Social Principles of Human-Centric AI

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1 Introduction

Our modern society faces many challenges that endanger the survival of humankind such as global environmental problems, growing economic disparity, and the depletion of resources. Japan is the first country to tackle many social issues confronting a mature society, such as the declining birthrate and aging population, labor shortage, rural depopulation, and increased fiscal spending. Artificial Intelligence (AI) is considered a key technology to rescue society from these problems, to address the goals set forth in the United Nation's Sustainable Development Goals (SDGs), and to build a sustainable world.

Japan, with the establishment of Society5.0[1], whose purpose is to address social issues and economic development using AI, aims to revitalize its society and economy, to be an internationally attractive society, and to contribute to the SDGs on a global scale.

Similar to many other types of science and technology, AI will bring many great benefits to society, but its large impact on society calls for appropriate development and implementation. In order to avoid or reduce the negative aspects in advance while making effective use of AI to benefit society, we should promote, together with the continued research and development (R&D) of technologies related to AI, a transformation into an "AI-Ready Society" where AI can be used effectively and safely. We need to redesign society in every way including Japan's human potential, social systems, industrial structures, innovation systems, and governance.

Depending on the researcher, there are various ways of thinking about the definition of AI (Artificial Intelligence), a central theme of this document, and there is no clear definition at present. For example, the EC High-Level Expert Group report[2] defines AI as a system that performs intelligent operations (which may have some autonomy) in response to environment and input. However, the expression "intelligent operation" itself is somewhat vague and open for interpretation. Also, the AI100 Report[3] published in the United States in 2016 cites Nils J. Nilsson's definition[4] of AI as a field of research according to which "Artificial intelligence is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment", but this definition is also highly ambiguous. In actuality, the vague definition of AI within the same report in and of itself has a positive side that is accelerating the study of AI. In light of these circumstances, although there is a certain consensus on what to judge as AI or AI technology, it does not appear appropriate at this time to define it more strictly.

In addition, various technologies normally called "AI" are seldom used alone but instead are generally incorporated and used as part of an information system. Advanced and complex

[1] Society 5.0 is the future society that Japan aims for, following the Information Society (Society 4.0). A society that realizes Society 5.0 is a sustainable human-centric society that implements AI, IoT (Internet of Things), robotics and other cutting-edge technologies to create unprecedented value, and a wide range of people can realize their own well-being while respecting the well-being of others.

[2] High-Level Expert Group on Artificial Intelligence (AI HLEG), "Draft Ethics Guidelines for Trustworthy AI", and "A definition of AI: Main capabilities and scientific disciplines", European Commission, Directorate-General for Communication, December 2018.

[3] Stone, P., et al., "Artificial Intelligence and Life 2030. One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel", Stanford University, Stanford, CA, Sept. 2016.

[4] Nils J. Nilsson, The Quest for Artificial Intelligence: A History of Ideas and Achievements, Cambridge, UK: Cambridge University Press, 2010.

information systems may incorporate a broad range of AI technologies; moreover, they may incorporate technologies reflected in the principles stated in this document. Based on these two premises, the principles herein may be regarded as applying to any "highly complex information systems in general" that include any such technology. Given such consideration, we do not define a particular technology or system as "AI", but regard AI as "highly complex information systems in general". After discussing some of the impacts on society, we will present a set of AI social principles and identify some issues to consider in AI R&D and social implementation. In order to make the ensuing Society 5.0 as effective as possible, it is essential for all relevant stakeholders to cooperate and interact closely with each other.

Figure 1 shows the overall structure of this document.

