Consideration of Utilization of Artificial Intelligence for Business Innovation

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In recent years, the growth of artificial intelligence (AI) has been remarkable. In the chemical industry, a wave of business innovation utilizing AI has arrived, including drug development that utilizes AI in the medical field. Sumitomo Chemical Co., Ltd. aims to realize dramatic business innovation through digitization corresponding to the IoT era in its medium-term plan. As a part of this AI is also being examined as a digitalization technology. In this paper, we will consider the utilization of AI for future business innovation based on the present state of artificial intelligence and efforts at Sumitomo Chemical Co., Ltd.

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Introduction

In recent years, the development of artificial intelligence (AI) has been remarkable. One novelty is that with the advent of AlphaGo™ *1, a computer was able to defeat a human in the game of Go, which was said to be impossible. AI has become familiar to us with its dissemination in virtual personal assistants*2 such as Google® Now, Apple® Siri® and Microsoft® Cortana® incorporated into the smart phones all around us. In the chemical industry, a wave of business innovation utilizing AI has come, starting with drug discovery that makes use of AI in the field of medicine.

Sumitomo Chemical Co., Ltd. aims to realize dramatic business innovation through digitalization matched to the IoT*3 era centered on the IT Innovation Department in its medium-term plan. As a part of this, digitalization is being promoted using a variety of the latest technologies, and AI is being examined as one such technology.

In this paper, we will consider the current state of artificial intelligence and work being done at Sumitomo Chemical Co., Ltd., as well as the use of AI for future business innovations.

Artificial Intelligence (AI)

Intelligence is the power to learn and understand things and make decisions. Artificial intelligence (AI) is the achieving of human intelligence itself with machines*4 or executing things done by humans using intelligence with machines. AI comes about through a combination of multiple technologies such as machine learning and deep learning.

Research has continued on AI for 50 years, from the advent of the term in 1956 up to now. With progress in AI technology such as accumulation of large amounts of data with the dissemination of the Internet, machine learning, deep learning and dramatic improvements in hardware specifications, the precision of AI has dramatically improved, and it is attracting new attention.

1. History of AI

AI has passed through two winter periods and is currently facing its third boom time. **Fig. 1** is a chronological table of the history of AI.

(1) First boom (1956 – 1960)

At a conference held at Dartmouth University in 1956 (commonly known as the Dartmouth Conference),

*1 AlphaGo™ is software for the game of Go developed by Google® using AI.

*2 Virtual personal assistant is a general name for services supporting the activities of individuals. Recently, intelligent applications using AI such as Google®Now, Microsoft® Cortana® and Apple® Siri® incorporated into the smart phones have become able to respond to user requests just by giving instruction by voice without operating forms, buttons, etc.

*3 Abbreviation for Internet of things

*4 Machines are not limited to computers in particular, but unless otherwise noted, in this paper, AI is handled by computers.

