Research Organization of Information and Systems

The Institute of Statistical Mathematics

2015-2016

ISM

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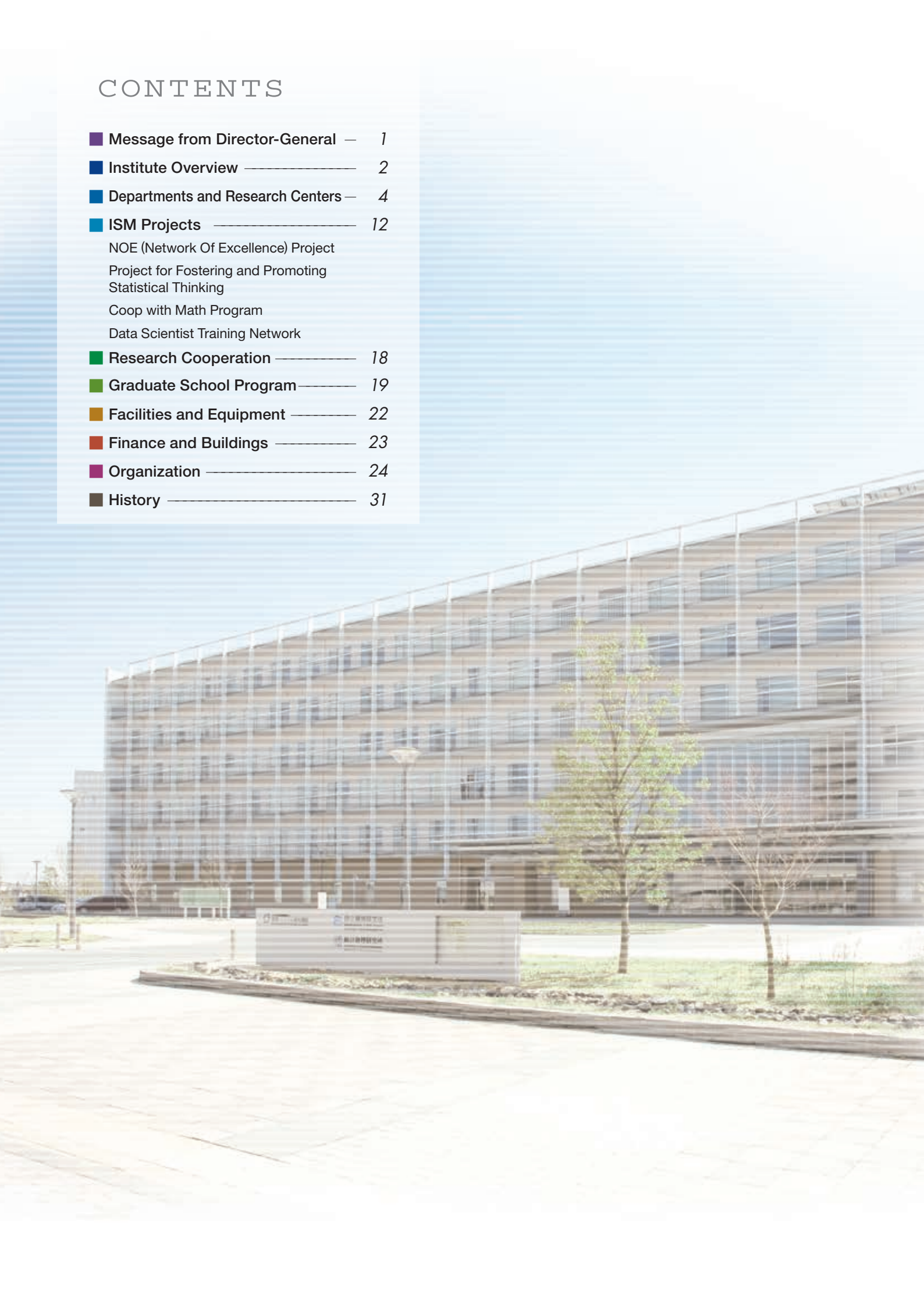


Message from Director-General

The Institute of Statistical Mathematics (hereinafter, ISM) was founded in 1944, not long before the end of World War II. Its original stated purpose was "to provide supervision for studies looking into the mathematical principles of probability and their application, and to facilitate, unify, and promote the publication of research results". Ever since its establishment, at a time of very conscious awareness of the realities of the world, ISM has steadily absorbed this attitude into its DNA, as it has contributed to the deeper understanding and advancement of statistical mathematics. We enter the final year of our second medium-term planning period as an Inter-University Research Institute Corporation, at a time when national research and educational institutions are facing a variety of pressing challenges, and so we are thinking ahead to our third medium-term goals and plans next year, through active consultation and exploration of how we can provide the greatest value to the various communities that we serve as an Inter-University Research Institute.

Following on from my first term (four years), I have been appointed as Director-General of ISM for a further term of two years, beginning this year. In my first four years, I focused much of my modest energies in getting ISM's two biggest projects—"NOE (Network Of Excellence) Project" and "Project for Fostering and Promoting Statistical Thinking"—off the ground and up and running stably. I would say that in terms of fulfilling ISM's duty as one of the Inter-University Research Institutes, which is "to advance joint usage and joint research functions", we're proud of the results that we have achieved.

Two of the main points of our operation policy in this final year of the second medium-term planning period are "consolidating organizational strength" and "promoting concrete collaborative initiatives with other institutes". To address the first of these goals, at the start of my second term as Director-General, we have reshuffled the personnel of executive directors of ISM by adding some younger people than those whom we have had in the past, to tackle the running of ISM with fresh, new energy. Under this new system, we are working on a variety of improvement measures, such as reorganizing an Information and Public Relations Unit, providing URA (University Research Administrator) functions to various sections of ISM, and increasing the organizational capabilities of our administration.

On the point of "promoting concrete collaborative initiatives with other institutes", we make available our supercomputer systems newly introduced over the previous year to the various communities—including by means of participating in the innovative "High-Performance Computing Infrastructure (HPCI)" project to provide one of our supercomputer system as the first Inter-University Research Institute, and we deepen our relationships with national university-affiliated research institutes and centers across Japan, National Research and Development Agencies, academic societies and education-related organizations through the "Coop with Math Program", a program undertaken on contract for the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and also through the "Data Scientist Training Network". These activities lead to the formulation of concrete collaborative initiatives. In addition, we make a special effort to connect with the research divisions of private companies, using "Data Science Research Plaza", the new program of "Project for Fostering and Promoting Statistical Thinking". Furthermore, in the previous year we have begun the construction for expanding our guesthouse, which has proved very fruitful in helping us to invite outstanding researchers from overseas. The five additional apartments will be completed by the end of September this year. The guesthouse facility is expected to play a much more important role in our collaborative programs with overseas institutes.

We expect that steering the operations of ISM will be very challenging, both in terms of research and also management in the difficult circumstances in these years. Nevertheless, "statistical mathematics", which joins various elements of technology and science and other fields, is indispensable in this "Big Data" Era. We try to explain the vital importance of ISM's research work more widely, and we are committed to making a fruitful contribution to society. We look forward to your wholehearted understanding and support.

Tomoyuki Higuchi
Director-General
The Institute of Statistical Mathematics

Institute Overview

Basic Research

Department of Statistical Modeling

The Department of Statistical Modeling works on the structural modeling of physical phenomenon related to numerous factors, and it conducts research on model-based statistical inference methodologies. By means of the modeling of spatially and/or temporally varying phenomena, complex systems, and latent structures, the department aims to contribute to the development of cross-field modeling intelligence.

Spatial and Time Series Modeling Group

The Spatial and Time Series Modeling Group works on the development and evaluation of statistical models, which function effectively in terms of predicting phenomena or scientific discoveries, through data analysis and modeling related to space-time-varying phenomena.

Complex System Modeling Group

The Complex System Modeling Group conducts studies in order to discover the structures of complex systems, such as nonlinear systems and hierarchical networks, through statistical modeling.

Latent Structure Modeling Group

The Latent Structure Modeling Group works on the modeling of variable factors as latent structures existing behind various dynamic phenomena in the real world. It also conducts research on methodologies for inference computation associated with structures on the basis of data related to phenomena.

Department of Data Science

The aim of the Department of Data Science is to contribute to the development of natural and social sciences by conducting research into the methodology of designing statistical data collection systems, measuring and analyzing complex phenomena for evidence-based sciences, and performing exploratory multivariate data analyses.

Data Design Group

The Data Design Group focuses on research toward designing statistical data collection systems and developing the related data analysis methods in a variety of survey and experimental environments.

Metric Science Group

The Metric Science Group studies methods for measuring and analyzing complex phenomena to extract statistical evidence behind them in the various fields of science.

Structure Exploration Group

The Structure Exploration Group advances statistical and mathematical research by applying or developing exploratory multivariate data analyses to clarify latent structures of real phenomena in various fields of both natural and social sciences.

Department of Mathematical Analysis and Statistical Inference

The Department of Mathematical Analysis and Statistical Inference carries out research into general statistical theory, statistical learning theory, optimization, and algorithms in statistical inference.

Mathematical Statistics Group

The Mathematical Statistics Group is concerned with aspects of statistical inference theory, modeling of uncertain phenomena, stochastic processes and their application to inference, probability and distribution theory, and the related mathematics.

Learning and Inference Group

The Learning and Inference Group develops statistical methodologies to describe the stochastic structure of data mathematically and clarify the potential and the limitations of the data theoretically.

Computational Inference Group

The Computational Inference Group studies mathematical methodologies in the research fields of numerical analysis, optimization, discrete mathematics, control and systems theory for computation-based statistical inference as well as their applications.

