

A wireframe model of a human head in profile, facing right, is the central focus. The head is composed of a dense mesh of white lines. The background is a dark blue field with a network of glowing blue lines and nodes, some of which are blurred to create a sense of depth. In the bottom right corner, there is a geometric design consisting of several overlapping triangles in shades of blue, purple, and magenta. Within these triangles, there are small inset images: one shows a path through a bamboo forest, and another shows a stone path through a garden.

# 2023

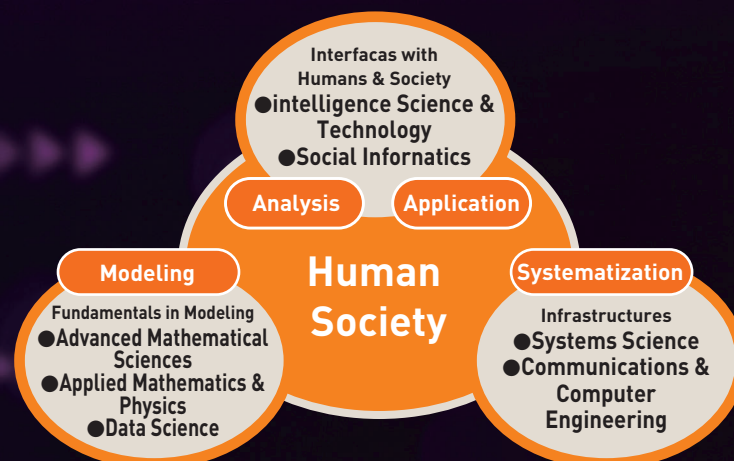
Kyoto University  
Graduate School  
of Informatics



# From Kyoto to the world.



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



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## Definition of Informatics

Informatics in Kyoto University is the study of information in natural and artificial systems.

Informatics studies the creation, recognition, representation, collection, organization, optimization, transformation, communication, evaluation and control of information in complex and dynamic systems.

Informatics has human, social, cognitive, biological, linguistic, computational, mathematical and engineering aspects. It includes systems science and communications engineering.

Informatics has close relations with a number of disciplines in the natural and human sciences. It is developed employing contributions from many different areas : in turn, it can contribute to their further development.

Interfaces to human and social areas, mathematical modeling and information systems are the three pillars of Informatics in Kyoto University.



# Welcome to Graduate School of Informatics

Kyoto University Graduate School of Informatics, which was the first graduate school in Japan to use the term “informatics” in its name when it was established in April 1998, recently celebrated the 25th anniversary of its founding. Here, I would like to offer an overview of the research fields and educational programs of Graduate School of Informatics and outline some of its outstanding features.

*Dean, Graduate School of Informatics*

*Atsushi Igarashi*



## *What is Informatics?*

The preceding section of this booklet includes a definition of informatics as envisioned by this graduate school. It states that “informatics in Kyoto University is the study of information in natural and artificial systems,” that “informatics has human, social, cognitive, biological, linguistic, computational, mathematical, and engineering aspects ... and includes systems science and communications engineering,” and that it “has close relations with a number of disciplines in the natural and human sciences.” The term “information” tends to highlight computer-based technologies, such as information and communication technologies (ICT) and artificial intelligence (AI), but our definition of informatics points to an academic discipline that is far more interdisciplinary than these technologies suggest.

As mentioned, our graduate school was the first in Japan to define itself using the term “informatics.” Up to that time, most schools and departments in Japan in this general field used names containing “computer science/engineering” or “information science,” but between the late 1990s and early 2000s, Kyoto University and some other leading universities, including Hokkaido University, Tohoku University, The University of Tokyo, Tokyo Institute of Technology, Nagoya University, Osaka University, and Kyushu University established graduate

schools in information-related science, typically with names like “Graduate School of Information Science/Engineering” or “Graduate School of Information Science.” Only Kyoto University adopted the broader term “informatics.” In fact, two years before Graduate School of Informatics was established, the “School of Informatics and Mathematical Science” was created in the Faculty of Engineering through a merger of the School of Information Science and the School of Applied Mathematics and Physics. The use of “informatics” was very unusual at the time. These name choices were motivated by the desire of the people involved in setting up this graduate school to establish a broader discipline of “informatics” to transcend the limits of the conventional disciplines of “information science/engineering” or “information science.”

I imagine that all the students who apply to this graduate school are keen to study their chosen field of specialization seriously. As they steadfastly pursue their desire, I hope that they also take the time to look around to survey the whole of the graduate school and experience the full breadth of “informatics.” As explained below, the educational program is designed to allow students to experience a wide range of this rich and broad field.



## *Education and Research in Graduate School of Informatics*

Graduate School of Informatics is one of the largest graduate schools at Kyoto University, with a current intake (per academic year) of 240 students for the Master's program and 60 students for the Doctoral program. The graduate school consists of seven "courses" of study under the "major" of informatics.

- Intelligence Science and Technology Course
- Social Informatics Course
- Advanced Mathematical Sciences Course
- Applied Mathematics and Physics Course
- Systems Science Course
- Communications and Computer Engineering Course
- Data Science Course

Each course is taught not only by faculty from within the Graduate School of Informatics, but also by faculty (as cooperating professors) from other departments within the university, such as the Academic Center for Computing and Media Studies, Disaster Prevention Research Institute, Kyoto University Hospital, Institute for Chemical Research, Research Institute for Sustainable Humanosphere, and Institute for Liberal Arts and Sciences, as well as by collaborating researchers from institutions outside the university, including RIKEN, NTT, Hitachi, Advanced Telecommunications Research Institute International (ATR), and Okinawa Institute of Science and Technology (OIST). The research fields (labs) of each course are described in the introduction to each course below. The names of these courses alone indicate the remarkable breadth of study and research covered by Graduate School of Informatics. Leading-edge informatics research is conducted in all these fields.

