

# Harmonizing Society and Information Technology

Global networking is rapidly expanding via information technology. Based upon the trends of technologies that interact with our daily lives, the Department of Social Informatics seeks to clarify the structures of highly complex information societies and actually design information systems that are globally useful. Therefore, we endeavor to support globalizing activities in the areas of culture, economics, ecology, disaster management, healthcare and education.



## Information is Born in the Lives of People

Sources of social information do not exist on the Internet. These sources are usually found in people's daily lives. Social informatics includes processes from the acquisition of information from the sources, through constructing systems to utilize the information, to designing a better society using those information systems. For example, we collect ecological information relevant to fish by using bio-logging techniques for fishery resource conservation. We also glean biological information from forest ecosystems using various types of sensors to optimize the sustainable utilization of ecosystem services. Then, we study methods for database development to organize that information on natural resources and environments. Moreover, we study informatics applications in the fields of medical services and education, and also determine what types of information are needed for disaster prevention and harm minimization. We consider ways to utilize the data to design societies and social systems. We, the people in the Department of Social Informatics, work to acquire data directly related to our lives and societies, and to reformulate and store it in the most accessible and useful way to enable the development of our sustainable future.



### *Nobuhito Ohte*

Department of Social Informatics

He is a Professor of the Biosphere Informatics Laboratory in the Department of Social Informatics at Kyoto University. His research themes are to understand mechanisms of hydrological controls of nutrient transformations and transportations in the forested catchment, and to elucidate the geographical variations of those ecosystem dynamics among various types of climatic and geological conditions. He holds a BA in forestry from Graduate School of Agriculture at Kyoto University in 1987, and a PhD also from Kyoto University in forest hydrology in 1992. He was awarded Biwako Prize for Ecology in 2013. He is currently an associate editor of Biogeosciences (European Geoscience Union).

## Applications of Information Technologies Expanding

Information technologies are causing our society to make great strides, with data science, artificial intelligence (AI), and information search becoming an integral part of our lifestyles. Meanwhile, robots, autonomous vehicles, and other information systems with advanced AI continue to blend into our physical world. As one new information technology after another is being developed, how can information systems be created that achieve harmony with society and are accepted and utilized? The Department of Social Informatics is privileged to have a faculty comprised of experts in information technologies and teaching staff versed in applications of information technologies in such fields as biology, agriculture, medical science, disaster management, and education. If you wish to create information technologies that lead to practical applications or information systems that are of genuine use to society, this is the place you want to conduct your research!



### *Takayuki Kanda*

Department of Social Informatics

He received a bachelor's degree from the Department of Information Science, Kyoto University Faculty of Engineering, in 1998, and completed his doctoral program at the Department of Social Informatics, Kyoto University Graduate School of Informatics, in 2003 to earn a Ph.D. in Informatics. He joined ATR Intelligent Robotics and Communication Laboratories in 2003 to successively assume the positions of researcher, senior researcher, and Group Leader. Since 2018, he has held a professorship at the Department of Social Informatics, Kyoto University Graduate School of Informatics. His research interests include human-robot interactions, especially robots' autonomous dialogue mechanisms and social competencies, dialogues by anthropomorphic robots using their bodies, and their applications to everyday life settings.



## Outline

### Divisions and Groups

Division	Group / Unit	Research and Education Topics	Professor
<b>Social Information Model</b>	Distributed Information Systems	Technical Issues and Applications Used in the Formation of Distributed Information Systems	Masatoshi Yoshikawa
	Human-Robot Interaction	Intelligent Robotics for Our Daily Society	Takayuki Kanda
	Social Media	Acquisition, Analysis, Extraction, and Retrieval of Social Information	Keishi Tajima
	Sociotechnical Design	Basic communication technology to enhance human relations	Naomi Yamashita
<b>Social Information Network</b>	Multiagent Systems	The Formation of Social Systems Based on Information Networks	Takayuki Ito
	Information Security (Adjunct Unit)	Encryption and Authentication System	Masayuki Abe
<b>Biosphere Informatics</b>	Bioresource Informatics	The Processing and Analysis of Biosphere Resource Data	
	Environmental Informatics	Investigating Interactions between Human Society and the Biosphere Environment	Nobuhito Ohte
<b>Regional and Disaster Management Information Systems (Affiliated)</b>	Integrated Disaster Management Systems	Disaster Information Systems and Building Disaster Prevention Systems	Hirokazu Tatano
	Emergency Management for Disaster Reduction Systems	Social Scientific Research for Disaster Damage Reduction	Katsuya Yamori
	Crisis Information Management System	Practical Disaster Management for Business Continuity	Michinori Hatayama
<b>Medical Informatics (Affiliated)</b>		Interaction between Information Systems and Medical and Social Organizations	Tomohiro Kuroda
<b>Learning and Educational Technologies (Affiliated)</b>	Learning and Educational Technologies	Information Systems that Support Learning and Education	Hiroaki Ogata
	Data Engineering and Platform Research	Research to support internet-scale data infrastructure	Kazuyuki Shudo

