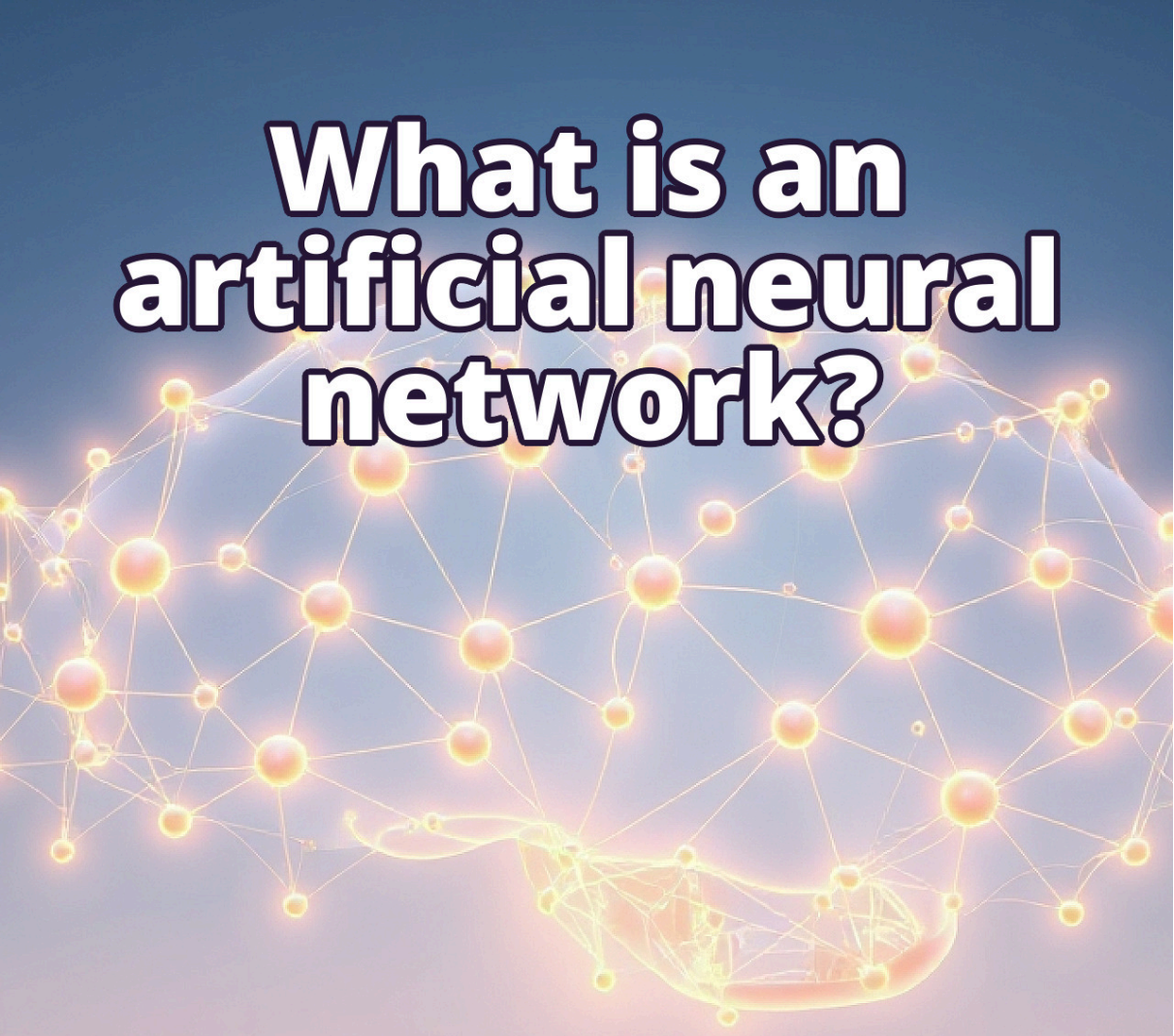
What is an artificial neural network?

