

**EMOCON  
2017 S/S**



# **텐서플로우 & 딥러닝 수박 겉핥기**

**@golbin**

**인공지능 > 머신러닝 > 딥러닝**

관념

개념

기술  
(인공신경망)

## 기존 인공지능



길다  
노란색  
약간 휙었다



바나나

## 머신러닝



바나나



길다  
노란색  
약간 휙었다



바나나

기존 인공지능



길다  
노란색  
약간 휘었다

or

하얀색  
납작하다  
둥글다



바나나

머신러닝



바나나



길다  
노란색  
약간 휘었다  
하얀색  
납작하다  
둥글다



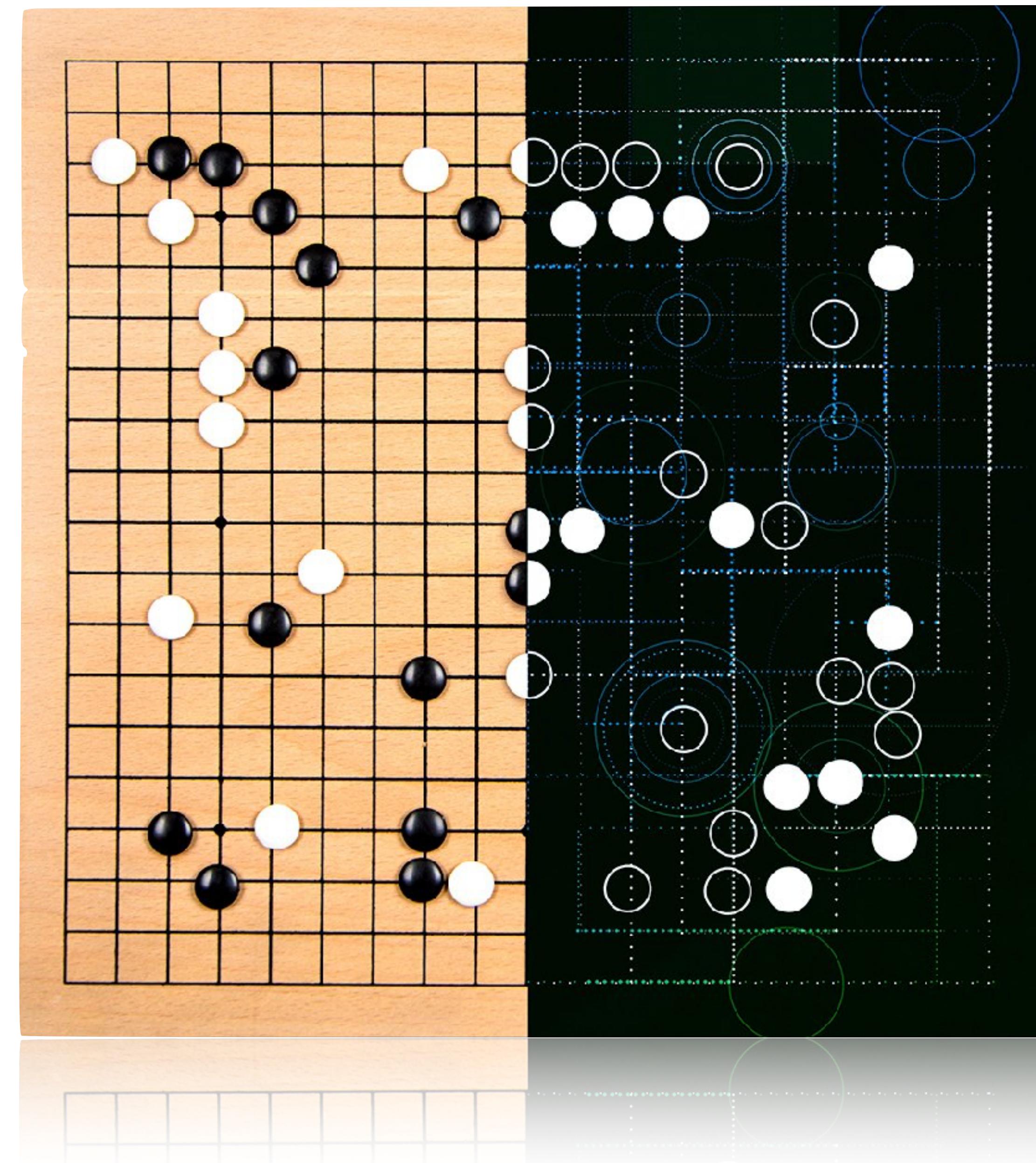
바나나

