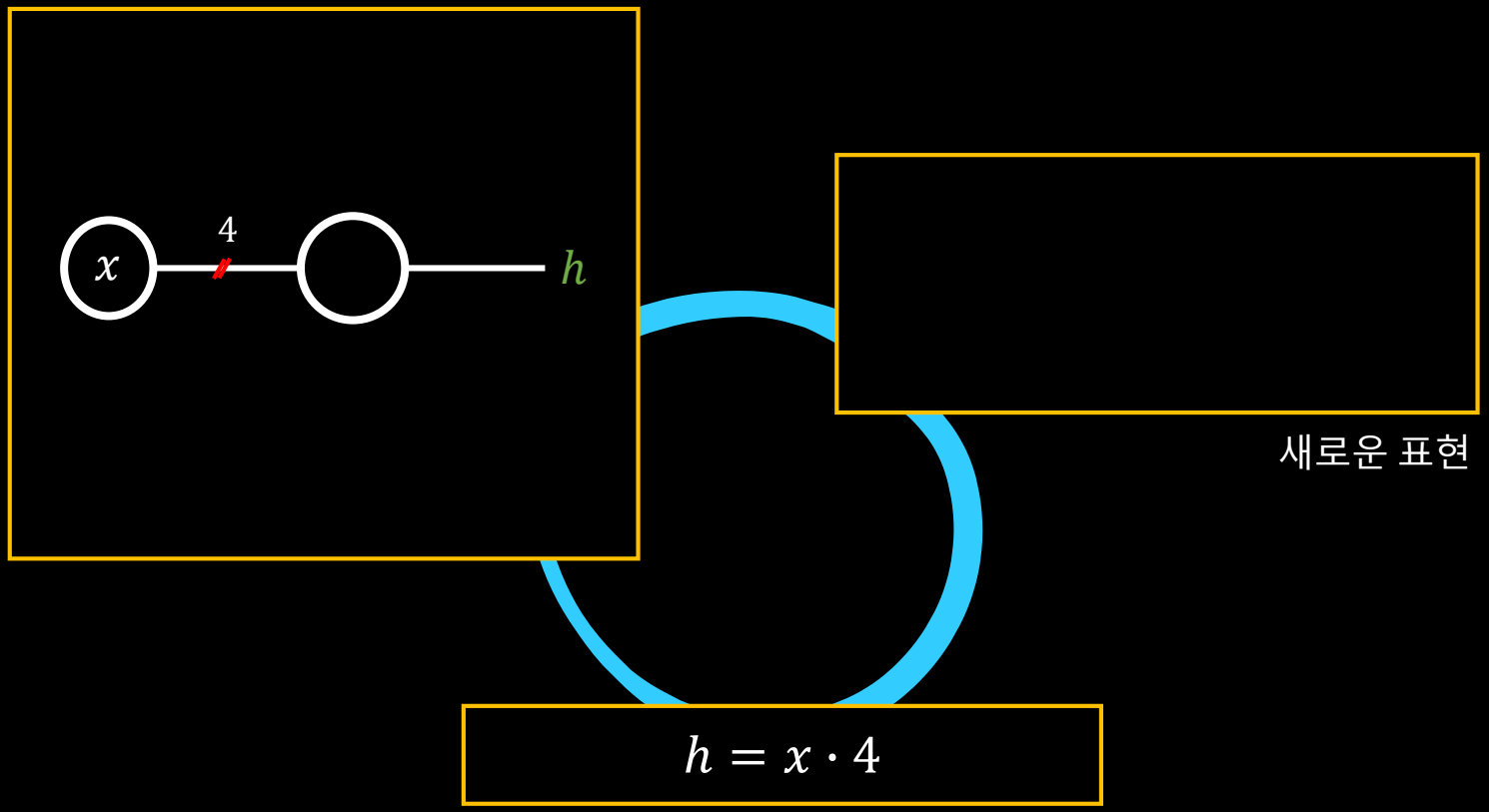

4
x
h


뉴런 그림
새로운 표현
수식 표현

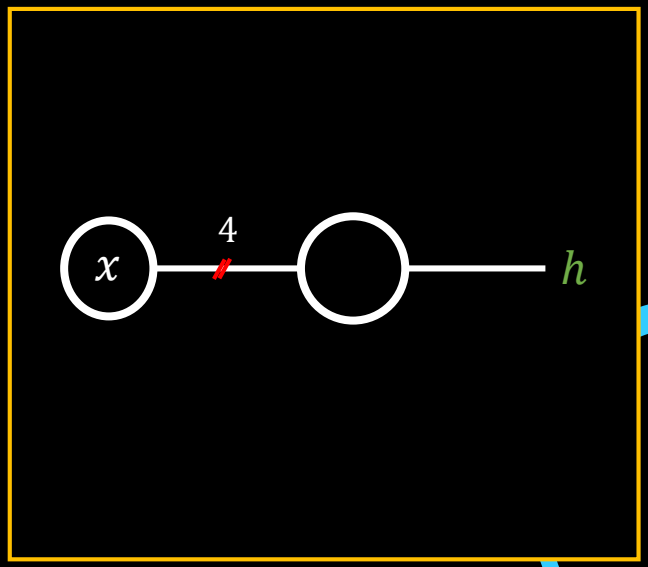
뉴런 그림



뉴런 그림



뉴런 그림



w h y

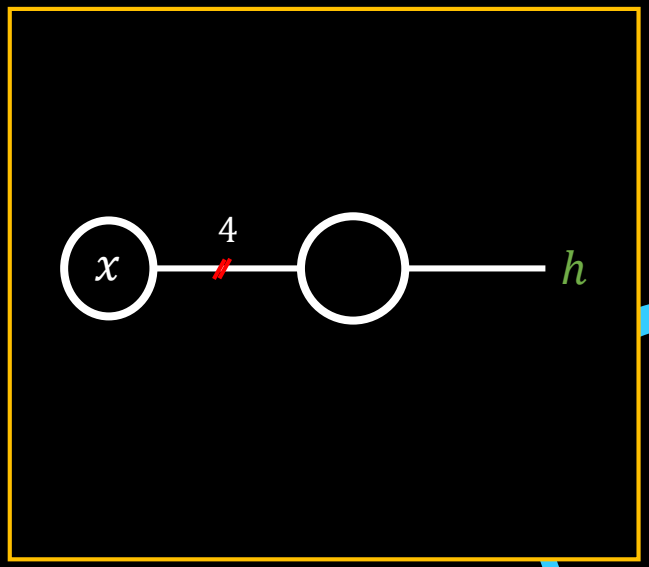
$(x)(4) \longrightarrow (1 \cdot 4)$

새로운 표현

$h = x \cdot 4$

수식 표현

뉴런 그림



데이터#1 : (1,1)