NOE-type Research

Risk Analysis Research Center

The Risk Analysis Research Center is pursuing a scientific approach to uncertainties and risks in society, which have increased with the growing globalization of society and economy. Our research projects are mainly seismology, finance, resources, environmentology, medical-health science, database development and risk mathematics. The Center also manages a network organization for risk analysis with the goal of contributing to creating a safe and resilient society.

Research and Development Center for Data Assimilation

Research and Development Center for Data Assimilation aims to construct simulation models that can predict the future and to produce designs for effective observation systems by means of "data assimilation", which is a fundamental technology integrating numerical simulations and observational data.

Survey Science Center

Founded on the accomplishments in social research by the Institute of Statistical Mathematics spanning over half a century including the Study of the Japanese National Character and the cross-national comparative research on national characteristics, the Survey Science Center was established in January of 2011 in order to facilitate further growth of the aforementioned sets of research as well as the establishment of networking ties with both domestic and international research organizations and the increase in the capacity to make contributions to wider society by creating what we call the NOE (Network Of Excellence).

Research Center for Statistical Machine Learning

Machine learning is a research field associated with autonomous systems that can learn their behavior from data. This field is based on both the statistical science concerning inference from data and computer science concerning efficient algorithms. It can be applied to broad disciplines ranging engineering and information science to natural science, such as robotics and brain sciences. Our research center aims at supporting the academic community of this field, as well as producing influential research through various joint projects.

Service Science Research Center

The aim of the Service Science Research Center is to apply data-centric methodologies to the service fields — from marketing, supply chain management, and management engineering, to the modeling of social systems. We integrate the insights from these fields to establish data-centric service sciences as a common discipline, through collaborations with universities and institutions worldwide, taking advantage of ISM's Network Of Excellence (NOE) program.

Professional Development

School of Statistical Thinking

The mission of the School of Statistical Thinking is to plan and implement various programs for statistical thinking, from extension courses to a professional development program. The researchers affiliated with the school are often involved with specific data analysis projects, which help them to gain hands-on knowledge of data science. We expect such an experienced researcher will play an active role as a number-cruncher, as a modeler, or as a project coordinator.

Research Support

Center for Engineering and Technical Support

The Center for Engineering and Technical Support assists academics and their collaborators in many ways: managing computer systems and networks, editing and publishing journals, maintaining the library, and manage extension courses.

Computing Facilities Unit

The Computing Facilities Unit is in charge of managing computer facilities, scientific software, networking infrastructure, and network security.

Information Resources Unit

The Information Resources Unit is responsible for maintaining a library and an electronic repository, and is in charge of planning statistical education courses open to the public.

Media Development Unit

The Media Development Unit is in charge of publishing and editing of research results and PR brochures.

Applied Statistics in Life Science

Our group is promoting the use of Bayesian statistics and machine learning to address a wide variety of problems in life science. In below, three of the primary focus areas of our research are introduced.

Data science-enabled computational molecular design

The chemical space subject to pharmaceutical developments consists of 10^{60} pharmaceutical candidates. Our challenge is to discover new compounds in the huge space that exhibit desired properties on various pharmacological activities. The aim of this study is to create a new molecular design method by the integration of Bayesian statistics, machine learning and quantum chemistry techniques. Our approach is as follows: (a) we develop forward prediction models based with experimental data that predict the properties of compounds from their chemical structure, (ii) the backward prediction is derived by inverting the forward prediction according to the Bayes formula, and (iii) the backward model is used to generate new compounds with the chemical structures likely to achieve desired pharmacological activities. Under industry-academia partnerships, we are putting into practice the molecular design method in the area of resin and pigment chemistry in addition to pharmaceutical developments.

Understanding of whole neural activities of *C. elegans* with bioimage informatics

The nervous system of living organisms realizes advanced and robust information processing in response to diverse input signals. In neuroscience, *C. elegans* has been extensively used as a well-established model organism. The neural circuit of *C. elegans* consists of 302 neurons and nearly 7,000 synapses, and their synaptic connections have been fully discovered. We are developing a live-cell imaging technique to simultaneously measure the activity states of the whole neurons. We use a confocal microscope to measure the spatiotemporal dynamics of the calcium ion concentrations in nerve cells. Bayesian methods play the essential role to quantify and visualize the neural activities from such time-lapse image sequences. This study is supported by JST-CREST 'Elucidation of operating characteristics of the neural circuit based on observational data of the whole nervous system' (Director: Yuichi Iino, The University of Tokyo).

Omics science with Bayesian methods

The spread of next-generation sequencer technology has created an explosion in the quantity of genomic data to analyze, and this in turn has necessitated a radical rethinking of the theoretical methodology for analyzing such data. Our challenge is to create innovating technologies of omics data analysis, specifically aimed for addressing the following subjects: (a) the development of a whole-genome map of RNA polymerase II transcription elongation rates, and the elucidation of the biological mechanism of the transcription elongation process in co-transcriptional RNA splicing, and (b) discovery of cancer-specific transcription regulatory pathways by analyzing genome-wide transcription factor ChIP studies.

Ryo Yoshida

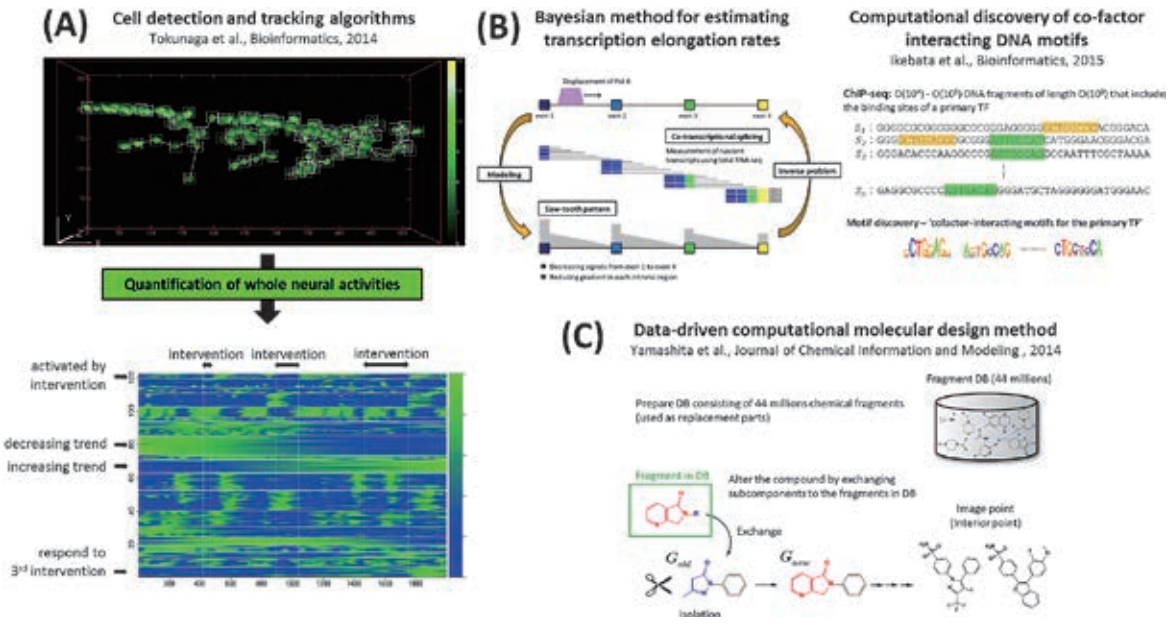


Figure 1: Three of the primary focus areas of our research: (A) development of bioimage informatics techniques for neuroscience, (B) omics sciences based on Bayesian statistics, (C) development of computational molecular design method.

Statistical Mathematics and Data Science for Developments of Advanced Medical Researches

Requirements of professionals for statistical sciences in medical researches

Due to the developments of evidence-based medicine since 1990s, it has been widely recognized that participations of professionals of statistical sciences are essential for medical researches. Due to the Recent discussions for proper managements of clinical researches in Japan, the government requires advanced research universities to set up positions of biostatistics professionals, and the role of the Institute of Statistical Mathematics has been increasingly important. We have conducted many collaborative studies with medical researchers in the advanced research universities, e.g., basic science studies for ES and iPS cells, clinical trials for developments of novel drugs, and epidemiologic investigations for $PM_{2.5}$ and yellow dusts.

Network meta-analysis: advanced synthesis methodology for clinical research evidences

Arrival of the population ageing era and the increase in medical expenses have been serious problems throughout the world. In modern medical researches, we should create reliable evidence for medical technology from multifaceted viewpoints involving comparative effectiveness. Network meta-analysis is a novel methodology for synthesizing past available evidences of published clinical trials and evaluating the comparative effectiveness of multiple available treatments. Because of complexities of these data, analysis of the network meta-analysis requires advanced statistical and computational techniques, e.g., hierarchical Bayesian modeling and the Markov Chain Monte Carlo. We have studied these advanced statistical methodologies, and have participated several international projects to generate novel evidence.

