Featured Articles I

Work on Applying AI to Financial Institutions

Norimasa Nakata
Jun Yoshida
Masayuki Nakagawa
Yoshiyuki Kobayashi, Ph.D.

OVERVIEW: Hitachi has acquired a wealth of AI-related technologies by accumulating research experience over many years and working on AI applications for use in many fields. Hitachi also has a growing portfolio of cases that include successful combinations of these technologies in the finance sector. Seeking to enable rapid creation of applications for business processes, Hitachi has started work on increasing the reusability of AI, treating it as a component. This article looks at the different ways in which AI is being used, and discusses Hitachi AI Technology/H and Hitachi's debating AI, presenting examples of research on these technologies and their application by financial institutions. Attempts to more efficiently develop solutions driven by an AI core are also presented.

INTRODUCTION

RECENT technological breakthroughs such as deep learning and today's ongoing advances in computing performance are enabling various problem-solving applications of artificial intelligence (AI) that are attracting interest. Many financial institutions are looking into the use of AI. Work has started on the use of AI to replace the work done by humans as a way to improve work efficiency and to discover new facts among large quantities of data.

This article looks at the future potential of AI, focusing on examples of Hitachi AI applications for financial institutions.

AI AND BIG DATA

Hitachi has been applying AI to various research topics since the 1970's. Two types of AI that have been attracting interest recently are pattern recognition AI, for use in image and sound recognition, and question-answering AI, which looks promising for applications in areas such as call centers, customer service counters, and the Web. Hitachi AI Technology/H (hereafter referred to as H) contains Hitachi's proprietary leap learning technology. It is classified as a decision-making AI for system operation and as a correlation extraction AI. The feature common to all types of AI is the ability to find rules, patterns, and answers among large quantities of data, making AI closely related to big data analysis. The data traditionally handled by financial institutions has been mostly structured data expressed in tabular form. But since these institutions also need to use unstructured text or image data, previously nonexistent uses of AI are expected to arise.

Potential AI Uses for Financial Industry Work

AI can learn starting from a zero state with no information. While typical uses of AI learning are in games such as *go* and *shogi* and in autonomous driving, it can also be used in fields that enable testing and simulation, where learning can be augmented by the feedback of positive and negative test results to the AI. In these cases, a large quantity of facts is used to enable learning, so precision can be seen to generally improve in proportion to the quantity of data provided. However, when using AI learning for practical business in the finance sector, it may not be possible to test, and the work can be affected by changes in the economic environment, so precision may not necessarily improve with larger quantities of data. On the other hand, since the work done by financial institutions involves handling large quantities of data, this data can be used as teaching data to enable AI learning instead of starting a simulation from zero.

Financial institutions already perform various types of analysis on a routine basis. Coordinating with other departments or outside organizations to gather information and assessing the analysis results are tasks that need to be done by humans. But when these tasks are broken down into smaller component tasks, many of them can be done by AI. These component tasks are currently Hitachi's most common types of AI applications for financial institutions (see Fig. 1).

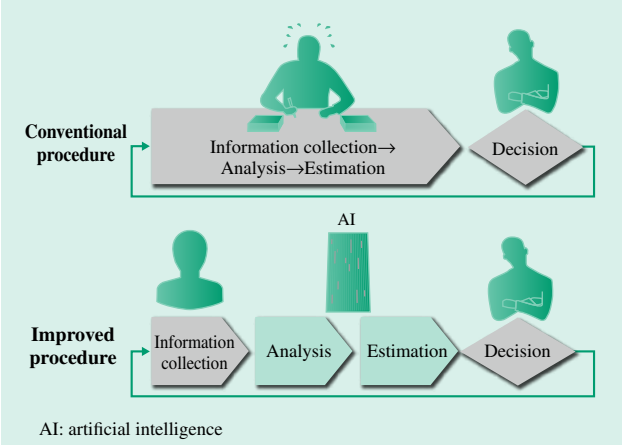

Fig. 1—Concept for Increasing Efficiency with AI.
While humans will still be needed to coordinate with other departments and outside organizations to collect information and to make critical decisions, it is highly likely that AI could take over other work.

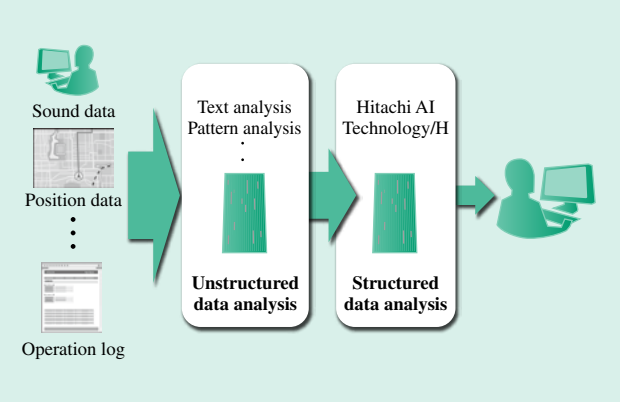

Fig. 2—Concept of Analysis Using Big-data AI.
A wider range of data can be used by combining unstructured data analysis with numerical analysis.

