



Episode 32 (about AI)

Concept of deep learning



Kitsune, I have no idea how the AI works, can you tell me?



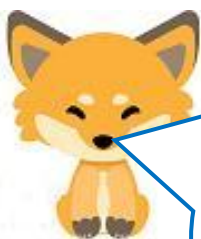
Tanuki! I've been programming in procedural and object-oriented languages, but the methods I learned in those languages (also called algorithms) and the methods of AI programming are totally different.

I wouldn't say 360 degrees, but 180 degrees different. In other words, it requires a change in thinking.

Deep learning is currently considered the most effective method for creating AI (Artificial Intelligence) systems.



Fox, what is deep learning?



Tanuki, deep learning means that a computer finds the best solution by capturing features from a large amount of data. Of course, it is the program that sends the commands to the computer. It is the same as before. However, the programming method (algorithm) is completely different from conventional programming methods. I will try to explain it now. One important point is that programming is based on the existence of a large amount of data.



Tanuki! What would you do if you were told to assign 2 to variable a and program it to display answer 4?



That's easy! Kitsune, you're making fun of me!

```
a = 2;
b = 2 * a;
print(b);
```

I'm not sure if this is the right thing to do.

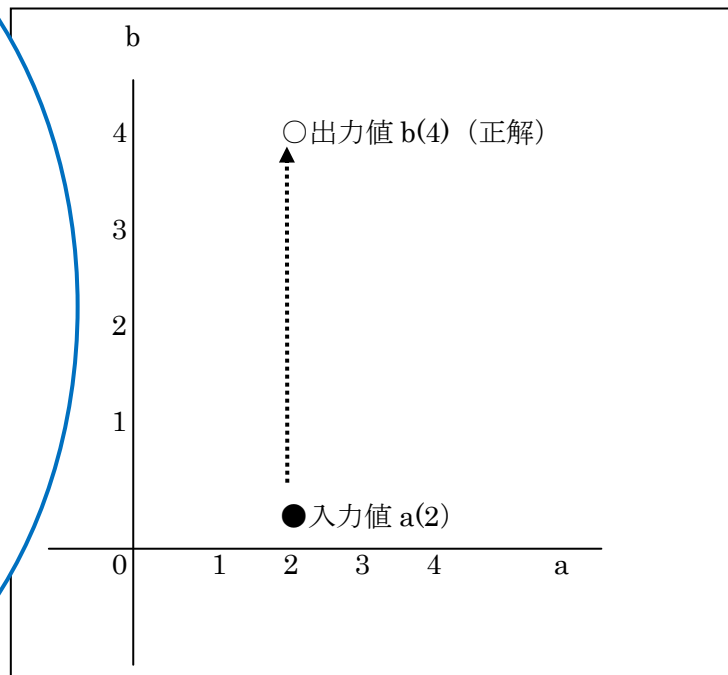


Tanuki! So, you're right. But that's just the way programming has always been done. For deep learning, we need to go back to the basics. Think of it this way.



This is an explanation of the figure on the right.

We move from the input value a (2) to the output value b (4), which is the correct answer, a little bit closer to 2, 2.5, 2.7, 3 . . . , and so on. In this case, the result obtained from the input value 2 to the output value 4 could be multiplicative or additive, but either is fine for deep learning. Rather, the operator is not used. What is important is that a single input value of 2 yields a result of 4.





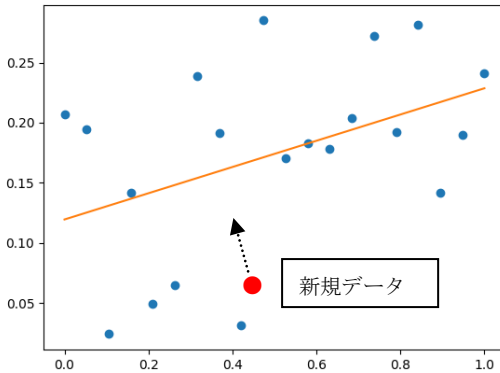
It's kind of like a method that would be better to have a kindergartner think about it than to have a programmer program it.



Tanuki, you're right! Deep learning is an iterative process of trial and error.
When you do the above with a large amount of data, you end up with a regression line (curve). I will explain that next.

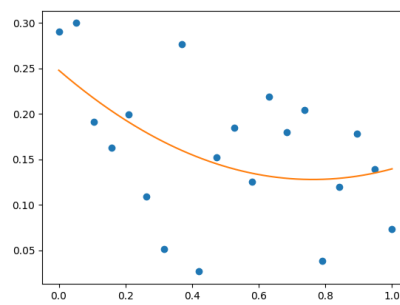
[Example 1]

Linear equation (regression line)



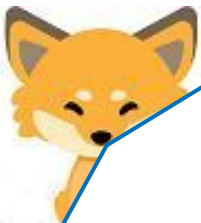
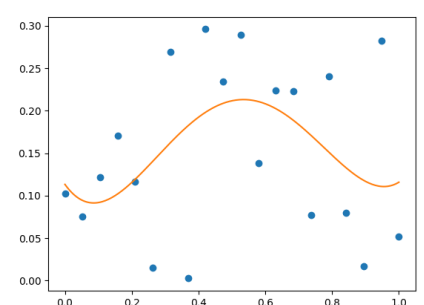
[Example 2]

Quadratic equation selection



[Example 3]

Cubic equation selection



This is the key to deep learning!

The key to deep learning is the availability of vast amounts of data that cannot be processed by humans and the selection of formulas that fit that data. The specific examples shown above. [In [Example 1], one straight line is drawn on random data (light blue ●: think of it as a huge amount of data). This line is called a regression line (orange linear equation: equivalent to formula selection). Suppose that this one straight line is drawn from a huge amount of data. The newly generated data (red ●: a picture of your cat is also acceptable) indicates how close to this straight line it is in terms of probability (indicated in %). The straight line may be split into two, not necessarily one. [Example 2] and [Example 3] are examples of trial and error in selecting a formula (curve) that fits a large amount of data. The ability to select the optimal formula depends on the mathematical ability of the AI developer. Once the regression line (curve) is determined, the parameters can be passed to the AI application, after which a large amount of data is no longer necessary. So, we can use AI apps on our smartphones. Tanuki, I hope you understand!



Tanuki, to summarize a little more clearly, it can be summarized as follows.

The conventional programming approach is " $2+2=$? ", so a solution of " ? " can be easily found.

In contrast, deep learning programming is like

" 2 ? ?? = 4 ".

If the first 2 is an addendum, then 「??」 is an addendum.

It may be strange to call it additive since it is unclear what operator to put in 「?」.

In the first place, it is better to consider that there is no 「?」 operator itself.

In other words, if you do some manipulation on the number 2, you get a result of 4.

So, the programming of deep learning is to come up with an algorithm for 「?」 and find 「??」.



In the next issue, we will cover an example of a simple AI (deep learning) program.

Stay tuned for episode 33!

Translated at DeepL