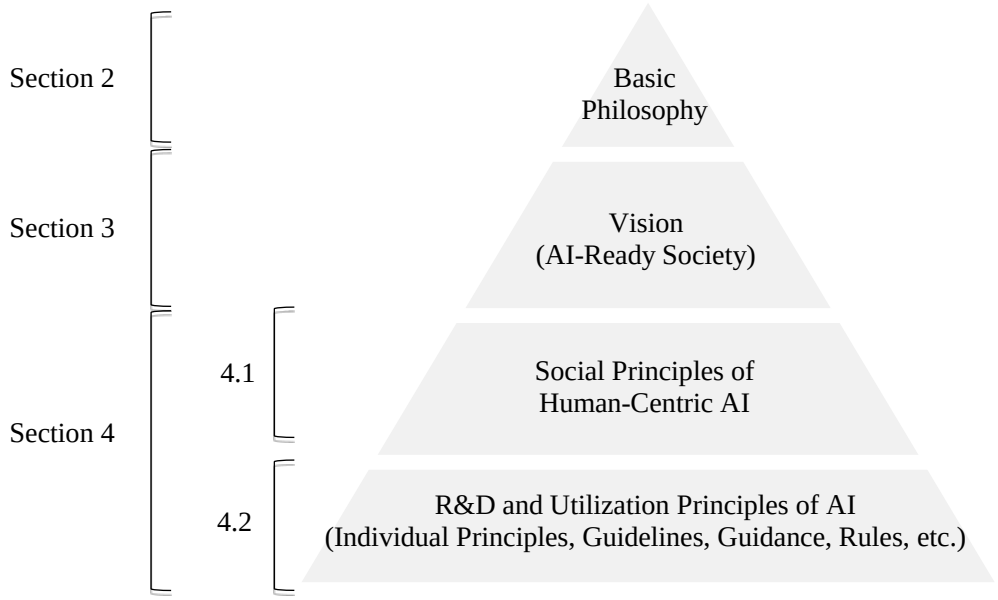

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Figure 1: Overall Structure of This Document

[5] An "AI-Ready Society" means that society as a whole has undergone the necessary changes to maximize the benefits of AI, enjoys the benefits of AI, or has introduced AI immediately when needed and is in a state of being able to receive the benefits. It means "a society adapted to the use of AI". For this purpose, society as a whole needs to be transformed, including individuals, business organizations, and the social innovation environment. Individually, for example, everyone should acquire appropriate AI literacy that allows them to use AI for work and life. In business organizations, meanwhile, corporate activities should be developed with strategies premised on the use of AI. In the social innovation environment, all information should be digitized in a form that allows for AI analysis, should be transformed into data, and should be maintained in a state in which it can be used for AI development and service provision.

2 Basic Philosophy

AI is expected to contribute significantly to the realization of Society 5.0. We consider AI important not only to return the benefits obtained from the efficiency and convenience of using AI to people and society, but also to use AI for the public good of humanity as a whole, and to ensure global sustainability outlined in the SDGs through qualitative changes in social conditions and true innovation.

We believe we should respect the following three values as our philosophy and build a society that pursues their realization.

(1) Dignity: A society that has respect for human dignity

We should not build a society where humans are overly dependent on AI or where AI is used to control human behavior through the excessive pursuit of efficiency and convenience. We need to construct a society where human dignity is respected and, by using AI as a tool, a society where people can better demonstrate their various human abilities, show greater creativity, engage in challenging work, and live richer lives both physically and mentally.

(2) Diversity & Inclusion: A society where people with diverse backgrounds can pursue their own well-being

It is both an ideal in the modern world and a major challenge to create a society in which people with diverse backgrounds, values and ways of thinking can pursue their own well-being while society creates new value by flexibly embracing them. AI is a technology powerful enough to bring us closer to this ideal. We need to change the nature of society in this way through the appropriate development and deployment of AI.

(3) Sustainability: A sustainable society

We need to use AI to create a succession of new businesses and solutions, resolve social disparities, and develop a sustainable society that can deal with issues such as global environmental problems and climate change. Japan, as a leading science and technology-oriented country, has an obligation to strengthen its accumulated scientific and technological resources by utilizing AI and thereby contributing to the creation of such a sustainable society.

3 Social Changes Needed to Realize Society 5.0 "AI-Ready Society"

Technologies expected to contribute to the realization of Society 5.0 include AI, IoT, Robotics, and ultra-high-speed broadband communication networks. Even if it becomes possible to some extent to entrust complex processes to machines using AI, it is still necessary for humans to set objectives that answer the question "What are we using AI for?" While AI can be used to better society, it might also be used for undesirable purposes or in inappropriate ways unconsciously. For this reason, we are advancing technological developments in terms of Human Potential, Social Systems, Industrial Structures, Innovation Systems, and Governance which can answer the question "What are we using AI for?" while paying close attention to their interaction with the progress of technology. These five aspects are equally important in achieving Society 5.0.

(1) Human Potential

In an "AI-Ready Society" that is responsive to the spread of AI to every corner of society, how human beings respond to AI is the key to realizing a society where AI can be fully utilized. To that end, the expected abilities and roles of people are as follows.

A) People should fully understand the advantages and disadvantages of AI. In particular, people should have the ability to recognize that biases are included in the algorithms and/or data that will become the information resources of AI, and for example, that these biases may be used for undesirable purposes. In addition, people should recognize that there are three types of data bias: statistical bias, bias caused by social conditions, and bias arising from malicious intent among AI users.

