What is machine learning?



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What is machine learning? The short answer is that it is a set of methods that lets computers learn to perform tasks by using relationships found in examples. Instead of writing a separate rule for every situation, you give the computer examples and a way to learn from them. This book explains that answer step by step, using simple language and one everyday example about electricity use.



A computer is a machine that follows instructions exactly. You tell it what to do, step by step, and it does only that. It does not guess or decide on its own. This is the normal way computers work, and it is the starting point for understanding what changes when a computer learns.



In the old way of programming, a person writes a separate rule for every situation the computer might meet. If the computer needs to handle ten cases, you write ten rules. If it needs to handle a thousand cases, you write a thousand rules. The picture is a pile of rules, one for each case, growing larger as the situations multiply.



Many real tasks have far too many situations to write a rule for each one. Think of recognising a face, understanding speech, or estimating tomorrow's electricity use. The number of possible cases is huge, and writing them all by hand is impossible. The pile of rules becomes too large to ever finish.



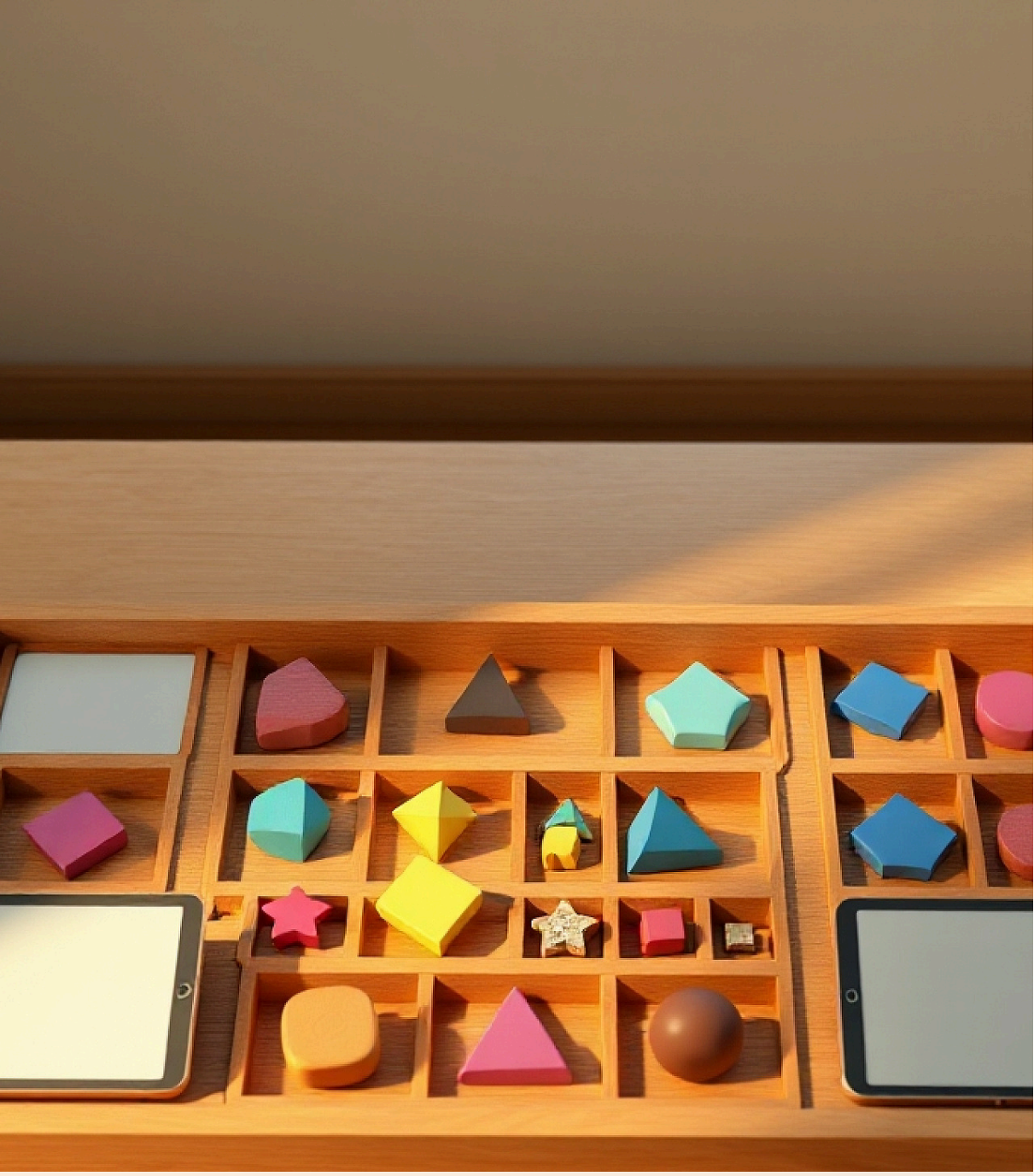
Instead of writing every rule, you can let the computer find the relationships in examples. You show it many examples of the task, and it works out the patterns that connect the situation to the answer. The computer learns the task from the examples rather than from hand-written rules. This is the core idea of machine learning.