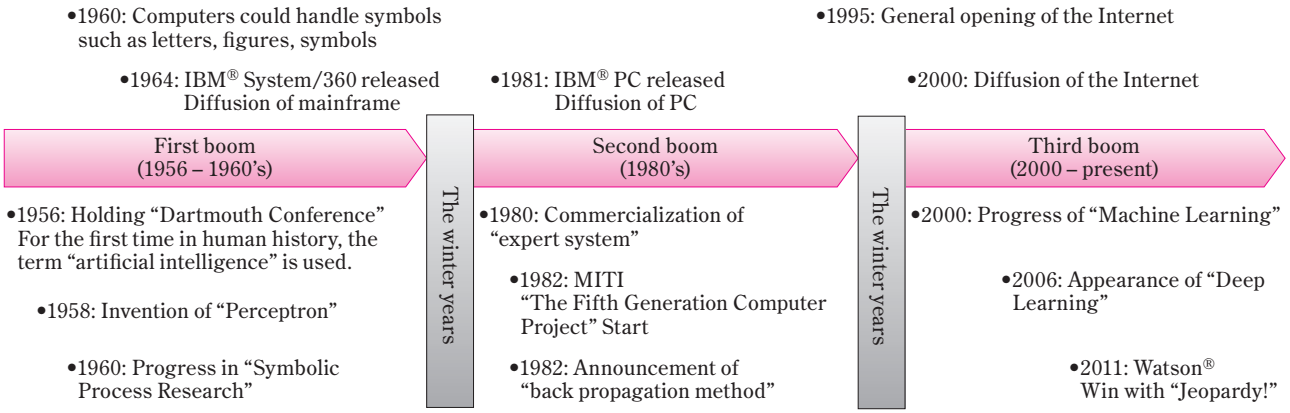

Fig. 1 History of artificial intelligence

"artificial intelligence" may have been used for the first time in human history.

In the proposal for this conference, it was stated that "every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."[1] After this conference, AI research heated up in companies and governments.

"Perceptrons" in neural networks, which are the prototypes of current deep learning were discovered in 1958. In addition, with the advent of computers being able to handle symbols such as characters, images and other symbols in the 1960s, progress was made on creating mathematical formulas for the "reasoning" and "cognition" carried out by human beings and in research on symbolic processing attempting to create programs and reproduce them with computers.

However, the limits of AI started to be seen with the disclosure that exclusive OR[*5] could not be solved by a simple logical equation with perceptrons, which was the technology leading to the expectations for achieving AI. In symbolic processing, humans would have to describe everything with rules.

As a result, the fever of companies and governments for AI cooled, and the first winter of AI research came on.

(2) Second boom (1980s)

In the 1980s, "expert systems" that emulated the decision-making abilities of experts in specific fields were commercialized and came into widespread use.

The Japanese Ministry of International Trade and Industry promoted the development of an "inference engine,"[*6] which is the core of expert systems, in 1982 and started the "Fifth Generation Computer Project" with a 57 billion yen investment. In this project, the evolution of computers was divided into first-generation (vacuum tubes), second-generation (transistors), third-generation (integrated circuits (ICs)), fourth-generation (large-scale integrated circuits (LSIs)), with the next generation to come, the fifth-generation computers, being defined as the achievement of artificial intelligence (AI). Because of this, it is mistaken as the start of general AI development with cooperation between the government and private industry in Japan (but actually centered on the development of inference engines), and to counteract this, similar projects were begun in Great Britain and the United States.

In addition, "backpropagation" was developed in research on neural networks, conquering the problems with perceptrons, and new research results were forthcoming.

However, expert systems have a frame problem of "becoming clever if large amounts of knowledge and rules are input, but all knowledge cannot be written down."[*7] In addition, the performance expected from neural networks was not obtained. Thus, once again, the limits of AI were seen, and AI research went into its second winter.

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*5 Exclusive OR is a logical operation, and is logically true when only one of two propositions is true. If both are true or both are false, it is false.

*6 An inference engine is a structure for deriving answers from a database in which expert knowledge is accumulated. As a result of the Fifth-Generation Computer Project, computers that could execute 500 million syllogisms per second were completed.

*7 Expert systems are constructed based on rules for execution on the basis of conditions. For example, all activities based on the condition of giving cold medicine when a cold is contracted are programmed. In such cases, all conditions are described, and the rules change one by one according to changes in information and conditions.

(3) Third boom (2000 – present)

The Internet, which generally opened to the public around 1995, exhibited an explosive expansion around 2000. In contrast to systems up to then, general consumers and not just companies could have business dealings and information exchange on the Internet; therefore, data of a different order of magnitude from the past came into use. A general rule for AI is that learning results are obtained to the extent of the volume of data. In these circumstances, research on AI heated up again.

First of all, "machine learning" centered on Bayesian statistics*8 developed in the automation of analysis and processing of data accumulating every second for reading customer preferences based on buying history and accumulated on the Internet and the recommendation of products.