B) It is preferred that the use of AI will create an environment in which many people can engage in highly creative and productive work. To that end, it is expected that a diverse range of people will acquire the ability to realize their own dreams and ideas with AI's support despite many differences in origin, culture, taste, and so on. An education system that achieves these goals as well as social systems that contribute to their achievement must be realized.

C) It is important to have sufficient human resources with acquired application skills such as implementation and design of AI systems and a basic knowledge of data and AI. These skills would be acquired in a cross-disciplinary range of fields in a combined and integrated framework. It is expected that such human resources will be the driving force of all activities in society, and that the capabilities of those people will contribute to the formation of an AI-based living environment. Given the establishment of such a living environment, we must implement social systems that allow many people to live a richer and more fulfilling life.

(2) Social Systems

The use of AI will most likely accelerate the evolution of individual service solutions and create various benefits from improved efficiency and individualization. In order to embrace the full benefits of this change in society, it is necessary for entire social systems including health care, finance, insurance, transportation, energy, and others to flexibly change and respond to the evolution of AI. This includes simple efficiency in light of existing socially accepted objectives (such as improved convenience and liberation from simple labor tasks). It also includes the realization of new value potentially created by diversification and fluidization of objectives and resolving negative outcomes (such as inequality, widening disparity, social exclusion, and so on) that may result from the evolution of AI.

To this end, we need to implement flexible architecture designs equipped with mechanisms for expandability, interoperability, developing improved social order, and so on, both in the software and the hardware aspects of each social system. Additionally, we need to establish a common data

utilization infrastructure for various social systems, in particular to ensure interoperability and connectivity.

(3) Industrial Structures

In order for a diverse group of people to realize their assorted dreams and ideas, it is necessary for labor as well as employment and entrepreneur environments to be flexible and internationally open. For this reason, companies should compete fairly and promote flexible working styles, human creativity should continually be demonstrated throughout industries, and investment in startup businesses should be promoted.

(4) Innovation Systems (environments that support innovation)

It is necessary for universities, research institutions, industries, and the public at large to participate in AI's R&D, utilization and evaluation across fields and positions, stimulating each other, and creating an environment in which innovation can flourish.

To that end, all types of data including real space data should be instantaneously and securely available at a level that AI can analyze. Additionally, it is advisable to ensure privacy and security so that everyone can provide and distribute data with ease, and for there to be an environment where they can benefit from the data that they have provided.

It is advisable to accelerate the desired development of AI by establishing an environment in which those involved in R&D, including users, can safely conduct R&D and utilization of AI, and the cycle of R&D and utilization can move rapidly. Preferably, the utilization of AI will create new ideas and possibilities, and significantly expand the potential of innovation.

(5) Governance

It is always necessary to continue to update the content and defined purposes discussed in the above-mentioned sections Human Potential, Social Systems, Industrial Structures, and Innovation Systems in line with social changes and technological developments.

For that reason, it is necessary to have a system that can be implemented and in place for various stakeholders, including government, industry, universities, research institutions, and the general public. Then they will be able to work together on such matters as identifying issues, evaluating impacts, and making decisions on regulatory governance including rules, systems, standardization and codes of conduct. Additionally, it is necessary to listen to people, including those who have a difficult time having their opinions heard, in addition the various stakeholders, and to establish a system that continuously addresses the most advanced social and technical issues. When implementing such governance, flexible and effective measures should be taken not only in terms of the law but also by means of industries with appropriate technical means taking the initiative. In addition, international coordination for governance is important, and in addition to governance in each individual country, an international system of cooperation for dealing with cross-border problems should be established.

4 Social Principles of Human-Centric AI

We recognize that in order to realize an "AI-Ready Society" and to promote an appropriate and proactive social implementation of AI, it is important to establish basic principles that each stakeholder should keep in mind.

In order for AI to be accepted and properly used by society, we will systemize these basic principles into "Social Principles of AI" to which society (especially state legislative and administrative bodies) should pay attention, and "R&D and Utilization Principles of AI" to which developers and operators engaged in AI R&D and social implementation should pay attention. The "Social Principles of AI" necessary for realizing a society with the three basic principles listed in Section 2, and the "R&D and Utilization Principles of AI" that developers and business operators should consider, are as follows:

4.1 Social Principles of AI

Social Principles of AI are principles relating to social frameworks that should be implemented across Japanese society including national and local governments as well as in multilateral frameworks in an "AI-Ready Society."