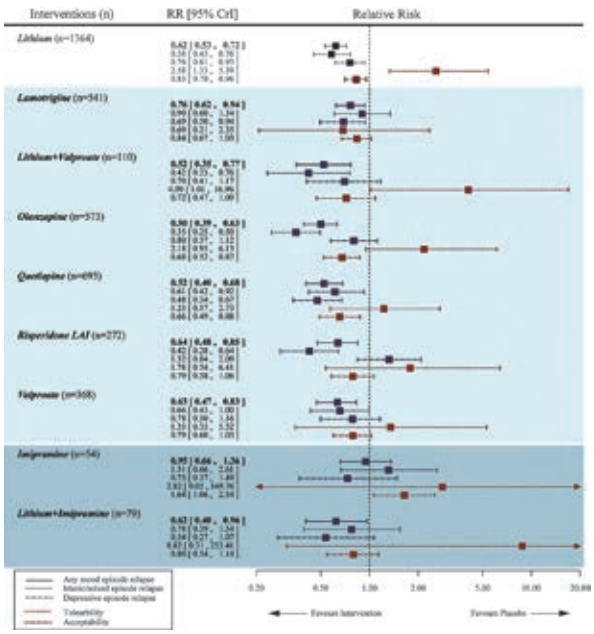


Figure 1: Network meta-analysis of bipolar disorders. Estimates and 95% confidence intervals for relative risks are presented, which the baseline treatment is placebo (Miura et al., Lancet Psychiatry 2014, 1: 351-9).

Developments of advanced methodology for biostatistical science

Advances of technologies supporting for developments of medical research have increasingly progressed in the few decades, e.g., appearance of big data in health sciences, clinical trials for developments of advanced medicine, and prediction of treatment effect for individualized medicine. In the scientific evaluations of these technologies, a number of problems for analyzing and interpreting data have appeared. Therefore, novel and effective solutions have been required for statistics and data science. We currently conduct theoretical and methodological researches for these challenging problems, and educational activities to spread these novel methodologies. We consider it should be a relevant mission for academic researchers to contribute medicine and society through these activities.

Hisashi Noma

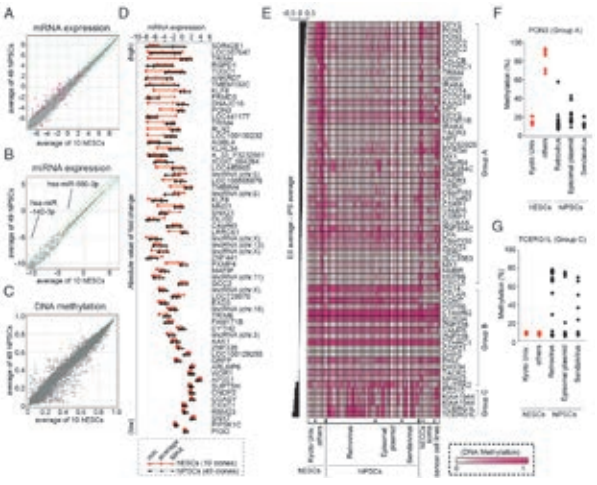


Figure 2: Results of microarray experiments comparing gene expression patterns between ES and iPS cells (Koyanagi-Aoi et al., PNAS 2013, 110: 20569–74).

Statistical Analysis Using Curvature of Data Spaces

Improving statistical analysis by tuning curvature of data spaces

When the data is distributed not on the whole space but only on a subset, called a data space, we can improve accuracy of statistical analysis by estimating the data space. In our study, we tune metric and curvature of the estimated data space and propose new statistics based on the data space. It has been known that if the curvature of a data space is non-positive, the intrinsic means, a generalization of ordinary average in Euclidean space to in general geodesic spaces, exist uniquely. We further change the curvature of the data space and control the number of local intrinsic means: multiple intrinsic means are sometime more welcome, for example, for clustering. However, in general the data space of real data is much more complicated than simple shapes being studied in theory. To solve this serious difficulty, we proposed a method using an empirical graph as an approximation of the original data space and changing the curvature by rescaling the edge lengths exponentially. We verified our methods can improve existing statistical methods for various kinds of real data including climate data.

Data spaces of graphs and statistical analysis using their CAT(0) property

The mean (middle point) of two points at the North Pole and South Pole of a sphere in a general sense is at the center and no more on a sphere. This can happen for most of the statistical analysis since their computation is usually linear. Meanwhile study of the tree space in phylogenetic tree analysis was a breakthrough since it has a good geometrical property called CAT(0) and linear methods like hypothesis testing and PCA can be applied. In this project, we search how this method can be applied to data of more general structures. For example, dendrograms are a special case of tree graphs and we can prove CAT(0) property for such a case, too. By using this theoretical fact, we proposed a permutation test by using geodesic metric on a space of dendrograms. We are now trying to generalize these theory and methods to more general graphs and complexes.

Kei Kobayashi

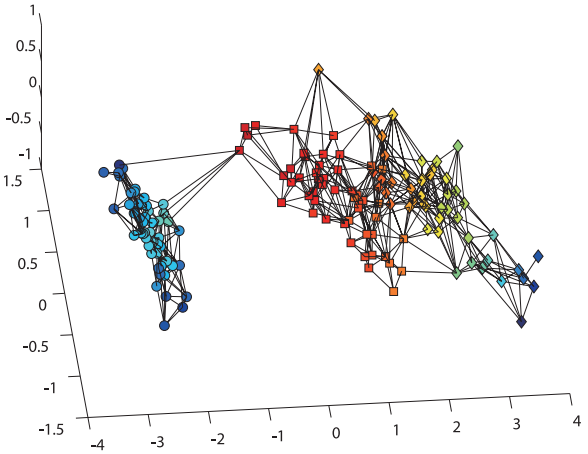


Figure 2: The number of edges used in some geodesics varies when we change the edge lengths exponentially. The curvature of data space can be controlled by this.

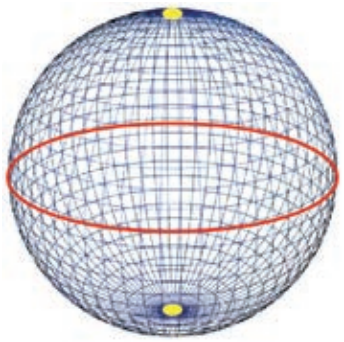


Figure 1: Uniqueness of the intrinsic means depends on curvature of the data space. For example on the sphere, whose curvature is one, the intrinsic means of two data at the North and South Poles are all points on the equator.

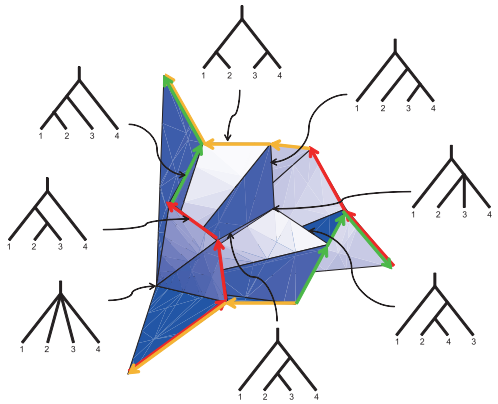


Figure 3: Data spaces of tree graphs are CAT(0) and have similar properties to spaces with non-positive curvature. We aim to generalize theory and method for such spaces.

Exploring Efficient and Effective Management Approaches to Mitigate Risk by Disturbance

Optimization model for forest management planning

"When, where and how much to harvest" has been a primary concern for resource managers for many years. In order to assist such decisions, considerable effort has been given to develop optimization models searching for the optimal management strategy, which maximizes the amount of harvest from resources or profit induced from such harvests subject to given constraints. Integer programming allows us to formulate the constraints necessary to avoid resource degradation due to unplanned harvesting activities. For example, harvested units can be dispersed over space and time to avoid the creation of large openings, simply by introducing adjacent constraints that prohibit harvesting adjacent management units in the same period.

Use of Geographic Information System (GIS)

In order to consider spatial distribution of resource harvest units, it is important to figure out adjacency relationships (Fig. 1) among management units based on the spatial information of each management unit. Not only can GIS be use to archive spatial information, but it can also be used efficiently to generate adjacency relationships among management units. GIS can be used to visualize the optimal spatial harvest pattern generated from an optimization model (Fig.2).

Figure 1: Adjacency relationships among management units.

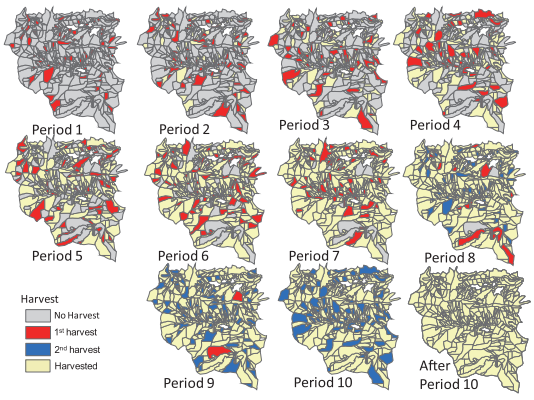


Figure 2: Visualizing optimal spatial harvest pattern with GIS.

Mitigating the risk surrounding forest resources with optimization model

As a result of global climate change, forest managers are now faced with the challenge of how to mitigate the damage caused by disturbance agents such as forest fires, insects attack, and invasive species. Damages caused by disturbance agents are spatial in nature, for example, fire spreads from an ignition location over space and time. Spatial patterns of forest vegetation affect the degree and extent of forest damages caused by these disturbance agents. Fire for example, spreads rapidly when it enters a contiguous area where fuel has been accumulated. Forest managers can mitigate the damage caused by disturbance agents simply by controlling the spatial distribution of forest vegetation which takes into account the expected spatial damage patterns. Optimization models can be used to explore the optimal spatial patterns that mitigate the damages caused by disturbance agents. The results presented in Fig 3 were produced by integrating a simulation model that projects spatial damage patterns into an optimization model to search for the efficient and effective forest management allocation patterns for mitigating these kinds of risk.