In 2006, an "autoencoder" was developed and, with the marked improvement in computer performance, multilayering of neural networks became possible. Thus, came the advent of "deep learning," which is a multilayer neural network, and the performance of AI made a marked improvement.

Results using AI that could not be conceived of previously were seen as in the IBM® question answering system Watson® taking on a human being in the American game show "Jeopardy!" in 2011 and winning, and in 2012, Google® imputing a large amount of image data and being successful in getting a computer to identify a cat by itself using deep learning.

In addition, an AI boom is occurring so that AI also feels closer to home in recent years with virtual personal assistants, such as Siri® on Apple,® installed in smart phones having become popular.

2. Current State of AI

(1) Strong AI and weak AI

AI is generally classified as strong AI and weak AI.

Strong AI is a machine that has the same intelligence as humans. Specifically, this is AI in which various intelligence is obtained by arbitrarily learning information and books which are flooding the world on the Internet or obtaining information visually and aurally using general learning algorithms with humans doing no thinking in particular. This is no less than machines that have intelligence equal to humans or greater as depicted in the world of science fiction.

Weak AI is the partial substituting of machines for human intelligence. Specifically, this is AI created by specialized learning data using a dedicated learning algorithm for specific problem-solving such as playing Go, answers in quiz shows, demand forecasting and distinguishing human emotions. In other words, there is individual AI for specific problem-solving, and that AI cannot be used outside of that specific problem-solving.

Moreover, all current artificial intelligence is weak artificial intelligence, and there are no prospects for the development of strong artificial intelligence.

(2) AI technology

A typical example of AI technology is machine learning. Deep learning, which has advanced AI in recent years, is a type of machine learning.

Machine learning is technology and techniques that try to achieve functions that are the same as the learning capabilities that humans perform naturally. Machine learning is a structure for a machine deriving a model (rule based, principle based, similarity based) on the basis of data. Inferred responses can be returned by inputting new data into this model that has been derived.

Statistical methods such as linear regression analysis, logistic regression analysis and Bayesian statistics are used in learning algorithms for deriving machine learning models. Machine learning algorithms may be used individually, but according to the characteristics of the data and the problems to be solved, multiple learning algorithms are combined in multiple stages.

Typical learning methods for machine learning are given in **Table 1**, and "supervised learning" and "unsupervised learning" are the two most important ones. In supervised learning, a human prepares accurate data (supervised data), and a model is derived by learning based on that data. On the other hand, unsupervised learning is a learning method for the computer deriving the model itself out of the set of data, using deep learning in particular.

Deep learning is machine learning using a neural network with a multilayer structure. A neural network is a

*8 Bayesian statistics are type of statistics based on the Bayesian theorem. The Bayesian theorem is a theorem concerning the occurrence of an event conditioned on the occurrence of another event. Bayesian statistics can estimate probabilities automatically based on incoming information; estimations are possible with little data, and the estimates have the characteristic of becoming more accurate if the data increases.

Table 1 Learning methods and Learning algorithms

Learning methods	Learning algorithm examples
Supervised learning	• Linear regression • Logistic regression • Naive Bayes • Perceptron • AR,MA,(s)ARIMA model
Unsupervised learning	• Hierarchical clustering (Ward system etc.) • Non-hierarchical clustering (K-means clustering etc.) • Topic model (Latent Dirichlet allocation etc.)

mathematical model aiming to express several characteristics seen in brain functions by computer simulation.

The perceptrons studied in the first boom are also neural networks. Perceptrons had a three layer structure (input layer, intermediate layer, output layer), but the "connection weight*9 did not change"; therefore, it was actually only possible to have a two layer structure. Thus, it was proved that they could only solve linearly separable problems, and it was found that problems having simple linear indivisibility, exclusive OR for example, could not be solved by perceptrons (first winter).