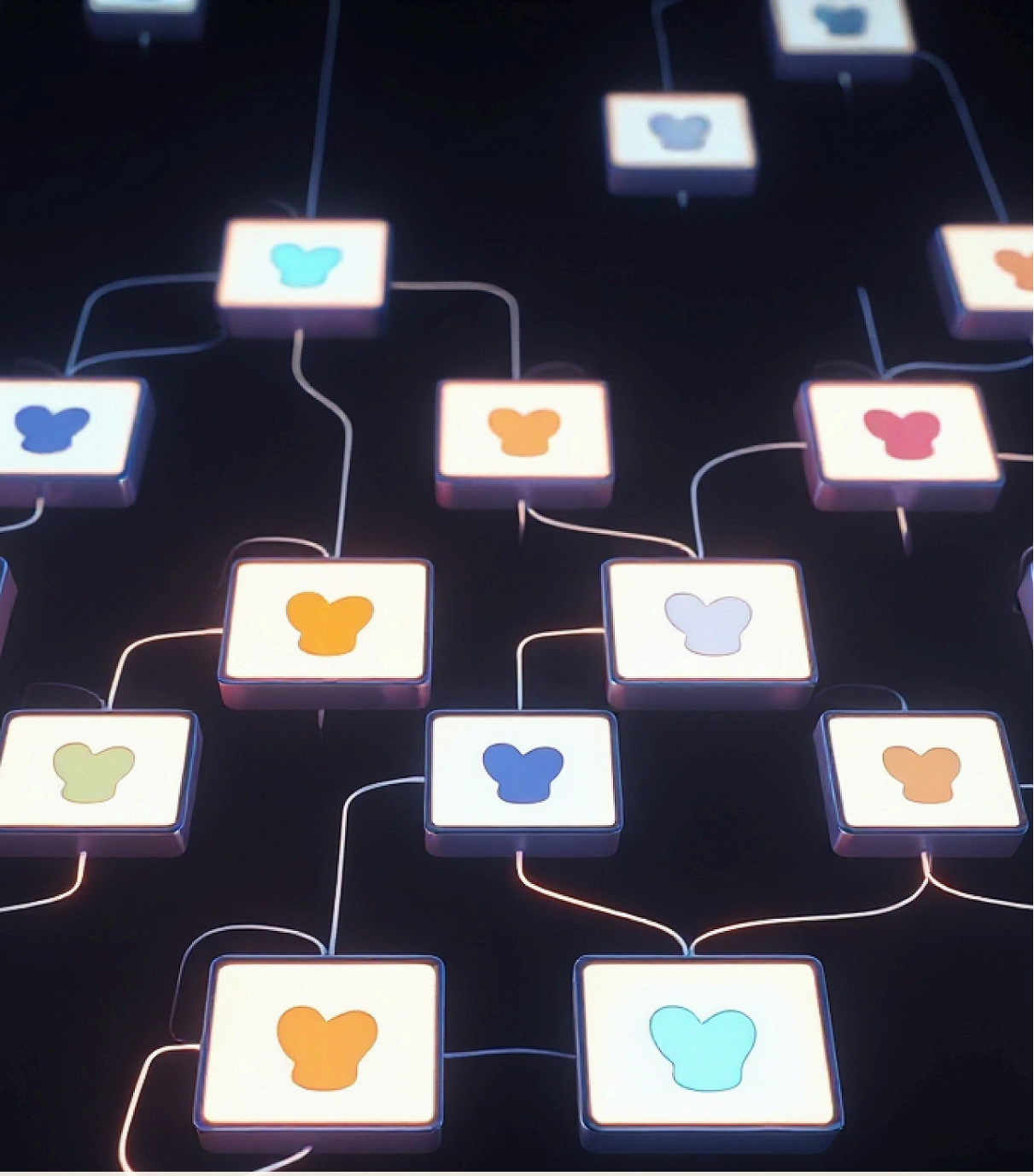


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