Atsushi Yoshimoto

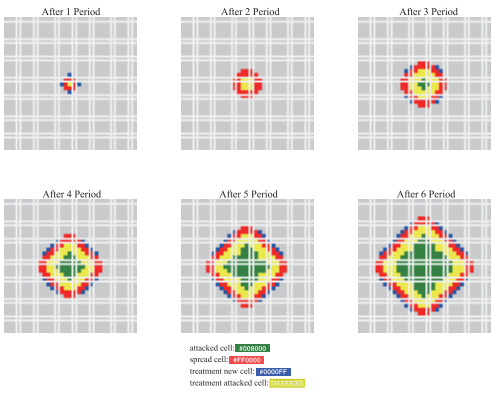


Figure 3: The optimal management pattern for mitigating the risk of damage from invasive species.

Modeling of Space Debris Generated by Breakup Events

The problem of space debris

Artificial objects in space, which are not operational, are called as space debris. For example, abandoned satellites, rocket bodies, fragments generated by explosions and collisions and slag of solid rocket motors are included. The velocity of object in orbit is about 7 km, therefore the collisions leads to the malfunction or destruction of operational satellites even if the collided object is small. Moreover, the fragments generated by collisions induce more collisions. On February 2009, Operational IRIDIUM 33 collided with abandoned COSMOS 2251. This breakup event generated a lot of fragments.

Fragments generated by breakup events

Since the launch of SPUTNIK 1, the number of artificial objects in space is increasing. Especially, there are a lot of fragments generated by explosion and collisions. Therefore, it is important for evaluating the risk and mitigation measures to model the fragments generated by breakup events. However, the small fragments cannot be observed from the Earth because of the limit of observation instruments. From the view of this fact, modeling of fragments generated by breakup helps to understand the current space debris population.

Modeling of space debris

NASA's standard breakup model is usually used for modeling of fragments generated by breakup events in predicting the future space debris population. However, this model does not formulate the distribution of the direction of ejecting fragments. With a focus on this point, I am engaging in modeling of the fragments generated by a breakup event using the measurements provided by the USA and data assimilation technique.

Yuya Ariyoshi

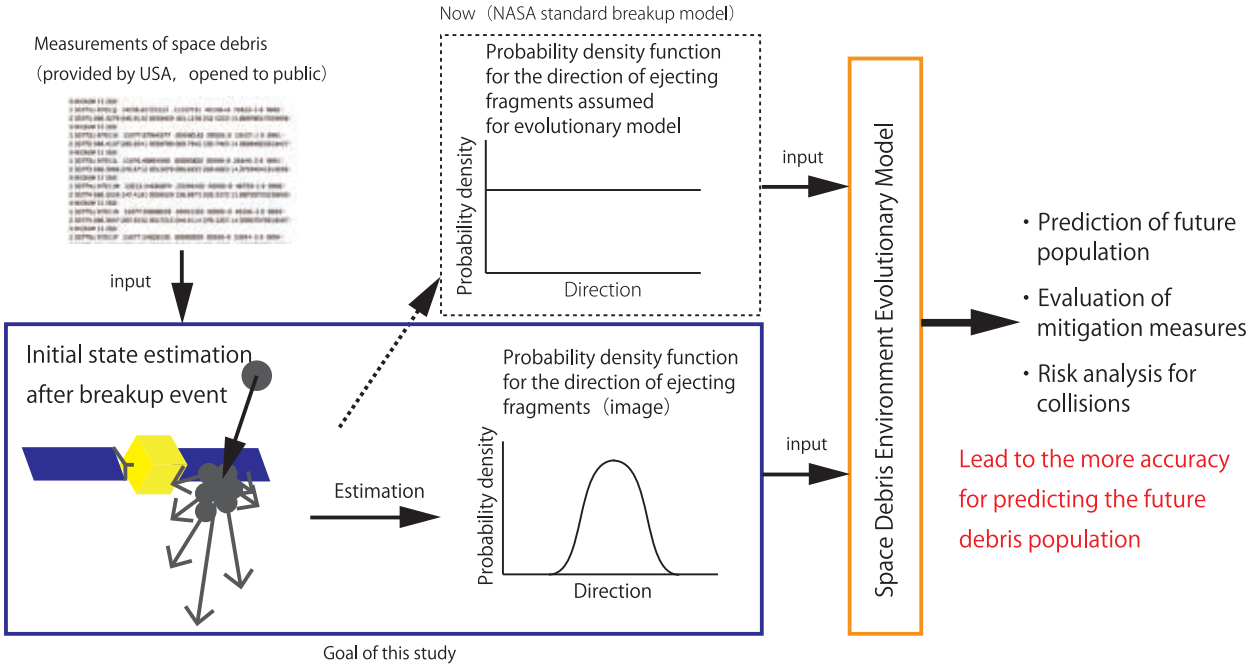


Figure 1: Outline of this research

Survey on Language Standardization in Tsuruoka City in Cooperation with NINJAL

What is the Survey on Language Standardization in Tsuruoka?

Up to the present time, the National Institute for Japanese Language and Linguistics (NINJAL) in Tachikawa, Tokyo, has conducted the continuous Survey on Language Standardization in Tsuruoka City, Yamagata Prefecture, (hereafter SLST) on four occasions. The first survey was conducted 65 years ago in 1950, the second in 1971, the third in 1991, and the fourth in 2011, meaning it has been conducted continuously at intervals of approximately 20 years.

The survey is conducted as joint research, and the Institute of Statistical Mathematics closely cooperated with NINJAL for the first and second SLSTs at each of the stages of survey planning, implementation, and data analysis. As part of a series of projects to create Networks Of Excellence (NOE), the Institute of Statistical Mathematics Survey Science Center and NINJAL conducted the fourth survey as a cooperative training survey.

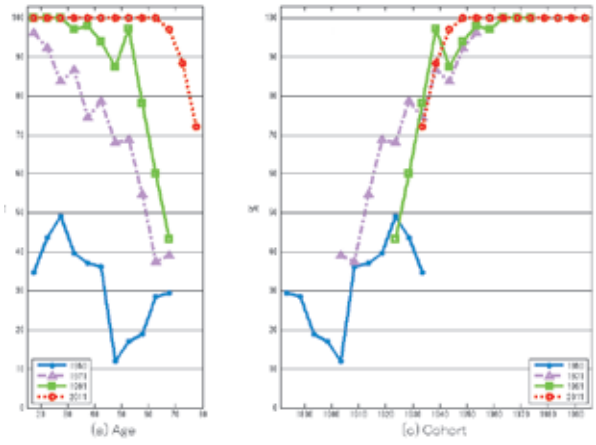


Figure 1: Changes in the standard language rate of the spoken item "211 'bell' *suzu*" (1st to 4th Tsuruoka RS Survey), totals for males and females, left: according to age group, right: according to birth cohort.

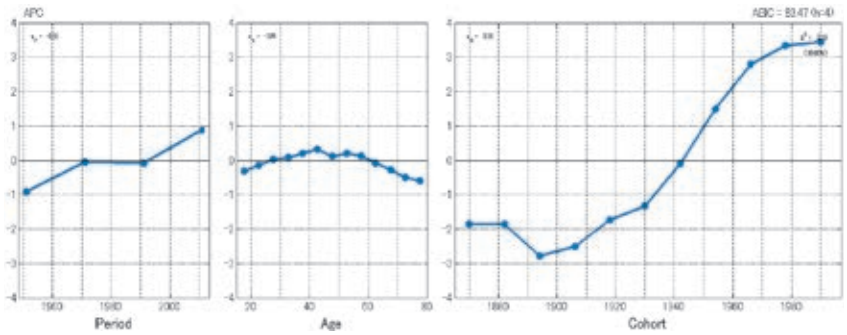


Figure 2: Results of the cohort analysis on the standard language rate of the spoken item "211 'bell' *suzu*" (1st to 4th Tsuruoka RS Survey), totals for males and females.

The objective of the SLST is to utilize survey items on dialect and standard language to clarify one aspect of the realities of people's language life in Japan. The SLST as a whole consists of a repeated cross-sectional random sampling (RS) survey and a longitudinal panel (P) survey. The RS survey is intended to ascertain changes in society as a whole, and the P survey changes to individuals' language life.

Changes in the standard language rate

As an example, Figure 1 shows the changes in the standard language rate of the spoken item 'bell' (in Japanese *suzu*). The survey participants were shown a picture of a bell, were recorded uttering it, and the rate of utterances that were considered standard was calculated and plotted.

In the figure to the left, which shows age groups on the horizontal axis, a trend can be observed of the standard language rate rising as a whole over the passage of each time period, with the tendency being that the higher the age group, the lower is the standard language rate (As of 2011, when the fourth survey was conducted, almost all respondents used standard language, excluding some elderly people.). Although the data are identical, in the figure to the right, which shows the birth year on the horizontal axis, the plot of the standard language rate can be seen as a connection of lines, from which it is understood that standard language use has increased with each new generation.

Separation of the effects of age group, time period, and generation; a cohort analysis

When data like those in Figure 1 are obtained from repeated surveys, it is possible to apply the cohort analysis method that separates the effects of age groups, time periods, and birth cohorts (a cohort is a group born at the same time = a generation). Figure 2 shows the results of the cohort analysis on 'bell' *suzu*. The cohort effects in the figure furthest to the right support the existence of generational differences, as it can be seen to connect with the plot according to birth year in the right-hand figure of Figure 1. The time-period effects in the furthest figure to the left clarify that there are changes to society as a whole, regardless of age group or generation. The age-group effects, shown in the central figure, capture the changes in the aging of individuals, which are not easily seen.