However, backpropagation was proposed thereafter and it became possible to change the connection weight of the intermediate layer by learning, making it possible to construct neural networks having three layer structures. Thus, more complex neural networks could be constructed, but performance could not be obtained because of the following problems (second winter).

– Vanishing gradients: as the number of layers increased, it became impossible to propagate information as the first layer was approached gradually with backpropagation.
– Overfitting: correct predictions are possible for training data, but predictions are impossible for unknown data. When the learning period is too long or unique data slips into the training data, there is excessive conformity with that data, and general use becomes impossible.

With current deep learning, the backpropagation problem has been overcome by the invention of "autoencoders,"*10 etc. and in addition to being able to construct multiple layers, hardware specifications have improved; in recent years in particular, the use of GPUs and dramatic increases in calculation speeds have made it possible to derive models at practical speeds. Thus, deep learning is once again in limelight.

(3) Possibilities of current AI

The possibilities if current AI technology is applied are given in **Table 2**.

Table 2 Possibilities for current Artificial Intelligence

Possibility	Description	Application example
Trend modeling and forecast	Modeling (formulas) based on past data, predicting the future from past trends.	• Demand forecast
Aggregation in multidimensional space	Mapping data in multidimensional order, grouping highly relevant data, and deriving similar trends that can not be predicted by humans.	• Spam classification • Repositioning of products / materials
Discovery of combinations of high relevancy	Visualizing the relevance of a large amount of data items (variables), grasping the situation such as work environments and detecting changes.	• Anomaly detection • Predictive Maintenance
Image recognition / speech recognition	By using the neural network method, we achieve something similar to the senses of living things, the ability to reproduce the motor system on a machine and recognize images and sounds.	• Human recognition • Emotion analysis • Voice recognition (Speech to text)
Understanding and responding to human empirical knowledge and language	Recognizing the human language and making appropriate responses and controlling according to the intention.	• Virtual Personal Assistant • Machine translation

＊9 Neurons propagate signals to each other, but the signal propagation efficiency is not uniform. Thus, the connection weight is set (integer 0 – 1) for each input. Neural networks output a signal to another neuron when the total of input values exceeds a certain threshold. Neural network learning is adjusted so that correct results are output by learning connection weights and threshold values.

＊10 An autoencoder is an algorithm for dimensional compression using a neural network. It was found that learning went well if the possibility of a vanishing gradient problem occurring was small even with deep layers by testing the idea of using ones trained by an autoencoder rather than random initial values for neural network parameters.

3. Future Possibilities for AI

There have been big developments in image recognition through the application of deep learning in the last several years and breakthroughs are happening. In 2012, Google® recognized a "cat" through learning of a large volume of data by deep learning. Thereafter, deep learning was used even in the ImageNet Large Scale Visual Recognition Challenge (ILSCRC)*11 and recognition rates were improved*12 dramatically from those in the contest up to now, exceeding the recognition prowess of humans in 2015.

In AlphaGo™ also, a method of applying image recognition using deep learning is being used instead of using the method of AI analyzing the logic of play and reproducing it as had been done up to now. Thus, there was success in discovering play that humans would not conceive of, and it was possible to beat a human.

Currently, progress is being made in applying deep learning to linguistic analysis, and when deep learning was used and improvements made to Google® Translate in 2016, translation performance was improved dramatically (in the subjective sense, no numerical basis).

This progress was first predicted to take 10 to 20 years, but it was achieved in the space of five years. In the future we can expect various breakthroughs through the application of deep learning.

Moreover, there is also information that we will achieve singularity in 2045,*13 and strong AI exceeding human intelligence will change the world from its foundations. There is no mistaking that hardware specifications and 2045 will have progressed to an extent we cannot even conceive of currently.

However, current deep learning is absolutely weak AI, and no theory has been established for achieving strong AI. With the current state of things, it can be assumed that the coming of singularity is not beyond conception.