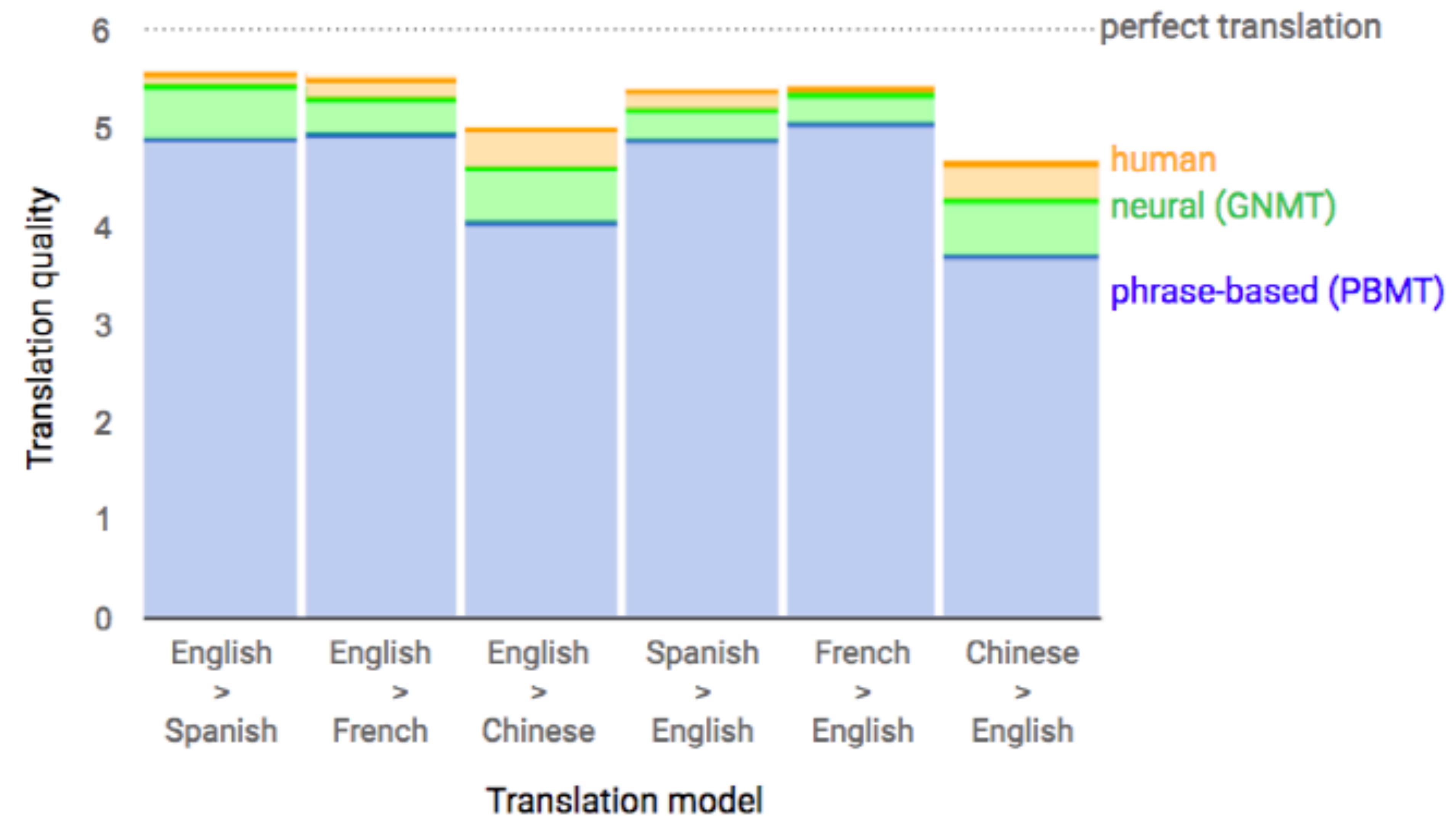


# Deep Learning

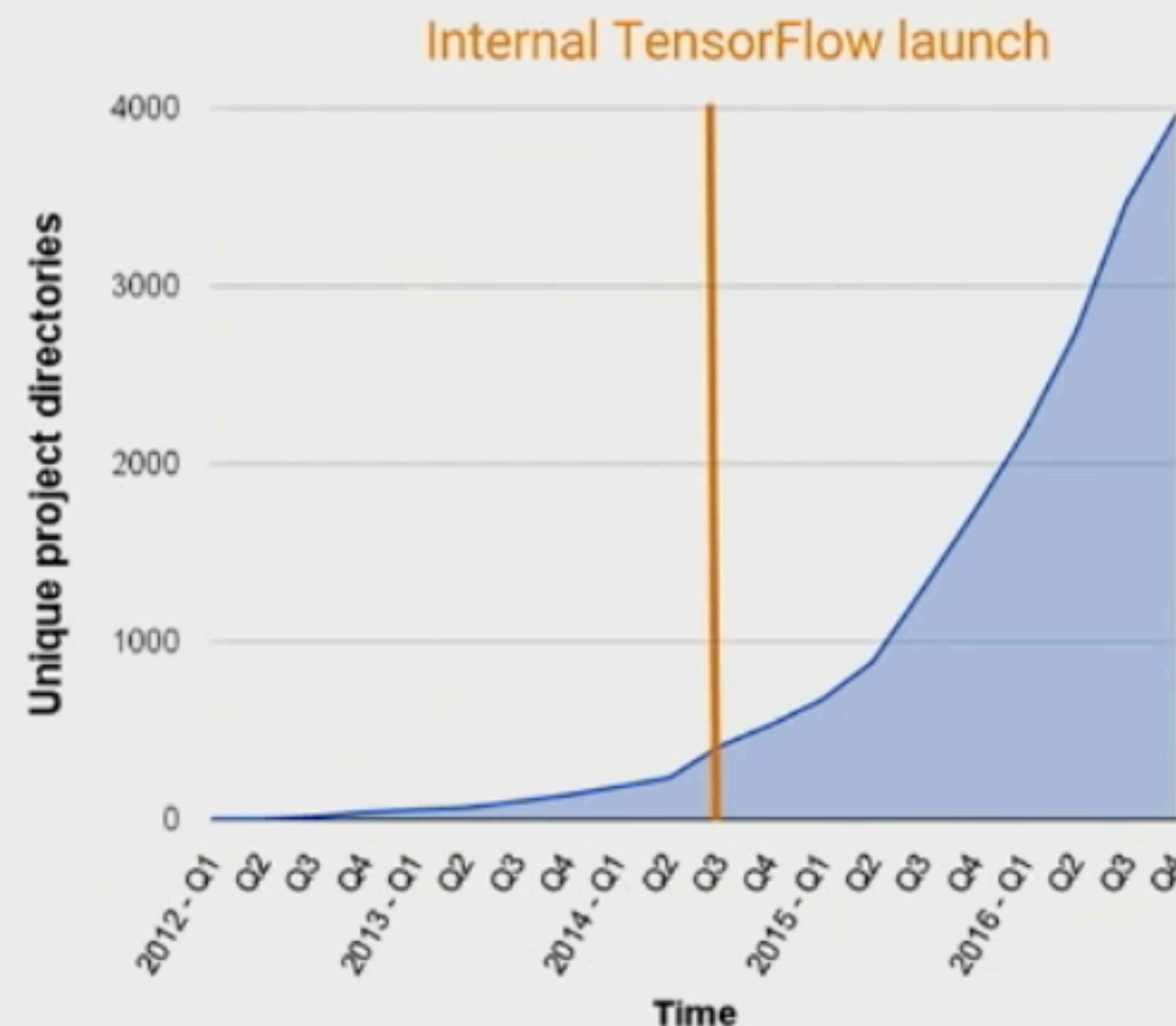
심층 인공신경망을 이용한 머신러닝

그 당시엔 인공신경망이라는 단어를 쓰면 왕따를 당하던 시절이라  
관심을 받기 위해 다른 이름을 썼다는 후문





# # of Google directories containing model description files



## Production use in many areas:

- Search
- Gmail
- Translate
- Maps
- Android
- Photos
- Speech
- YouTube
- Play
- ... many others ...

