2019

Kyoto University
Graduate School of Informatics

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Graduate School

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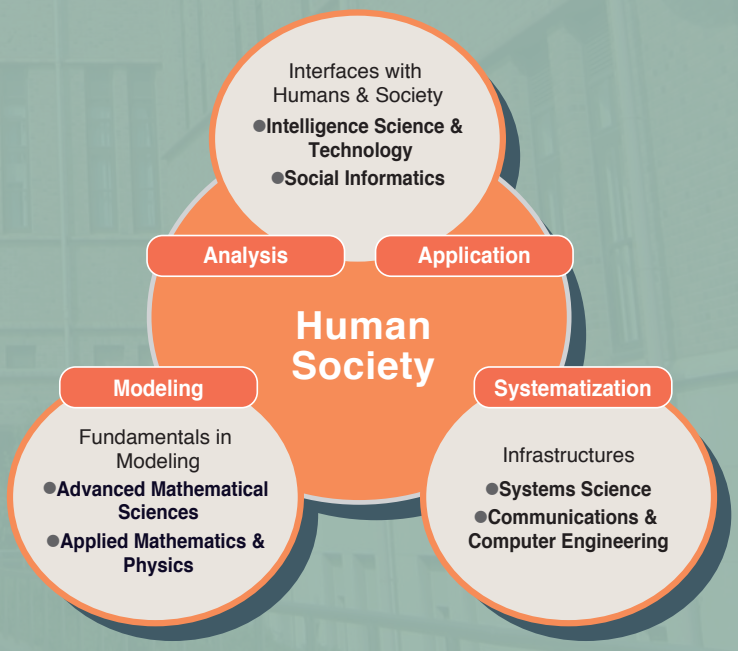
Information

of Informatics

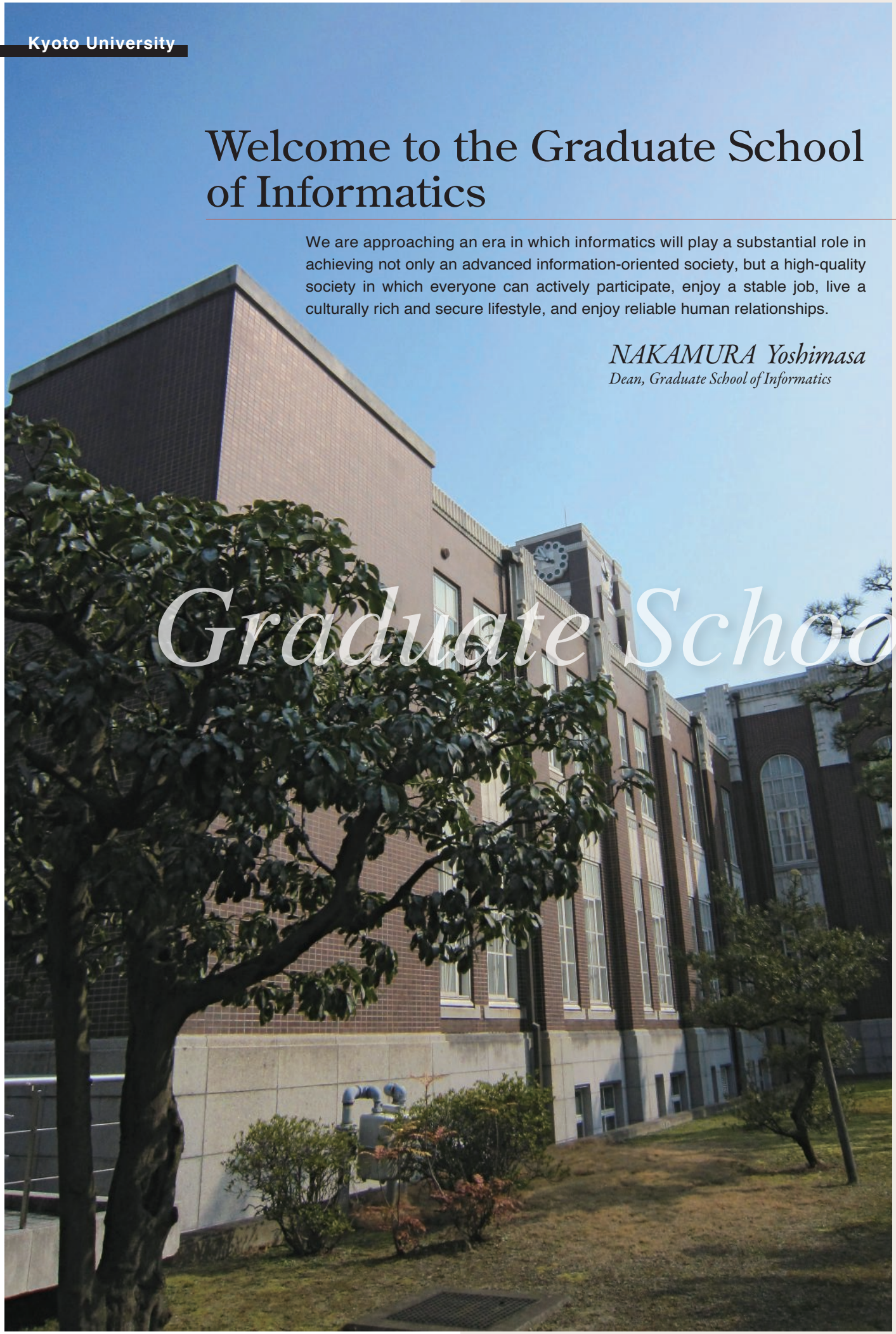
Informatics is a cutting-edge interdisciplinary field for the 21st century which assimilates information with humans and society.



