2021

Kyoto University
Graduate School of Informatics

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Graduate School

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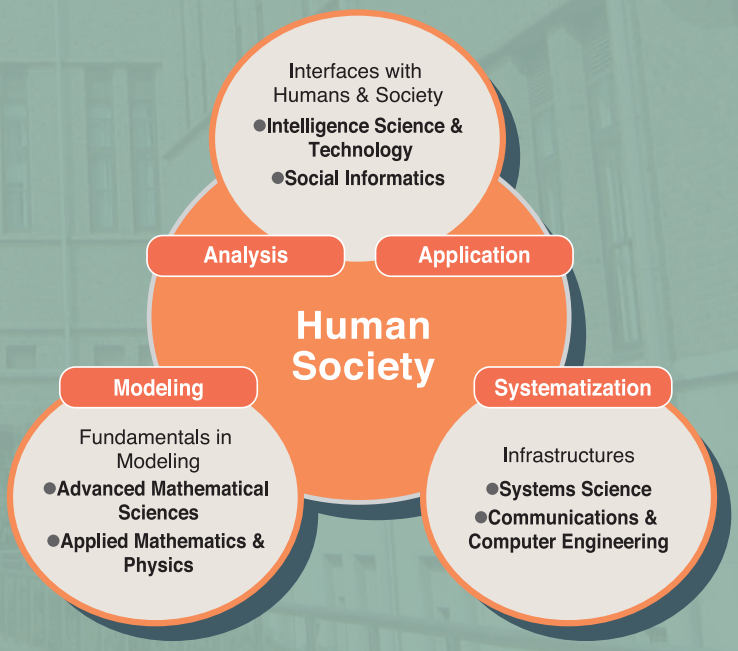
Information

of Informatics

Informatics is a cutting-edge interdisciplinary field for the 21st century which assimilates information with humans and society.



Graduate School

Welcome to the Graduate School of Informatics

KAWAHARA Tatsuya
Dean, Graduate School of Informatics

of Informatics

Information as the Foundational Infrastructure of Society, Industry, and Science

What do you think is the biggest difference in our society and lifestyle between now and your childhood? Most likely, it is the high availability of smartphones and social networking services (SNSs). While it is a truly revolutionary change to be able to communicate with anyone, any time, and anywhere during your waking hours, it all happened within the last 10 years or so. IT companies such as those whose services you use daily, like Google and LINE, are around 20 years old. I wonder how many people 10 or 20 years ago could have predicted where we would be today (anyone that did would now be wildly successful).Some of the by-products of the COVID-19 pandemic are online lectures and meetings, something which would have been close to impossible 10 to 20 years ago.

I myself have been involved in the research of speech recognition and interaction for nearly 30 years, and I am excited that these technologies have found their way into many corners of society. It is safe to say that an advanced information-oriented society is here to stay, and it happened faster than anyone could have imagined.

Information has triggered dramatic changes in the realms of industry and science, too. Some say that we are in the middle of the fourth industrial revolution. All sorts of natural and social phenomena and production and distribution processes of goods have been digitalized (IoT), stored in large databases together with search, purchase, travel, and other human behavioral data (big data), and optimized by AI. Meanwhile, we are witnessing the advent of the fourth paradigm in science, where the methodology of pooling data to build a model is being applied across disciplines in fields as diverse as humanities and social sciences, such as economics and linguistics, as well as natural sciences, including medicine, pharmacology, engineering, and agriculture. There is no denying that information has thus come to form the foundation of industry and science.

The Fourth Industrial Revolution

①Mechanization Steam engines → ②Electrification Electric motors → ③Automation Computers → ④Optimization AI + IoT

The Fourth Paradigm in Science

①Empirical science → ②Theoretical science → ③Computational science → ④Data-intensive science

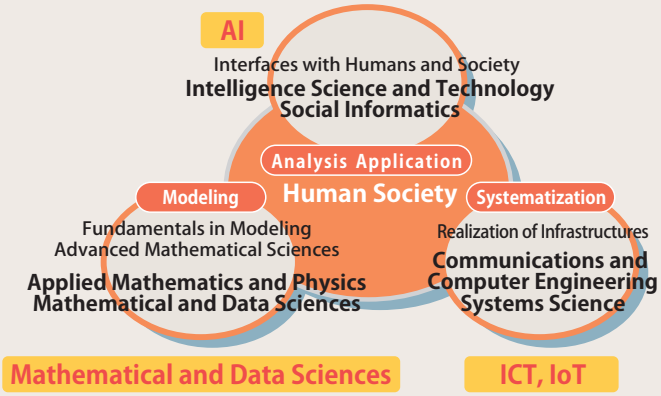
Kyoto University Graduate School of Informatics