### Graduate Curriculum

#### Courses for the Master's Program

Social Informatics	Biosphere Informatics	Distributed Systems
Information System Analysis	Disaster Information	Cryptography and Information Society
Practice of Information Systems	Emergency Management	User Experience
Multiagent Systems	Medical Informatics	Theories of Service Modeling
Distributed Information Systems	Informatics of E-business	Advanced Study in Social Informatics 1
Human-Robot Interaction	Information Education	Advanced Study in Social Informatics 2
Field based Learning/Problem based Learning (FBL/PBL) 1		
Field based Learning/Problem based Learning (FBL/PBL) 2		

#### Courses for the Doctoral Program

Advanced Seminar on Social Information Models	Advanced Seminar on Medical Informatics
Advanced Seminar on Social Information Networks	Advanced Seminar on Information Education
Advanced Seminar on Biosphere Informatics	Advanced Seminar on Social Informatics
Advanced Seminar on Regional Disaster Prevention Information Systems	

(D) : Disaster Prevention Research Institute, Kyoto University  
 (H) : Division of Medical Information Technology and Administration Planning, Kyoto University Hospital  
 (M) : Academic Center for Computing and Media Studies, Kyoto University  
 (I) : Institute of Liberal Arts and Sciences, Kyoto University

### Teaching Staff

#### Professors

Masatoshi Yoshikawa; Takayuki Kanda; Keishi Tajima (I, Secondary Appointment); Takayuki Ito; Nobuhito Ohte; Hirokazu Tatano (D, Affiliated); Katsuya Yamori (D, Affiliated); Michinori Hatayama (D, Affiliated); Tomohiro Kuroda (H, Affiliated); Hiroshi Tamura (I, Affiliated); Hiroaki Ogata (M, Affiliated); Kazuyuki Shudo (M, Affiliated); Naomi Yamashita (NTT, Adjunct); Masayuki Abe (NTT, Adjunct)

#### Associate Professors

Qiang Ma; Kazunari Sugiyama; Yang Cao; Dražen Brčić; Donghui Lin; Lina A. Koyama; Toshio Fujimi (D, Affiliated); Subhajyoti Samaddar (D, Affiliated); Masamitsu Onishi (D, Affiliated); Kei Hiroi (D, Affiliated); Goshiro Yamamoto (H, Affiliated); Mehdi Tibouchi (NTT, Adjunct)

#### Senior Lecturers

Jani Even; Yukiko Mori (H, Affiliated); Brendan John Flanagan (M, Affiliated); Rwitajit Majumdar (M, Affiliated)

#### Assistant Professors

Stela H. Seo; Malcolm Doering; Ryuta Arisaka; Rafik Hadfi; Jawad Haqbeen; Sofia Sahab; Hideaki Nishizawa; Christian Vincenot; Huan Liu; Genta Nakano (D, Affiliated); Chang Liu (H, Affiliated); Izumi Horikoshi

# Social Information Model

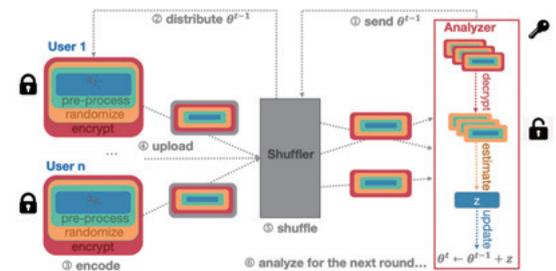
The development of information networks has enabled the widespread use of information bases distributed throughout the world. The Social Information Model Division's Groups are based around a discussion of the formation of these distributed information bases. Through a study of the creation of working social information systems such as multimedia libraries, the Groups in this Division teach and study information models of today and their possible forms in the future, covering such topics as the problems that information systems cause and their impact on society.