x w h y

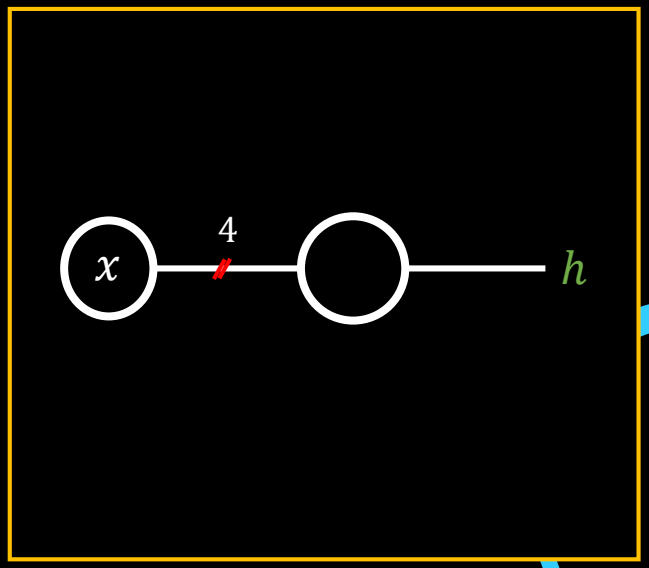
$(1)(4) \rightarrow (1 \cdot 4) \quad (1)$

새로운 표현

$h = x \cdot 4$

수식 표현

뉴런 그림



데이터#2 : (2,2)

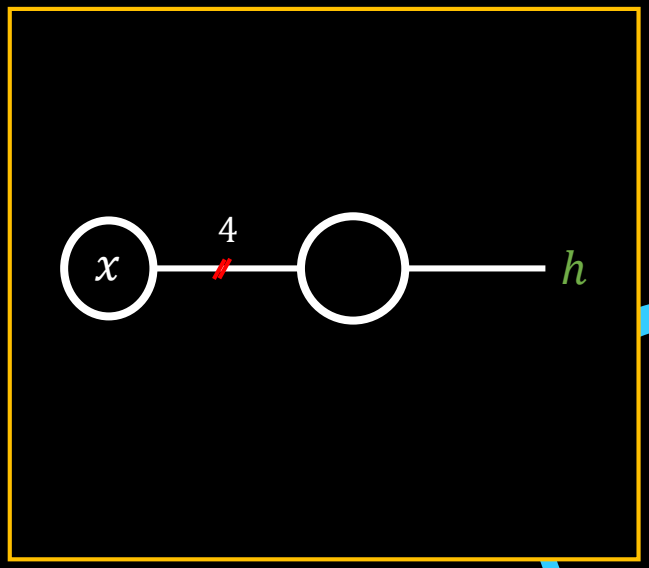
x	w		h	y
(1)	(4)	$\longrightarrow$	$(1 \cdot 4)$	(1)
(2)	(4)	$\longrightarrow$	$(2 \cdot 4)$	(2)

새로운 표현

$$h = x \cdot 4$$

수식 표현

뉴런 그림



데이터#2 : (2,2)

$x \quad w \qquad\qquad h \qquad y$

$$\begin{pmatrix}1\\2\end{pmatrix}(4) \rightarrow \begin{pmatrix}1\cdot 4\\2\cdot 4\end{pmatrix} \quad \begin{pmatrix}1\\2\end{pmatrix}$$

