even for the first time

Thorough understanding of “AI” in 10 minutes

From “The Basics of AI” to “Deep Learning”

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1. What is AI?

Artificial intelligence (AI) is the artificial reproduction of part of human intellectual behavior using software.

In particular?

Is it possible to say that "what a machine judges even once is an AI"?

In extreme terms,

"A rice cooker that cooks rice at 5 o'clock" judges that it is 5 o'clock,In general, it is not called an AI rice cooker.

So, how much judgment do you have to make to say that it is an AI home appliance?

A situation where there is no clear definition of AI?

2. History of AI

Boom	Period	keyword	machine learning	example
first boom	1950s - 1960s	logic	×	puzzle, maze game
second boom	1980s	knowledge	△	robots, expert systems
third boom	2010 -	deep learning	○	image recognition, voice recognition

Practical use of machine learning from big data has progressed

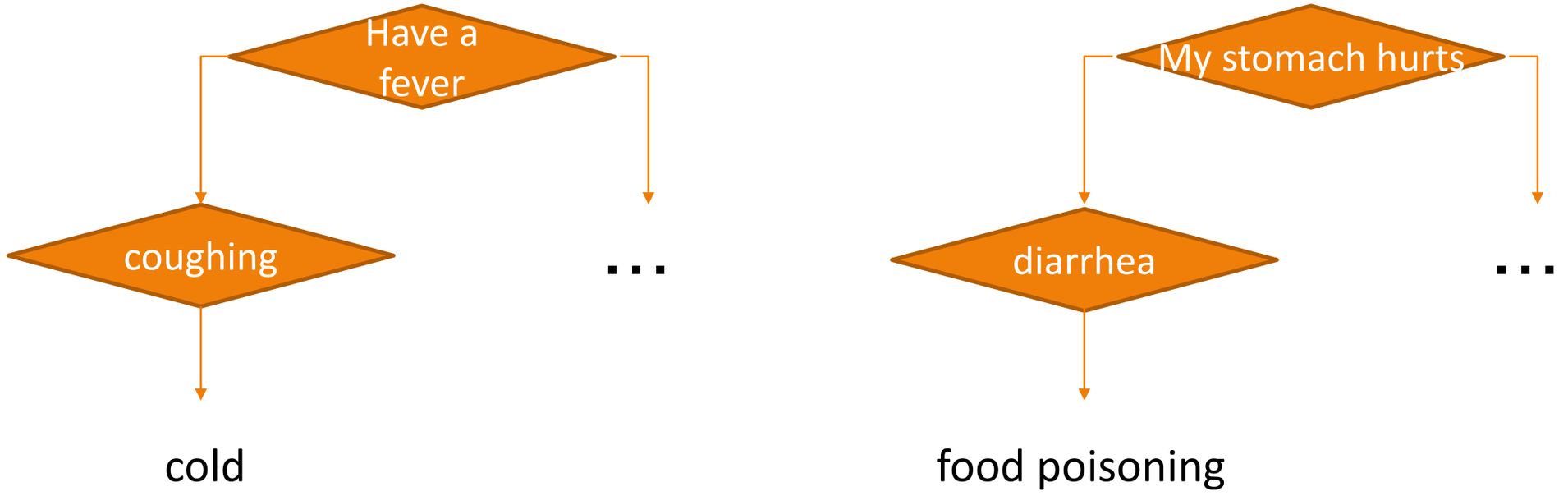
The current tertiary boom spread at once in 2012 when Professor Jeffrey Hinton's team at the University of Toronto, Canada, demonstrated overwhelming accuracy using deep learning and won the image recognition contest in 2012. rice field.