## Research use for:

100s of projects and papers



**EMOCON  
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**인공신경망**

**Artificial Neural Network**

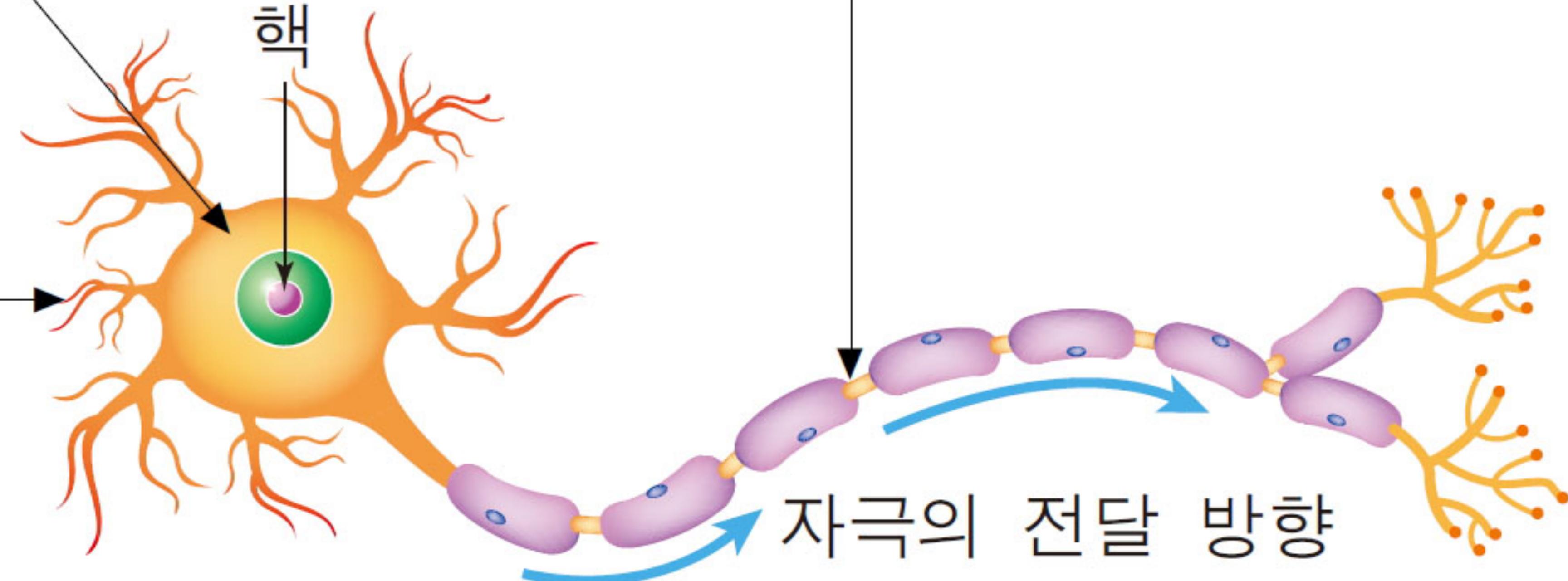
신경 세포체

축삭 돌기

가지돌기

핵

자극의 전달 방향

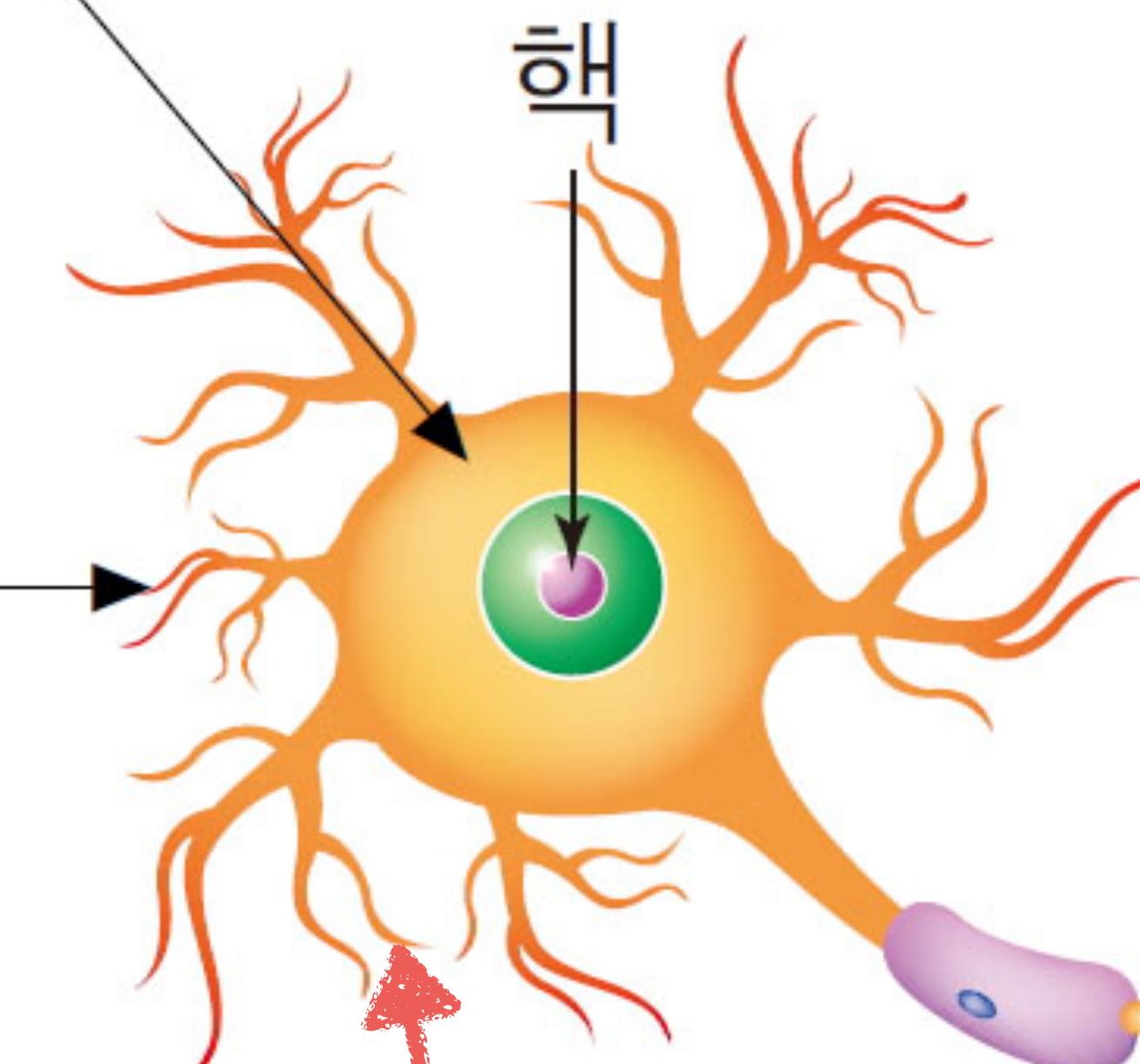


뉴런(Neuron)