Consideration of AI Applications for Business Innovation

1. Possibilities for Business Innovations Using AI

Systemization up to now has only been able to automate in a range based on predetermined business processes and decision logic. With the use of AI, automation of work that has been thought only possible by humans, such as things dependent on human experience or intuition and determinations and actions based on the results of recognition by the human eye or ear are possible, and large improvements in productivity can be expected with rapid and accurate execution of work.

There are also possibilities for the following business innovations in the Sumitomo Chemical Group through the use of AI.

– Manufacturing and sales plans based on demand forecasts
– Discovery of new materials ahead of other companies
– Effective use of research assets by repositioning materials
– Predictive maintenance based on forecasts of equipment failures
– Automatic detection and warning of hazardous situations such as fire from image monitoring
– Optimal personnel placement based on organization and work matching predictions based on personnel characteristics and skills
– Automatic collection of information necessary for business and recommendations
– Global communications using simultaneous automatic interpreting by voice

2. Status of AI Verification at Sumitomo Chemical Co., Ltd.

Sumitomo Chemical Co., Ltd. is moving forward with the project aimed at "realizing dramatic business innovation through digitalization matched to the IoT era" centered on the IT Innovation Department. Business innovation is being promoted based on digitalization

*11 ILSVRC (ImageNet Large Scale Visual Recognition Challenge) is a large-scale image recognition contest started in 2010 and held by "ImageNet" at Stanford University. Computers detect and recognize "what is being shown" from photographic data in which airplanes, people, pianos and various other objects are shown.

*12 Since deep learning came into use in 2012, the error rate dropped all at once from 25.7% up to then to 16.4%. Thereafter, as of February 2015, it had become 4.9% and passed by the human error rate of 5.1%. At present, it has dropped to 3.5%.

*13 Singularity was proposed by Ray Kurzweil. It is said that if the development of AI exceeds a certain fixed measure, machines will outstrip human control, and human life will be transformed in a horrible manner. It is said to be around 2045 and is called the "year 2045 problem." The mass media started picking it up to a great extent starting around 2016.

using the latest IT technologies in this project, but the use of AI is being investigated as one of these.

Since AI is a technology with few achievements, verification is first being carried out based on actual data to assess the accuracy and effects of investments.

Furthermore, preparations are being made aimed at the use of AI in operations by acquiring technology for AI during the verification.

(1) Human network analysis tool

The network (people) of knowledgeable persons inside and outside the company and potential customers for new products is extremely important for research and development of new materials and products as well as sales. Up to now, knowledgeable people inside and outside the company and potential customers for new products have been found through networks based on personal experience. If these are visualized, anyone can contact knowledgeable people inside and outside the company and potential customers for new products. Furthermore, there are also cases leading to improvements in development efficiency of materials and products and tying to the development of new sales routes based on knowledge of related materials and products but from a completely different angle rather than directly related materials and products.

Verification is being performed on AI for construction of this kind of network and recommendations for related materials and products. **Fig. 2** shows the verification concept.

To construct the network, natural language analysis was performed based on patent information, academic papers and exchange of business cards, and the relationships between the names of people, materials and products were extracted with a database created from the results. Grouping of material and product information appearing in patent information and academic papers was tested by applying latent Dirichlet allocation (LDA)*14 for recommendations of related materials and products.