3. Image of AI until the second boom (until the 1980s)

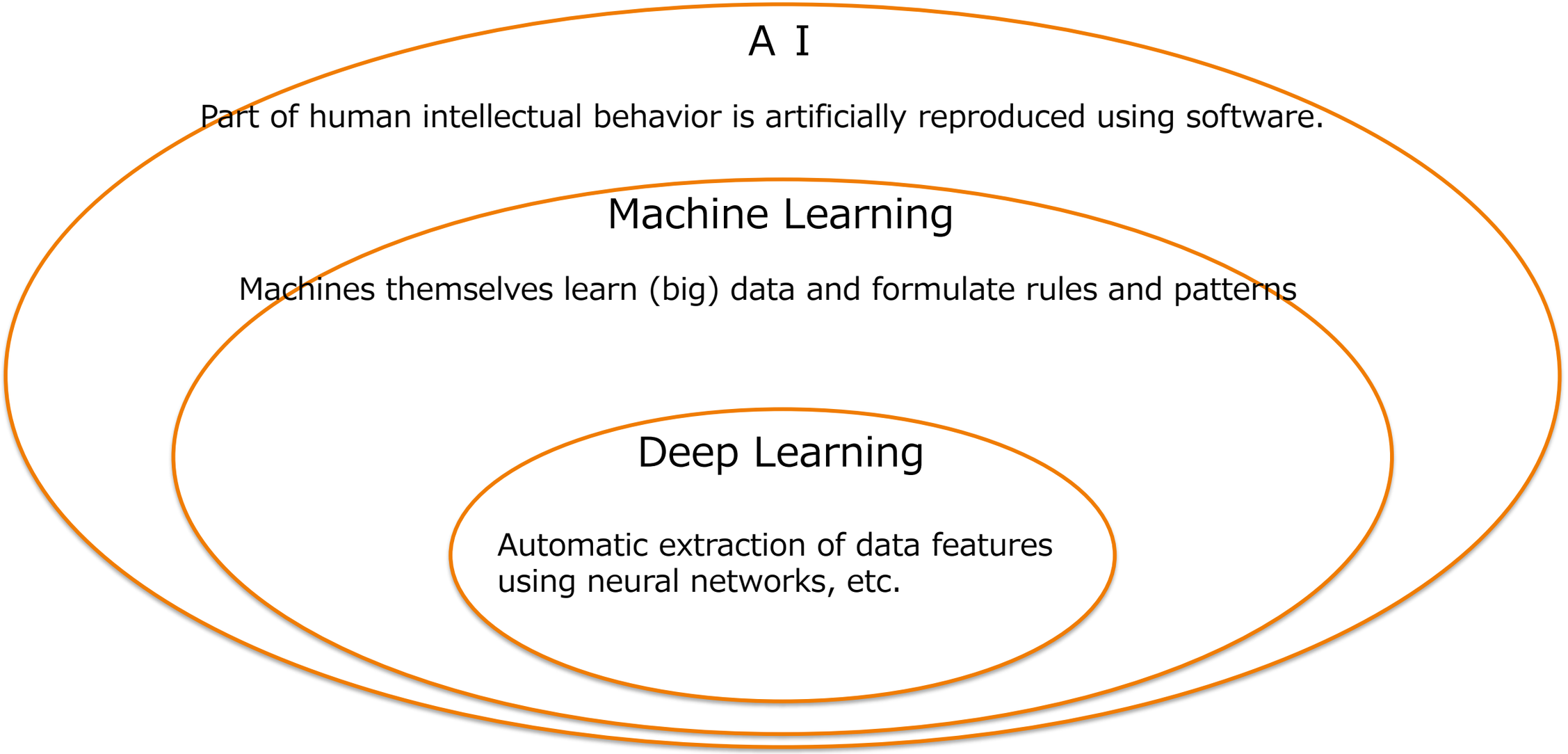
"Expert system" image

Humans (experts) set rules (knowledge) for judgment. The more detailed the rules are set, the higher the accuracy, but it is necessary for people to create all the rules.