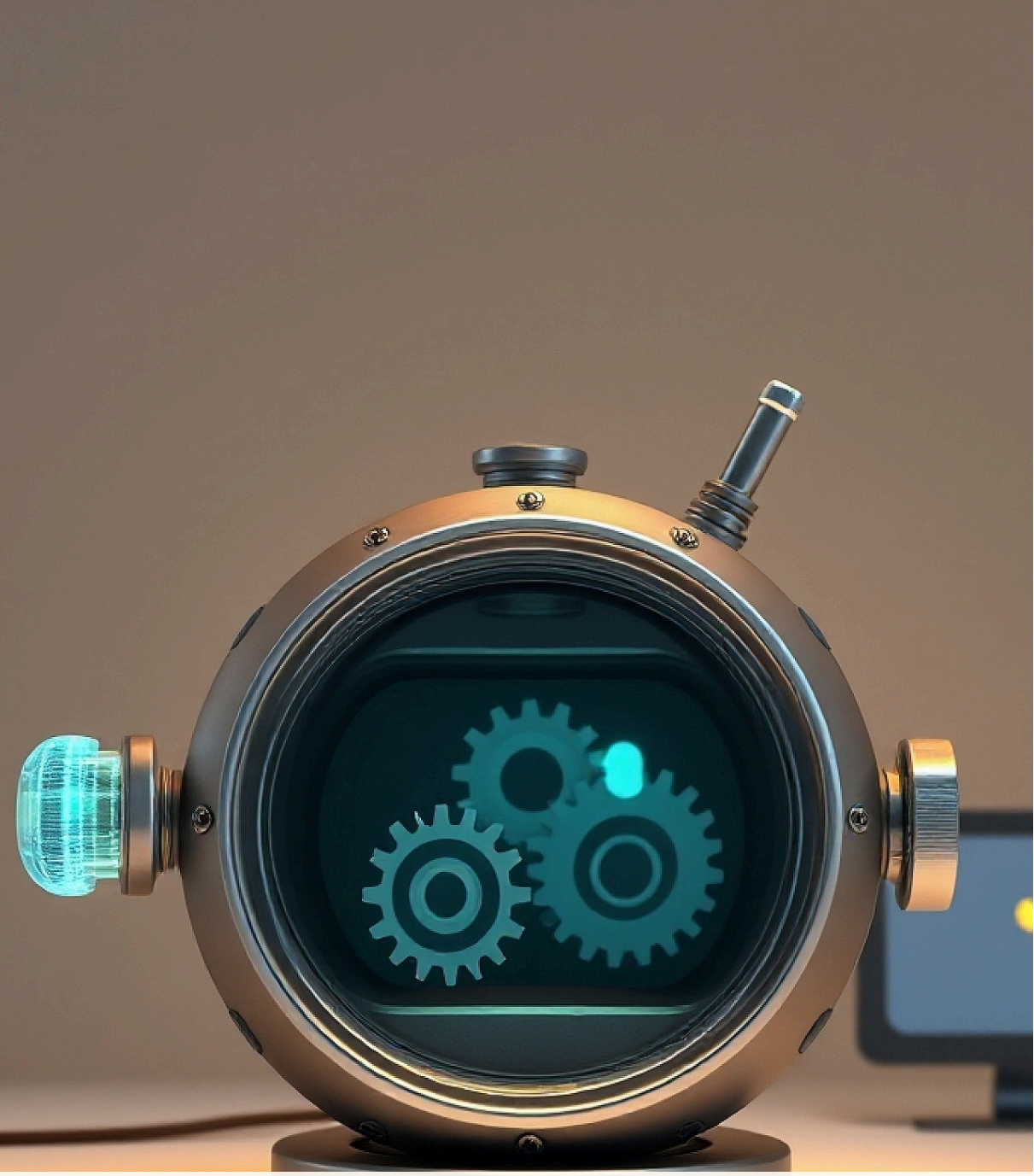
What is an artificial neural network?