신경 세포체

축삭 돌기

가지돌기



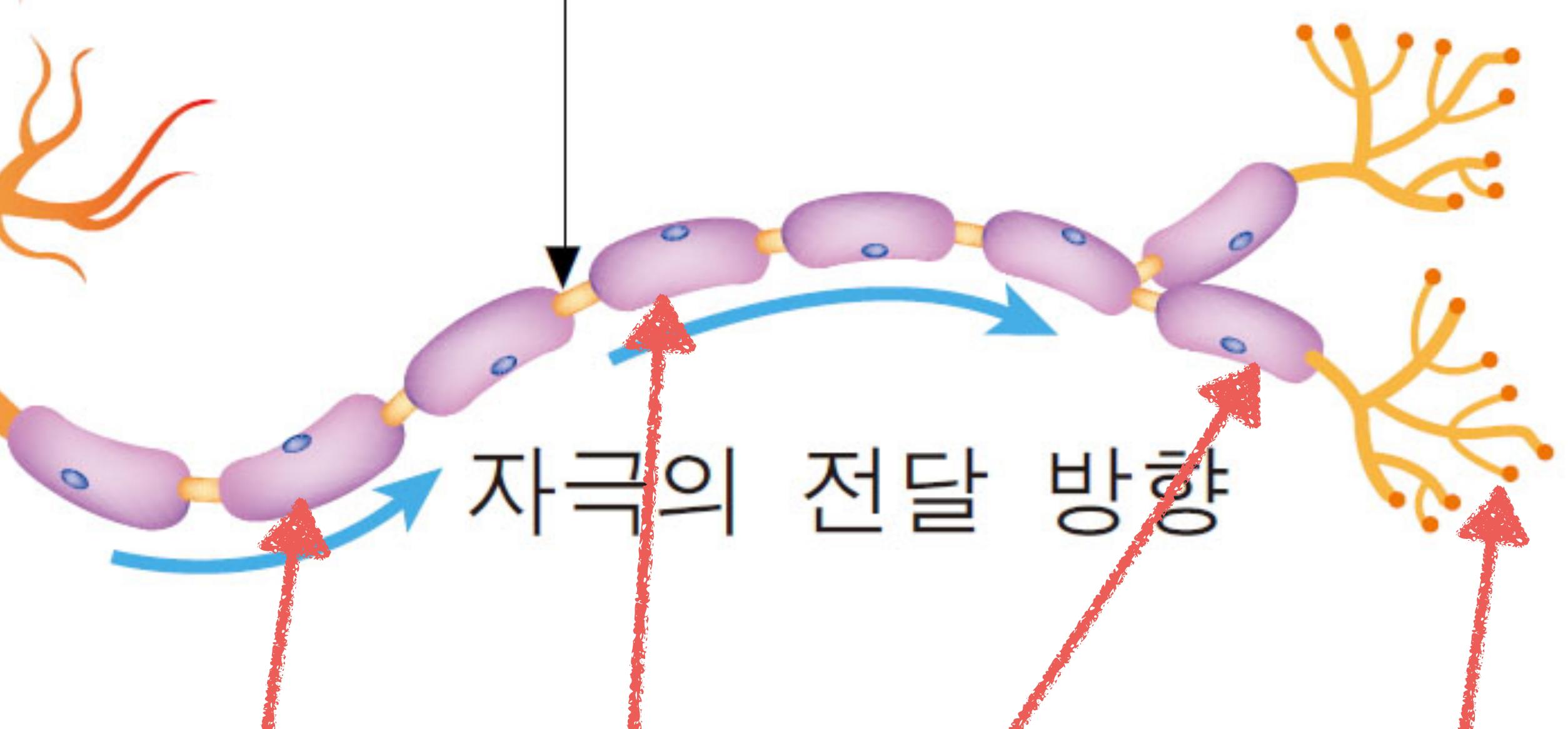
X  
input

$\times W$   
(Weight)

+ b  
(bias)