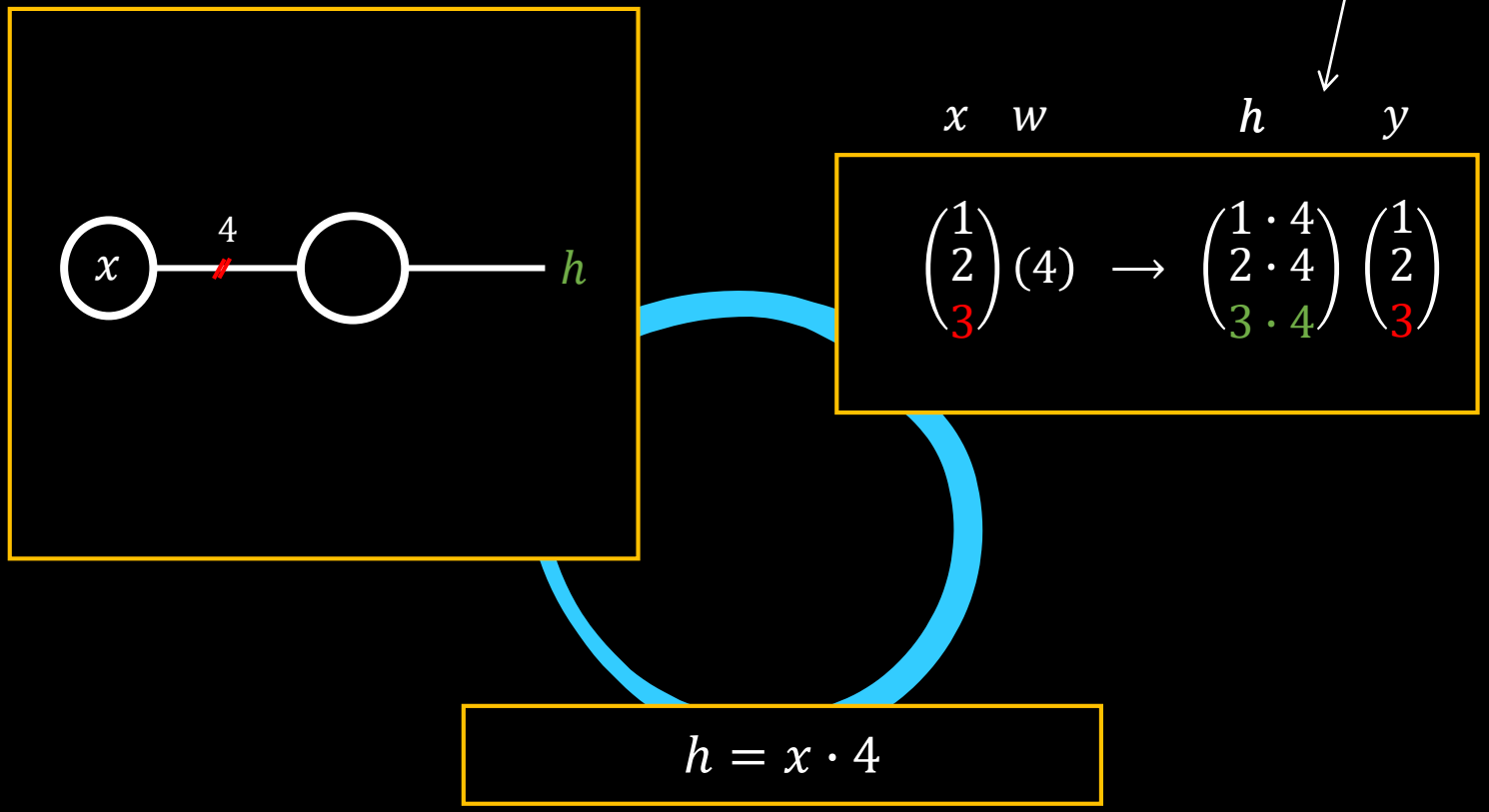
새로운 표현

$$h = x \cdot 4$$

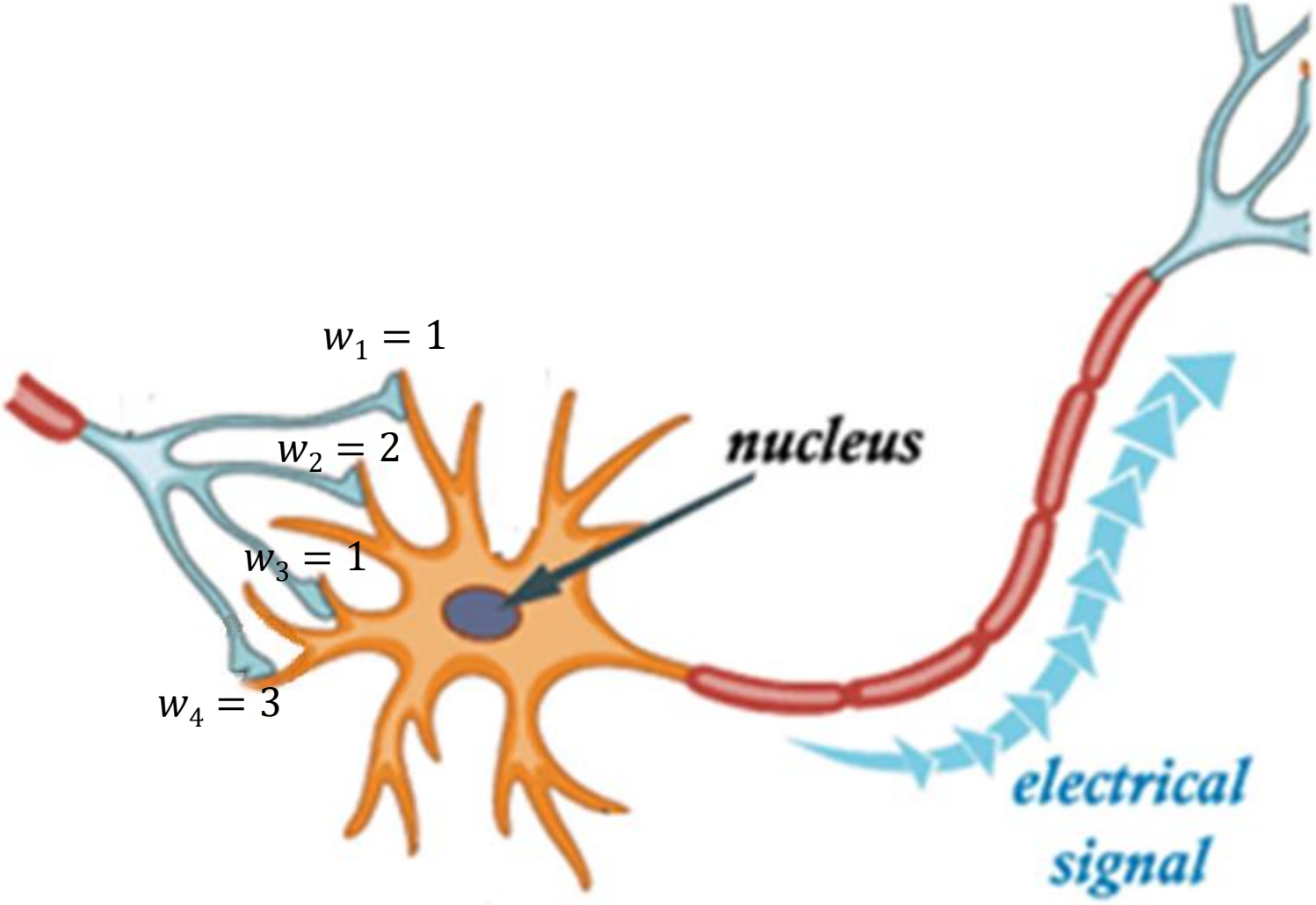
수식 표현

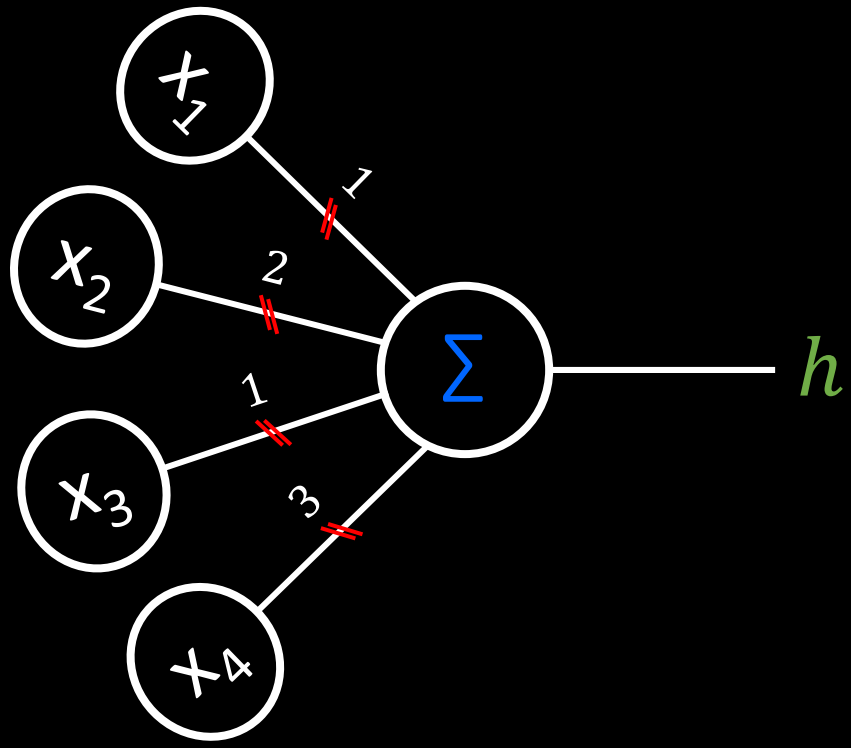
데이터가 늘면 어떻게 표현?

데이터#2 : (3,3)