## Distributed Information Systems

*New technologies for managing and utilizing distributed information can make our society evolve much more*

Contemporary society relies heavily upon the massive amount of information that is found mostly on the Internet. Social progress will depend upon the establishment and continuous evolution of a) technologies to enable the rapid and accurate transmission of data; and b) technologies to allow rapid searches of vast volumes of data to retrieve required information in a timely manner. For this reason, we conduct fundamental research on data mining, geographic information systems, Web information systems, social network analysis, and privacy protection. We also carry out application-oriented research such as health/medical big data analysis, scientific data management, integrated utilization of knowledge bases and search engines, utilization of scholarly data, educational information systems, in cooperation with domain experts.

[Professor: Masatoshi Yoshikawa; Associate Professor: Qiang Ma;  
Program-Specific Associate Professors: Kazunari Sugiyama, Yang Cao]



Differentially Private Federated Learning in the Shuffle Model

## Human-Robot Interaction

*Intelligent robotics for our daily social environments*

There are a growing number of everyday applications for artificial intelligence and robotics such as social robots, self-driving cars, and automated shops. We expect that future society will be ubiquitous with various robots. Towards such a robotized society, we aim to study robots that interact with people and operate in harmony alongside them. Such robots are embodied agents with sensory feedback that have the ability to interact in real-time with their environments. Consequently, we conduct fundamental research in intelligent robotics, human interaction, sensor networks, and artificial intelligence (AI). We are aiming for applications in the service industry, elderly care, health care, collaborative work places, and learning.

[Professor: Takayuki Kanda; Associate Professor: Dražen Brčić;  
Program-Specific Senior Lecturer: Jani Even;  
Assistant Professor: Stela H. Seo;  
Program-Specific Assistant Professor: Malcolm Doering]



## Social Media

*Information environment for sharing and utilizing all useful information in the world*

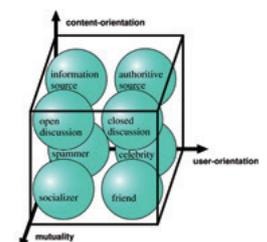
"Sharing and utilizing all useful information in the world" may sound to you like a mission statement of a major search engine company. It has, however, been the dream of researchers in the area of database systems and information retrieval since a long time ago. Thanks to the advance of computer and network technologies, we can now easily share and utilize data of large volume and high diversity which we cannot even think about until decades ago, and this "dream" is not a daydream anymore but is the goal. To achieve this goal, we conduct research on technologies for collecting, analyzing, extracting information and technologies for retrieving information you want from the extracted information. Our recent research themes includes: extraction of social information from the Web, social network analysis, information retrieval, and information access interface.

[Professor: Keishi Tajima]



Web = distorted mirror  
Need to remove distortion

Extraction of social information from the Web



Example of Twitter follow link classification

Outline

## Social Information Network

Information networks enable us to communicate by various means, regardless of spatial or temporal constraints, and influence the structure of our society. The use of these information networks will create new social information systems and contribute to social change on a global scale. The Social Information Network Division consists of the Global Information Network Group, and the Information Security Adjunct Unit.

## Consensus Informatics

*Creating the Next-Generation Social Systems with Multi-Agent Technology*

The explosive diffusion of SNSs and smartphones has brought about intrinsic changes in the way we interact. Social systems that we avail ourselves to daily are the epitome of human wisdom and collective intellect, yet most social systems are classical and were developed when there were no SNSs or smartphones. Meanwhile, groups of insects and fish are advancing their collective intellect at a tremendous speed for their evolutionary survival. We humans need to realize new social systems to expedite the development of collective human intellect.

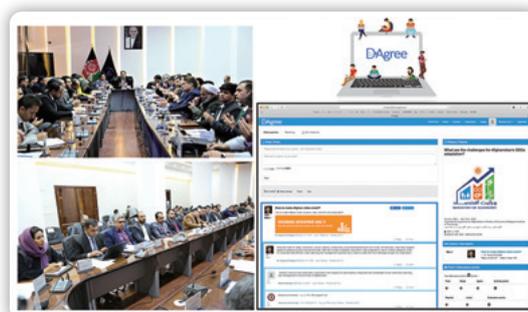
The multi-agent system presents a methodology and concepts that allow us to realize such new social systems and promote them with collective intellect and intelligent information technology. In multi-agent systems, we mainly explore possibilities of new social systems and implement such systems, while seeking the essence of social intelligence, with a focus on interdisciplinary studies with such fields as distributed AI, simulations, robotics, and game theory.