(1) The Human-Centric Principle

The utilization of AI must not infringe upon the fundamental human rights guaranteed by the Constitution and international standards.

AI should be developed, utilized, and implemented in society to expand the abilities of people and allow diverse people to pursue their own well-being. In a society making use of AI, it is desirable that we introduce appropriate mechanisms for literacy education and for the promotion of proper use of AI so that people do not become over-dependent on AI or misuse AI to manipulate other people's decision-making.

- AI can expand human abilities and creativity not only by replacing aspects of human labor but also by assisting humans as a technologically advanced tool.
- When using AI, people must judge and decide for themselves how to use it. The appropriate stakeholders involved in the development, delivery and utilization of AI should be responsible for the consequences of AI utilization, depending on the nature of the problem.
- In the process of AI deployment, each stakeholder should take into consideration the user-friendliness of the system in order to allow all people to enjoy the benefits of AI and avoid creating a digital divide with so-called "information poor" or "technology poor" people left behind.

(2) The Principle of Education/Literacy

In a society premised on AI, we do not desire to create disparities or divisions between people or create those who are socially disadvantaged. Therefore, policy makers and managers of businesses involved in AI must have an accurate understanding of AI, knowledge and ethics permitting appropriate use of AI in society. They should take into account the complexity of AI and appreciate the possibility that AI could be intentional

misused. AI users should have a general understanding of AI and should acquire sufficient education to use it properly, given that AI platforms are much more complicated than already developed conventional tools. Regarding developers of AI, meanwhile, it is of course necessary for them to master the basics of AI technology. Additionally, from the viewpoint of developing AI that is useful to society, it is important for developers to learn business models for how AI can be used in society, as well as to master a wide range of liberal arts such as social sciences and ethics including normative consciousness.

From this point of view, we believe that an educational environment that fosters education and literacy in accordance with the following principles must be provided equally to all people.

- In order to prevent generating disparities between people or to create socially vulnerable individuals, opportunities for education in a wide range of literacy skills are to be provided in early childhood education and primary and secondary education. Opportunities are also to be provided for the reeducation of working adults and the elderly.

- With regard to literacy education and skills required to use AI, our society needs an educational system that allows anyone to acquire the basics of AI, mathematics, and data science. All people need to learn beyond the boundaries of literature and science. It is also necessary to prepare content in literacy education on the limits of security and AI technology in order to raise awareness of AI and data characteristics. These characteristics include bias in data, the possibility of causing bias depending on how AI is used, and issues of fairness, impartiality, and privacy protection that are inherently needed in the use of AI.

- In a society where AI is pervasive, it is to be expected that the educational environment will change from the current unilateral and uniform teaching style to one that makes use of individual interests and skill sets. For that reason, society as a whole shares a sense that the education system is always changing flexibly to the optimal form of teaching regardless of previous successful experiences in the educational environment to date. In education, it is desirable to have an interactive educational environment for the prevention of dropouts and an environment that fully utilizes AI technologies to allow students to work together.

- It is desirable not to impose an unnecessary burden only on the administration or schools (teachers), but to work independently with private enterprises and citizens toward the development of such an educational environment.

(3) The Principle of Privacy Protection

Not all AI technologies increase the risk associated with the use of personal data, but in a society premised on AI, it is still possible to gauge each person's political position, economic situation, personal hobbies, personal preferences, and so forth with great accuracy based on data about matters such as data subject's individual behavior. This means, when utilizing AI, that more careful discretion may be required than the mere handling of personal data in accordance with the level of importance and sensitivity of the data. Each stakeholder must handle personal data based on the following principles to ensure that no individuals are disadvantaged from the unexpected distribution or use

of personal data in undesirable ways.

- We should make sure that any AI using personal data and any service solutions that use AI, including use by the government, do not infringe on a person's individual freedom, dignity or equality.

- If the use of AI threatens to increase the possibility of harming individuals, technical mechanisms and non-technical frameworks should be developed to reduce the risk. In particular, AI using personal data should have mechanisms to ensure accuracy and legitimacy, and to allow individuals to be substantially involved in managing the privacy of their personal data. This would make it possible for people to provide personal data with peace of mind when using AI, and effectively benefit from the data they provide.

- Personal data must be protected appropriately according to its degree of importance and sensitivity. Personal data contains a variety of information, ranging from matters that are highly likely to have a great influence on an individual's rights and interests (these would typically be personal thoughts, beliefs, medical history, criminal records, and so on), to matters that are semi-public in nature in a person's social life. Keeping this in mind, we need to pay close attention to the balance between the use of, and need for protection of, personal data based on the cultural background and common understanding of society.