A key feature of the curricula of our graduate school is that it is designed not only to allow students to study the primary academic major of their choice, but also to equip them with a broad range of knowledge that transcends the boundaries of their chosen field of specialization. One example is the inter-departmental course "Perspectives in Informatics," required electives for the Master's program. In the Doctoral program,

students naturally cultivate a deeper knowledge of their field of specialization through the research guidance of their academic advisors, but they also acquire a comprehensive academic vision through seminar subjects in each course.

As part of its efforts to internationalize education, the school offers a number of courses in English. These are taught by both Japanese and non-Japanese faculty. In some courses, we even enable students to earn a Master's degree without learning Japanese, by offering classes and research guidance in English ("International Program"). In the case of Doctoral programs, students can pursue their research and earn a PhD in any of the courses without the need to learn Japanese. Even Japanese students (who are not international students) can choose to take the International Program if it is offered for the course they are pursuing. On successful completion, such students are awarded an "International Program Completion Certificate" along with their degree.

Graduate School of Informatics also takes part in five-year doctoral programs offered by multiple Kyoto University graduate schools in collaboration with companies, overseas universities, research institutes, and other external organizations. These are the Kyoto University School of Platforms and Kyoto University Collaborative Graduate Program in Design, run by the Center for the Promotion of Excellence in Higher Education (CPEHE). Students in Graduate School of Informatics can take advantage of these programs to earn a degree. For additional information, see a more detailed outline or access applicable website URLs of these programs below (in this booklet).

It is not an overstatement to say that graduates of this school who have received this kind of advanced education are becoming increasingly sought after for a variety of roles as the field of informatics expands. Such graduates typically find work as researchers in universities or corporate research labs, and as expert engineers in a wide range of industries, including ICT, manufacturing, finance, broadcasting, and services.



### *Our Reorganization*

In April 2023, on the 25th anniversary of its establishment, Kyoto University Graduate School of Informatics was reorganized. The six existing departments (Intelligence Science and Technology, Social Informatics, Advanced Mathematical Sciences, Applied Mathematics and Physics, Systems Science, and Communications and Computer Engineering) were merged into a single Department of Informatics. The educational programs of the previous six departments were transformed into “courses” and a new “Data Science Course” was added (making a total of seven courses). At the same time, the total student intake for the Master’s program was increased (from 189 to 240 students per academic year).

The main purposes of the reorganization were to respond to the sharp rise in the number of students wishing to study informatics in recent years, as well as to cultivate experts in the increasingly important field of data science, which is closely connected to informatics. Creating multiple educational courses under a single major (field of specialization) also allows the school to establish and deliver more flexible educational programs. In fact, education in the new Data Science Course will be provided both by faculty who work primarily in Graduate School of Informatics and faculty from the Center for Innovative Research and Education in Data Science of the Kyoto University Institute for Liberal Arts and Sciences, who will concurrently serve in Graduate School of Informatics. Structuring the educational program in this way would have been difficult under a conventional framework of majors. We regard this reduction to a single major as an important initiative for enabling us to provide education that is better attuned to the anticipated changes and developments in informatics over the coming years.

### *Concluding Remarks*

This brief overview of Graduate School of Informatics is focused on educational programs. Of course, a wide variety of research in informatics is also conducted within the school. The presentations of the labs in each of the courses offer a glimpse of these research activities. Graduate School of Informatics also

places great importance on pure research. Without a deep knowledge of the fundamentals, it is not possible to create robust technologies that can remain useful for many years. Informatics as a field of study is still in its nascent phase. Given the youthfulness of this field, it seems very fitting to pursue research in informatics at Kyoto University, in a city where tradition and innovation have coexisted for many centuries. We look forward to seeing students take up exciting challenges under this new structure.

### *Atsushi Igarashi*

*Dean, Graduate School of Informatics*

Atsushi Igarashi is a Professor at Graduate School of Informatics, Kyoto University. He received his B.S., M.S., and D.S. degrees from Department of Information Science, University of Tokyo in 1995, 1997, and 2000, respectively. Formerly, he belonged to Dept. of Graphics and Computer Science, Graduate School of Arts and Sciences, University of Tokyo. His major research interests are in theoretical computer science, in particular, principles of programming languages and program verification. He has been awarded a few domestic and international academic prizes, including the AITO Dahl-Nygaard Junior Prize for his investigations into the foundation of object-oriented programming languages and their type systems.



# Courses in Graduate School of Informatics





Applied Mathematics and  
Physics Course

Applied Mathematical Analysis  
Discrete Mathematics  
System Optimization  
Control Systems Theory  
Physical Statistics  
Dynamical Systems  
Applied Mathematical Modeling  
(Adjunct Unit)

Communications and Computer Engineering Course

Computer Algorithms  
Computer Architecture  
Computer Software  
Digital Communications  
Integrated-Media Communications  
Intelligent Communication Networks  
Processor Architecture and  
Systems Synthesis  
Integrated Circuits Design Engineering  
Advanced Signal Processing  
Remote Sensing Engineering  
Atmospheric Observations  
Supercomputing  
Multimedia and Secure Networking

Systems Science Course

Mechanical Systems Control  
Human Systems  
Integrated Dynamical Systems  
Mathematical Information Systems  
Statistical Intelligence  
Learning Machines  
Integrated Systems Biology  
Biomedical Engineering  
Computational Neuroscience  
(Adjunct Unit)

Data Science Course

Statistical Mathematics  
Statistical Inference  
Information-Theoretic Learning  
Signal and Information Processing  
Applied Machine Learning  
Medical and Healthcare Data Science  
Computational Intelligence Systems  
(Adjunct Unit)