여러 입력을 갖는 뉴런



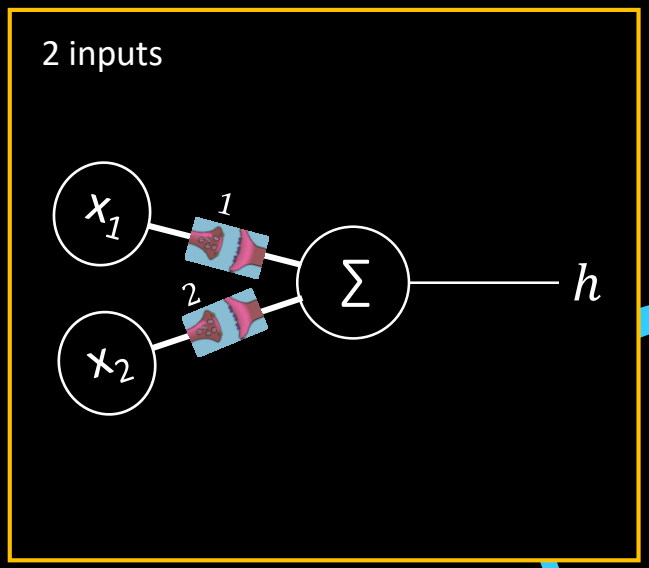


데이터 (x_1, x_2, x_3, x_4, y)가 $(1,1,1,1,4)$이면

$$h = x_1 \cdot 1 + x_2 \cdot 2 + x_3 \cdot 1 + x_4 \cdot 3$$

입력의 수만큼 연결이 존재
(Synapses, Weights)