(4) The Principle of Ensuring Security

The active use of AI automates many social systems and greatly improves safety. On the other hand, at least within the scope of currently available technologies, it is not always possible for AI to respond appropriately to rare events or deliberate attacks. Therefore, the use of AI poses a new set of risks to security. Society should always be aware of the balance between the benefits and risks, and endeavor to improve social safety and sustainability as a whole.

- Society must promote broad, deep research and development related to AI (from immediate measures to deep essential understanding), such as the proper assessment of risks in the utilization of AI and research to reduce risks. Society must make firm efforts to conduct risk management including the safeguard of cybersecurity.

- Society should always pay attention to sustainability in the use of AI Society, in particular, must not be uniquely dependent on just one type of AI or a few specific types of AI.

(5) The Principle of Fair Competition

A fair competitive environment must be maintained in order to create new businesses and services, to maintain sustainable economic growth, and to present solutions to social challenges.

- Even if resources related to AI are concentrated in a specific country, we must not have a society where unfair data collection and infringement of sovereignty are performed under that country's dominant position.

- Even if resources related to AI are concentrated into specific companies, we must

not have a society where unfair data collection and unfair competition take place using their dominant position.

- The use of AI should not generate a situation where wealth and social influence are unfairly biased towards certain stakeholders.

(6) The Principle of Fairness, Accountability, and Transparency

In an "AI-Ready Society", it is necessary to ensure fairness and transparency in decision-making, appropriate accountability for the results, and trust in the technology, so that people who use AI are not subject to undue discrimination with regard to personal background, or to unfair treatment in terms of human dignity.

- Under AI's design concept, all people are treated fairly without unjustified discrimination on the grounds of diverse backgrounds such as race, gender, nationality, age, political beliefs, religion, and so on.

- Appropriate explanations should be given on a case-by-case basis depending on the application of AI and each particular situation, including such things as when AI is being used, how the AI data is obtained and used, and what measures have been taken to ensure the appropriateness of results obtained from AI operations.

- In order for people to understand AI's proposals and make judgments on them, there should be appropriate opportunities for an open dialogue, as required, regarding the use, adoption, and operation of AI.

- Taking into account the above viewpoints and in order to use AI safely in society, a mechanism must be established to ensure trust in AI, and in the data and algorithms that support it.

(7) The Principle of Innovation

- To realize Society 5.0 and aim for continuous innovation that advances as people evolve together with AI development, we should transcend boundaries such as national borders, industries, academia, governments, race, gender, nationality, age, political convictions and religion. We should promote total globalization, diversification, and industry-academia-government cooperation in both human resources and research, based on a wide range of knowledge, perspectives, ideas, and so on.

- We must promote equal collaboration among universities, research institutions and companies, and the flexible movement of human resources.

- To implement AI efficiently and safely in society, methods for confirming the quality and reliability of AI, and for efficient collection and maintenance of data used by AI must be promoted. In addition to establishing AI engineering such as methods for the development, testing and operation of AI, it is necessary to promote the establishment and development of a wide range of studies such as ethical and economic aspects of AI.

- To ensure the sound development of AI technology, while securing privacy and

security, it is necessary to establish a platform environment where data from all fields can be effectively utilized across national borders without being monopolized. In addition, to promote research on AI, R&D environments should be established where computer resources and high-speed networks that promote international collaboration and accelerate AI are shared and used.

- The government must proceed with regulatory reforms to reduce impeding factors in all related fields in order to establish an efficient and beneficial society with the aid of AI technologies.

4.2 AI R&D and Utilization Principles

We believe that developers and business operators of AI should establish and comply with the AI development and utilization principles based on the fundamental philosophy and social principles of AI outlined above.

Since many countries, organizations, companies, and so on are currently discussing AI development and utilization principles, we believe it is important to create an international consensus quickly through open discussions, and share results internationally in a non-regulatory, non-binding framework.

5 Conclusion

In order to lead the world in building the first "AI-Ready Society," Japan should share the principles herein with the government, related industries, organizations, and so on, and reflect them in government policies.

In addition, Japan should share these principles with other countries around the world and take a leadership role in international discussions with the goal of establishing an AI-Ready Society worldwide. In doing so, Japan should present to the world a social image of Society 5.0 that supports the realization of the SDGs, and should contribute to cooperative and creative new development of the international community.