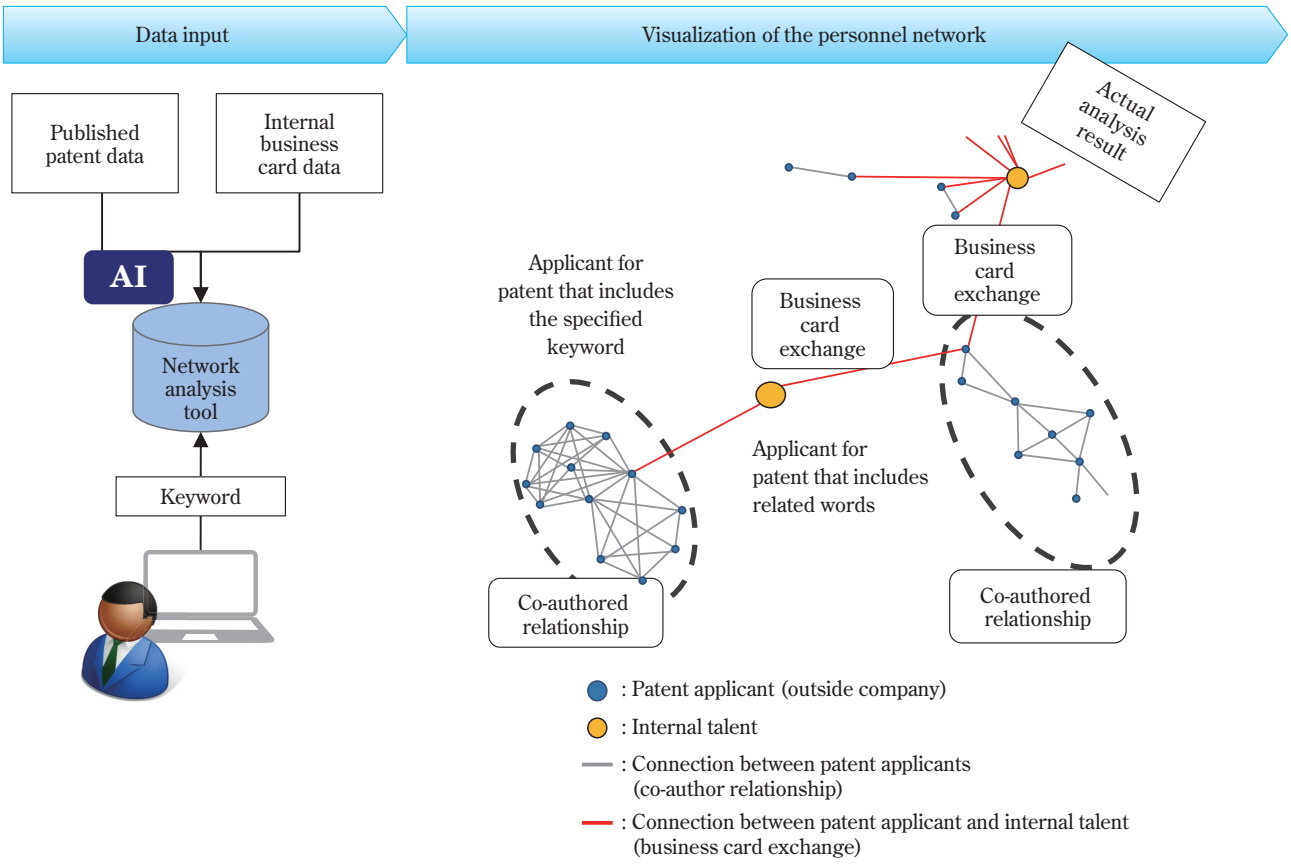

Fig. 2 How the personnel network analysis tool works

*14 LDA is a type of linguistic model that assumes that a single document is generated from multiple topics (topics, categories, etc.) and estimates the topics from sentences by unsupervised learning.

The results of the verification were that by creating a graph database,*15 it was possible to visualize the network, and it was predicted that search results would be related to knowledgeable persons inside and outside the company and potential customers for new products if a material or product were specified. However, the expected results were not forthcoming for recommendations for related materials and products, and it was found that improvements were necessary.

In terms of network information, it is possible to construct a more practical network by adding internal and external information; therefore, investigation of developments based on the needs of Sumitomo Chemical Co., Ltd. are planned. There are plans for improving precision in related material and product recommendations by changing the AI algorithm, etc.

(2) Query results using natural language

Queries to help desks, etc., by telephone or email are currently handled by humans. Naturally, natural language such as Japanese or English is used for the queries and answers. Verifications have been carried out as to whether these operations can be automated using AI.