for example



4. Meaning and relationship between "machine learning" and "deep learning"

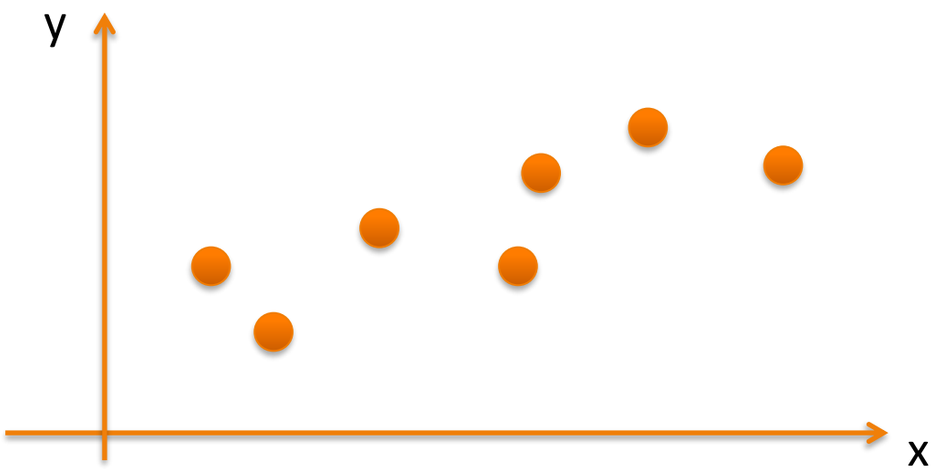


5. Types of AI learning

Presence or absence of a teacher	content	use	technique
Supervised learning	Giving a set of problems and correct answers to the machine to learn	classification	support vector machine deep learning (neural network)
		Regression (prediction)	
Unsupervised learning	Let the machine learn only the problem, and the AI itself will find and learn the characteristics etc.	Clustering (Grouping)	K-means self-organizing map deep learning
		data reduction	Principal Component Analysis (PCA) deep learning
Reinforcement learning	AI tries itself, gives rewards, and learns to get the maximum reward	shogi and go motor control and maze exploration	Q-learning actor critic

6-1. Machine learning Example 1) Simple linear regression

Simple linear regression is a linear function (y = ax + b) that can express the data of two variables x and y



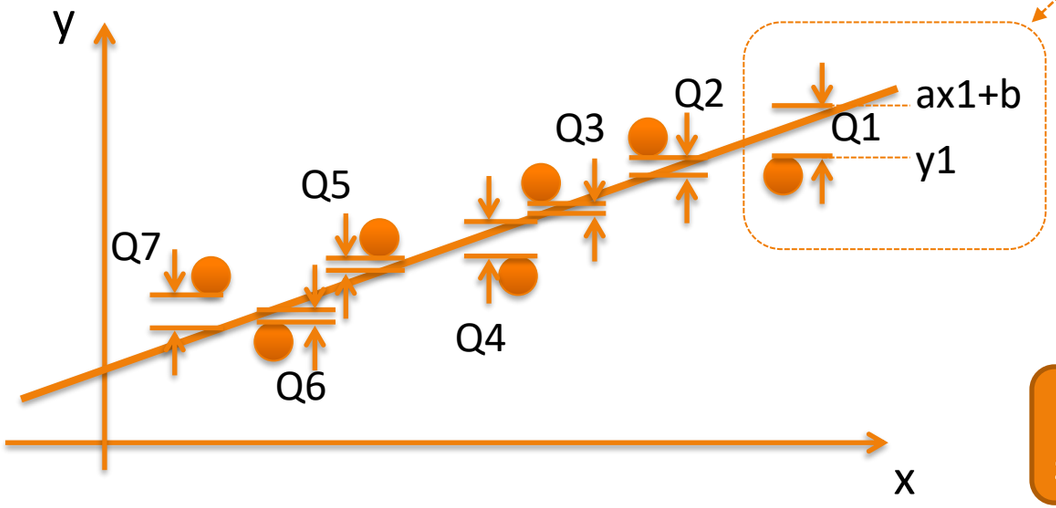
There is data that can be represented by a straight line, and a relational expression is sought.

error is「Q1 = y1 – (ax1 + b)」

Since there is an error on the top and bottom, sum the squares

Sum of errors ： Qt = Q1 + Q2 + Q3 + ...
= { y1 – (ax1 + b)}² + { y2 – (ax2 + b)}² + { y3 – (ax3 + b)}² + ...

Relational expression that minimizes the sum of errors



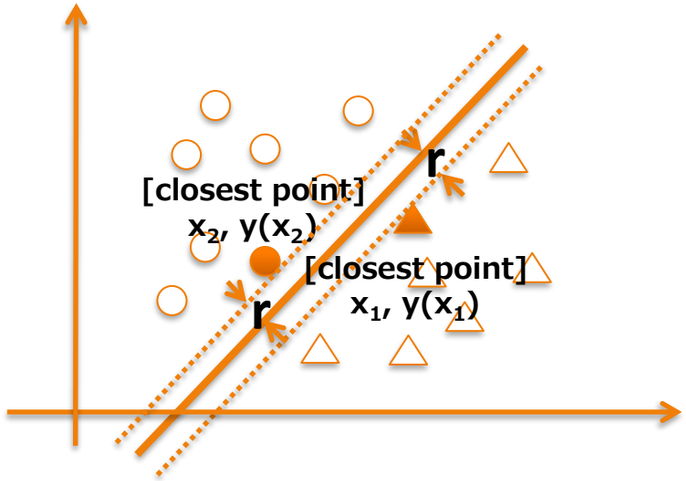
The parameters a and b are determined so that the total error (objective function) Qt is minimized.