It was in the context of this cross-disciplinary spanning of information that the Kyoto University Graduate School of Informatics was established in 1998. Prior to that, there existed faculties and graduate schools that called themselves "computer science/engineering" or "information science" in Japan, but ours was the first graduate school to adopt the term "informatics." Around the same time, other universities in Japan began to establish graduate schools focusing on information, but the Kyoto University Graduate School of Informatics distinguishes itself from others by the breadth of fields it covers (the study of information in a broad sense of the term). For example, we have a wide spectrum of courses and chairs on information and communications technology (ICT), some of which focus on computers and others on communication. Our courses and chairs on mathematical and data sciences, on the other hand, encompass wide-ranging fields from mathematics and statistical machine learning to physics and control theory. We even have courses and chairs on human intelligence, on top of those with a focus on AI. We also have cooperating chairs and courses that cover an even broader range of fields such as ecology and environment as well as healthcare and disaster management.

What makes our graduate school even more special is that leading experts in all respective fields are in charge of these courses and chairs. When new professors are recruited, their achievements are read aloud in the faculty meeting, and I am always impressed by their outstanding qualifications. Our students also come from diverse backgrounds in terms of the undergraduate programs they attended, the universities/colleges from which they graduated, and the countries from which they hail, and they are well motivated to attend to their academic pursuits and research with passion.

The Graduate School of Informatics has over 100 faculty members, making it the sixth largest among the 15 graduate schools at Kyoto University and one of the largest graduate schools in this discipline in Japan.

Every year, we admit about 200 students for the Master's program and about 60 students for the Doctoral program, a capacity that is more than double the size of the Kyoto University Undergraduate School of Informatics and Mathematical Sciences. Many international students are enrolled, too.



To Prospective Students: What AI Can't Do

The Graduate School of Informatics opens its doors wide to prospective students who seek to learn "the study of information in the broad sense of the term." This is evidenced by the fact that we accept both domestic and international students from a variety of backgrounds, unfettered by the conventional framework of sciences versus humanities.

I hope that you will learn to do things that AI cannot accomplish. AI has already surpassed humans in terms of knowledge capacity and the ability to make inferences from large-scale data, with the result that what used to be regarded as intellectual professions are increasingly being replaced by AI. What then are the things that AI cannot do?

First, it is the ability to identify a problem and formulate it. AI that we have now functions only when both the input and output are clearly defined. However, many of the problems in the natural world and in human societies are so complex that it is extremely difficult to clearly formulate them. For example, the problem to "develop a robot that is capable of having natural conversations as humans do," could be reduced to questions such as how to generate natural backchannels and responsive actions, or to understand/express emotions. In other words, once you formulate your problem, you have only to collect data and leave the training and inference to AI.

The second thing that AI is not good at is communicate. The ability to solve problems through dialogue is what current AI is lacking. As science and technology have advanced this much, most of the remaining tasks are hard to be resolved alone. For instance, it took cross-border collaboration among researchers from various fields to visualize a black hole.To address various challenges caused by the COVID-19 pandemic, too, we need to bring together the wisdom of many experts. In many of the informatics research fields, code and data are shared within the international community of researchers, thus making rapid progress even as I write this. We are virtually "standing upon the shoulders of giants," and we must have good communication within and outside of labs to continue to progress.

This third thing that AI is incapable of is having a broad perspective. As I mentioned earlier, respecting diversity is crucial. Unfortunately, AI is blind to the deeper meanings that underlie data. For example, AI that has learned from data gathered in a male-dominated society will make decisions advantageous to males in recruitment and promotion. To find a good model and make a good decision, I would like you to take an interest in what is going on in the world and what persons around you are doing, rather than exclusively focusing inward on your own circumstances and activities. Coming from diverse backgrounds and conducting fascinating studies, the faculty and researchers at Kyoto University and its Graduate School of Informatics will surely stimulate your intellectual curiosity.

For Potential Partners to the Graduate School of Informatics: What Private Enterprises Can't Do

The Graduate School of Informatics is most proactive in joint research with other institutions and industry-government-university collaboration. This is because, as I stated at the outset, information serves as the foundational infrastructure for society and industry, and "the study of information in the broad sense of the term" is interdisciplinary by nature. True to this belief, we have conducted numerous joint research and contract research projects and signed academic exchange agreements with universities outside of Japan.

Needless to say, the Graduate School of Informatics is working on research projects that private enterprises find it difficult to do for one reason or another. Every year, we sponsor a joint seminar with overseas universities, and many of our counterparts say that the research themes our faculty members often choose are both "basic and long-term." If you seek to collaborate with us, therefore, I would appreciate it very much if you would share our long-term perspective. We also promote open innovations and I would appreciate your understanding in this regard.

Preparing for the Future

As I mentioned before, information technology is innovating every second. Just as it was 10 or 20 years ago, it is extremely difficult to predict what the future will hold 10 or 20 years from now. It is even more difficult to predict what will come next after the fourth Industrial Revolution and fourth paradigm in science.