Takashi Nakamura

Inference of Uncertain Systems — Fusion of Kernel Methods and Sampling —

System with uncertainty

There are two major methodologies for system modeling: *parametric and nonparametric inference*. The former assumes the system can be described well by a function class with finite parameters, and estimates them; the latter constructs a more and more flexible function as the sample size increases, without restricting the degree of freedom. In modern data analysis, by the advance of information and sensor technologies, we need modeling of complex systems, which often involve parts described well with a parametric model and parts that do not allow simple parametric modeling but require data-driven nonparametric modeling.

State-space model

To illustrate such situations, consider a vision-based robot localization problem, where we wish to estimate the location of a robot in a fixed environment such as a building. Since the robot follows a mechanical dynamics, we can basically estimate the current location and orientation given location, orientation, and motor input in the previous time step. More accurate estimation is possible, however, if we can calibrate it based on sensor information such as vision images of the robot. The problem is thus how to effectively combine the state-transition rule and the sensor information. It is known that this type of inference problem can be formulated and inferred with the general framework of *state-space models*. Difficulty of this robot-localization problem lies in the complex measurement model: the relation between the images and the location-orientation of a robot is very difficult to describe with a parametric model because of its high-dimensionality and dependence on environment. With the lack of explicit functional form, it is not possible to apply the standard Kalman filters or particle filters.

Figure 1: Robot localization

Fusion of kernel methods and sampling

Our research group has developed the *Kernel Monte Carlo Filter*, which is a new approach combining kernel methods and Monte Carlo sampling for solving the above inference problem. For inference involving the uncertain measurement model, we apply the data-driven nonparametric method, *Kernel Bayes' Rule*, which has been proposed by our group, while the known state-transition is utilized by Monte Carlo sampling. In application to the robot-localization problem, the proposed method shows significant improvement of estimation accuracy in comparison with other existing methods which are applicable to this problem setting.

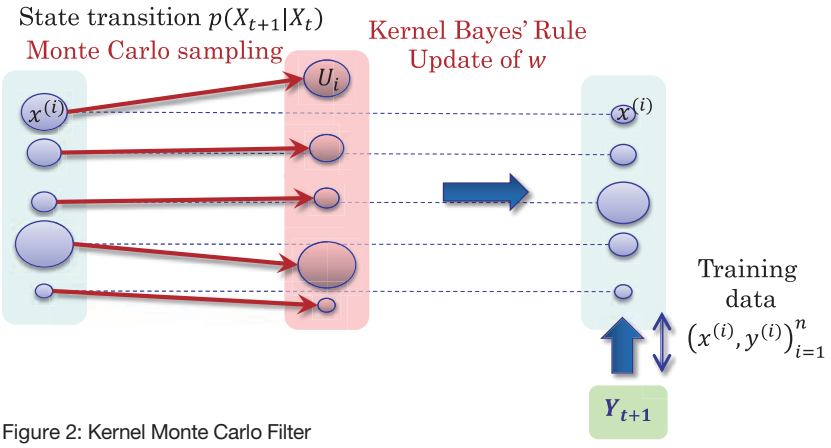


Figure 2: Kernel Monte Carlo Filter

This work has been done in international collaboration with Prof. Arthur Gretton, Gatsby Neuroscience Unit, University College London. We are aiming at extending our method to inference on systems of further uncertainty.

Kenji Fukumizu

Privacy-preserving Publishing of Pseudonym-based Trajectory Location Data Set

Overview

Nowadays a huge number of people are using mobile devices equipped with a GPS receiver, and so it has become feasible to keep track of people's movements over a wide area by collecting GPS data from those mobile devices. Such a large volume of location data gives us a precise global view of people's mobility patterns, and we can thus support analytic location-based services, such as real-time traffic monitoring and urban planning for future sustainable cities.

However, due to the significant concern about location privacy, the sharing of mobile users' location traces has largely been restricted to anonymized data sets where users' identities are removed. We usually need to follow the practice of ensuring *k*-anonymity, which degrades the granularity of location data to ensure that every location contains more than *k* people. Consequently, *k* anonymized data sets provide little information on users' mobility patterns, which makes it difficult to link multiple data points produced by the same user.

We, therefore, propose a new dynamic pseudonym scheme for constructing a location data set that retains users' path information while preserving their location privacy. Our basic approach is to exchange multiple users' pseudonyms only when they meet at the same location to eliminate the linkability of their pseudonyms before and after that exchange. We believe that such a dynamic pseudonym approach is effective since many people move through hub locations (e.g., a train station near sightseeing spots) where many people meet, as shown in Figure 1. Our privacy metrics in Figure 2 requires that, at a given time t, every user has a sufficient number of plausible paths heading towards *k* different locations.

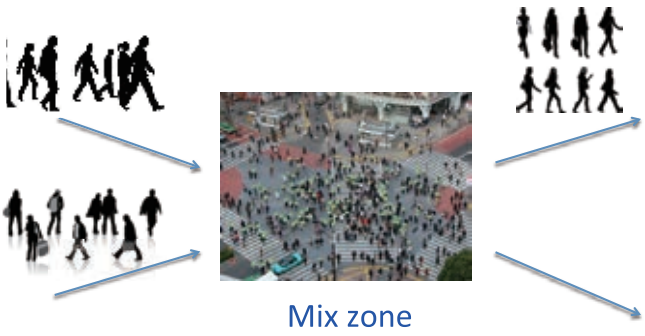


Figure 1: Concept of the mix zone

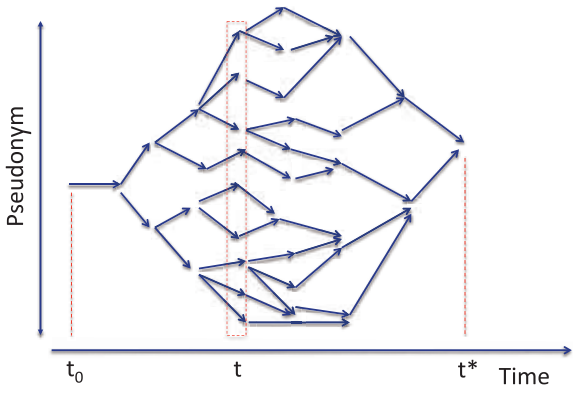


Figure 2: Concept of pseudonym-based location privacy. Y-axis represents indexes to pseudonyms taken by the user. Each node in the graph represents a mix zone where the user meets some other users.

Experimental results

Our pseudonymization technique essentially divides a user's whole trajectory path into multiple segments and thus degrades the utility of the dataset. We thus conduct experiments with the real location dataset containing mobility traces of taxi cabs in San Francisco, USA and quantitatively evaluate tradeoffs between users' privacy and data utility. Our initial results in Figure 3 show that it is possible to achieve high data utility in pseudonymized datasets while satisfying realistic privacy requirements.

Kazuhiro Minami

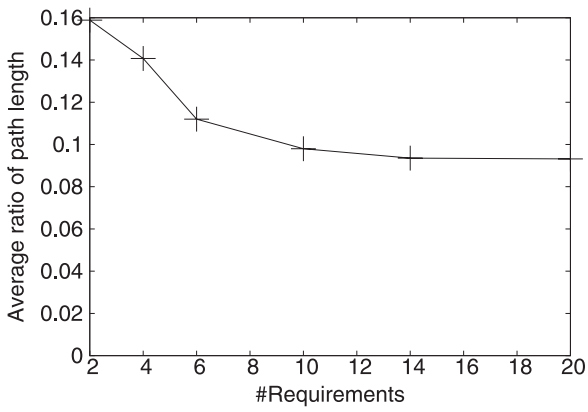


Figure 3: Tradeoff between privacy and data utility.

Building a Framework for Advancing Strategic Research and Pursuing a New Approach to Collaborative Research

Research and educational activities by Biaxial Structure

The Institute of Statistical Mathematics (ISM) pursues research and education along the two lines of basic research, NOE (Network Of Excellence)-type research (we will explain about "NOE" later) and professional development. These are respectively conducted by the basic research departments along a horizontal axis, and the NOE-type research centers and the school for professional development along a vertical axis (Figure 1).

By its nature, the basic research departments (along the horizontal axis) cut across and link various disciplines, developing tools for interdisciplinary research. The field of statistical mathematics must itself evolve to meet the changing needs of society and the data environment, and is therefore constantly evolving as a field of study. At the same time, there are approaches and directions that remain unchanged as the field evolves. For that reason, we have chosen not to call it fundamental research or foundational research but "basic research", to reflect both the fixed and evolving qualities of statistical mathematics. There are three basic research departments: Statistical Modeling, Data Science, and Mathematical Analysis and Statistical Inference. These departments engage in cutting-edge research to develop methodologies for rational prediction and decision making, based on data and existing knowledge. All professors and associate professors in the Institute are assigned to one of these basic research departments.

On the other hand, the NOE-type research centers and the school for professional development (along the vertical axis) are staffed by permanent researchers within the Institute, project professors/researchers (postdoctoral staff), and visiting professors and researchers.

The current NOE-type research centers are "Risk Analysis Research Center", "Research and Development Center for Data Assimilation", "Survey Science Center", "Research Center for Statistical Machine Learning", and "Service Science Research Center". These centers conduct research activities that interface statistical mathematics with individual scientific disciplines in order to find solutions to urgent social problems.