⇨ least squares method

Finding a relational expression that minimizes (or maximizes) the sum of errors (objective function) is the same idea as deep learning.

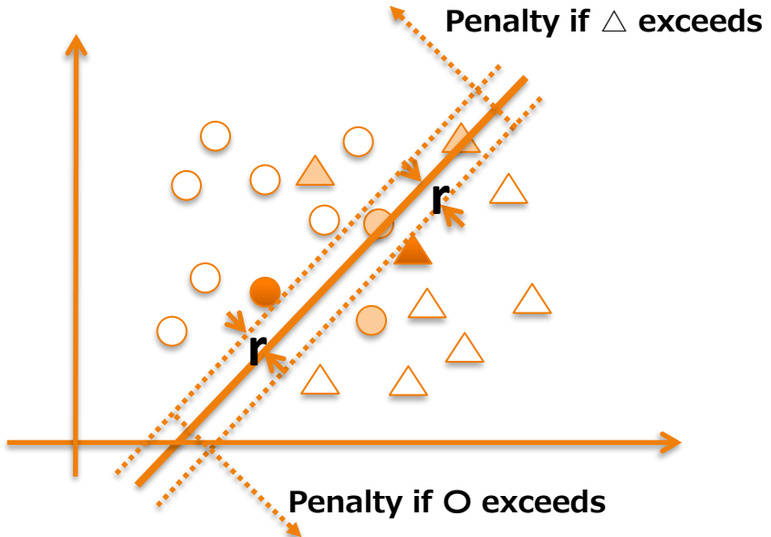
6-2. Machine learning　Example 2) Support vector machine

Learn theory with two classes (classifiable into two) of linear support vector machines (classifiable by straight lines).
Support Vector Machine determines the regression line [y = a x + b] by maximizing the margin.
(vector: point, support vector: point closest to boundary)



Determine the parameters of “a” and “b” so that the margin “r” of the closest point (support vector) is maximized.

Normally, it cannot be divided neatly, so it is calculated with a penalty

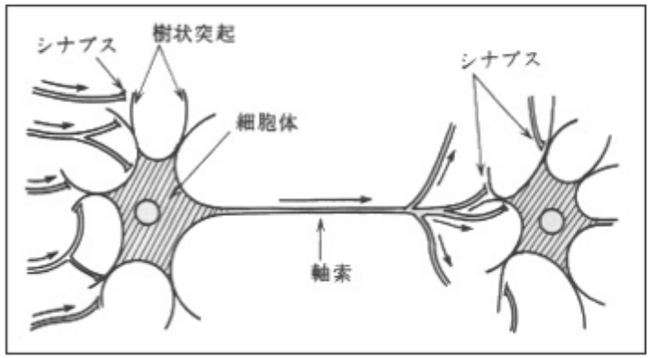


Determine the parameters “a” and “b” so that the penalty is minimal and the margin “r” is maximal.

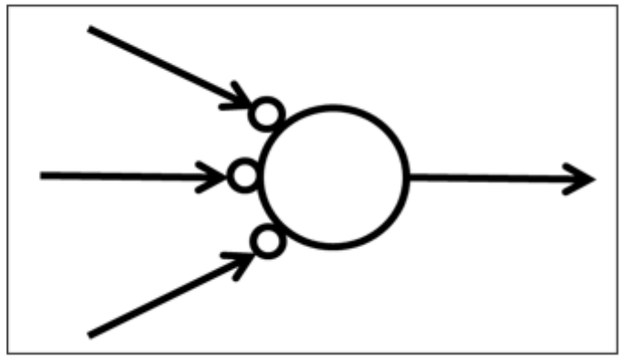
6-3. Machine learning　Example 3) Perceptron (artificial neuron)