Using the IBM® Watson® API*16 natural language classifier (NLC),*17 verification was carried out for a mechanism for answering based on questions in natural language on the basis of a FAQ*19 database in a consolidated management information system.*18 Moreover, since Watson® won at the American quiz show Jeopardy!, many people think that if information (data) is entered, it will learn by itself and return results. However, the Watson® that won at Jeopardy! and the Watson® supplied as a service are actually completely different. AI services supplied not only by Watson® but also by Microsoft,® Google,® etc., provide one or multiple functions related to AI and are such that some problems can be solved by using combinations of these.

To improve the precision of the query results, multiple patterns of Japanese sentences corresponding to queries are prepared and learning is necessary. In this verification, 10 patterns of related query sentences were prepared for each of 622 base queries for a total of 6220 pieces of data read in.

The results are shown in **Table 3**. The results were approximately 70% correct responses for normal queries among possible common queries, and one would like to say that it was usable at the time of the verification.

Table 3 Result of inquiry response using natural language

Level	Definition	Correct answer rate
Easy	Questions close to the original	About 95%
Normal	Simple sentence (Less than 40 characters), including complex words* Compound sentence (40 characters or more), no complex words	About 70%
Difficult	Compound sentence (40 characters or more), including complex words	About 50%

* Complex words are words that combine words. For example, the management information system is composed of three words “management”, “information” and “system”. In Japanese processing, meaning differs depending on how words are delimited, so processing becomes difficult if complex phrases are included in sentences.

Currently, Sumitomo Chemical Systems Service Co., Ltd. is investigating the automation of operations for help desk responses in cooperation with the China Delivery Center (CDC).*20 In this project, realization of automatic query responses using AI for the help desk is being investigated. The plan is to work on achieving automation using the knowledge of natural language processing obtained in this verification.

(3) Demand forecasting

Verification of predicting future demand and supply

*15 A graph database is a database having a data structure composed of edge groups that represent the relational nature between node groups and nodes.

*16 Watson® is a service providing AI functions supplied by IBM.® IBM® does not use the term artificial intelligence and calls it cognitive computing. Watson® is made up of micro services called application program interfaces (APIs).

*17 The natural language classifier (NLC) is one Watson® API, and the NLC can analyze natural language and group questions with the same intention. Thus, it can discriminate what field a question is applicable to for questions it is given, induce other processing and can give responses.

*18 The consolidated management information system is an information system responsible for core business at Sumitomo Chemical Co., Ltd.

*19 Frequently asked questions (FAQ) are a collection of commonly asked questions and answers.

*20 China Delivery Center (CDC) is a location for Accenture® system development and maintenance. Sumitomo Chemical Co., Ltd. consigns help desk and system operations such as executive information systems to it.

balances for input as to "when" and "what product" should be invested in and "when," "who" and "at how much" should it be sold was carried out. Verification of a predictive model using machine learning based on an AR model based on actual results of domestic production amounts from January 1989 to December 2014 for low-density polyethylene (LDPE) was carried out. As a result of comparing actual values and predicted values for January 2015 to December 2015, verification results showing a trend approximately reproducing the actual results were obtained.

The AR model is used in event analysis where past activity for parameters influences the near future. For example, it is used for stock predictions, economic predictions, etc. Moreover, the actual demand and supply balance can be thought of as being controlled by the effects of petroleum naphtha, foreign exchange rates, GDP of various countries, etc. In this verification, only data for the domestic production was used; therefore, the AR model was determined to be optimal, but besides the AR model, there are the MA model, ARMA model, ARIMA model, SARIMA model, etc., algorithms. Optimal forecasts are possible by dividing use according to the characteristics of the data and combinations of data.

Moving forward, the plan is for further combining data and optimizing algorithms as well as investigating forecasts with higher precision and applications other than LDPE.

3. Problems for the Use of AI

AI is currently developing rapidly, but it is not technology that anyone can use easily and there are many problems for its utilization.

