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Overview of the Research Activities of Jpn. Soc. Promot. Mach. Ind. Econ. Res. Inst.

Research Group on Industrial Innovation by AI
Overview of FY2020 Activities

1. Intent and Objective of the Research Group

In recent years, technological innovation has been continuing to evolve at an accelerating pace on a global scale, bringing about significant changes not only in industry but also in the social structure. AI in particular has the potential to revolutionize human society in an extremely broad and significant way.

Under these circumstances, AI has the potential to significantly change the value creation process in industry as well and is greatly increasing the value of various types of data on companies. In this age, it is essential to wisely exploit the analysis results of data not only for improving the productivity of companies but also for industrial innovation and development, such as the creation of new businesses and the construction of new business models.

On the other hand, many Japanese companies have not made significant progress in business innovation so far, which encompasses the transformation of business processes themselves and the creation of new business by exploiting AI and data science. In addition, it has been pointed out that the background to this slow progress is the situation in which awareness of the importance of exploiting AI and data and the ability to take action are not sufficiently high from the top management to management levels, or there is a problem with the organization or management of a company that cannot promptly implement innovation by AI.

Japanese companies, especially manufacturers, tend to view IT as a tool to save labor. Needless to say, IT has that function, but what is more important than that is that we desire to make IT accepted as a means to actively create value, and it is one of the points of problem consciousness of the Research Group.

The use and exploitation of AI and data science really linked to products, services, etc. are expected to rapidly start in various business fields in Japan and overseas countries in the future. In the ongoing great change, it is important for Japan to grasp the essence of AI and to speedily commit itself to industrial innovation and the creation of value through the use and exploitation of AI and data science.

In the Research Group, we desire to deepen our understanding of the essence of AI by first analyzing and examining the wide-range and significant effects of the rapid evolution and ubiquity of AI not only on industry but also on economy, society, culture, and so on. Based on this understanding, we desire to show the possibility and expectations of what kinds of new businesses will be created in what fields in Japan in the future in order to realize Industry-2-Innovation through the use and exploitation of AI and data science.

2. Workshops held

In FY2020, the following four workshops were held: All workshops were held online.

Fourth workshop:
Date: July 10, 2020
Theme: “Direction of Development of DX by Japanese Companies in the Post-COVID-19 Era and Issues”
Lecturer: Mr. Takashi Masuda (Director and Executive Economist, Toray Corporate Business Research, Inc.)
Overview:

1. Accelerated DX by Japanese Companies against COVID-19 crisis: The ongoing COVID-19 crisis has resulted in accelerating efforts by Japanese companies toward digitalization (DX, digital transformation), such as remote meetings outside companies.
2. Transition to a "new normal": The era of coexisting with COVID-19 is expected to be prolonged. In the future, risk management will be required on the assumption that a similar situation will occur once every few years. Instead of excessively focusing on countermeasures against COVID-19, uncertainty itself needs to be regarded as a new normal.
3. Industrial changes caused by the COVID-19 pandemic and DX in the manufacturing industry envisaging the post-COVID-19 era: The significance of DX in the past was to enhance business competitiveness, but through the COVID-19 pandemic, the view that DX is a means to lead a decent life by valuing health and family has emerged. In the manufacturing industry, “cyberspace” has attracted attention.
4. New growth areas to be created by contactless needs: Businesses providing solutions to avoiding contact are emerging around the world. As one of the advantages of robot, the capability of performing work in a non-contact manner without human intervention has captured attention. The value of "safety, security, and hygiene" is increasing, and the need to "visualize" it is rising accordingly.
5. Practical use of VR, etc. moved forward due to the COVID-19 crisis: VR and AR are drawing attention as technologies that support real communication and help obtain “experience” beyond mere information. The COVID-19 pandemic is a tailwind for digitalization.