뉴런 그림



h

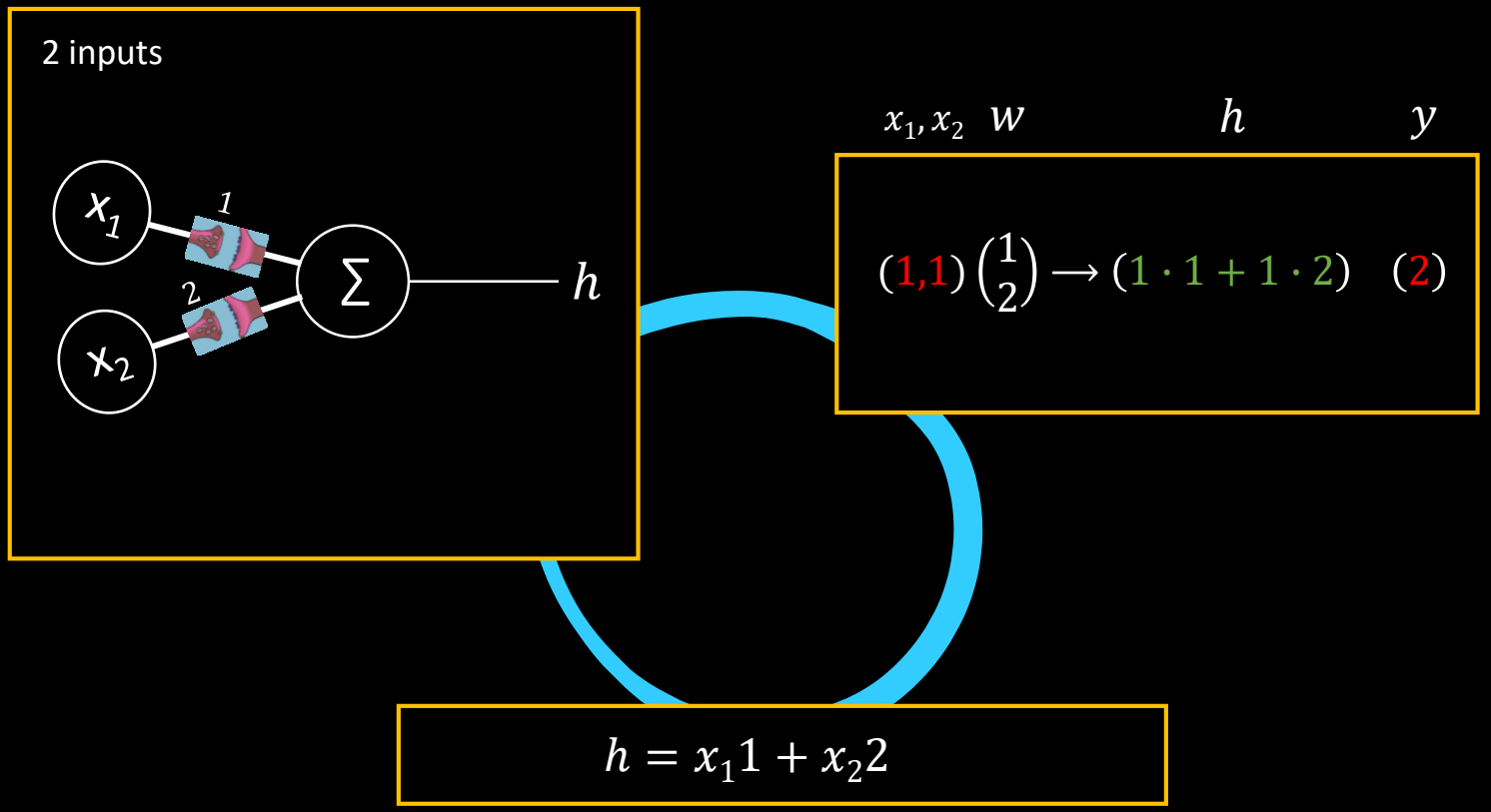
$$(x_1, x_2)\begin{pmatrix}1\\2\end{pmatrix} \rightarrow (x_1 \cdot 1 + x_2 \cdot 2)$$