These principles should be flexibly revised in the future according to the progress of AI-related technologies, social changes, changes in the world situation, and many other factors.

[Appendix]

Establishment of the "Council for Social Principles of Human-centric AI"

February 15, 2019
AI Strategy Expert Meeting for Strength and Promotion of the Innovation Decision

1. The "Council for Social Principles of Human-centric AI" (hereinafter the "Council") is established, under the AI Strategy Expert Meeting for Strength and Promotion of the Innovation, for the purpose of examining the basic principles for implementing and sharing AI in a better way and reflecting it in AI strategy. Based on discussions in the "Review Council for Social Principles of Human-centric AI" established under the Artificial Intelligence Technology Strategy Council, this Council will examine "Social Principles of Human-centric AI" and propose them to the Integrated Innovation Strategy Promotion Council.

2. The Chairperson, Vice-Chairperson, and members of the Council are as described in the attachment.

3. The Council as a rule will be open to the public. However, this will not be the case when the Chairperson deems it appropriate not to make the proceedings public.

4. The Chairperson will make the contents of discussion at Council meetings publicly available by publishing the minutes of meetings and any other appropriate means. However, when the Chairperson deems it appropriate not to make public the contents of discussion at Council meetings, all or part of the contents may remain undisclosed.

5. The Cabinet Office with the cooperation of relevant administrative agencies will handle the general affairs of Council meetings.

6. The Chairperson shall determine any matters concerning the operation of Council meetings and other necessary matters not previously listed in preceding clauses.

(Attachment)

"Council for Social Principles of Human-centric AI"
Chairperson, Vice-Chairperson, and Members

◎Chairperson

Osamu SUDOH	Professor, Graduate School of Interdisciplinary Information Studies, The University of Tokyo; Director of the Center for Research and Development of Higher Education, The University of Tokyo

○ Vice-Chairperson

Hiroaki KITANO	Chair, Task Force on Principles of AI Applications, Committee on New Industry and Technology, Japan Business Federation (Keidanren); President and CEO, Sony Computer Science Laboratories, Inc.

○ Members

Kazuto ATAKA	Professor, Faculty of Environment and Information Studies, Keio University; Chief Strategy Officer, Yahoo Japan Corporation
Toshio IWAMOTO	Principle Executive Advisor, NTT Data Corporation
Shinichi URAKAWA	Director and Managing Executive Officer, Sompo Japan Nipponkoa Insurance Inc.
Arisa EMA	Project Assistant Professor, Policy Alternatives Research Institute, The University of Tokyo
Takehiro OHYA	Professor, Keio University Faculty of Law
Ryota KANAI	CEO and Co-founder, Araya, Inc.
Yutaka KIDAWARA	Director General of AI Science Research and Development Promotion Center, National Institute of Information and Communications Technology
Yasuo KUNIYOSHI	Professor, School of Information Science and Technology, The University of Tokyo; Director of Next Generation Artificial Intelligence Research Center, the University of Tokyo
Noriko KONDO	Secretary General, the Study Group for Elderly-assisting Technologies

Satoshi SEKIGUCHI	Vice-President, National Institute of Advanced Industrial Science and Technology
Isamu TAKAHARA	General Manager, BR-Frontier Research in Policy and Technology Department, Toyota Motor Corporation; Director and Special Appointed Professor, R&D Center for Frontiers of MIRAI in Policy and Technology, University of Tsukuba
Haruo TAKEDA	Corporate Chief Engineer, Hitachi Ltd.
Hiroshi NAKAGAWA	Group Director, RIKEN Center for Advanced Intelligence Project
Miho NAGANUMA	Manager, Corporate Technology Division, NEC Corporation
Hinae NIORI	CEO, manma, Inc.
Yutaka HATTORI	Executive Board Member, Japan Medical Association
Tomoyuki HIGUCHI	Executive Director of Research Organization of Information and Systems; Director-General of The Institute of Statistical Mathematics
Susumu HIRANO	Dean, Chuo University Graduate School of Policy Studies; Professor, Chuo University Faculty of Policy Studies
Shinnosuke FUKUOKA	Partner, Nishimura & Asahi
Koichi HORI	Professor, Graduate School of Engineering, The University of Tokyo
Yutaka MATSUO	Chairman of Japan Deep Learning Association (JDLA)
Hiroshi MARUYAMA	PFN Fellow, Preferred Networks, Inc.
Hiroshi YAMAKAWA	Director of the Dwango Artificial Intelligence Laboratory, Dwango Co., Ltd.

END