Welcome to the Graduate School of Informatics

We are approaching an era in which informatics will play a substantial role in achieving not only an advanced information-oriented society, but a high-quality society in which everyone can actively participate, enjoy a stable job, live a culturally rich and secure lifestyle, and enjoy reliable human relationships.

NAKAMURA Yoshimasa
Dean, Graduate School of Informatics





a message

Foreword

It has been 20 years since the founding of the Kyoto University Graduate School of Informatics. I would like to speak about the initial objectives behind the creation of the Graduate School of Informatics and the education and research currently being carried out here. And while it is my personal opinion, I would also like to send a message about the future of informatics to those in the younger generation who are interested in and have expectations about informatics and the potential of this field.

The Study of Information, "Informatics"

In April 1998, Kyoto University created the Graduate School of Informatics through the reorganization and integration of information-focused research areas at five schools (Engineering, Science, Agriculture, Letters, and Integrated Human Studies). This new school was designed "to incorporate research on the processes of information generation, transmission, conversion, reception and storage, and research on computer hardware, software and communications technology which facilitate such processes. This was in addition to mathematical, systems-scientific, simulation-based and social research on information-related issues which encompass the abovementioned themes".

Given the disciplinary breadth and variety of the new school, the term "informatics" — the study of information — was adopted rather than applying one of the terms that were already being used at the time, such as information engineering, information science, or information systems. Around the same time, information-related graduate schools were also established at Hokkaido University, Tohoku University, University of Tokyo, Tokyo Institute of Technology, Nagoya University, Osaka University, Kyushu University, and elsewhere, but the objectives for each school and the composition of the fields differed substantially among the universities. I would like to thank my predecessors who first hung out the big "informatics" signboard, which has held up well over time.

The Graduate School of Informatics currently admits 189 students for the Master's program and 60 students for the Doctoral program. This makes it one of the largest graduate schools at Kyoto University in terms of both faculty members and students. Because of the similarity of the names, it is sometimes said that the Graduate School of Informatics is a graduate program that builds on the Undergraduate School of Informatics and Mathematical Science (Faculty of Engineering) and therefore actually has an undergraduate program. However, that is not accurate. The School of Informatics and Mathematical Science is small, with a capacity of 90 students, and the School is only handled by just over half of the 43 labs in the Graduate School of Informatics. The undergraduate program comprises of two courses of study — computer science and applied mathematics & physics — while the Graduate School of Informatics covers a broader and more diverse range of disciplines, as evidenced by its six departments —intelligence science and technology, social informatics, advanced mathematical sciences, applied mathematics and physics, systems science, and communications and computer engineering. The graduate program implements a curriculum that binds together diverse research fields through the broad themes indicated by these department names. Above all, priority is placed on what is called Research Guidance, which is a course that helps students prepare their Master's or Doctoral thesis. The students learn on their own as they aim to be an independent researcher or high-level technical expert. The majority of students make presentations at academic meetings in Japan or abroad, or they present papers before submitting their final thesis, and many students receive awards for their papers or incentive prizes.