새로운 표현

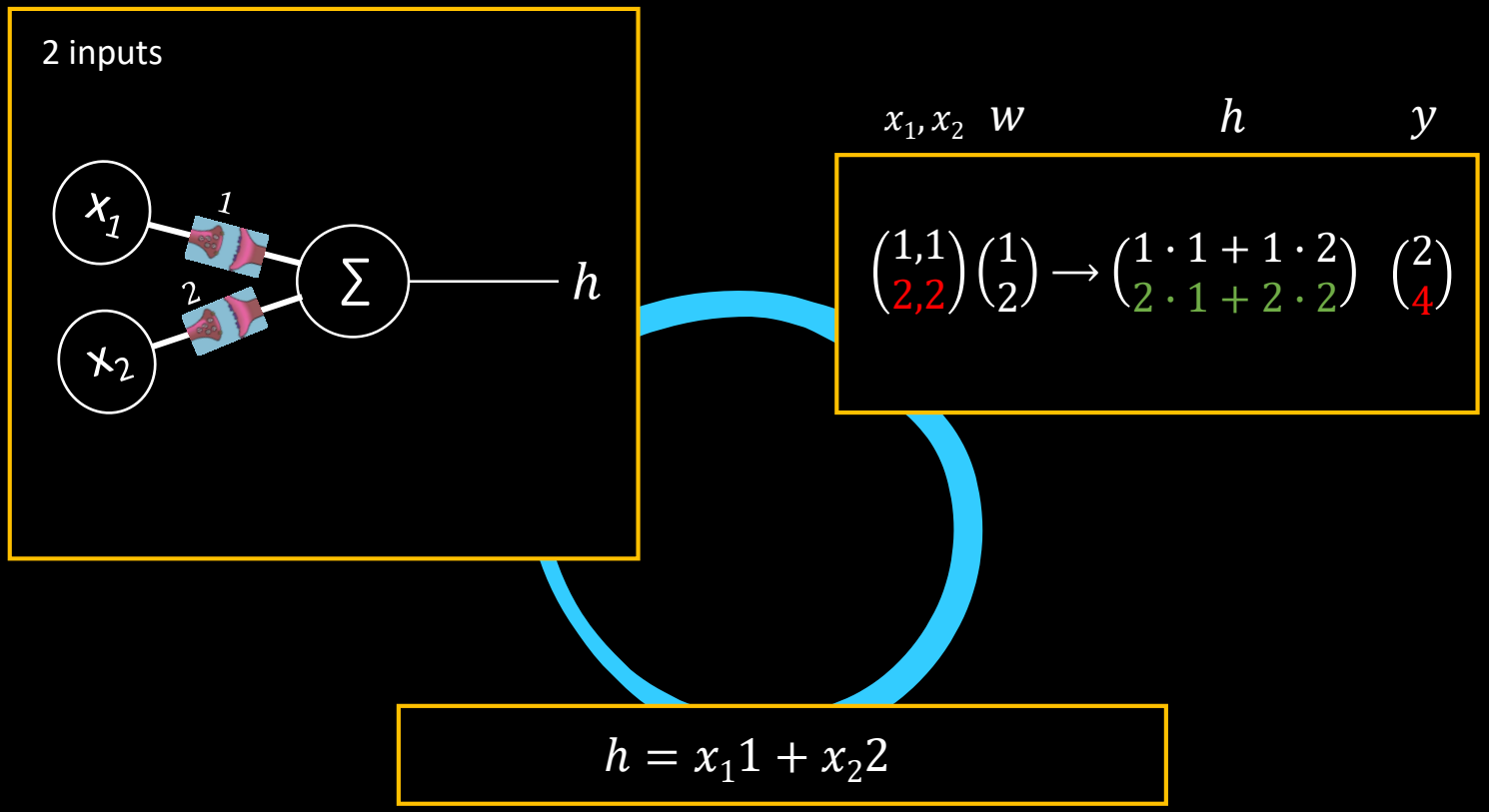
$$h = x_1 \cdot 1 + x_2 \cdot 2$$

수식 표현

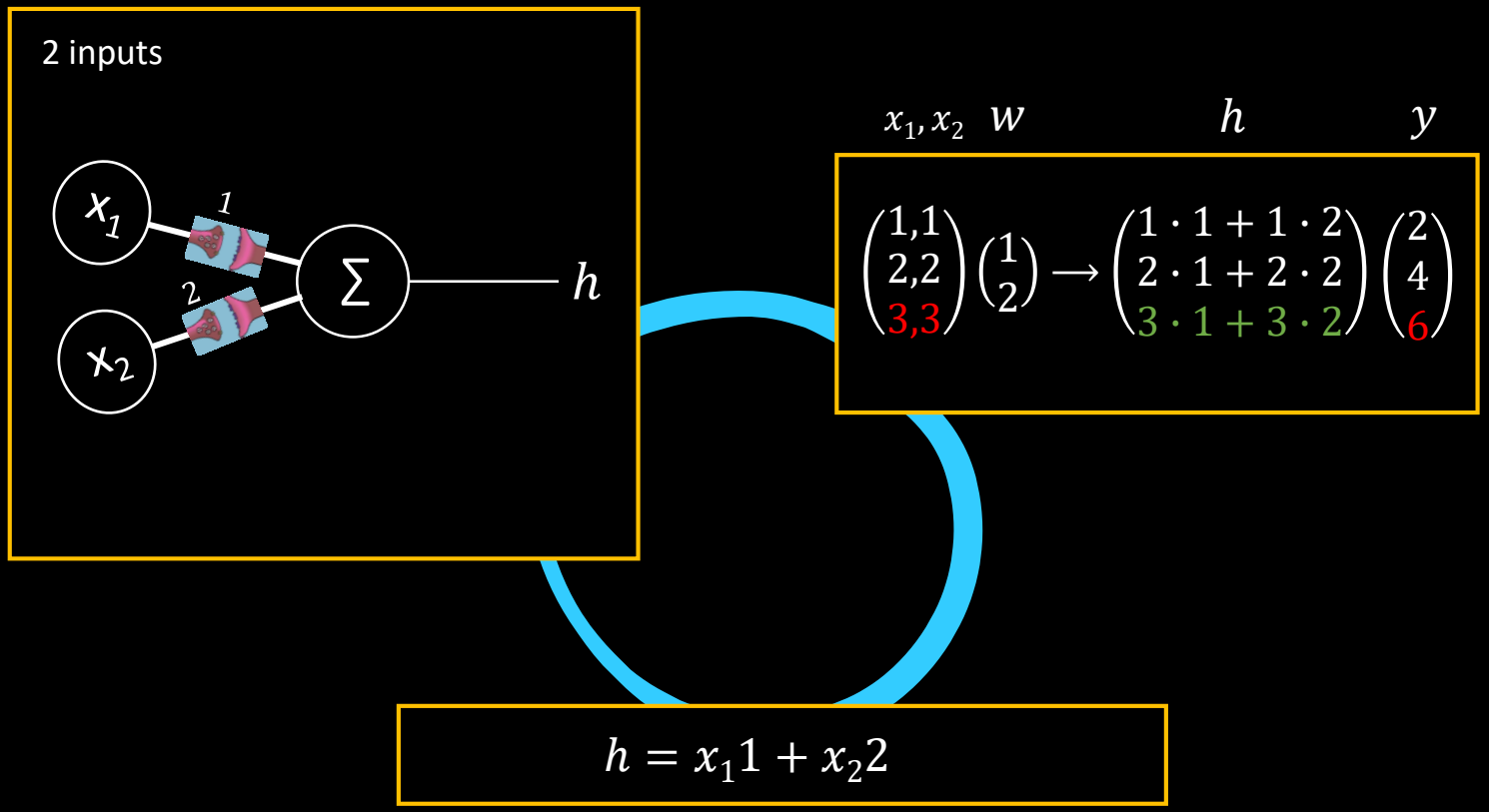
데이터#1 : (1,1,2)


2 inputs
x_1
x_2
1
2
Σ
h
x_1, x_2 w h y
$(1,1)\begin{pmatrix}1\\2\end{pmatrix} \rightarrow (1\cdot 1 + 1\cdot 2)$ (2)
$h = x_1 1 + x_2 2$

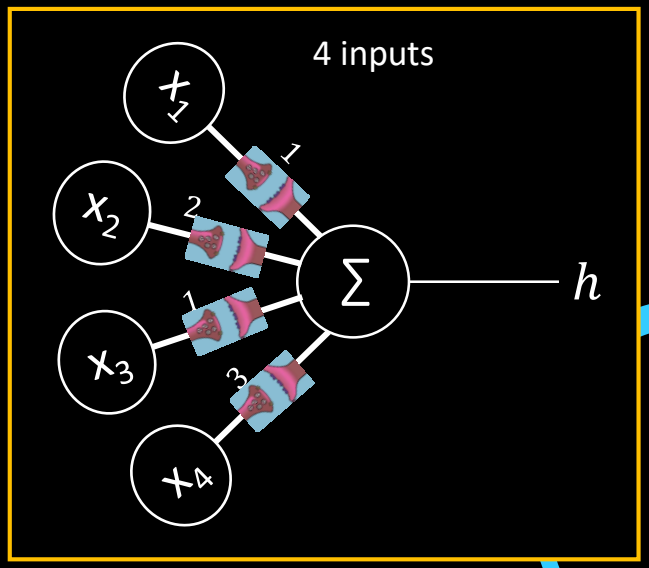
데이터#2 : (2,2,4)


2 inputs
x_1
x_2
1
2
Σ
h
x_1, x_2 w h y
$\begin{pmatrix}1,1\\2,2\end{pmatrix}\begin{pmatrix}1\\2\end{pmatrix} \rightarrow \begin{pmatrix}1\cdot 1+1\cdot 2\\2\cdot 1+2\cdot 2\end{pmatrix}\begin{pmatrix}2\\4\end{pmatrix}$
$h = x_1 1 + x_2 2$