Artificial neurons (perceptrons) modeled on human brain neurons

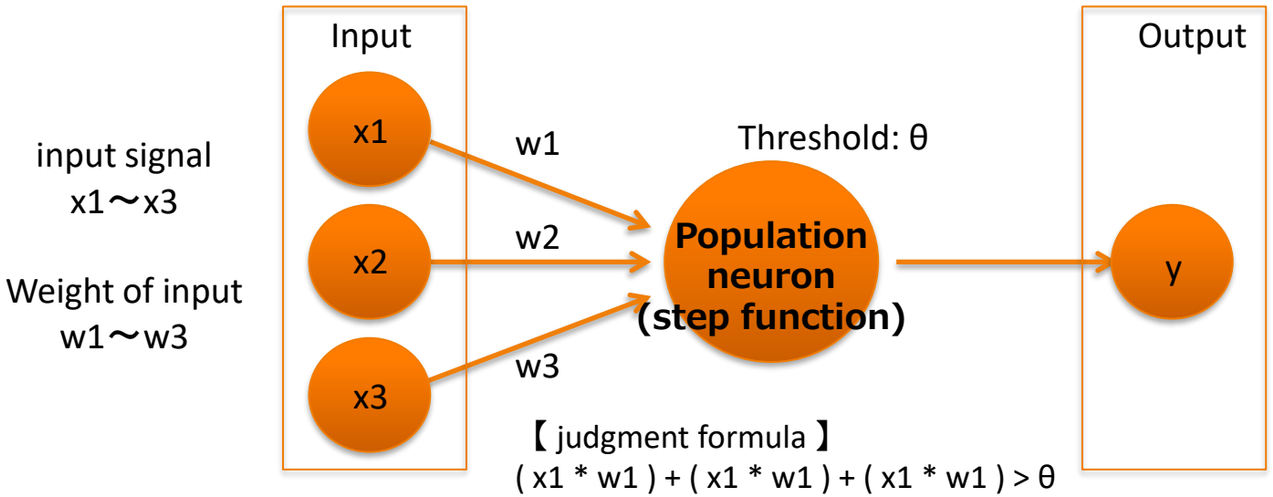
Human neurons (nerve cells)



Neuron (nerve cell) modeling



参考：https://aitokuconsult.hatenablog.com/entry/neuralnetwork



【 judgment formula 】

(x1 * w1) + (x1 * w1) + (x1 * w1) > θ

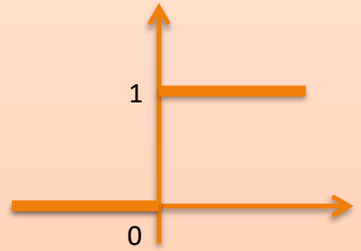
Ex) When each input is 1, 2, 3, all weights are 1, and the threshold is 5

(1 * 1) + (2 * 1) + (3 * 1) > 5

6 > 5　⇒ correct, so the output is "1"

There are many functions in the output

(1) Activation function: Step function

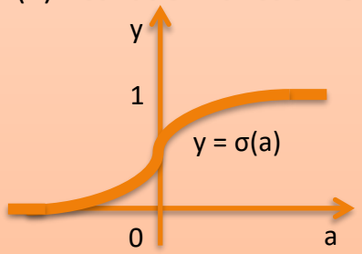


The output is a binary value of 0 or 1

(x1 * w1) + (x1 * w1) + (x1 * w1) > θ

1 if true, 0 if false

(2) Activation function: Sigmoid function



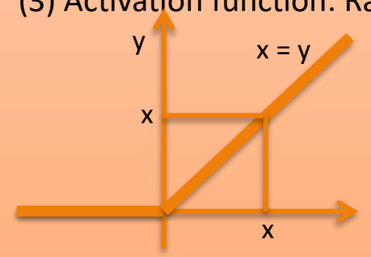
Output can be any value between 0 and 1

The output is expressed as y = σ(a).
σ is a sigmoid function and
σ(x) = 1 / (1 + Exp-x)a is called the "linear sum of the inputs“

(x1 * w1) + (x2 * w2) + (x3 * w3) – θ

Often used in the output layer.