Sigmoid  
ReLU

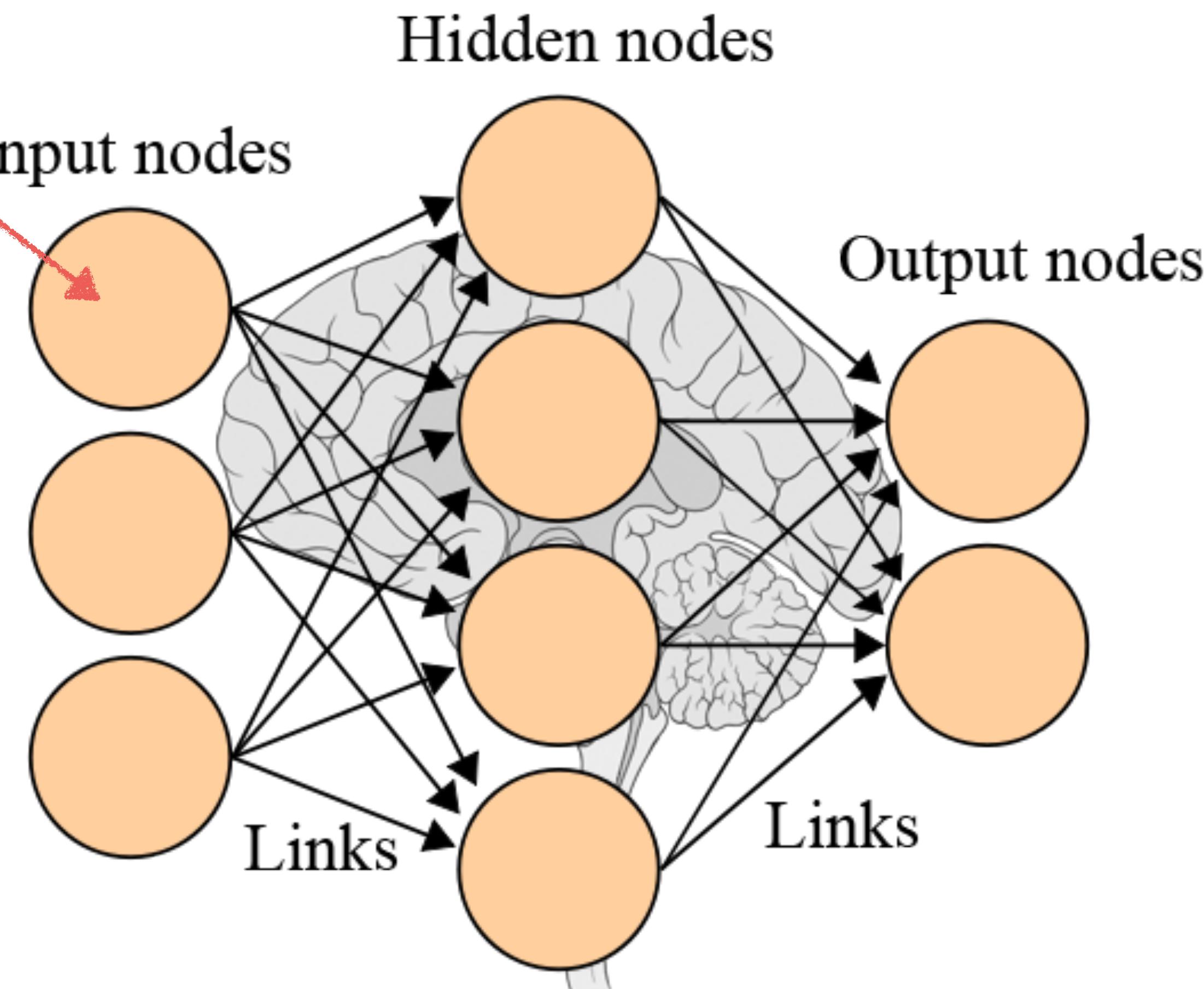
Y  
output



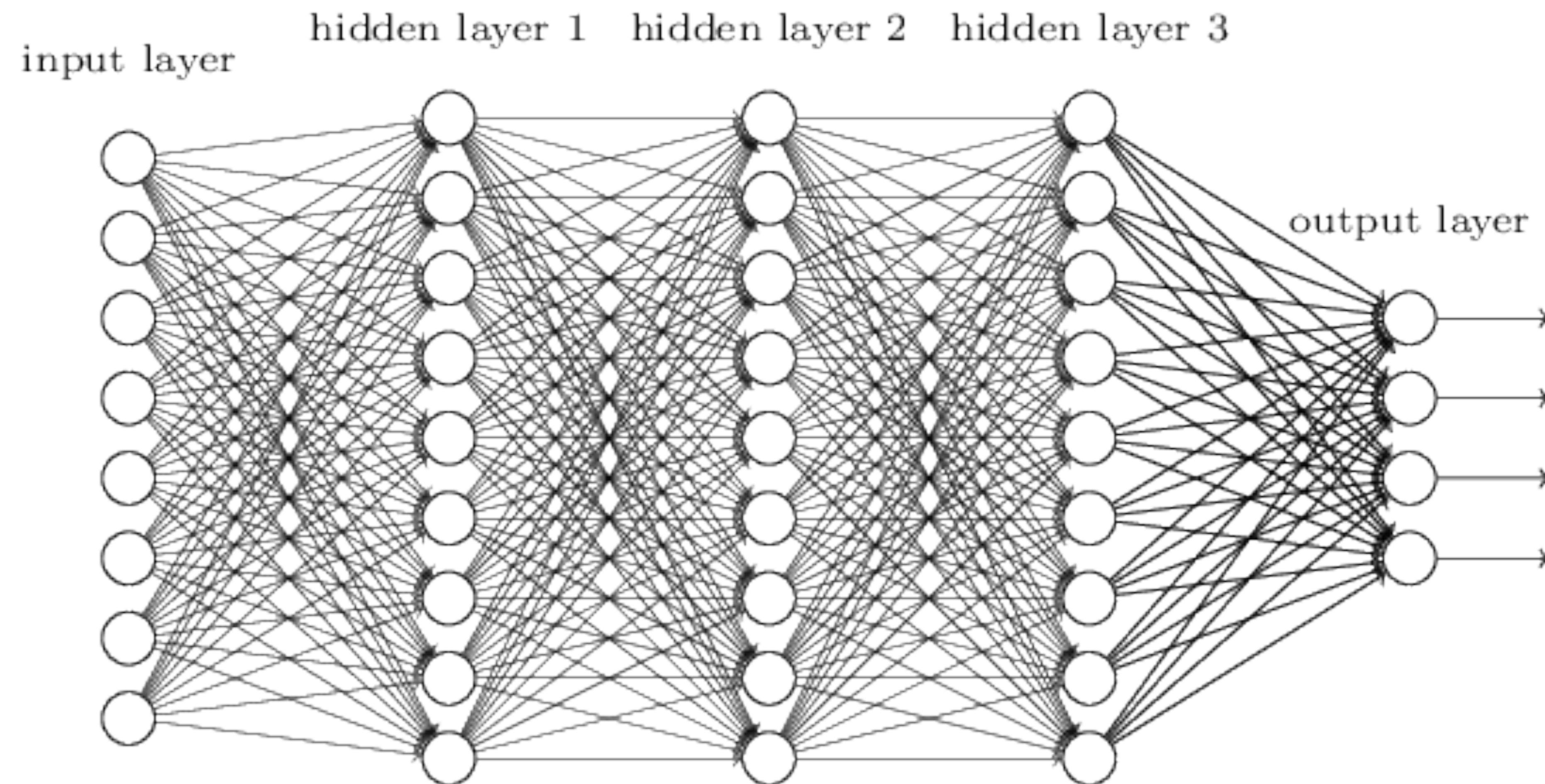
$$y = \text{sigmoid}(x * w + b)$$

인공뉴런(Artificial Neuron)

$\text{sigmoid}((X * W) + b)$



인공신경망(Artificial Neural Network)



심층신경망(Deep Neural Network)



**Training set**  $\{(x^{(1)}, y^{(1)}), \dots, (x^{(m)}, y^{(m)})\}$

Set  $\Delta_{ij}^{(l)} = 0$  (for all  $l, i, j$ ).