You may have heard the term artificial neural network and wondered what it means. The short answer is that it is a mathematical model made of connected units that turn numbers into results. This book unpacks that idea step by step, starting with the simplest pieces and building up to the whole picture. By the end, you will understand the core idea clearly.



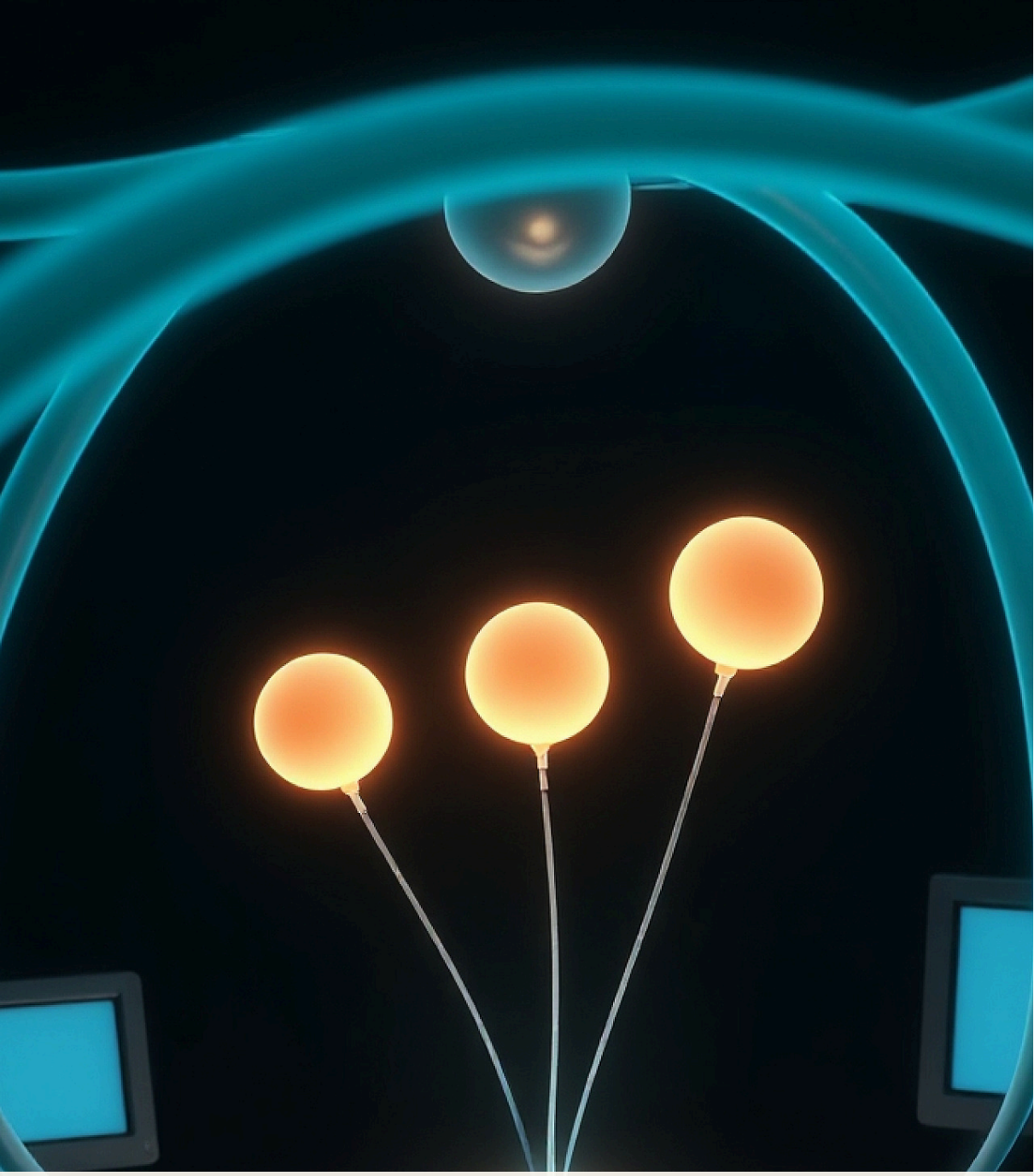
Everything inside an artificial neural network is a number. The inputs you give it are numbers, the weights on the connections are numbers, and the output it produces is a number. There is nothing mysterious happening, only arithmetic on numbers. Keeping this in mind makes the rest of the explanation much easier to follow.