Our laboratories are conducting research on the theories, models, simulation, and social implementation of multi-agent systems, in particular, advanced research into support for

consensus formation, computational mechanism design, automated negotiating agents, and social simulations.

We will pursue both high ideals (theoretical studies) and down-to-earth approaches (commercialization of research achievements).

[Professor: Takayuki Ito;  
 Program-Specific Associate Professor: Donghui Lin;  
 Assistant Professor: Ryuta Arisaka;  
 Program-Specific Assistant Professors: Rafik Hadfi,  
 Jawad Haqbeen, Sofia Sahab]



## Column From the World to Japan, from Japan to the World

Over 40 foreign students are enrolled in the Department of Social Informatics, representing more than 15 countries. You may obtain a sense of global community by studying in such a diverse environment. Many students from the Department of Social Informatics

make presentations, discuss research, and join internship programs abroad. A welcome party is held in October to welcome newcomers from foreign countries, and various kinds of international exchanges happen on a daily basis.



Research presentation at an international conference (Canada)



An international event

## Biosphere Informatics

There is a great variety of organisms in the biosphere, for example in environments such as forests, farmlands or seas. These organisms have complex interrelationships, and influence our society in various ways. Our division attempts to comprehensively understand the information about individual animals as well as bioresources and production by using various methods and techniques to gather data about the biosphere. We also study the influence of human activities on the global environment and human society itself through the production and management of bioresources and ecosystems.

## Bioresource Informatics

*Seeking utilization and conservation of bioresources*

This group discusses and studies a wide range of themes including system evaluation for the sustainable production of bioresources, the conservation of endangered species, and the revitalization of local communities engaged in bioresource production. In order to gather and analyze bioresource data, this group works in the development

and application of new research methods involving the use of GPS, biotelemetry, biologging and image analysis.

[Assistant Professor: Hideaki Nishizawa]



Various methods and techniques are applied



## Environmental Informatics

*Seeking conservation and utilization of ecosystems*

Recently, society has been interested in environmental changes at various spatial/temporal scales. This group works on topics such as understanding/monitoring environmental information or the role of various organisms in ecosystems. Our research interests cover various fields related to terrestrial ecosystems, ranging from their diverse inhabitants such as plants, animals and microbes to their complete physical environment. We study how these relate to other organisms or environments in the ecosystems, or how human

society influences them with respect to their sustainability in a changing environment. Various methods/approaches such as field investigation, questionnaires, remote-sensing or chemical/isotopic analyses are applied to collect and analyze key information about these ecosystems and organisms.

[Professor: Nobuhito Ohte;  
Associate Professor: Lina A. Koyama;  
Assistant Professor: Christian Vincenot]



Fieldwork is conducted in various types of sites



## Regional and Disaster Management Information Systems (Affiliated)

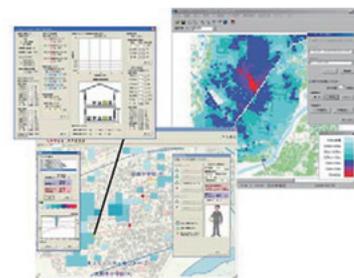
Disasters are abrupt and large-scale environmental changes. The natural, artificial and social environments (and especially the balance among them) that have been constructed and maintained by regional communities are forced to change. If the impact of a disaster is sufficiently severe, local communities may be unable to recover the balance that they had before the catastrophe, and may be forced to create a new balance. This was demonstrated in dramatic fashion by the catastrophic damage inflicted by the Great Hanshin-Awaji (Kobe) Earthquake and the subsequent suffering in the stricken area. The objective of disaster prevention is to minimize the effects of disastrous events. Unfortunately, it is beyond our power to eliminate natural threats, such as the disasters wrought by earthquakes and typhoons. Efforts at disaster prevention help to make society more resistant to disasters by: (1) enhancing our ability to foresee and predict threats; (2) improving our ability to limit the degree of damage; and (3) minimizing the effects of the damage. Disasters are the greatest obstacle to the sustainable development of humankind. According to figures from the International Red Cross, disasters annually take the lives of 130,000 people and cause some \$US440 billion in damage. Population growth is driving urbanization. Societies are becoming more complex and diverse. Meanwhile, disasters are growing in scale and occurring more frequently. It could be said that society's ability to withstand disasters is rapidly diminishing. Information processing lies at the heart of disaster prevention. This Division will focus primarily on disaster prevention in urban areas and will teach students about establishment of information systems designed to achieve "urban disaster reduction" that both minimizes the immediate effects of disasters and shortens aftermath duration.