The essential point is that the founding objective of this graduate school is not simply to be an assemblage of information-related research fields, but rather "to cultivate highly talented individuals with a broad perspective and insight through the pursuit of pioneering and creative interdisciplinary research and constructive contributions to the field of informatics itself". For that reason, since its inception, the Graduate School of Informatics has provided a broad education by establishing cooperative lecture courses with research institutes within the university and collaborative fields with corporate research institutes.

Since that time, to achieve this objective, the Graduate School has established collaborative units and lecture courses in collaborative research with corporations and other research institutions. It has introduced a number of Centers of Excellence (COE) Programs, programs for the internationalization of education, the Program for Leading Graduate Schools, the Program to Enhance Graduate School Education through a request to MEXT for budget appropriation (Special Funds for Education and Research), the Seminar on Informatics in Asia, the Special Program for International Doctoral Students, and so on. These "Educational Activities of the Graduate School of Informatics" were deemed to "exceed the expected level" in the National Institution for Academic Degrees and Quality

Enhancement of Higher Education's 2nd Medium-Term Objectives Evaluation (FY2010–FY2015).

Under a separate evaluation item, it was noted, "The graduate school's objective of passing on exceptional intellect and the cultivation of scholarly learning related to informatics in the broad sense of the term is incorporated throughout. As a rule, careful instruction is provided when taking classes and programs, and each student receives the educational guidance suited to their needs". The "educational content and methodology" also received an "exceed the expected level" evaluation. Also, based on the strong evaluation of the research results of the school's graduate students, the Doctoral program was found to greatly exceed the level expected by relevant parties regarding the high standard of talented individuals being produced. In addition, the evaluation of "status of employment or progression to further education", based on "whether those who have completed their studies at the graduate school are satisfied with the education they received there, and whether that is true even after they are employed", was also judged to "exceed the expected level".

For further information on these positive evaluation results for the education offered at the Graduate School of Informatics, please refer to the website of the National Institution for Academic Degrees and Quality Enhancement of Higher Education.

Informatics Today, Informatics in the Future

Around the time that the Graduate School of Informatics was established, it was claimed that "the steam engine brought the first Industrial Revolution, the development of the heavy and chemical industries brought the second Industrial Revolution, and now the third Industrial Revolution has arrived with an advanced information-oriented society". Just 20 years later, we are already hearing people talk about a fourth Industrial Revolution. The further advancements in information and communications technology (ICT) and networking make it possible for information, people, organizations, logistics, finances, and so on — all types of "things" — to be instantly connected in the global environment, influencing one another. As a result of such new circumstances created, without being confined by the framework of the existing industrial structure or technological fields, entirely new added value is starting to be produced, new businesses and markets are emerging, and changes are occurring in the way that people work and live. I would like you to recall the arrival of virtual currencies of which monetary value depends on trust in cryptographic technology.

As a result, we need to not simply seek technological revolutions as we have in the past, but rather produce a new value that can respond to people's diverse needs and sympathies. Also, new technologies that have a substantial impact not only on human society but on human existence itself, such as artificial intelligence (AI), IoT (Internet of Things), big data, robotics, and neuroscience, are entering an era of great progress.

In 2018, the Graduate School of Informatics celebrates its 20th anniversary. What is the current state of informatics and what will its future hold?

In keeping with Kyoto University's Mission Statement that it will "strive for diverse development in pure and applied research in the humanities, sciences, and technology, while seeking to integrate these various perspectives", it is essential that there be dialogue and collaboration — or at times rivalry and conflict — across disciplines if we are trying to "be recognized as world-class universities and develop preeminent education and research". As history teaches us, not only can the introduction of findings and ways of thinking from one field into another lead to new insights, but multidisciplinary collaboration also creates academic dynamism.

Informatics, which is characterized by the breadth and diversity of disciplines it encompasses, is an integrated field that was created through that type of multidisciplinary cooperation. However, there is not much meaning in diversity if each field co-exists separately. To achieve the vision of "constructing informatics", it is extremely important to fully utilize Kyoto University's strength in "independent learning" and to transform the breadth and diversity of informatics into a new vitality by having teachers and students respect one another's work and stimulate one another's thinking.

In the recent AI boom, there has been a focus on the use of big data based on machine learning/deep learning algorithms and Bayesian statistics. In mathematical modeling to acquire large quantities of high-quality data, as well as in AI that extracts meaningful information concealed in massive data and long tails, the foundation lies in cross-disciplinary collaboration between mathematical algorithms, statistics, and programming. Without some level of knowledge of mathematics and statistics, you cannot master the use of AI technology with the computer alone. Of course, you cannot develop it either. By using AI to create new products and develop new services, you can significantly change society.