Fifth workshop:
Date: September 30, 2020
Theme: “Potential of AI & IoT”
Lecturer: Mr. Keiichiro Mitani (Executive Officer, NTT Data Institute of Management Consulting, Inc.)
Overview:

1. The decline in the competitiveness of Japan's manufacturing industry: The international competitiveness of large Japanese companies is declining. In addition, the number of growing startup companies is not enough. Behind the woes of Japanese companies are market changes that would be a head wind against the mass production type manufacturing industry.
2. IT investments in the COVID-19 pandemic: The majority of companies responded that DX

will accelerate in the future in the wake of the COVID-19 pandemic. In the past, IT was "defensive IT," and its main purpose was to save labor for routine back-end work. At present, it is "offensive IT," and its main purpose is to create new added value by incorporating nonroutine front-end work into a system.

3. AI & IoT: "AI & IoT (artificial intelligence and the Internet of things) will be a weapon for manufacturers to capture reality. Do not end the business by selling the ownership of things, but continue to provide the things as services. There are many examples of Japanese companies that are working on them. The Product Liability Act and some other laws are premised on conventional things and are less adaptable to AI and IoT. Since software failures can lead to serious accidents not only in the virtual world but also in the real world, with whom the responsibility will lie, for example, will be an issue.

Sixth workshop
Date: November 29, 2020
Theme: "How Should We Deal with Advanced AI?"
Lecturer: Mr. Hitoshi Matsubara (Professor, Graduate School of Information Science and Technology, the University Tokyo / Professor, Future University Hakodate)
Overview:

1. What is AI?: There is no clear definition, and it changes with the times. It is often said that machine learning is AI, but AI fundamentally has a broader concept than that. The fact that there are so many different ideas about what AI is shows that intelligence has various aspects.
2. AI creativity: In shogi and go, AI has already shown creativity in that it can find new moves human beings cannot imagine. AI can also write novels and compose haiku.
3. Social implementation of AI: We are thinking about what AI can do to revitalize local cities. Companies that use AI to share taxis have been founded and are spreading nationwide. In the fishery industry, AI recognizes images in nets used for fixed-net fishing and determines whether there is any banned fish.
4. Relationship between AI and human beings: Since there are many things human beings can still do better than computers, human beings and AI will share roles. AI can learn from human beings, and human beings can learn from AI. AI is a useful tool, and the smarter the tool, the easier life will be. Human beings have become smarter with tools, but in the future, human beings with smarter with AI.

Seventh workshop
Date: February 16, 2021
Theme: "The Creativity of Human Beings in a Democratization Era of AI, and Toward a New Society That Will Develop by Using and Exploiting AI"
Lecturer: Mr. Takafumi Nakanishi (Dean and Associate Professor, Department of Data Science, Faculty of Data Science, Musashino University / Research Fellow, Asian AI Institute / Chief Researcher, GLOCOM, International University of Japan / Visiting Professor, Graduate School of Digital Hollywood University)
Overview:

1. Real thrill of data science: In conventional science, human beings first created "models" in the form of formulas and formulations to verify whether data fitted the models. In data science, data exists first, and models are created from it using statistics and such tools as machine learning and AI.
2. AI is indispensable to the evolution of human beings: The evolution of human beings was the evolution of knowledge processing and sharing methods. Computers were developed, and data could be accumulated in them. It is AI that turns that data into knowledge, which is indispensable to the evolution of knowledge processing by human beings. The strength of the third AI boom is that data already exists and there are needs for handling it.
3. What can AI do?: AI can do six things; search (finding information that matches a designated keyword or condition); inference (deriving the answer to a problem based on a given rule); classification (determining what is presented from past data); regression (predicting the future a little ahead from past data transitions); clustering (dividing similar things into groups); and dimensionality reduction (reducing the "solution space" for resolving a problem).
4. From "games" to the real world: AI was once in a virtual world like games or in laboratories but has become an integral part of our life. Key AI technologies are open sources and "democratized." It cannot be differentiated by algorithm performance, and the way of exploiting them is important.
5. “Digital twin” to be created by AI, big data, and the Internet of Things (IoT): The essence of the Internet of Things (IoT) lies in a mechanism or environment where real-world data can be obtained in real time.
6. Launching AI services: It will take four steps: externalization (verbalizing an issue); requirement setting (giving all requirements for resolving the issue); digitalization (considering whether the requirements can be converted into data); and indexing (defining how the data should be interpreted).