(1) Individual development according to area of AI application

Since current AI is weak AI, it cannot be used for general purposes, and specialized AI is necessary for solving specific problems. In the last few years, many products in services incorporating AI have made their appearance in the world, but it is difficult to use those products and services as is when applying them to business (cannot be thought of as being usable just by purchasing, mastering them and setting parameters as with packaged systems). Therefore, when solving specific business problems with AI at present, there is a high probability of separate programming being necessary.

Looking at it in terms of the current development of AI, there have been many examples of AI applications within the last five years, and it can be assumed that products and services incorporating AI will be generally usable like packaged systems to a certain extent sometime. However, even if such products and services are used in the future, one cannot use them more appropriately or determine their value without understanding what goes on inside.

Particularly at Sumitomo Chemical System Service Co., Ltd., which is a company that develops IT functions, there is a need to learn technology related to AI while carrying out individual development for problems applying AI starting now, and when AI products and services become more general-purpose in the future, to provide them so that effective introduction is possible.

(2) Data maintenance and human resource development

The basis for AI is data. To improve the performance of AI, a large amount of data must be prepared first. However, it is not true that if there is simply data, it will be good. To derive the correct results, accurate data is necessary. The accurate data differs according to the characteristics, such as purpose for using AI, technology for learning, programming, algorithms, etc.

Moreover, preparing accurate data cannot be done automatically. Conversely, if data can be prepared automatically by machines, it is a step closer to achieving strong AI. No target has been established for the development of strong AI for automatically preparing accurate data; therefore, the power of humans is necessary for preparing accurate data.

To prepare accurate data, it is necessary not only to have full knowledge of the technical background of AI, but also to be familiar with the characteristics (that is, knowledge of the operations) of the data. In addition to this, it is difficult to quickly acquire the human resources for the preparations. Human resources must be developed steadily.

(3) Literacy aimed at taking advantage of AI

The logic of AI (particularly deep learning) cannot be seen (because it is automatically created); therefore, the kinds of cause and effect relationships leading to derivation of responses cannot be known. Moreover, the likelihood of an answer can be confirmed by

matching past data with predictive data (responses output by AI). However, it does not mean that it will be correct in the future. In addition, AI does not derive 100% correct answers, but rather there is always a possibility of a mistake (no difference with humans in terms of mistakes).

AI must be used based on this premise.

The activity of finding a basis for responses output by AI one by one defeats the significance of automation and improving work efficiency. When AI is used, it must be used with advance investigations into countermeasures for risks when AI makes mistakes by comparing it with accuracy found in operations.

4. Future work toward utilization

In the project for "realizing dramatic business innovation through digitalization matched to the IoT era," there are plans to work on verification of the validity of research materials, repositioning of materials and predictive maintenance in addition to the verifications described above.

In addition, there are plans to expand the scope of use based on business needs in accordance with the development of AI in the future. While making the most of these opportunities at Sumitomo Chemical Systems Service Co., Ltd., internal human resources that have the technology for AI will be fostered, and activities for making the realization of business innovations using AI in the Sumitomo Chemical Group possible will be promoted.

Conclusion

AI activities are the automation of operations carried out by people up to now, and they tend to lead to reductions in staff.

However, in Japan in particular, the working population is steadily decreasing with the progressively aging society with fewer children. As a result, it will be difficult for the Sumitomo Chemical Group to maintain its personnel, and we must work under the stress of the needing to aim at greater improvements in business efficiency and productivity while smoothly passing on technology to a small number of personnel.

Considering this situation, it can be assumed that humans must put their main energy into that which only humans can do, and allowing AI to handle that which can be automated by AI will lead to development of the Sumitomo Chemical Group.

In light of this, it is probably important that we bring sufficient maturity to AI and make it usable in operations and in the next five years integrate AI technology into the Sumitomo Chemical Group to create the circumstances where it is possible to make operations more efficient and improve productivity.

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PROFILE

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