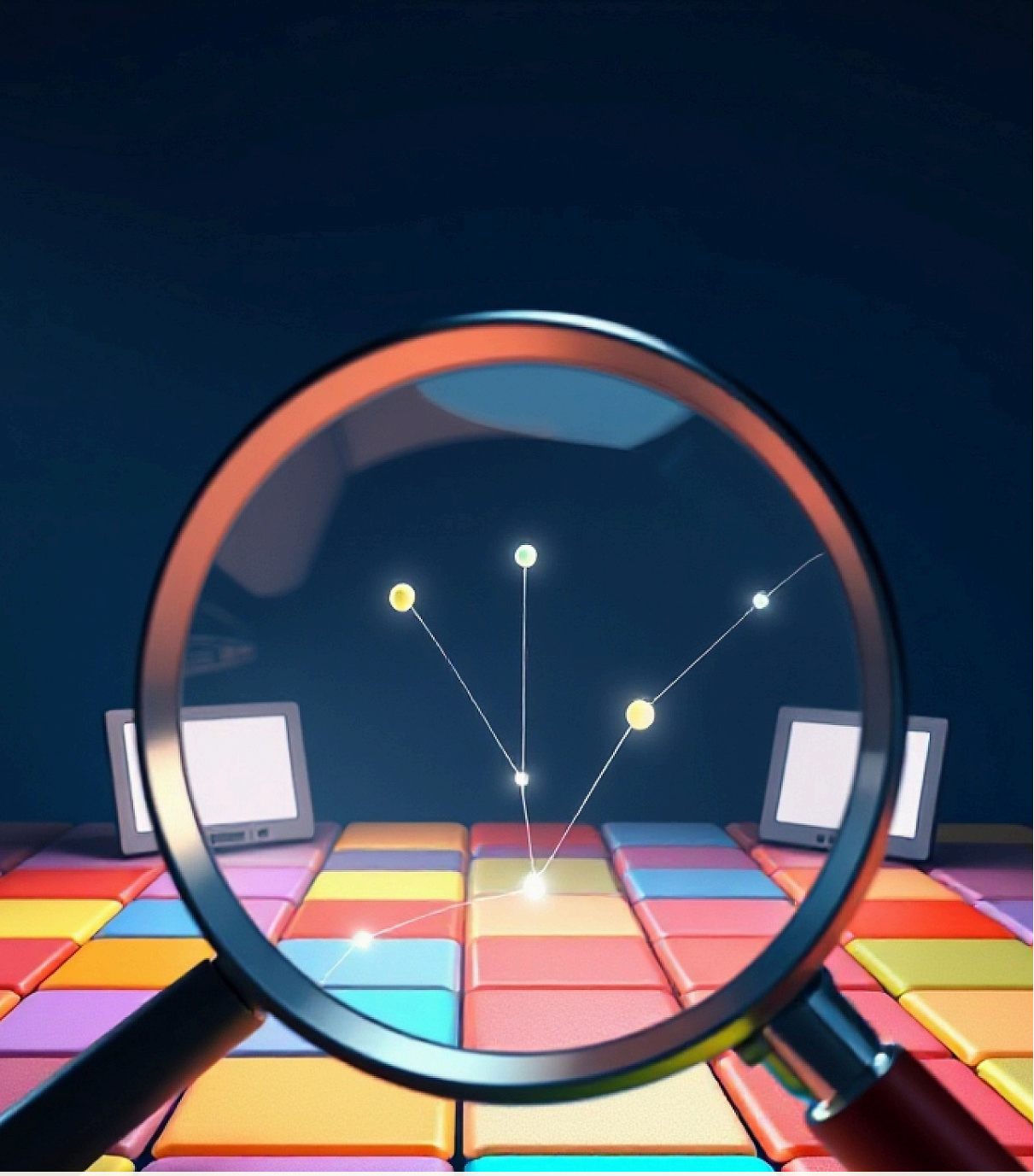
The programmer's job changes. Instead of writing rules for every case, the programmer prepares two things: the learning method and the data. The learning method is the general procedure the computer will use. The data is a set of examples of the task. The picture shows these two things being handed over together.