Hitachi AI Technology/H

H is a big data analysis engine that contains a combination of statistical functions and is used to efficiently extract causes of correlations. Specifically, data that are likely to affect the attainment of a particular objective are entered as the explanatory variables, the categories of explanatory variables are defined, and then these categories are combined to automatically generate a massive quantity of composite indicators. These composite indicators are searched to extract a list of composite indicators that are highly correlated to the outcome (sales, earnings, or other values that need to be improved in order to attain the objective). The extracted composite indicators are combinations of two conditions, such as "people who are at least 20 years old and who live in Tokyo." Focusing on highly correlated combinations enables the discovery of previously unnoticed hypotheses without relying on rules of thumb or intuition. It is a method that has already been used for various applications such as marketing and work efficiency improvement.

This AI can create scoring models from highly correlated composite indicators, so attempts have already begun to incorporate the created scoring models into systems to improve work efficiency. Specifically, researchers are looking into the use of models calculated by H in tasks conventionally done by humans such as demand forecasting, fraud detection, and financial product pricing.

While H is AI that analyzes structured data, it can also be used to analyze unstructured data when combined with other AI for applications such as text analysis or image recognition. For example, text analysis of sales records can be used to assess whether the consumer reaction to a particular promotional product was positive or negative, and to extract the features of the consumers who reacted positively and negatively (see Fig. 2).

Since H can search a wide range of data, it is more likely than conventional analysis (done by creating a hypothesis in advance) to find important overlooked factors. The discovered factors can help in creating business policy proposals or in uncovering useful tips. For example, one bank's marketing analysis consisted of a preliminary process that used another system to aggregate account balance history data, followed by a subsequent process that used H to help make new discoveries among the data.

AI for Assisting Human Decisions

Hitachi is also working on developing a question-answering AI. For this application also, Hitachi aims to use a combination of various AI technologies to assist or take over business processes. The intent is to develop more advanced customer support processes by combining sound recognition functions, text comprehension functions, and functions that can find answers among large quantities of text data.

One example is Hitachi's debating AI. This technology searches large volumes of text data to find text that is related to a particular debate topic, and then generates opinions both for and against the debate proposition based on multiple differing perspectives. Examining both the pro and con opinions output by the technology will enable humans to make assessments and decisions efficiently without having to study large volumes of text (see Fig. 3).

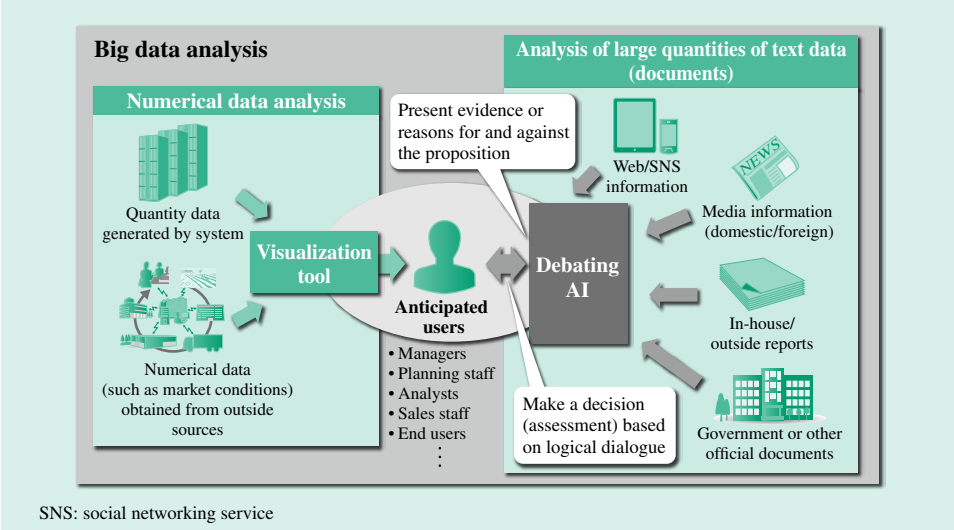

Fig. 3—Concept of Using Hitachi's Debating AI. Decisions can be made more efficiently by checking conventional numerical data after examining the evidence and reasons for and against a debate proposition presented by Hitachi's debating AI.