(3) Activation function: Ramp function

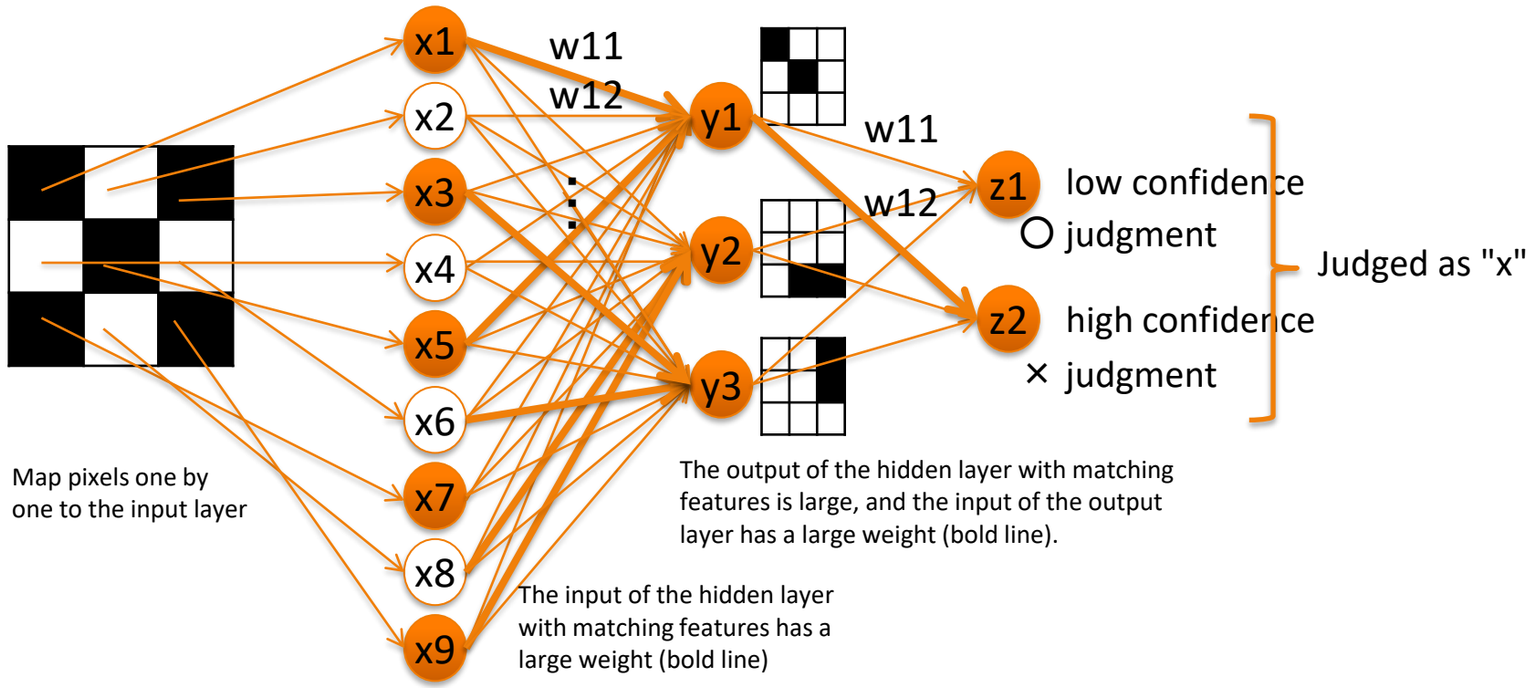


output is any value from 0

Simple and easy to calculate.
Commonly used in the middle class.

6-4. Machine learning　Example 4) Neural network

In order to understand the neural network, the intermediate layer (hidden layer) learns with a single layer model
(Neural network that judges ○ “circle” and × “cross” of 3*3 images)