We set "School of Statistical Thinking" as the school for professional development, which also serves multiple programs of the project for fostering and promoting statistical thinking. In School of Statistical Thinking, researchers, students, and contract researchers from private companies who have an eye on the creation of a new statistical research field and various people who realize the necessity of statistics in their particular research field train together to foster statistical thinking. Of special importance, young project researchers receive on-the-job training from their senior mentors and thereby obtain the assorted skills of "statistical thinking". In consideration of the importance of "statistical thinking", we have changed the personnel system to post newly employed assistant professors at School of Statistical Thinking since the 2013-2014 Japanese academic year.

NOE (Network Of Excellence) Project

In accordance with the second medium-term plan of Research Organization of Information and Systems, the Institute of Statistical Mathematics has set as a goal the establishment of NOE (Network Of Excellence) in statistical mathematics. With the formation of NOE in each of five research fields—"Risk Research", "Next-Generation Simulation", "Survey Science", "Statistical Machine Learning", and "Service Science"—we are conducting joint

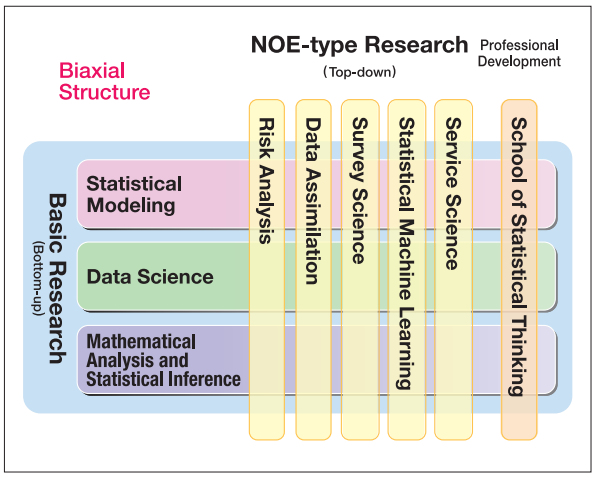


Figure 1: Biaxial Structure for research and education

Professor Emeritus, Tokyo Institute of Technology	Dr. Takatoshi Imai
Adjunct Professor, Computational Science Education Center, Kobe University	Dr. Yoshio Oyanagi
President, The Japan Pharmaceutical Manufacturers Association	Mr. Masayo Tada
President, Toyota Technological Institute at Chicago	Dr. Sadaoki Furui
Director-General, Center for Research Development and Strategy, Japan Science and Technology Agency	Dr. Hiroyuki Yoshikawa
Director-General, Institute for Monetary and Economic Studies, Bank of Japan	Mr. Kenichiro Watanabe

Table 1: Members of Advisory Board of "NOE Project" (as of April, 2015)

research activities that serve to deepen collaborative relationships with other institutes, both within Japan and overseas. The aim of this project is to establish new scientific methodologies ("Fourth Paradigm"), develop hubs for cross-disciplinary exchanges, and create new styles of networked joint research. The aforementioned five NOE research centers serve as core hubs in each NOE domain.

To fulfill the goal of establishing the new scientific methodologies ("Fourth Paradigm") in a knowledge-based society, in which the importance of knowledge goes beyond merely solving individual problems, NOE activities are being systematically pursued through the coordination and support efforts of NOE Promotion Unit, under the unified project guidelines decided by Managing Committee of NOE Project. At the same time, advice is also taken from the members of Advisory Board of NOE Project (see Table 1), made up of experts from the industrial, academic, and government sectors.

NOE Project, which is made possible by ISM's specialist focus in the cross-disciplinary field of "statistical mathematics", is attracting strong support from each of these communities. On the basis of this project, ISM, as an Inter-University Research Institute, will be providing further opportunities to the industrial, academic, and government communities, for joint usage (of facilities) and joint research.

Expansion of NOE activities

As described above, the five NOE research centers serve as core hubs for their respective fields. ISM is promoting the signing of MOUs (Memorandums of Understanding) with research organizations within Japan and overseas, and so these NOE research centers are planning for the expansion of their NOE activities. Since 2013, MOUs spanning a variety of NOE research fields have gone into effect. On top of this, our exchanges with organizations with which MOUs have been in effect for longer have grown stronger, resulting in concrete collaborative activities. It is clear that NOE Project is establishing much deeper roots within the research community.

With its focus on methodology, ISM continues to plan research in each of these fields: Risk Research, Next-Generation Simulation, Survey Science, Statistical Machine Learning, and Service Science. With all research activities concentrated under NOE Research Promotion Organization, the general body that oversees the five NOEs, ISM is expanding and developing its NOE projects with the aim of establishing new scientific methodologies ("Fourth Paradigm"), creating new research disciplines, and developing new styles of joint research. Figure 2 shows a diagram of NOE Project. For a more detailed outline, please visit our website.

http://www.ism.ac.jp/noe/en/project/

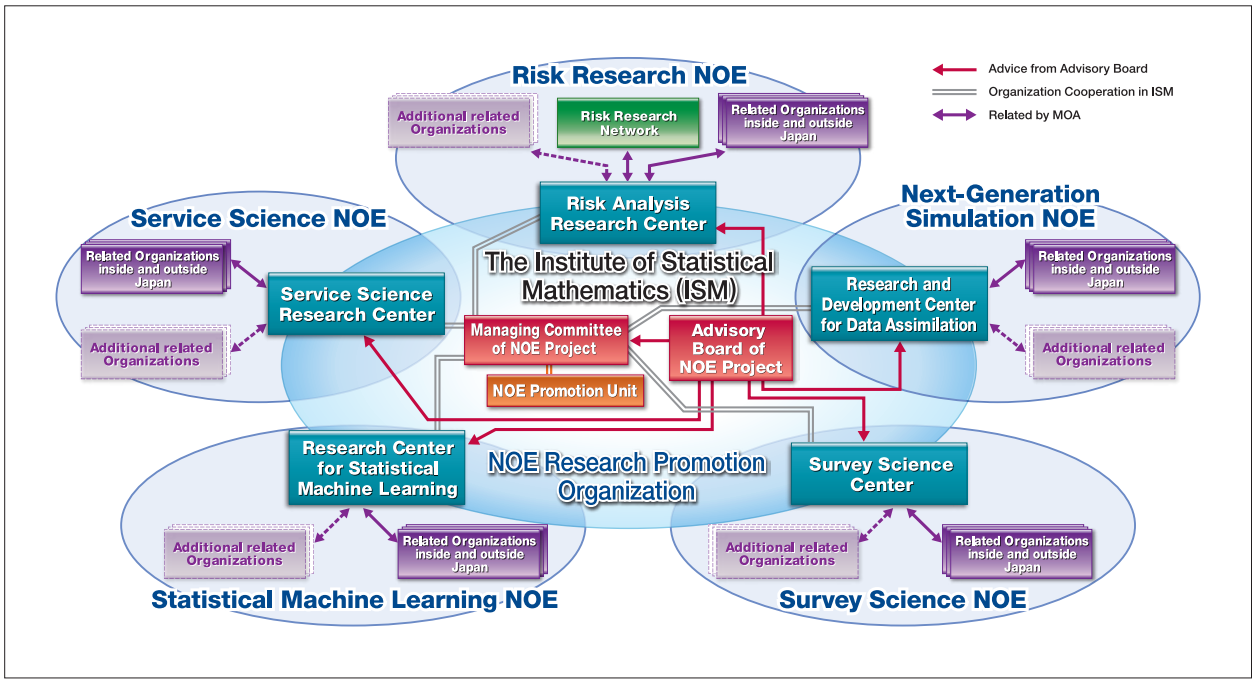


Figure 2: Relationship Diagram of NOE (Network Of Excellence)

Project for Fostering and Promoting Statistical Thinking

Rapid development of information and communication technology has led to the explosion of data. Now surrounded by "Big Data", everybody is expected to "think statistically". More than ever, there is a need for data scientists who can handle such big data and are able to extract useful knowledge from it. Meanwhile, Japanese higher education is exhibiting a deplorable lack of production capacity in terms of data scientists. This can be accounted for by the fact that no academic institution other than ISM has a department of statistics and the small number of statisticians in academia are isolated from each other, being scattered over various disciplines. Hoping to gain a little traction on this problem, ISM established the School of Statistical Thinking, into which we integrated all of our educational resources. The following are the principal projects.

Research Collaboration Start-up

The Institute had been providing a consultation service on statistical science. Along with the launch of the School of Statistical Thinking in November 2011, this service was reorganized as a research collaboration start-up. This program, being one of the projects to foster and promote statistical thinking, is mainly aimed at supporting applied scientists and other related people. Expert statisticians affiliated with the Institute give scientists and others advice on statistical modeling, data analysis, and research. Some cases develop into official research collaborations, which are our primary duty as an inter-university research institute. The start-up program covers a variety of topics, ranging from introductory to more specialized studies. Half of the clients are from the private sector, and the rest are staff at public organizations, university professors, or students. The Institute accepts about 40 cases annually, some of which benefit society in diverse ways.

Open-type Human Resource Development Program

In order to foster and promote "statistical thinking", the Institute of Statistical Mathematics invites proposals of research projects and workshops to develop young researchers. In FY 2015, four workshops have been adopted after review.

Statistical Mathematics Seminar Series

The Institute holds weekly seminar series on statistical mathematics every Wednesday. The seminars are led by in-house and external lecturers to showcase their latest studies. These lectures are free to attend. To view the seminar schedule and learn more about the program, please visit the Institute of Statistical Mathematics website.

http://www.ism.ac.jp/index_e.html

Open Lecture

We hold an open lecture during Education and Culture Week every year (November 1 through 7), to introduce the Institute's activities and to promote statistical science. We invite lecturers to speak on a timely topic relating to statistical science. The lecture is open to the general public. For further information, please visit the website of the Institute of Statistical Mathematics.

http://www.ism.ac.jp/kouenkai/

Data Science Research Plaza

Researchers from private-sector firms can have a desk and phone inside the School of Statistical Thinking. This program is subject to fees, and the contract can be renewed annually. Visitors can freely attend various events, such as seminars, workshops, conferences, and extension courses.