### Integrated Disaster Management Systems

*Aiming to build disaster prevention systems to ensure a safe and secure society*

To build a safe and secure society, we need to put in place disaster prevention systems that will enable the planning and implementation of disaster risk control, financing, and other integrated policies in a rational manner. We will take an informational, organizational and economic approach to find out what kind of disaster prevention system will result in cities with greater resistance to natural disasters.

[Professor: Hirokazu Tatano;  
Associate Professors: Toshio Fujimi, Subhajyoti Samaddar;  
Program-Specific Assistant Professor: Huan Liu]



Flood Risk Communication Support System

### Emergency Management for Disaster Reduction Systems

*Social scientific research for disaster damage reduction*

Society is required to prepare and take actions to reduce the potential damage of disasters by sharing information and knowledge concerning potential disaster risks through communication among the members of society. This laboratory aims at developing disaster risk reduction systems through practical studies from the perspective of social psychology and systems analysis. The research interests include disaster psychology, disaster risk information and communication, disaster education, regional crisis management and decision making support, financing for disaster recovery.

[Professor: Katsuya Yamori; Associate Professor: Masamitsu Onishi;  
Assistant Professor: Genta Nakano]



Disaster education materials developed in our lab

## Crisis Information Management System

### *Disaster Information Systems with Information Technology*

Our goal is to establish design methodologies for the development of effective disaster management systems against various types of disaster for National/Local Governments, local communities in affected areas and disaster relief organizations. One of the most important key technologies are spatial temporal database to record, visualize and analyze current/near future status in affected areas. In addition our laboratory focuses on human behavior before/during/after disasters as targets to supply valuable services.

[Professor: Michinori Hatayama;  
Associate Professor: Kei Hiroi]



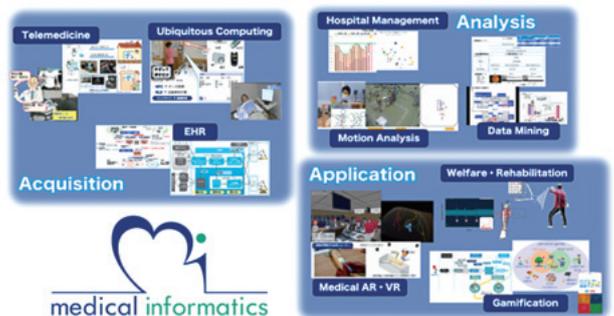
Development of Building Damage Certification System considering Operator's Ability in the Great East Japan Earthquake

## Medical Informatics (Affiliated)

### *Exploring approaches to medicine in the information age*

The Medical Informatics Laboratory seeks to create a new vision for medicine in the information age by developing information platforms, analyzing real-life clinical information, and providing feasible information support for existing clinical entities. Our research covers all areas at the interface of information and medicine, including system development for ubiquitous hospital information systems, remote medical information systems, electronic health records, and other systems, hospital administration analysis, clinical epidemiological information analysis, data health research, VR-based medical education, clinical decision and surgery support, and information support for health tourism.

[Professors: Tomohiro Kuroda, Hiroshi Tamura; Associate Professor: Goshiro Yamamoto;  
Senior Lecturer: Yukiko Mori; Assistant Professor: Chang Liu]



## Learning and Educational Technologies (Affiliated)

### Learning and Educational Technologies

#### *Information Systems that Support Learning and Education*

Our research focuses on information technology that supports activities in education and learning by analyzing their log data:

- (1) Development of the infrastructure for accumulation and analysis of educational big data
- (2) Analysis of learning experiences by using life log technologies
- (3) Knowledge awareness for collaborative learning support
- (4) Educational systems for Information security and ethics

[Professor: Hiroaki Ogata;  
Senior Lecturers: Brendan John Flanagan,  
Rwitajit Mujumdar]



Outline

## Data Engineering and Platform Research

*Research in support of internet-scale data infrastructure*

Centering on the configuration of distributed systems ranging from several computers to tens of thousands of computers in size, this laboratory's research addresses topics from core systems for the handling of big data to methods for analysis of such data. Specific topics include:

- Peer-to-peer (decentralized-distributed system) algorithms
- Large-scale distributed system simulations
- Blockchain networks
- Decentralized-distributed machine learning methods
- Social graph analysis methods

[Professor: Kazuyuki Shudo]