**For**  $i = 1$  to  $m$

**Set**  $a^{(1)} = x^{(i)}$

Perform forward propagation to compute  $a^{(l)}$  for  $l = 2, 3, \dots$ ,

**Using  $y^{(i)}$ , compute**  $\delta^{(L)} = a^{(L)} - y^{(i)}$

**Compute**  $\delta^{(L-1)}, \delta^{(L-2)}, \dots, \delta^{(2)}$

$$\Delta_{ij}^{(l)} := \Delta_{ij}^{(l)} + a_j^{(l)} \delta_i^{(l+1)}$$

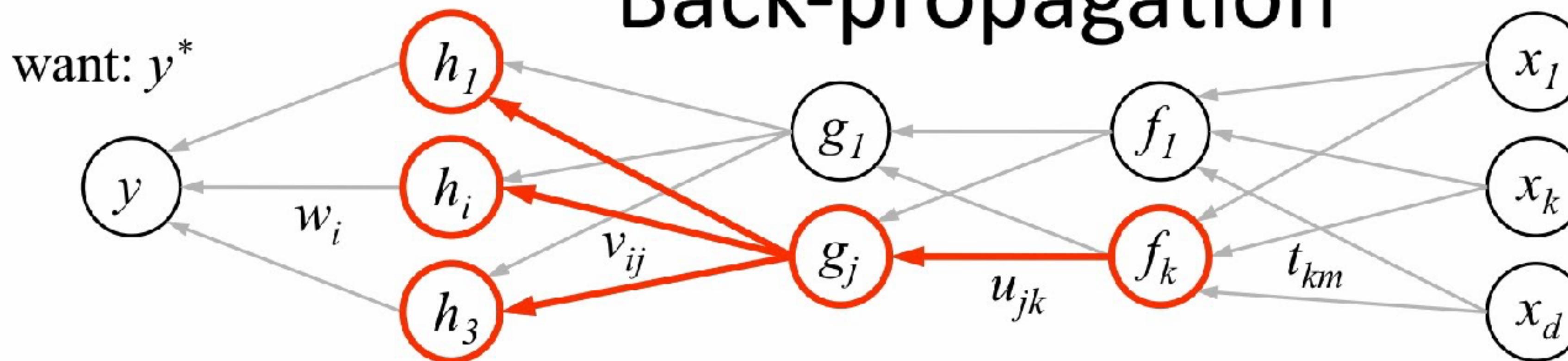
$$D_{ij}^{(l)} := \frac{1}{m} \Delta_{ij}^{(l)} + \lambda \Theta_{ij}^{(l)} \text{ if } j \neq 0$$

$$D_{ij}^{(l)} := \frac{1}{m} \Delta_{ij}^{(l)} \quad \text{if } j = 0$$

$$\frac{\partial}{\partial \Theta_{ij}^{(l)}} J(\Theta) = D_{ij}^{(l)}$$



# Back-propagation



1. receive new observation  $\mathbf{x} = [x_1 \dots x_d]$  and target  $y^*$
2. **feed forward:** for each unit  $g_j$  in each layer  $1 \dots L$   
compute  $g_j$  based on units  $f_k$  from previous layer:  $g_j = \sigma \left( u_{j0} + \sum_k u_{jk} f_k \right)$
3. get prediction  $y$  and error  $(y - y^*)$
4. **back-propagate error:** for each unit  $g_j$  in each layer  $L \dots 1$

(a) compute error on  $g_j$

$$\frac{\partial E}{\partial g_j} = \sum_i \underbrace{\sigma'(h_i)}_{\text{should } g_j \text{ be higher or lower?}} \underbrace{v_{ij}}_{\text{how } h_i \text{ will change as } g_j \text{ changes}} \underbrace{\frac{\partial E}{\partial h_i}}_{\text{was } h_i \text{ too high or too low?}}$$

should  $g_j$  be higher or lower?  
how  $h_i$  will change as  $g_j$  changes  
was  $h_i$  too high or too low?

(b) for each  $u_{jk}$  that affects  $g_j$

(i) compute error on  $u_{jk}$

$$\frac{\partial E}{\partial u_{jk}} = \frac{\partial E}{\partial g_j} \underbrace{\sigma'(g_j)}_{\text{do we want } g_j \text{ to be higher/lower?}} \underbrace{f_k}_{\text{how } g_j \text{ will change if } u_{jk} \text{ is higher/lower}}$$