Financial sector work often consists of studying large volumes of documents on topics such as related financial laws and regulations. Investment decisions are also made by studying various data on topics such as economic conditions, markets, corporate information, and past trends. In the future, Hitachi's debating AI is expected to be able to improve the efficiency with which humans assess work, by searching large volumes of text to extract items that are relevant to a particular decision, and presenting pro and con opinion summaries. It can also be expected to help make more precise assessments efficiently by presenting general arguments and evidence that can be examined and then studied numerically by humans.

MORE ADVANCED USE OF AI

The human brain apportions the various processes of recognition, memory, and judgment to various parts that work together to function as a control tower for biological activities. AI also combines multiple functions to enable it to work that could not be done by one function alone. While many people picture humanoid robots when they talk about AI, it does not necessarily have to take this form. AI can assist humans over the Internet, from a tablet terminal, or in various other forms as the case requires.

Forms for Efficient Use of Multiple AI Technologies

Hitachi has a history of many years of research using AI to solve problems in various areas, and a variety of technologies. For example, Hitachi has used AI for application-specific problems in areas such as recognition, natural language processing, prediction, optimization, and statistical analysis. Hitachi has also responded to the recent rise in popularity of humanoid robots by creating robots that combine various AI technologies to enable interactions with people. But, since financial institutions have contact with their customers through various channels, they will need to use more than just humanoid robots for AI-based human interactions. AI-based human interaction methods adapted to these various channels will be needed too. To respond to this need, Hitachi is aiming to provide more advanced use of AI in finance, based on a system composed of a knowledge layer that handles data gathering, analysis and learning, a communication layer that handles dialoging and conversion, and an interface layer that serves as the point of user contact (see Fig. 4).

Key Points for Efficient Use of AI

The key points for enabling efficient use of AI in a variety of applications are to treat AI technologies as components to be combined, and to improve the reusability of each AI technology component. Hitachi has started working on organizing in-house and third-party AI technologies to improve reusability by breaking down business systems into general-purpose components and components that are specialized to particular industries or business processes.

General-purpose components are AI processing engines, engines that implement deep learning and H are examples of these components. Components that are specialized to particular industries or business processes include industry-specific terminology dictionaries and data aggregation processes. Data