A single unit takes in several numbers. It multiplies each incoming number by a weight and adds the results together to produce one output number. For example, if the inputs are 2 and 3 and the weights are 0.5 and 1, the unit computes 2 times 0.5 plus 3 times 1, which equals 4. This tiny calculation is the building block of the whole network.



A weight tells a unit how much an incoming number matters. A large weight means the number has a strong influence on the unit's output, while a small weight means it has little influence. For instance, a weight of 10 makes an input ten times more important than a weight of 1. Weights are the numbers that training will later adjust.



Several units can be linked so that the output of one becomes an input to another. This web of connections is what makes it a network. For example, three units in a first group can each send their results to a single unit in a second group. The connections carry numbers from unit to unit, forming a flow through the network.



Numbers enter the network at one side, pass through the connected units, and come out at the other side as a result. This flow is how the network produces an answer. For example, an input number might go through two units in sequence, each multiplying and combining, before reaching the final output. The path from input to output defines the network's calculation.



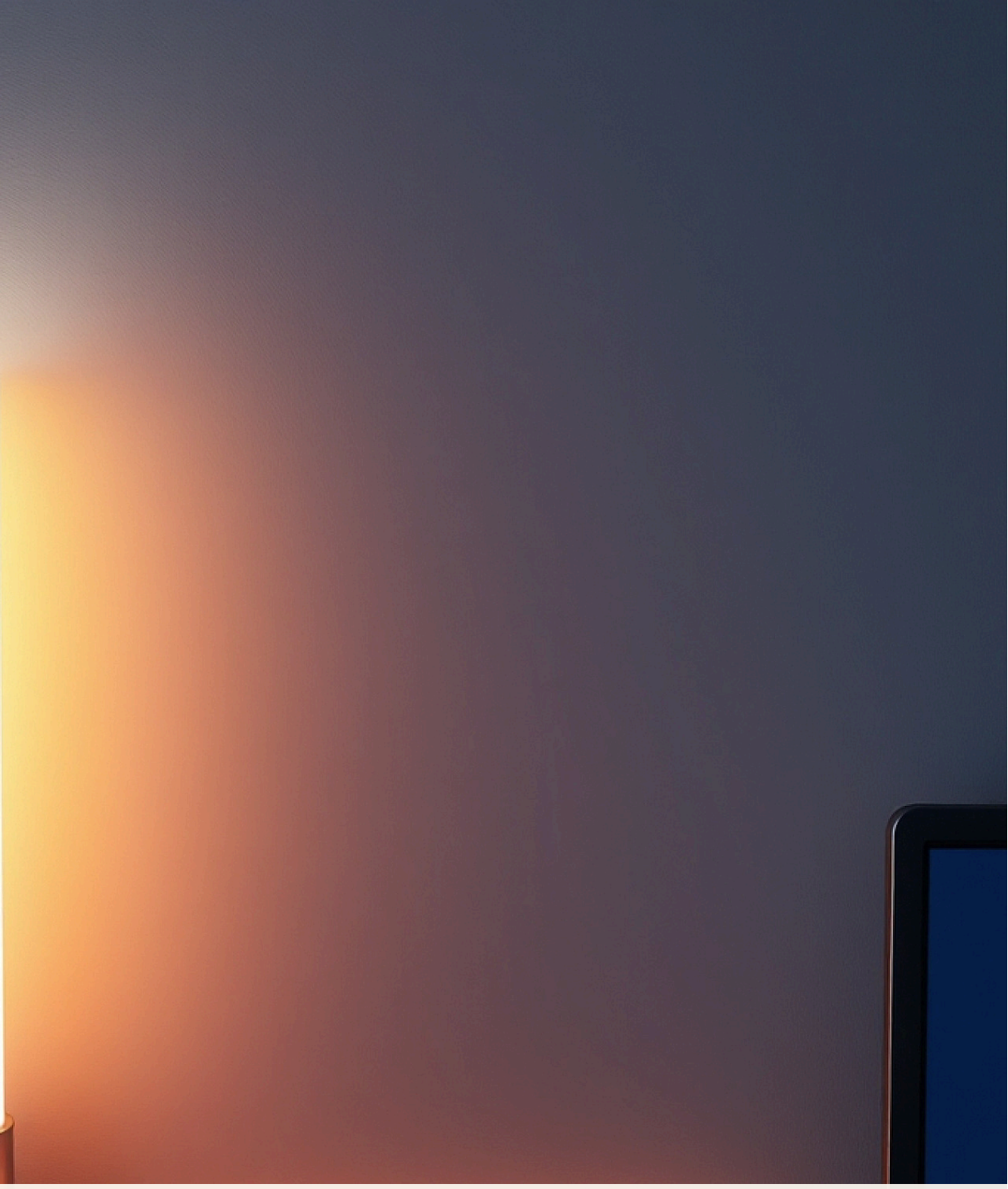
Consider an image described by numbers, such as pixel brightness values. A network can take these numbers as input and produce a probability that the image contains a certain object. The output is a number between 0 and 1, which you can read as a chance. For example, an output of 0.9 means a high probability, while 0.1 means a low one.