Tutorial Courses

The education program at ISM dates back to 1944, the year of founding. The Ministry of Education installed a training center within ISM to foster technicians in numerical computation. After the World War II, this training center was relaunched in 1947 to develop pollsters and census takers. It helped to cultivate professionals in the field of statistical surveys, while a growing number of entries from business and industry coming for various types of training were also observed.

When ISM joined the Inter-University Research Institute Corporation in 1985, the training center was formally shut down. We nevertheless tried to maintain 4 courses per year, relying on support from the private sector. The number of courses was tripled when ISM became an independent agency in 2005. Now the tutorial courses are operated by the School of Statistical Thinking, which was established in 2011.

In the 2014 academic year, 13 courses were held and the number of participants was 776. The total number of courses held from 1969 to March, 2015 was 321, with a total of 23,046 participants. These courses covered a wide range of fields from basic to applied statistics. The schedule of tutorial courses can be found on the website of the Institute of Statistical Mathematics.

http://www.ism.ac.jp/lectures/kouza.html

Towards the Formation of Research Foundations for Collaboration between Mathematics, Various Scientific Fields, and Industry

What is the Coop with Math Program?

The Coop with Math Program is a MEXT funded project which was originally planned in 2012 in an atmosphere of promoting research via collaborations between mathematics and other scientific fields, as well as industries. The aim of this program is to provide mathematicians and researchers in various scientific fields and industries with opportunities for inter-field discussions, and thus, to promote the finding of solutions to challenging problems via collaborations. It was started as a five-year project and commissioned to The Institute of Statistical Mathematics. The Institute currently manages the following activities under the Program with the aid of eight cooperating institutions along with main themes decided by the steering committee.

Activities of the Coop with Math Program

The Program mainly consists of supporting and organizing workshops, study groups, working groups, and outreach activities for the general public.

Workshops aim to discover new or challenging problems which it is hoped will be solved by the collaboration of industries and various scientific fields with mathematical science.

Study groups, which originally started at Oxford University in 1968, differ from workshops. Generally, coordinators first provide several problems and each participant chooses one of these and concentrates on solving it for about a week. At the end of a study group, participants who worked on the same problem together give presentations about solutions or proposals for solutions to the problem.

In fiscal year 2014, the Program conducted 21 workshops and 9 study groups focusing on various areas. Remarkably, more than half the problems in study groups come from industries.

The Program independently supports finding problems in specific fields which are expected to be solved by mathematical science through organizing tutorial seminars and workshops, which include the activities of working groups. In fiscal year 2014, we have produced a proposal for collaborations between mathematical science and life science. We have also begun to organize a community in which all researchers can easily access activities not only of mathematicians but also of materials scientists, so that research via collaborations between mathematics and materials sciences is promoted.

The Program organizes various outreach activities not only for researchers but also for the general public. For example, we have organized talk-exhibition events at Odaiba (2013, 2014), which helped people feel more familiar with mathematical sciences. The Program also supports career-path seminars so that students, and academic and industrial researchers can exchange their thoughts in detail.

By continuing these activities, we hope that mutual comprehension and collaborations between researchers in mathematics and other fields will be enhanced as much as possible.

Information about the Program can be accessed through its website (http://coop-math.ism.ac.jp), which consists of the original application system, SNSs such as Facebook (https://www.facebook.com/CoopMath) and Twitter (@CoopMath), and our mail magazine. To learn more about the Program, please visit these websites.

Figure 1: Discussion and Experiment in Study Group

Figure 2: Demonstration of Robots in Science Agora

How to Develop Data Analytics Talents

Developing talents for big data

Data analytics is quickly becoming an essential tool to make business decisions in various industries, such as retail, distribution, medical, education, and public sectors. One of the major obstacles of applying data analytics is the lack of talents. To address this issue, The Ministry of Education, Culture, Sports, Science & Technology in Japan (MEXT) launched a three-year project for developing data analytics talents and making the best use of them. The ISM is leading this project with the help of The Graduate School of Information Science and Technology, The University of Tokyo. The goal is to identify the model of talent development and their career that are best suited in Japan, and to share the model among the stakeholders such as academia, industry, and the governments as well as NGO's.

Figure 1: Joint session on the internship program

Figure 2: Data Scientist Crash Course

Current status of "Data Scientists" in Japan

In the first year of the project, we conducted a study on the current status of "data scientists" in Japan. The study consists of a) a survey on those who passed certain levels of the certification tests of Japan Statistical Society Certificate (319 valid responses) and b) a series of interviews with 20 well-known data scientists in Japan. The results indicate that typical data scientist in the United States and those in Japan are somewhat different: in the US, data scientists are more product-focused, meaning that they develop working systems with embedded data analytics, while in Japan, data scientists are typically service professionals who help analyzing their clients' data.

Training materials and their deployment

Based on the findings acquired in the first year of the project, we have identified skills needed in these data scientists and started to develop a program for them. The program includes a) an online training material, titled "Data Scientist Crash Course," that teaches basic data analytics concepts in a very concise manner, and b) an internship program that presents an opportunity for students who want to be a data scientist to get first-hand experiences of analyzing data. We also compiled approximately 200 data scientist training courses, both free and with a charge, into a database.

Research Cooperation

International Cooperation

Associated Foreign Research Institutes

Organization name	Address	Conclusion day
The Statistical Research Division of the U.S. Bureau of the Census	USA (Washington)	July 27, 1988
Stichting Mathematisch Centrum	The Kingdom of the Netherlands (Amsterdam)	May 10, 1989
Institute for Statistics and Econometrics, Humboldt University of Berlin	Germany (Berlin)	December 8, 2004
Institute of Statistical Science, Academia Sinica	Taiwan (Taipei)	June 30, 2005
The Steklov Mathematical Institute	Russia (Moscow)	August 9, 2005
Central South University	China (Changsha)	November 18, 2005
Soongsil University	The Republic of Korea (Seoul)	April 27, 2006
Department of Statistics, University of Warwick	the United Kingdom (Coventry)	January 16, 2007
The Indian Statistical Institute	India (Kolkata)	October 11, 2007
Department of Empirical Inference, Max Planck Institute for Biological Cybernetics	Germany (Tubingen)	August 11, 2010
Faculudade de Medicina da Universidade de São Paulo	Brasil (Sao Paulo)	April 15, 2011
Department of Communication Systems,SINTEF Information and Communication Technology	Norway (Trondheim)	January 30, 2012
Human Language Technology Department, Institute for Infocomm Research	Singapore (Singapore)	February 16, 2012
Centre for Computational Statistics and Machine Learning, University College London	the United Kingdom (London)	February 16, 2012
Department of Electronics and Telecommunications, Norwegian University of Science and Technology	Norway (Trondheim)	May 22, 2012
Department of Probability and Mathematical Statistics, Charles University in Prague	Czech Republic (Prague)	October 10, 2012
The Department of Ecoinformatics, Biometrics and Forest Growth of the Georg-August University of Goettingen	Germany (Goettingen)	October 18, 2012
The Korean Statistical Society	The Republic of Korea (Seoul)	July 9, 2013
Toyota Technological Institute at Chicago	USA (Chicago)	February 10, 2014
Mathematical Sciences Institute Australian National University	Australia (Canberra)	May 15, 2014
RiskLab ETH Zurich	Switzerland (Zurich)	February 7, 2015
Institut de Recherche en Composants logiciel et materiel pour l'Information et la Communication Avancee (IRCICA)	France (Paris)	February 9, 2015
Le laboratoire de mathematiques de l'Universite Blaise Pascal	France (Clermont-Ferrand)	February 11, 2015
Centre de Rechereche en Informatique, Signal et Automatique de Lille (CRIStAL) UMR CNRS 9189	France (Paris)	February 12, 2015
University College London (UCL) Big Data Institute	The United Kingdom (London)	February 26, 2015
The Institute of Forestry, Pokhara of Tribhuvan University	Nepal (Pokhara)	March 6, 2015
The Institute of Forest and Wildlife Research and Development of the Forestry Administration of Cambodia	Cambodia (Phnom Penh)	March 6, 2015
The Chancellor masters and Scholars of the University of Oxford	The United Kingdom (Oxford)	March 10, 2015

Research Collaboration

This academic study program provides researchers from other academic institutes with access to the facilities of the Institute, and provides opportunities for researchers to conduct theoretical and applied studies on statistics.

Number of Activities

2009	2010	2011	2012	2013	2014
154	135	172	182	181	177

Fields of Research Collaboration

Research collaboration is classified by research field as follows. Applicants can use the table below to find the most appropriate type of project.