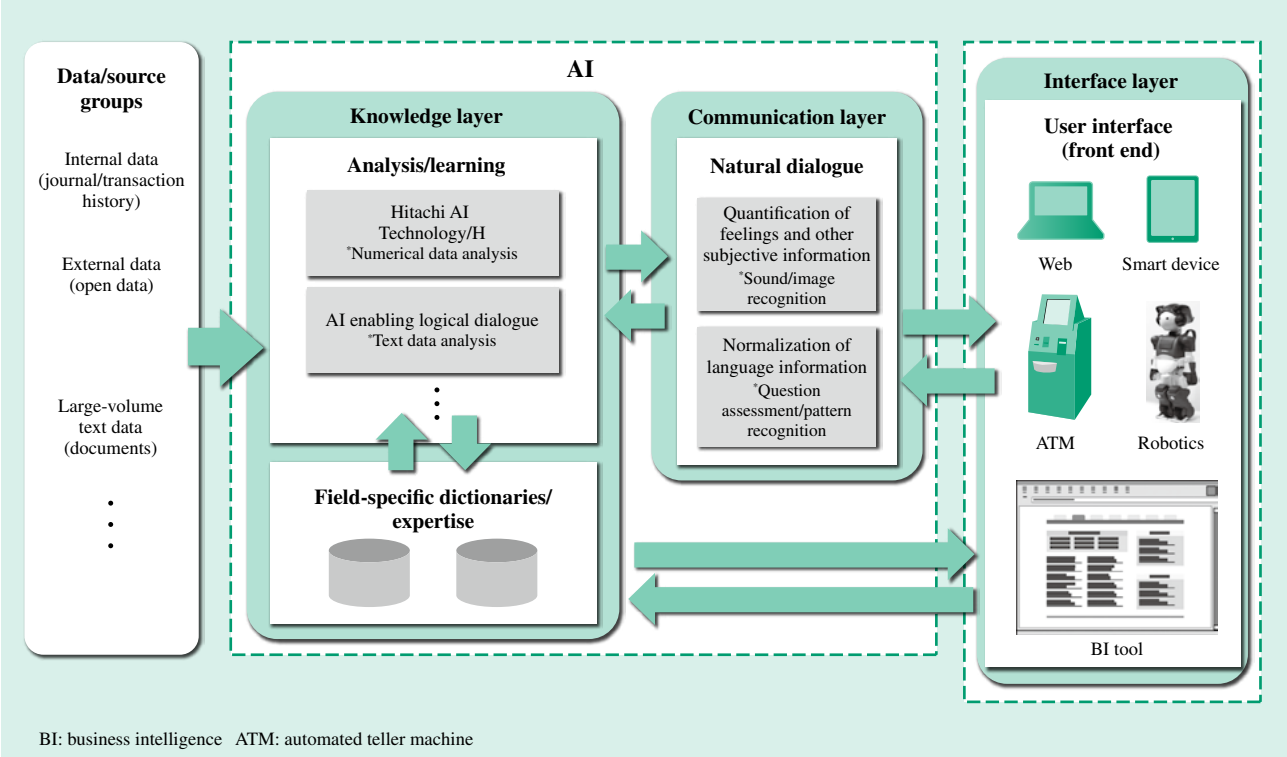

Fig. 4—Hitachi's Idea for a System that Uses AI.
The system will enable the use of AI for a variety of applications by organizing the roles of AI and other functions.

aggregation processes specialized to particular industries include, for example, processes such as data aggregation for extracting features from bank account balance histories, and data aggregation for extracting market features. Properly combining these general-purpose components and industry-specialized components will achieve a system that efficiently constructs and provides a variety of services and systems.

FUTURE USE OF AI

The human brain apportions various functions to various parts, and AI can provide functions that match or exceed some human brain functions. Many reports have been written about how these AI functions have been put to practical use. Combining AI component technologies can be expected to enable a wider range of AI applications. Financial institutions have also begun making attempts to use AI to assist the operations currently done by the human staff at branches and call centers.

Once the Internet of Things (IoT) becomes well-established, it will be possible to analyze various types of personal data with the owner's consent. This development could spur the emergence of new market entrants and enable the finance sector to provide more advanced services driven by information that has higher value. AI will play an indispensable role in that environment, serving as the core technology that enables large quantities of data to be used. And, a wider range of business processes should also start to incorporate AI as diversity and performance improvements increasingly enable it to take over human tasks.

Cost performance issues and other limitations are currently impeding the use of AI and other information technology (IT) for some applications, as embodied by the large number of financial institutions that still use paper forms. But as companies seek to cut costs by upgrading systems through outsourcing or process standardization, digitalization should continue to advance, and areas ranging from branch processes to Internet banking are likely to see growing use of AI.

The spread of AI could also have benefits for customers. AI learning that bridges the gap between the conventional knowledge and expertise of financial institution staff and the experience of individual customers could enable more customer-focused financial services tailored to those individual customers' values. The thought is that this could result in high-quality services that maintain continuity

and consistency across all channels and financial institutions. The time may also come when AI acts as a trusted partner that provides financial advice about potential risks that customers themselves have overlooked.

CONCLUSIONS

There has been recent concern about the prospect of AI taking over human jobs in the future, but the likelihood of losing a job to AI decreases in proportion to the importance of communication with humans in that job. Similarly, AI cannot be held liable for problems, so this will ultimately create a continued need for human judgment in the future, because humans will always be blamed for errors in design or operation that cause system or mechanical accidents.

These observations lead Hitachi to believe that the progress of the modern world is ideally produced by humans and machines working together in harmony.

REFERENCES

(1) K. Yano, "Invisible Hand of Data: The Rule for People, Organizations, and Society Uncovered by Wearable Sensors," Soshisha Publishing Co., Ltd. (Jul. 2014) in Japanese.

(2) Artificial Intelligence as a Hope—AI for Taking the Challenges of Unpredictable Era, Hitachi Review **65**, (Jul. 2016).

ABOUT THE AUTHORS

Norimasa Nakata

Big Data Project Group, Financial Innovation Center, Financial Information Systems Sales Management Division, Financial Institutions Business Unit, Hitachi, Ltd. He is currently engaged in the development of AI and big data solutions for financial institutions.

Jun Yoshida

Big Data Business Development Center, Digital Solution Business Development, Service Platform Business Division Group, Information & Communication Technology Business Division, Hitachi, Ltd. He is currently engaged in consultation for data analysis services.

Masayuki Nakagawa

1st Group, 5th Business Unit, Financial Information Systems Division, Financial Institutions Business Unit, Hitachi, Ltd. He is currently engaged in the development of IT solution services with AI for financial institutions.

Yoshiyuki Kobayashi, Ph.D.

Intelligent Information Research Department, Center for Technology Innovation – Systems Engineering, Research & Development Group, Hitachi, Ltd. He is currently engaged in research into natural language processing. Dr. Kobayashi is a member of the Japanese Society for Artificial Intelligence (JSAI), the Information Processing Society of Japan (IPSJ), the Association for Natural Language Processing (ANLP), and the Association for Computing Machinery (ACM).