(ii) update the weight

$$u_{jk} \leftarrow u_{jk} - \eta \frac{\partial E}{\partial u_{jk}}$$



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# Live Coding

<https://github.com/golbin/TensorFlow-Tutorials>

응용 프로그램을 만들 때  
컴파일러부터 만드는 사람은 없다

물론 제프딘은 제외

게임을 만들 때  
엔진부터 만드는 사람은 없다

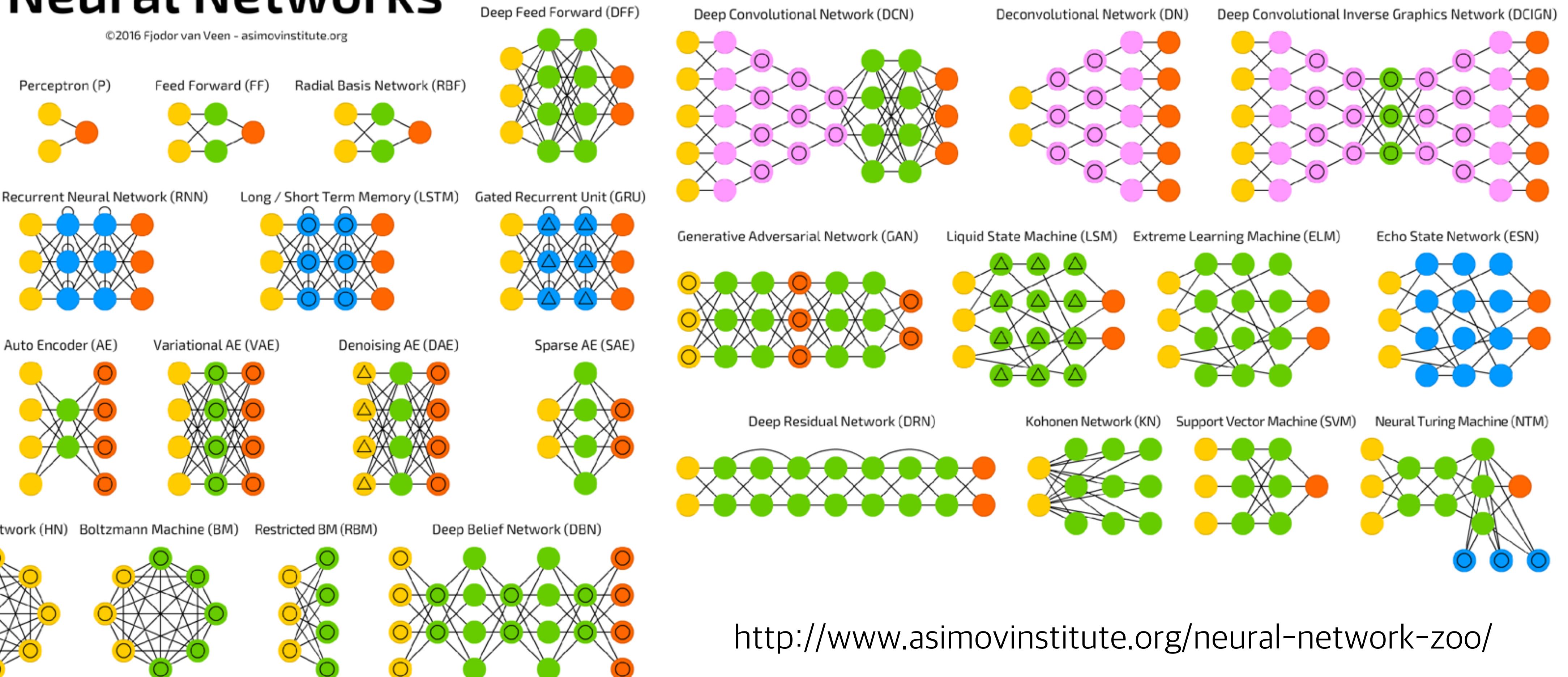
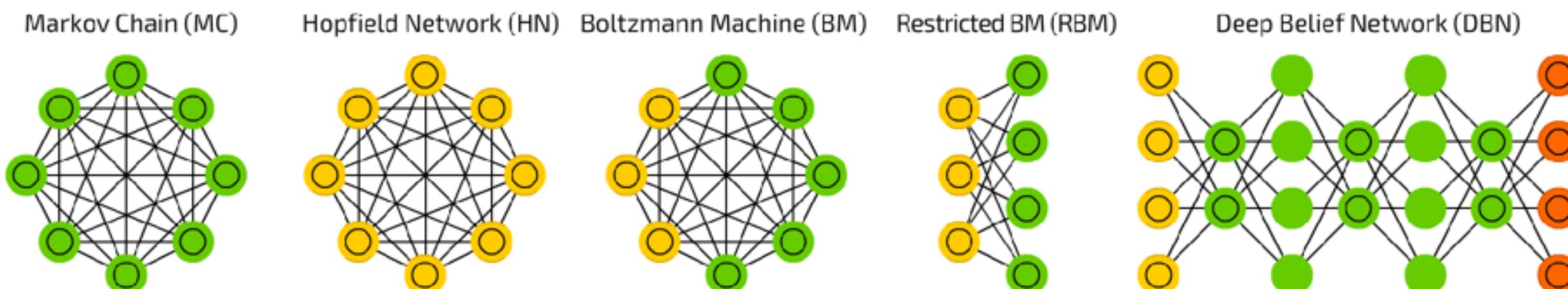
~~물론 존 카맥은 제외~~

*A mostly complete chart of*

# Neural Networks

©2016 Fjodor van Veen - asimovinstitute.org

- (○) Backfed Input Cell
- (○) Input Cell
- (△) Noisy Input Cell
- (●) Hidden Cell
- (○) Probabilistic Hidden Cell
- (△) Spiking Hidden Cell
- (●) Output Cell
- (○) Match Input Output Cell
- (●) Recurrent Cell
- (○) Memory Cell
- (△) Different Memory Cell
- (●) Kernel
- (○) Convolution or Pool