When a network is first created, its weights are set to random numbers. With these random weights, the network's answers are usually bad. For example, it might give a probability of 0.5 for every image, which is no better than guessing. The network needs a way to get better at its task.



Training is the process of adjusting the weights so that the network's answers improve. The structure of the network stays the same; only the numbers on the connections change. For example, after training, the same network might correctly give high probabilities for images that contain the object. Training is how the network learns from examples.



To train the network, you compare its output with the correct answer. The gap between them measures how wrong the network was. For example, if the correct answer is 1 and the network outputs 0.3, the gap is 0.7. This gap tells the network how much it needs to improve.



After each comparison, the weights are nudged slightly in the direction that reduces the gap. For example, if increasing a weight would make the output closer to the correct answer, that weight is increased a little. Repeating this process many times makes the answers get closer to correct. Each nudge is small, but together they add up.



The training loop runs over and over on many examples. Each round consists of a guess, a comparison with the truth, and an adjustment of the weights. For example, you might show the network thousands of images, one after another. Each round makes the weights a little better at the task, so the network's performance improves.



The name comes from the biological nervous system, where neurons connect and pass signals to one another. The units and connections in an artificial neural network loosely echo that picture. For example, a unit receiving numbers from other units is somewhat like a neuron receiving signals. This resemblance inspired the name, but it is only a loose analogy.



An artificial neural network is not an exact copy of the human brain. It is a simplified mathematical model inspired by the idea of connected cells. For example, it does not have emotions, consciousness, or awareness. It simply performs arithmetic with weights that were tuned during training. The biological name is a metaphor, not a literal description.



A common confusion is to think the network thinks or understands like a person. It does not. It just does arithmetic with weights that were tuned during training. For example, it can label an image without any understanding of what the object is. The network is a mathematical tool, not a mind.



To sum up, an artificial neural network is connected units that combine numbers with weights. Training adjusts those weights to improve the task. Remember the loop of guess, compare, and adjust. For example, a network trained on images learns weights that give high probabilities for images containing the object. That is the core idea in one paragraph.