At a university, it is important to tackle substantive and fundamental challenges. The basic design of Kyoto University's Graduate School of Informatics includes "mathematical,



systems-scientific, simulation-based, and social research on information-related issues" and it can be said that it has leapt to the vanguard with the advent of the AI boom. By producing a particular scale of talented individuals who have pursued the basics of informatics — a fusion of mathematical algorithms, statistics, and programing — the Graduate School of Informatics can respond to the expectations of society. Above all, by deepening the foundations of mathematics and statistics, which are at the root of AI technology, it will enable the development of the next generation of that technology.

Finally, let me conclude by citing the evaluation of "research" in the 2nd Medium-Term Objectives Evaluation (FY2010–FY2015) to touch on our ability to propel a new era of research and development. First, in terms of the "status of research activities", based on the substantial levels of the number of academic papers per faculty member; reviews and think pieces in professional journals; keynote speeches and lectures at academic meetings; the securing of grants-in-aid for scientific research and other competitive funding; the number of foreign faculty members; and industry-academia, international, and regional cooperation, the Graduate School of Informatics was considered to "exceed the expected level". In addition, the "status of research achievements" was also "exceed the expected level", as it was noted, "This graduate school has its ideal state that research that is recognized as being of a high standard within the individual fields encompasses an extremely comprehensive range of fields in order to provide opportunities within the school to learn about research in other fields, stimulate one another's thinking, and thereby raise the level of research throughout the school even further". Some of those achievements are described in this brochure.

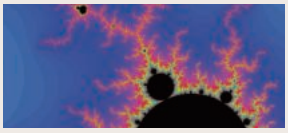
Conclusion—Informatics That Transforms Society

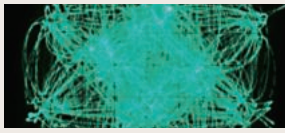
Kyoto University's Mission Statement states that we "will encourage cooperation with local and national society, and will disseminate knowledge informed by the ideals of freedom and peaceful coexistence". For us, that can be understood as aiming to achieve a better society through the "construction of informatics" based on free thinking. Looking at the future of new technologies, as exemplified by AI, we are entering an age when informatics will play a substantial role in achieving a high-quality society where all individuals can actively participate. I am counting on the highly-motivated talented young individuals who are able to feel the enormous potential of informatics alongside their colleagues.

NAKAMURA Yoshimasa
Dean, Graduate School of Informatics

After receiving his B.S. degree from Kyoto University's Faculty of Engineering in 1978, Professor Nakamura received his PhD from the university's Graduate School of Engineering in 1983. He was appointed as an associate professor at Gifu University in 1986, became a professor at Doshisha University in 1994, and a professor at the graduate school at Osaka University in 1996, before returning to Kyoto University as a professor in the Graduate School of Informatics in 2001, where he remains to this day. (During that time, for five years since 2002, he held a concurrent appointment as a researcher under the Precursory Research for Embryonic Science and Technology [PRESTO] program, a Japan Science and Technology Agency initiative.) Professor Nakamura's area of expertise is applied mathematics. Among his publications are Kasekibunkei no suri [The mathematics of integrable systems], (Asakura Publishing, 2018, co-author), Kasekibunkei no kino suri [The functional mathematics of integrable systems], (Kyoritsu Shuppan, 2006), Kasekibunkei no oyo suri [The applied mathematics of integrable systems] (Shokabo, 2000, co-author).

Graduate School





Departments

Division	Group / Unit / Research Group			
Department of Intelligence Science and Technology P.09				
Brain and Cognitive Sciences	Neuroinformatics	Psychoinformatics	Cognitive Communication	Computational Cognitive Neuroscience (Adjunct Unit)
Cognitive System	Computational Intelligence	Collective Intelligence	Conversational Informatics	
Intelligent Media	Language Media Processing	Speech and Audio Processing	Visual Information Processing	
Application of Multimedia (Affiliated)	Video Media	Network Media	Media Archiving Research	
Bio-system Informatics (Affiliated)	Biological Information Networks			
Cooperative Intelligence (Joint Research Chair)	Cooperative Intelligence			
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)	Market and Organizational Information Systems (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	Integrated Circuits Design Engineering	Advanced Signal Processing	
Radio Atmospheric Sciences (Affiliated)	Remote Sensing Engineering	Atmospheric Observations		