

Interview #1: Dr. Kazuo Yano By Using AI, Data Itself Will Be Intelligent

Dr. Kazuo Yano, Corporate Chief Engineer,
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(Interview 1/3)



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A recent move in industry is to capitalize on the IoT to increase efficiency in operations and to discover hidden trends. Dr. Kazuo Yano, a researcher at the Research and Development Group, Hitachi, Ltd., says that AI is essential for making the most of massive amounts of collected data. This series of three articles presents his fascinating opinions that the development of the only multi-purpose AI in the world can lead to the resolution of various business-related issues and can even lead to an increase in human happiness.

AI is essential for making the most of the IoT



Today, we frequently see the words “IoT” (Internet of Things) and “AI” (artificial intelligence). I believe that these two words are not be separated. AI is included in the concept of the IoT, and the IoT is included in the concept of AI. In other words, there can be no IoT without AI.

Recently, sensors and network technologies have evolved to enable data to be easily collected from devices such as wearables or robots.

IoT is becoming exactly what the term is defined as: the Internet of Things. However, the massive amounts of

accumulating information have reached levels that are too large to be processed by the capacities of human beings.

Although the IoT has recently become a major focus of discussions, I've been talking about this concept to people around me for the last 12 or 13 years. A diagram that I drew at the beginning of this period shows a sensor being used to collect a large amount of data, and that data then being processed by a computer, with feedback being generated automatically. This is almost the same as in the diagrams we are seeing now.

Some magazines have been saying that this concept has already become a reality. However, such a system was never achieved! In fact, nobody knew how to implement this concept until recently. I was also researching topics along the lines of this concept, but none of my efforts resulted in success. It was the arrival of AI that changed the situation.

So, what can the IoT and AI bring to business and society? To understand this, we have to think about how the computer actually originated.

Conventional ways of thinking cannot continue to improve productivity

In the period from the late 19th century to the early 20th century, Frederick Taylor* proposed *The Principles of Scientific Management* and put them into action. His ideas were that an operation should be broken down into many processes, tools and procedures should be standardized, and all aspects should be organized rationally. If these principles were followed, a job that formerly could only be done by a master who had honed his or her skill over dozens of years could be performed easily by anyone after only minor training. *The Principles of Scientific Management* were able to improve productivity 50 times more than before. Improved productivity meant that a small input produced a large output, which resulted in higher profits.



In those days, nobody believed in such a possibility. In fact, there was a strong reaction against his ideas because they threatened to break the conventional social structure composed of masters and apprentices. However, the principles were proven to be effective in some situations, including mass production at Ford Motor Company, and these principles then spread to other advanced countries and made people richer.

Computers then emerged in the late 20th century. To make the most of computers, people again had to separate operations into processes and reorganize them, as an extension of *The Principles of Scientific Management*. That is to say, they tried to extract the work processes that could be standardized from the operations that had been done by

hand, and then made computers perform these processes. As the result, our operations became more and more standardized. Computers are not flexible, and users are often confronted with “This cannot be input into the computer. Please follow the rules.” Overall, these procedures were able to further improve productivity, and advanced countries were able to further develop their economies. However, this concept is now going out of date.

The conventional methods based on *The Principles of Scientific Management* are highly effective in operations that are mainly comprised of routine tasks. Currently, however, in Japan and other advanced countries, 70–80% of all jobs are knowledge based and service based. The essential feature of such work is that they change. Your job tomorrow will be different from your job today. That is to say, there is little of this work that can be standardized into computerized tasks.

As a result, productivity in Europe, the United States, and Japan has peaked, and their economies are facing sluggish growth. Additionally, income disparities are becoming wider. To eliminate such disparities, you must generate more wealth. To generate wealth, you must increase productivity. However, conventional methods can no longer increase productivity. In other words, in the 21st century, conventional computers have reached their limits. At the same time, I think that the key issue we face is to identify the ways that will enable us to overcome this difficult situation.

* Frederick Taylor (1856–1915) was an American mechanical engineer and scholar of business administration. He proposed *The Principles of Scientific Management* as a way to improve productivity by standardizing workers’ tasks and tools. *The Principles of Scientific Management* have become one of the basics of conventional business administration.

AI can support knowledge-based work



Originally, computers were devices that worked according to programs written by humans. When a human creates a hypothesis or business process and inputs it into the computer as a program, the computer works as programmed.

However, computers in the 21st century will be required to learn automatically according to changes or to grow as a situation changes: that is, they increase the productivity of knowledge-based tasks.

As I mentioned, we are now seeing fast-moving technologies obtain data from the real world: for example, via smartphones, wearable devices, and drones. The obtained data actually shows the changes that are occurring in the world.

So, might it be possible to use such data not as an object to be processed by programs, but rather as a source from which computers can create programs? When data reflecting changes in the world is turned into programs automatically, computers might flexibly change the things that they need to do. These are my thoughts about AI. The artificial intelligence that we've developed based on these ideas is called *Hitachi AI Technology/H*.

We want to thoroughly improve the productivity of knowledge workers and service workers who are working amid these changes. We want to empower these workers, like Taylor did in the 20th century. That's why we created this AI.

Birth of a Computer that Requires No Programming

As I mentioned, from 12 or 13 years ago, we had a concept for a system in which computers process an enormous amount of data obtained from the real world and feed the results back to the real world. We used statistical analysis and machine learning methods to obtain feedback from an enormous amount of data; however, none of our efforts resulted in success, and we learned that these methods had costs that were not proportional to their results.



Then, about seven years ago, based on a new realization, we changed the direction of our research. What we realized was that, no matter how much data we collect, that data has no “intent.” That is to say, a human must take charge of the “intent” part.

Take, for example, an enterprise that has an enormous amount of data that is too large to be dealt with by humans, such as sales information and customer information. The information does not have any intent, and a human must decide that the intent is “to increase sales,” which is the desired outcome. The user must then input the desired outcome into the computer. Then, from massive amounts of data (Big Data), the computer can generate hypotheses regarding “how to increase sales” and calculate the procedures for this goal. This is what “generating a program from data” means. In the beginning, we searched for a computer that was capable of performing this kind of work, but we couldn't find any applicable machines. We had no other choice but to create the artificial intelligence software ourselves.

A key feature of our AI is that it is multi-purpose, meaning *versatile*. In other words, our AI can be combined with various systems that are currently in operation around the world. For example, by combining our AI with an ERP system, you can turn the system into an AI-based ERP that learns and grows. Whether you have an SCM system or a CRM system, you can combine our AI with that system to turn it into a system that learns and grows by itself.

In the past, there have been many AI systems dedicated to specific business operations. However, an enterprise has many types of operations. Making a dedicated AI for each operation requires too much time and cost. Hitachi AI Technology/H, our multi-purpose AI, can provide solutions for various enterprise issues.

PROFILE

Dr. Kazuo Yano

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Dr. Yano joined Hitachi, Ltd. in 1984. From around 2003, he has helped develop world-leading technology that can collect and utilize Big Data. His dissertations have been cited 2,500 times, and he has applied for 350 patents. He is known for the width and depth of his expertise, from artificial intelligence to nanotechnology. Currently, he is the corporate chief engineer of the Research and Development Group. His book, *Invisible Hand of Data*, was selected as one of Bookvinegar's top 10 business book bestsellers in 2014. He has a Ph.D. in engineering and is an IEEE fellow.