Yet, one cannot help wonder if today's world is better than how it was 20 years ago. Is our lifestyle truly more affluent now? It could be argued that the COVID-19 pandemic is a natural disaster, but some of the major social problems, including political division, economic disparity, and global warming, may be regarded as side effects of the advanced information-oriented society.

Or it could be the case that more people suffer from stress, depression, and dependence because society as a whole has become busier and less generous and tolerant. I believe that it is the responsibility of informatics researchers to find clues to solutions to these various problems and shape a better society by taking these aspects into account. After all, this approach has much in common with Society 5.0, a vision for the future society which is being promoted in Japan, and with the Sustainable Development Goals (SDGs) proposed by the United Nations.When this pandemic is behind us, our world will become increasingly computerized and virtualized, which in turn will enhance the importance of informatics. It would bring me great joy if we can produce individuals who, with solid foundations and broad perspectives, challenge themselves by journeying into the great unknown.

KAWAHARA Tatsuya

Dean, Graduate School of Informatics

1987 B.E. degree from the Department of Information Science, Faculty of Engineering, Kyoto University
1989 M.E. degree from the Graduate School of Engineering, Kyoto University
1990 Research Associate, Faculty of Engineering, Kyoto University
1995 Dr.E from the Graduate School of Engineering, Kyoto University
1995 Associate Professor, Faculty of Engineering, Kyoto University
1998 Moved to the then newly-established Graduate School of Informatics, Kyoto University
2003 Professor, Academic Center for Computing and Media Studies and Graduate School of Informatics, Kyoto University, where he majors in speech processing, particularly speech recognition and interaction systems
2012 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology of Japan
Board member, International Speech and Communication Association (ISCA)
Editor-in-Chief, APSIPA Transactions on Signal and Information Processing
Fellow, Institute of Electrical and Electronics Engineers (IEEE)
Associate Member, Science Council of Japan

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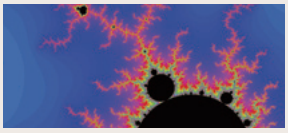

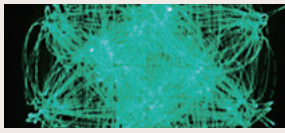

Departments

Division	Group / Unit / Research Group			
Department of Intelligence Science and Technology				**P.09**
Brain and Cognitive Sciences	Neuroinformatics	Psychoinformatics	Cognitive Informatics	Computational Cognitive Neuroscience (Adjunct Unit)
Cognitive System	Computational Intelligence	Collective Intelligence	Conversational Informatics	
Intelligent Media	Language Media Processing	Speech and Audio Processing	Computer Vision	
Application of Multimedia (Affiliated)	Video Media	Network Media	Text Media	
Bio-system Informatics (Affiliated)	Biological Information Networks			
Department of Social Informatics				**P.19**
Social Information Model	Distributed Information Systems	Human-Robot Interaction	Social Media	
Social Information Network	Global Information Network	Information Security (Adjunct Unit)		
Biosphere Informatics	Bioresource Informatics	Environmental Informatics		
Regional and Disaster Management Information Systems (Affiliated)	Integrated Disaster Management Systems	Emergency Management for Disaster Reduction Systems	Crisis Information Management System	
Medical Informatics (Affiliated)				
Learning and Educational Technologies (Affiliated)				
Department of Advanced Mathematical Sciences				**P.29**
Applied Analysis	Applied Analysis			
Nonlinear Physics	Nonlinear Physics			
Applied Mathematical Sciences	Computational Mechanics	Industrial Mathematics		
Department of Applied Mathematics and Physics				**P.35**
Applied Mathematics	Applied Mathematical Analysis	Discrete Mathematics		
Applied Mathematical Systems	System Optimization	Control Systems Theory	Applied Mathematical Modeling (Adjunct Unit)	
Mathematical Physics	Physical Statistics	Dynamical Systems		
Mathematical Finance (Affiliated)				
Department of Systems Science				**P.41**
Human Machine Symbiosis	Mechanical Systems Control	Human Systems	Integrated Dynamical Systems	Mobility Research
Systems Synthesis	Adaptive Systems Theory	Mathematical System Theory	Computational Intelligence Systems (Adjunct Unit)	
Systems Informatics	Information Systems	Integrated Systems Biology	Biomedical Engineering	Computational Neuroscience (Adjunct Unit)
Applied Informatics (Affiliated)				
Department of Communications and Computer Engineering				**P.49**
Computer Engineering	Computer Algorithms	Computer Architecture	Computer Software	
Communications Systems Engineering	Digital Communications	Integrated-Media Communications	Intelligent Communication Networks	
Integrated Systems Engineering	Processor Architecture and Systems Synthesis	Ultrafast Signal Processing		
Radio Atmospheric Sciences (Affiliated)	Remote Sensing Engineering	Atmospheric Observations		

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