데이터#3 : (3,3,6)


2 inputs
x_1
x_2
1
2
Σ
h
x_1, x_2 w h y
$\begin{pmatrix}1,1\\2,2\\3,3\end{pmatrix}\begin{pmatrix}1\\2\end{pmatrix} \rightarrow \begin{pmatrix}1\cdot 1+1\cdot 2\\2\cdot 1+2\cdot 2\\3\cdot 1+3\cdot 2\end{pmatrix}\begin{pmatrix}2\\4\\6\end{pmatrix}$
$h = x_1 1 + x_2 2$

뉴런 그림



데이터#1 : (1,1,1,1,4)

x_1, x_2, x_2, x_2 w h y

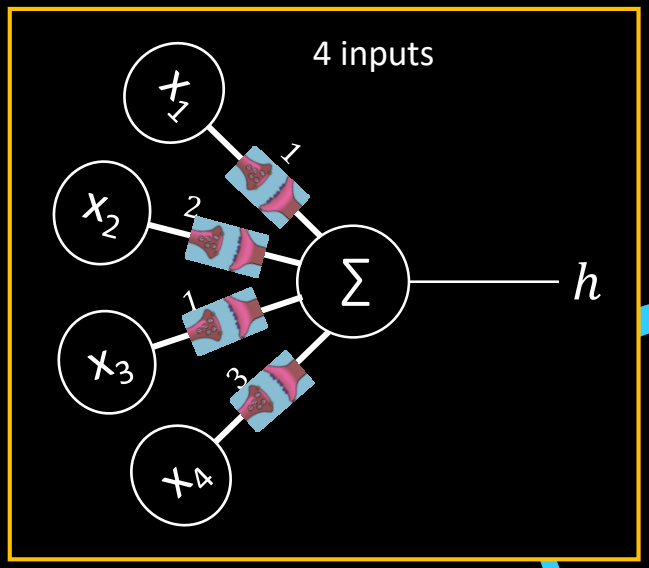
$$(1,1,1,1)\begin{pmatrix}1\\2\\1\\3\end{pmatrix} \rightarrow (7) \quad (4)$$

새로운 표현

$$h = 1 \cdot x_1 + 2 \cdot x_2 + 1 \cdot x_3 + 3 \cdot x_4$$

수식 표현

뉴런 그림



데이터#2 : (2,2,2,2,8)

x_1, x_2, x_2, x_2 w h y

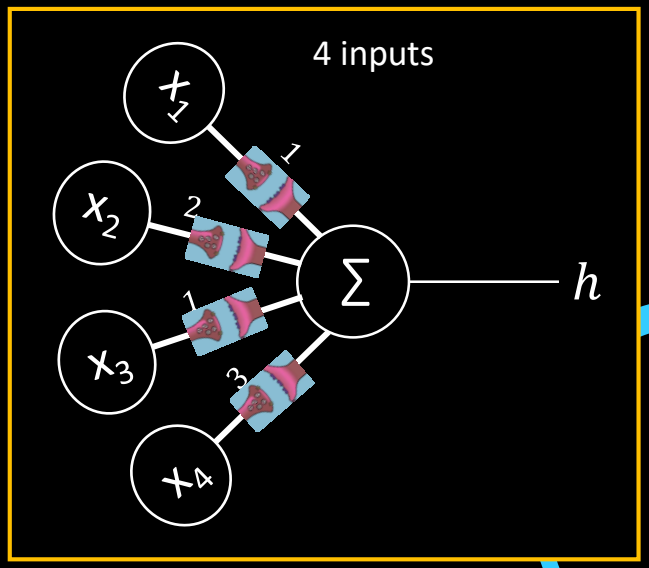
$$\begin{pmatrix}1,1,1,1\\2,2,2,2\end{pmatrix}\begin{pmatrix}1\\2\\1\\3\end{pmatrix} \rightarrow \begin{pmatrix}7\\14\end{pmatrix} \quad \begin{pmatrix}4\\8\end{pmatrix}$$

새로운 표현

$$h = 1 \cdot x_1 + 2 \cdot x_2 + 1 \cdot x_3 + 3 \cdot x_4$$

수식 표현

데이터#3 : (3,3,3,3,12)



x_1, x_2, x_2, x_2 w h y

$$\begin{pmatrix} 1,1,1,1 \\ 2,2,2,2 \\ 3,3,3,3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 1 \\ 3 \end{pmatrix} \rightarrow \begin{pmatrix} 7 \\ 14 \\ 21 \end{pmatrix} \quad \begin{pmatrix} 4 \\ 8 \\ 12 \end{pmatrix}$$

$$h = 1 \cdot x_1 + 2 \cdot x_2 + 1 \cdot x_3 + 3 \cdot x_4$$

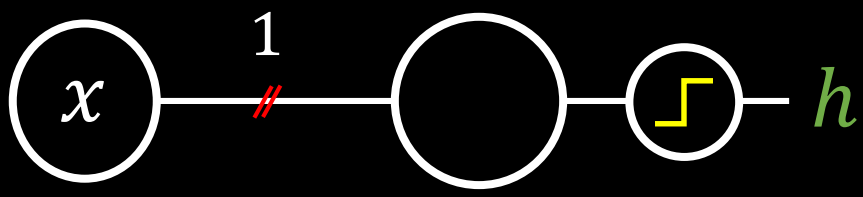
x_1, x_2, x_2, x_2 w h y

$$\begin{pmatrix} 1,1,1,1 \\ 2,2,2,2 \\ 3,3,3,3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 1 \\ 3 \end{pmatrix} \rightarrow \begin{pmatrix} 7 \\ 14 \\ 21 \end{pmatrix} \quad \begin{pmatrix} 4 \\ 8 \\ 12 \end{pmatrix}$$