<http://www.asimovinstitute.org/neural-network-zoo/>

# 필수개념

$$y = x^* W + b$$

행렬곱

활성화 함수

# 참고자료



<https://hunkim.github.io/ml/>

<https://github.com/golbin/TensorFlow-Tutorials>



```
04 - ChatBot — python chat.py — python — Python chat.py...
[→ 04 - ChatBot git:(master) ✘ python chat.py
깨어나는 중 입니다. 잠시만 기다려주세요...

> 안녕.
안녕.

> 난 여우야.
이리 와서 나하고 놀자.

> 어떻게 해야 하는데?
참을성이 있어야 해.

> 난 너하고 놀 수 없어.
아! 미안해.

> 난 좀 지겨워.
그래서 목요일은 무척 신나는 날이지!

> 대단하군!
그러구 . . . 하나 시간이 . .

> 시간이 뭐?
넌 어떤 길들인 것에 대해 다르게 책임이 있어.

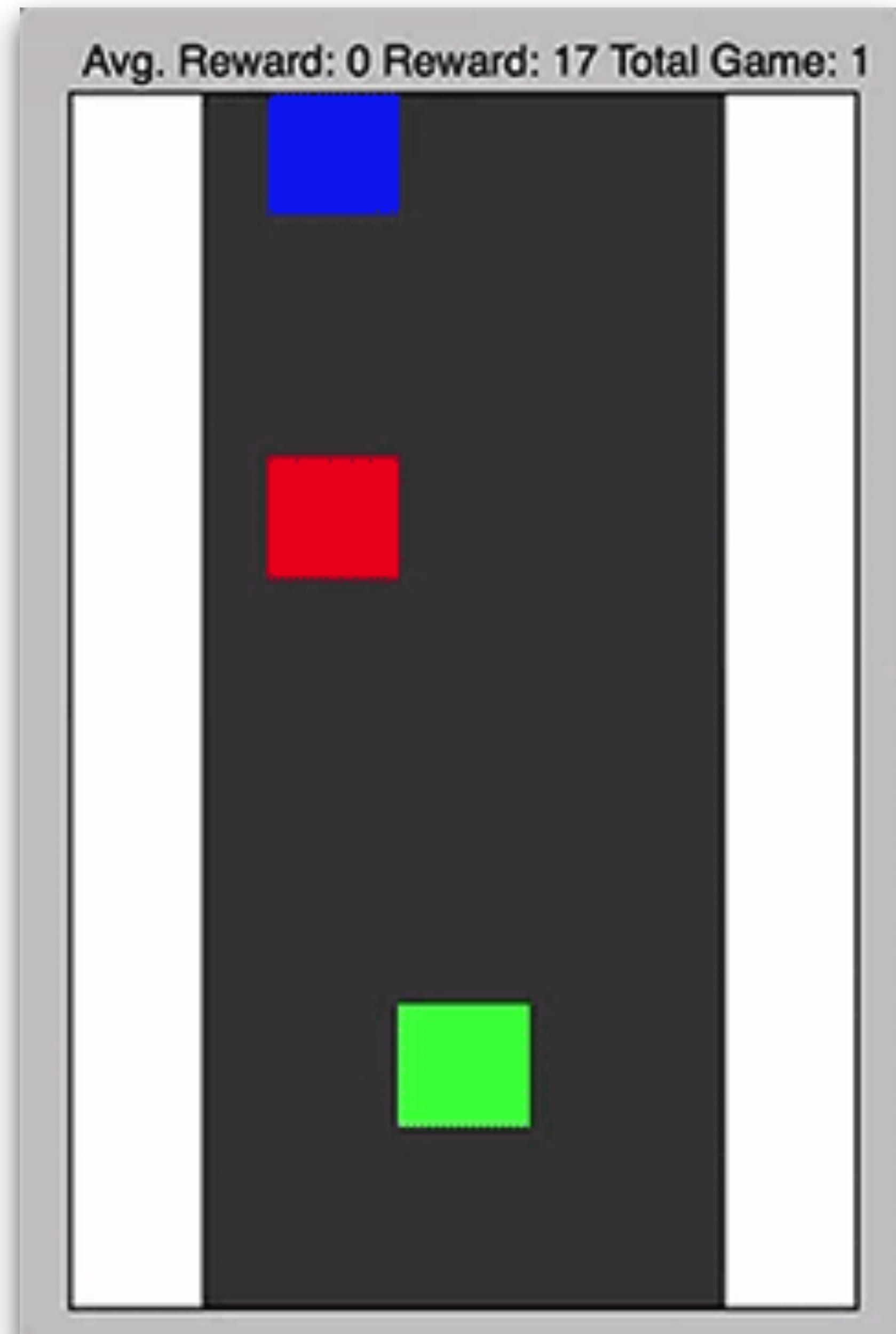
> 알았어..
잘 대단하군. 사과나무 밑에 . .

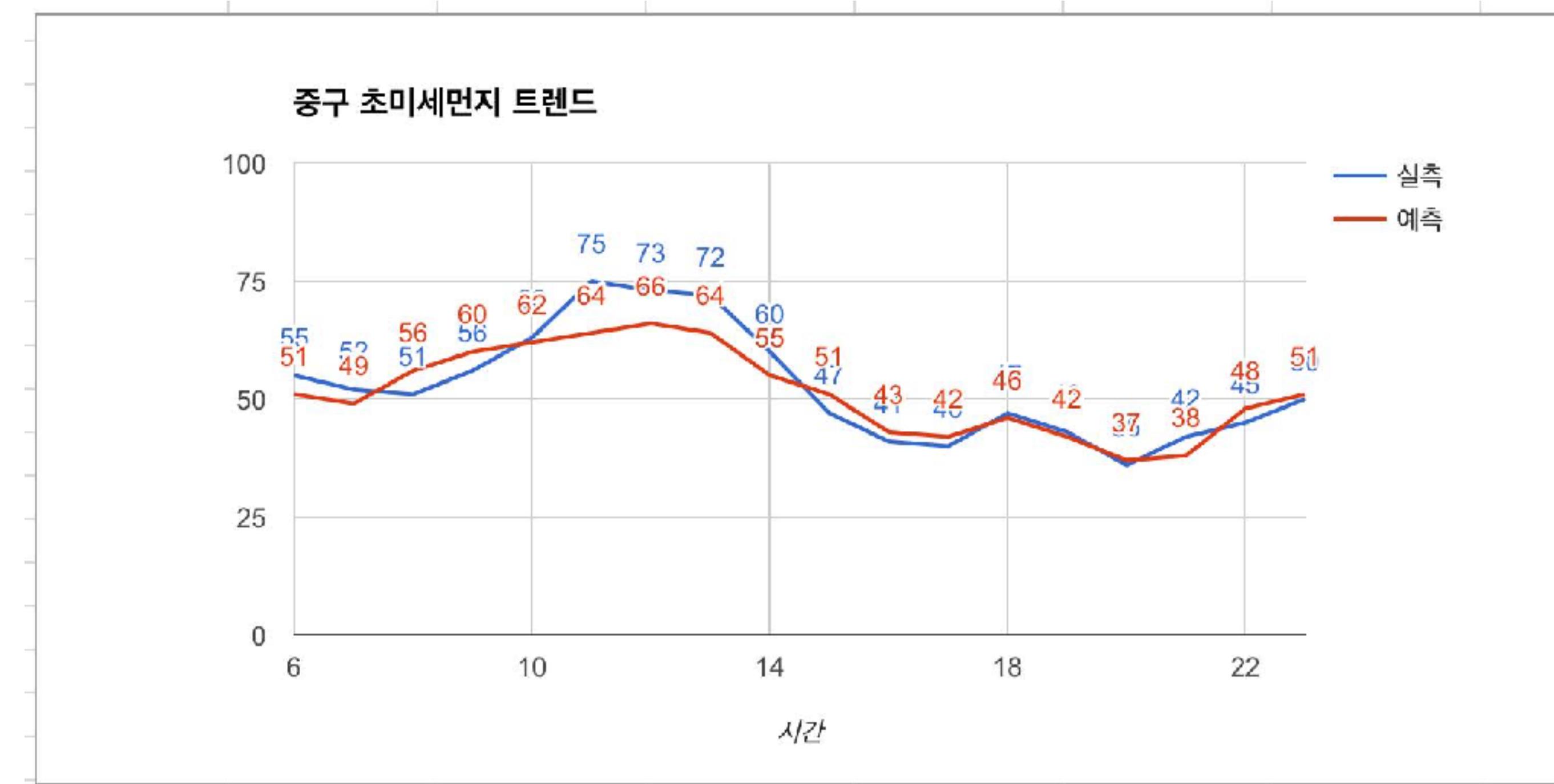
> 밑에 뭐가 있어?
이리 와서 나하고 놀자.

> 싫어.
여기 하나 좀 있어.

> 잘 있어.
잘 가.

>
```





**Thanks**

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