## Adjunct Units

### Sociotechnical Design

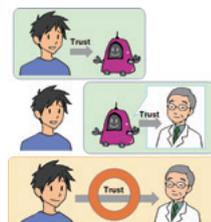
*Toward an inclusive future society (in collaboration with NTT Corporation)*

The progress of the information society has enabled people to connect with anyone more easily, but at the same has given rise to problems such as weakening of interpersonal relations, fragmentation, and isolation. These problems cannot be resolved simply by providing more opportunities to connect with other people or support for those who are isolated. It is crucial to engage the surrounding community and environment in order to achieve solutions. This laboratory pursues research on basic communication technologies that foster deeper human relations and ensure that diverse individuals are included rather than left isolated.

The research topics addressed include:

- Information technologies for the realization of inclusive societies
- Basic communication technologies that foster deeper human relations
- Information technologies that serve the collective good
- Collaborative technologies that enable sustainable work styles

[Professors: Naomi Yamashita, Takayuki Kanda]



Dialogue agents fostering person-to-person trust



"Minamo-mate": a support tool for families of people with depression



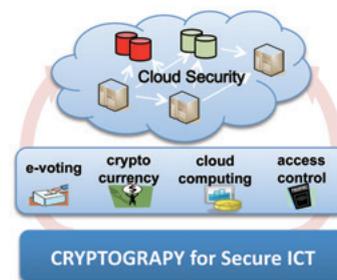
Support for non-native speakers in multilingual projects

### Information Security Adjunct Unit

*Creating a safe networked society through cryptography (in collaboration with NTT Corporation)*

In today's world, where the Internet is increasingly used to conduct electronic transactions such as electronic settlements and bidding in online auctions, or to carry out functions required by the government, such as the filing of tax returns, the maintenance of safe and secure network services is becoming increasingly important. Modern cryptography is a technology to achieve this safety and security, and goes far beyond concealment technology to prevent eavesdropping. It is a field of intense study that is developing rapidly. It involves technical and logical systems which include digital signatures that verify the identity of the party you are communicating with and guarantee the authenticity of the data (which means that the data have not been altered), as well as cryptographic protocols that enable advanced network services which guarantee privacy. In our laboratory, we will study and develop various applied cryptographic technologies commonly used today such as public key cryptosystems, crypto currency, electronic voting, and other applications suitable for cloud computing with rigorous security analysis based on a firm theoretical foundation.

[Professors: Masayuki Abe, Takayuki Kanda;  
Associate Professor: Mehdi Tibouchi]



Information Security Adjunct Unit  
— Creating a safe networked society through cryptography —  
(in collaboration with NTT Corporation)

# Special Education Program of the Department of Social Informatics

## 1. Specialized Subjects and Special Lecture



Special lecture

In the first year of the Master's program, students are introduced to specialized subjects including the design and analysis of information systems, and the relationship between information and society. They can acquire the fundamentals of informatics from the ground up through these subjects, and even students with less specific experience in informatics can benefit by combining their informatics and other expertise. In addition, we have more than 30 special lectures a year in our department, for which we invite lecturers from various universities, research institutes and government offices.

## 2. Education for Innovation



FBL (Field based Learning)/ PBL (Problem based Learning)

The Department of Social Informatics joins Kyoto University Design School, in which students take a course titled "FBL (Field based Learning)/ PBL (Problem-based Learning)" that helps them acquire the skills needed to find and solve real-world problems. In this course, students select one of a variety of themes, and form small groups to tackle specific problems. The themes include "Designing a new environment for education: creating a place that fosters creativity", "Design of places for conversation over books and tea", and "Organization design in crowd-sourcing". Kyoto University Summer Design School arose from activities mainly led by the Department of Social Informatics, and has become a seasonal tradition in summer, attracting more than 250 participants to share the same innovative space. Over 20 different kinds of themes were proposed by companies and universities, and were tackled by many students eager to solve real-world problems: they went into the field, and used trial-and-error methods by actually creating prototypes. The Department of Social Informatics proposed themes such as "Predicting Kyoto in 2050 by simulation" and "Designing safety into apartment buildings: first priority, disaster prevention".

## 3. Education for Globalization



Strategic communication seminar

Department of Social Informatics has an International Course Program in the curriculum. Students in the International Course Programs can take lectures in English, receive guidance in English from their supervisors, and acquire Master's and Doctoral degrees exclusively in English. Students who complete the course will receive a certificate of completion for the international course.