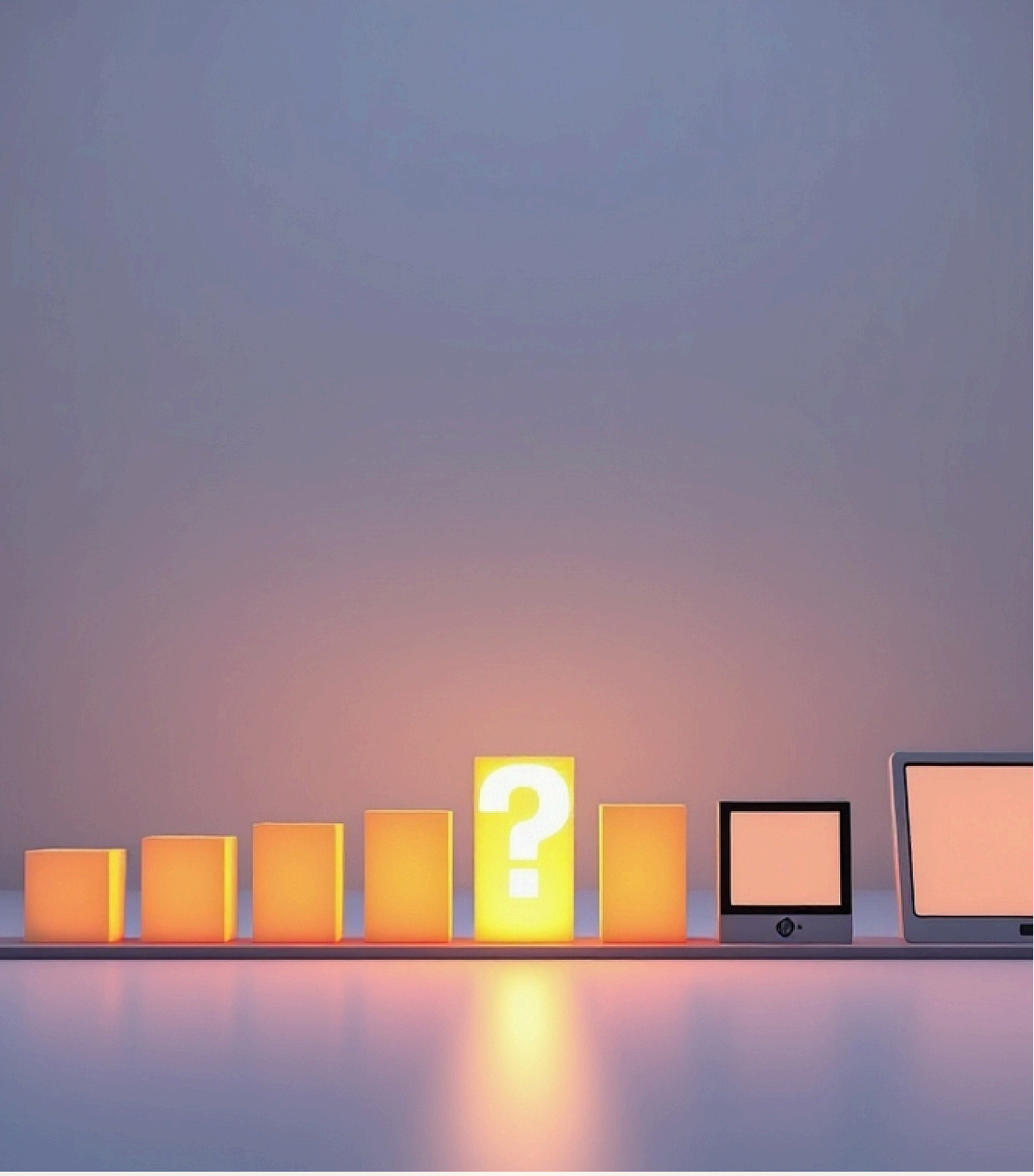
The learning method is a general procedure that looks at examples and adjusts itself to do the task better. It is not a rule for one situation. It is a way of learning from many situations. As it sees more examples, it changes its internal settings so that its answers fit the examples more closely. This is how the computer improves without new hand-written rules.