Image

Input layer

Input information to all hidden layers as it is

hidden layer

The hidden layer has a detection pattern and performs feature extraction

Output layer

Make ○ × decision

Each neuron weights the input and outputs the result calculated by the threshold

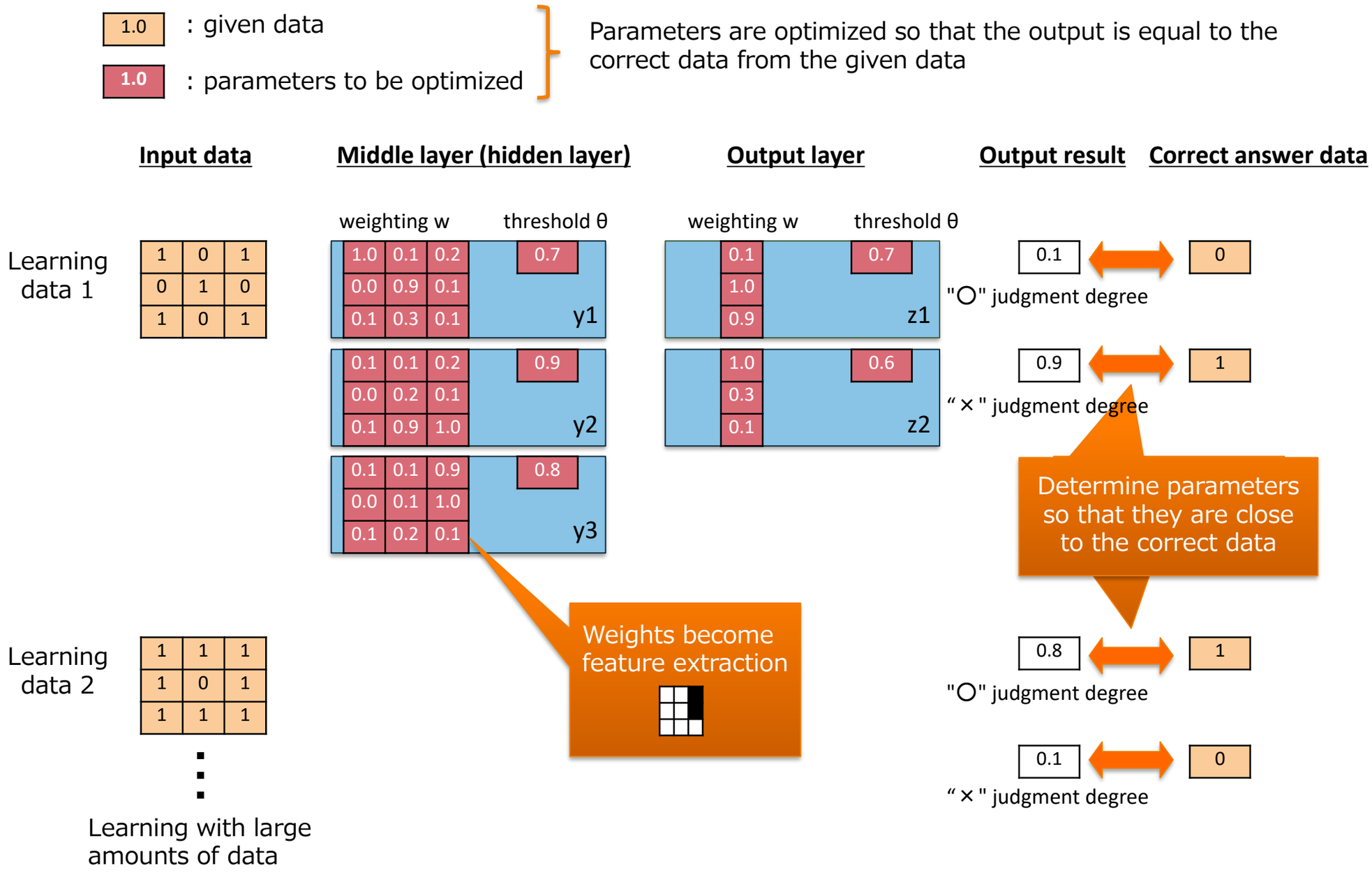
【 Middle layer formula】

a1 = (x1 * w11) + (x2 * w12) ・・・ + (x9 * w19) – θ1
a2 = (x1 * w21) + (x2 * w22) ・・・ + (x9 * w29) – θ2
a3 = (x1 * w31) + (x2 * w32) ・・・ + (x9 * w39) – θ3
y1 = σ(a1), y2 = σ(a2), y3 = σ(a3)
σ is a sigmoid function

【 Output layer formula 】

z1 = (y1 * w11) + (y2 * w12) + (y3 * w13) – θ1
z2 = (y1 * w11) + (y2 * w22) + (y3 * w23) – θ2