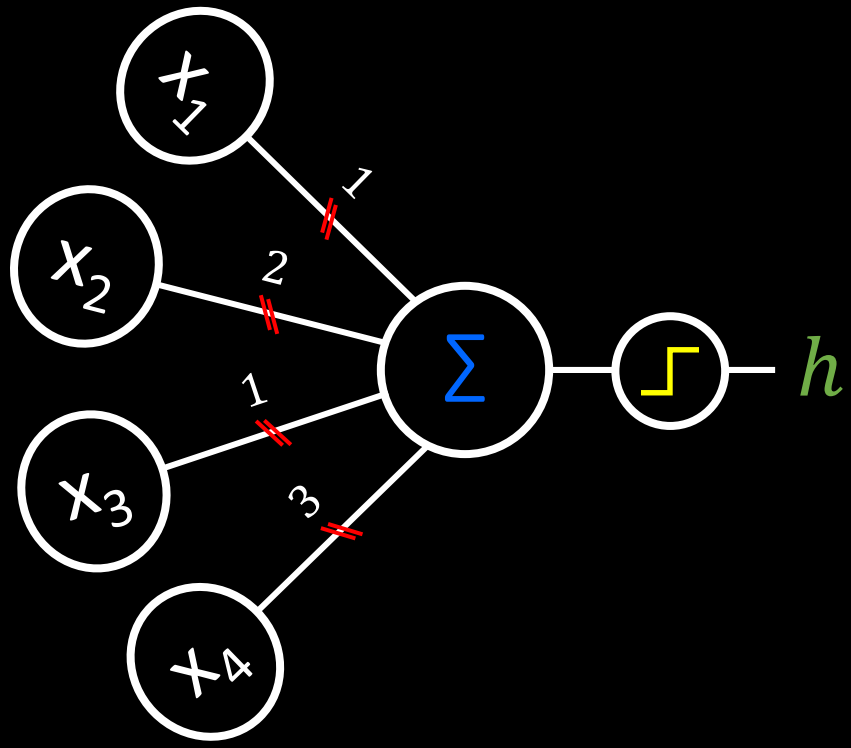
x_1, x_2, x_2, x_2	w	h	y	$(h-y)^2$	$\frac{1}{3}\sum(h-y)^2$
$\begin{pmatrix}1,1,1,1\\2,2,2,2\\3,3,3,3\end{pmatrix}$	$\begin{pmatrix}1\\2\\1\\3\end{pmatrix}$	$\rightarrow \begin{pmatrix}7\\14\\21\end{pmatrix}$	$\begin{pmatrix}4\\8\\12\end{pmatrix}$	$\begin{pmatrix}9\\36\\81\end{pmatrix}$	(42)

사실은..

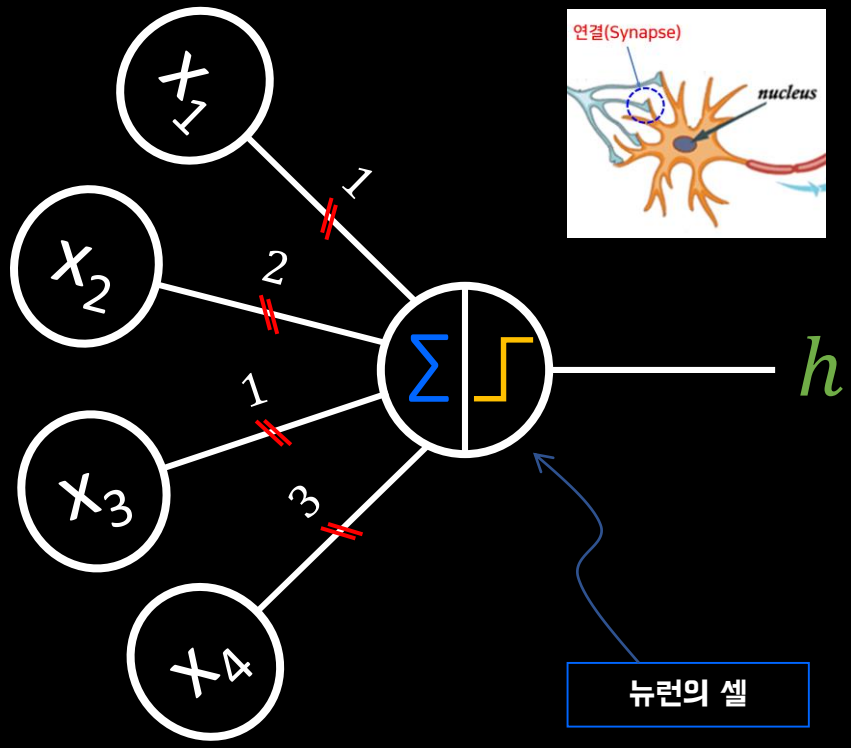
- 뉴런은 모두 더해서(weighted sum) 일정한 값 이상일 때만 시그널 ON (Fire)
- 그렇지 않으면 시그널 OFF



특정 값(T) 이상이면 ON(1),
아니면 OFF(0)



모두 더해서 특정 값(T) 이상이면 ON(1),
아니면 OFF(0)



모두 더해서 특정 값(T) 이상이면 ON(1),
아니면 OFF(0)

다음 뉴런을 그려보자.

(1) $h = 1x$

(2) $h = 1x_1 + 2x_2 + 1x_3 + 3x_4$

(3) $h = \begin{cases} 1 & if\ 1x_1 + 2x_2 + 1x_3 + 3x_4 > T \\ 0 & otherwise \end{cases}$

학습이란 무엇이다?

어떻게 자동으로 학습할 수 있을까?

이번 학습에서는

- 학습을 통하여 뉴런이 어떻게 변하는지 알 수 있다.
- 뉴런을 그림으로 그릴 수 있다.
- 뉴런의 입력의 수와 시냅스 수가 같음을 이해할 수 있다.
- 뉴런의 출력을 수식으로 표현할 수 있다.