The data is a collection of examples of the task. Each example shows a situation and what goes with it, such as a day's electricity use and the day before it. The computer uses these examples as its material for learning. Without data, the learning method has nothing to learn from, so the examples are essential.



The computer searches the examples for relationships. It looks for which situations tend to go together, such as high use on cold days or low use at night. These found relationships are what it uses later to handle new situations it has not seen before. The relationships are not written by a person; they are discovered from the data.



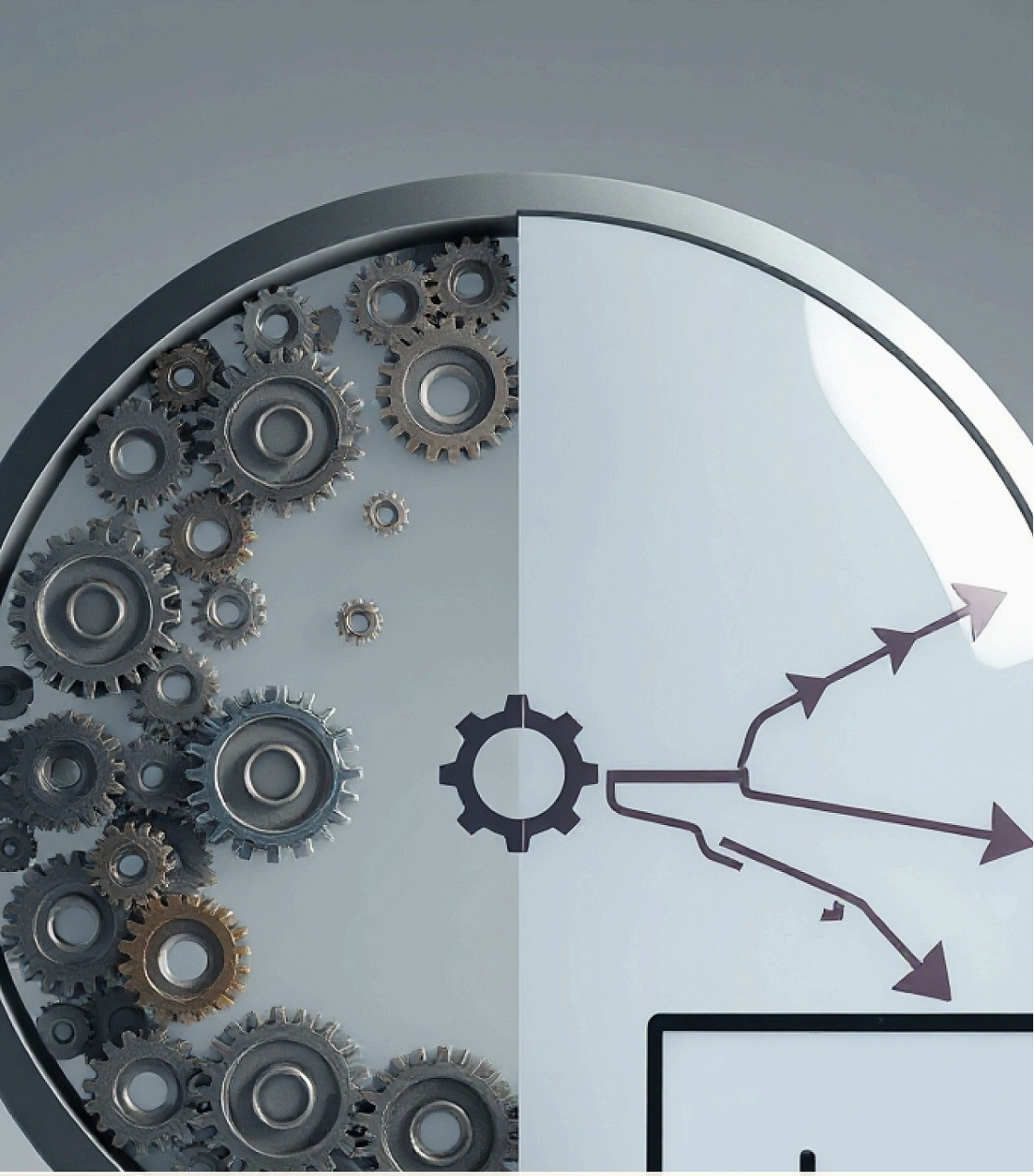
Consider a simple example: predicting tomorrow's electricity consumption. The data is past electricity consumption, recorded day by day. What you want to know is tomorrow's consumption. The picture shows past days' use leading to a guess for tomorrow. The computer learns from the past numbers how use tends to change from one day to the next.



The relationships found in past consumption are used to predict tomorrow's use. The computer does not follow a written rule for tomorrow. It uses the pattern in the past data, such as how today's use relates to yesterday's. Then it applies that pattern to today's number to produce a guess for tomorrow. The guess is a prediction, not a certainty.



Machine learning is a subfield of artificial intelligence. Artificial intelligence is the big area of making computers do tasks that seem to need intelligence. Machine learning is one part inside that big area. The picture shows artificial intelligence as a large circle and machine learning as a smaller circle inside it.



Not all artificial intelligence systems have to use machine learning. Some AI systems work in other ways, for example by following carefully written rules or by searching through possibilities. So machine learning and artificial intelligence are not the same thing. Machine learning is one part of AI, and some AI systems do not learn from examples at all.



A common mistake is to think the computer understands or thinks like a person. It does not. It finds relationships in examples and uses them to answer. The picture shows examples going in and a learned method coming out, nothing more. There is no understanding, no awareness, and no magic, just patterns found in data.



Another common mistake is to think machine learning is only about the method. The data is just as important. If the examples are poor or do not match the real task, the learned method will give poor answers. The programmer must prepare both the method and the examples with care. Good data and a good method work together.



To remember: machine learning lets computers learn tasks from relationships in examples instead of a rule for every case. The programmer prepares the learning method and the data. Past electricity consumption can predict tomorrow's use. Machine learning is one part of artificial intelligence, but not all AI systems use it. Keep in mind the method, the data, and the electricity example.