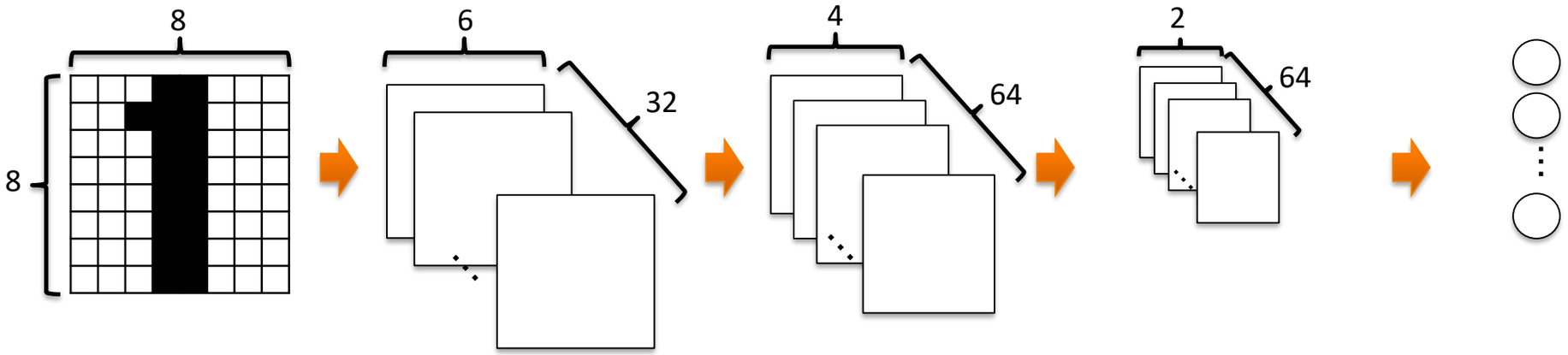
6-4. Machine learning　Example 4) Neural network



6-5. Machine learning　Example 5) Neural network "deep learning"

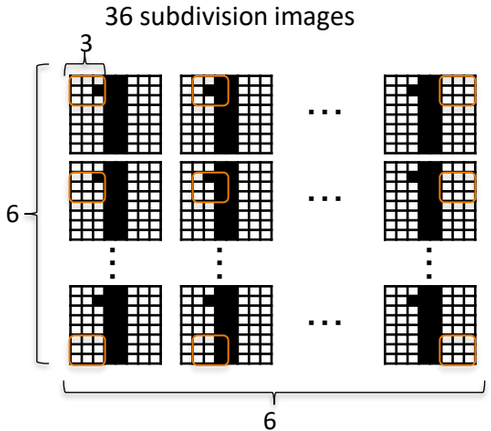
Deep learning : Neural network with two or more intermediate layers
Convolutional neural network : A method of learning by subdividing the intermediate layer

Example) Convolutional neural network

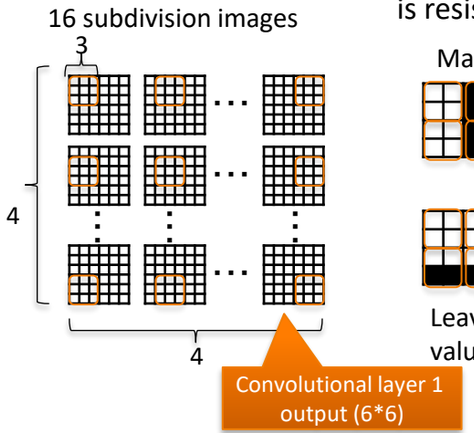


Input layer
8*8 pixels, so 64 neurons

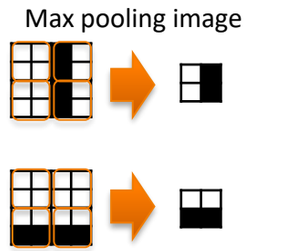
Convolutional layer 1
32 groups are divided into 36 subdivisions in a 3*3 frame



Convolutional layer 2
64 groups are divided into 16 subdivisions in a 3*3 frame



MAX pooling layer
Reducing 4*4 to 2*2 frame for feature extraction that is resistant to deviation



Output layer
Judge each element by judging with a threshold from the input