ISM Fields

Number	Fields	Number	Fields	Number	Fields
a	Spatial and Time Series Modeling Group	d	Data Design Group	h	Learning and Inference Group
b	Complex System Modeling Group	e	Metric Science Group	i	Computational Inference Group
c	Latent Structure Modeling Group	f	Structure Exploration Group	j	Others
		g	Mathematical Statistics Group		

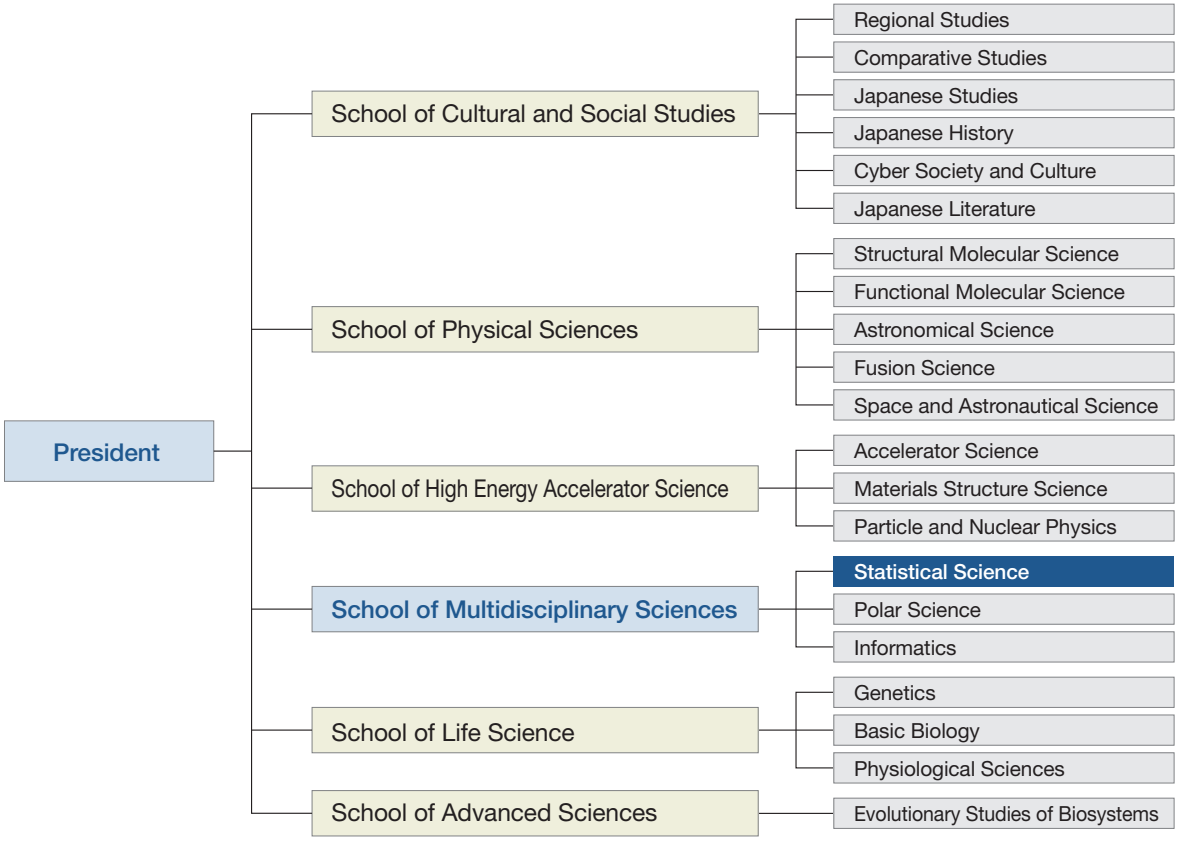
Major Research Fields

Number	Fields	Major Research Domains	Number	Fields	Major Research Domains
1	Statistical mathematics	Mathematical theory of statistics, optimization, etc.	6	Human science	Philosophy, art, psychology, education, history, geography, culture, language, etc.
2	Information science	Algorithms, use of computer in statistics, etc.	7	Social science	Economics, law, politics, society, management, official statistics, population, etc.
3	Biological science	Medicine, pharmacy, epidemiology, genetics, etc.	8	Environmental science	Environmental Statistics, Environmetrics, Agricultural Statistics, Land Economics, Landscape Management, Forest Management, etc.
4	Physical science	Space, planet, earth, polar region, materials, etc.			
5	Engineering	Mechanics, electronics, control, chemistry, architecture, etc.	9	Others	Other research fields

Graduate School Program

Organization

The Institute of Statistical Mathematics is one of the platforms of SOKENDAI (the Graduate University for Advanced Studies; the headquarters in Hayama, Kanagawa), which was opened in October 1988 to offer graduate education. Since its opening, the Institute has included the Department of Statistical Science and, since April 1989, has accepted students for education and research in doctoral programs. In 2006, the Institute adopted a five-year system, offering either a five-year education and research program, or a three-year education and research program starting from the third year of study.



Outline of Education and Research

The course includes designing of data-gathering systems, modeling, inference and forecasting in order to extract information and knowledge from the real world based on empirical data, as well as basic, mathematical and applied education and research related to these fields. The course aims to provide the student with skills that help to contribute to solving important and connected issues and give the ability to perform original research.

Field of Education and Research	Contents
Statistical Modeling	Education and research focuses on dynamic modeling such as spatial and space-time modeling, graphical modeling of temporally and/or spatially inter-related complex phenomena, and intelligent information processing. We also provide education and research on statistical inference based on various models, methods of calculation for inference, and evaluation of models based on data.
Data Science	We provide education and research on data design, investigation and analytical methods to cope with the uncertainty and incompleteness of information, as well as on computational statistics.
Mathematical and Statistical Inference	We provide education and research on the theory of statistics and related basic mathematics, statistical learning theory to extract information from data by automated learning and inference techniques; as well as theory and applications of optimization and computation algorithms which serve as the basis for computational inference.

Features of Education and Research

- The course is the only integrated doctoral program on statistical science in Japan. It has received students from a wide variety of disciplines and has offered education and research on statistical science by professors specialized in many different fields, from theory through to practical applications.
- The Institute of Statistical Mathematics, the platform for the course, is equipped with a world-class super computer, high-speed 3D graphic computers and simulators to generate physical random numbers, as well as a variety of software, including original statistical software developed by the Institute.
- The academic publications and books on statistical and mathematical sciences produced are some of the best in the world.
- In its role as an inter-university research institute, the Institute holds frequent workshops and seminars by visiting professors and researchers from both Japan and abroad. Students are free to attend and participate.
- It is possible to collaborate with researchers from other universities and institutions. It is also possible for students to develop their own projects by participating in research projects with other institutions through the Transdisciplinary Research Integration Center, Research Organization of Information and Systems.

Course Requirements and Type of Degree Granted

- Requirements to complete the doctoral course are as follows:
  Completion of at least 40 credits, including the required ones, by a student in the five-year program, or completion of at least 10 credits, including the required ones, by a three-year doctorate student who previously completed a Master's course; meeting all the criteria set by the thesis committee of the Institute; and successfully completing the final examination.
- On completion of the course, either a Doctorate in Statistical Science or, if the thesis deals mainly with an inter-disciplinary field related to statistical science, a Doctorate of Philosophy is awarded.
- The required number of years of study will be flexible if a student demonstrates outstanding research results.

Number of Students (As of April 1, 2015)

■ Doctor's course five years

Year of enrollment	2010	2012	2013	2014
Number of students	2	2	2	2

■ Doctor's course three years

Year of enrollment	2008	2011	2012	2013	2014	2015
Number of students	1 ①	3 ③	3 ②	4 ②	8 ⑤ (1)	1 ①

* The figures in parentheses indicate the number of foreign students being supported at government expense.
* The figures in circles indicate those who are employed by other organizations.

University Background of Students

National and public universities

• Hokkaido University (3) • Tohoku University (3) • Fukushima University (1) • University of Tsukuba (6) • Saitama University (1) • Ochanomizu University (1) • Hitotsubashi University (6) • Chiba University (1) • The University of Tokyo (9) • Tokyo Medical and Dental University (1) • Tokyo Gakugei University (2) • Tokyo Institute of Technology (4) • Tokyo University of Marine Science and Technology (1) • Tokyo University of Agriculture and Technology (1) • Tokyo Metropolitan University (1) • Shizuoka University (1) • Japan Advanced Institute of Science and Technology, Hokuriku (1) • Nagoya University (3) • Toyohashi University of Technology (2) • Kyoto University (4) • Osaka University (2) • Osaka City University (1) • Nara Institute of Science and Technology (1) • Okayama University (2) • Shimane University (3) • Kyushu University (2) • Oita University (1)

University Background of Students

Private universities

• Okayama University of Science (1) • Tokyo University of Science (6) • Kyoto Sangyo University (1) • Keio University (8) • Waseda University (8) • Chuo University (7) • Toyo University (1) • Nihon University (2) • Hosei University (7) • Kurume University (1) • Japan Women's University (1) • Shibaura Institute of Technology (1) • Nanzan University (1) • Kansai University (1) • Kitasato University (1) • Ritsumeikan University (1)

Foreign universities

• Aston University (1) • University of California, Irvine (1) • University of Campinas (1) • University of Colorado at Boulder (2) • University of Dhaka (2) • University of Hawaii (1) • Jahangirnagar University (2) • University of Malaya (1) • Northeast Normal University (1) • Ohio University (1) • University of Rajshahi (2) • Stanford University (1) • Center for Analysis and Prediction, China Seismological Bureau (1) • Northeastern University of Technology, China (1) • The Hong Kong University of Science and Technology (1) • University of Science and Technology of China (1) • Chinese Academy of Sciences, Institute of Applied Mathematics (1)

Degrees Awarded

Year	2009	2010	2011	2012	2013	2014
Doctor of Philosophy	5 [1]	7 [1]	4	6 [1]	6	5

* [ ] Ph.D. on the basis of the dissertation only (included in the total)

Alumni

National and public universities, and public organizations

• Obihiro University of Agriculture and Veterinary Medicine • University of Tsukuba • University of Hyogo • The University of Tokyo • The University of Electro-Communications • Saitama University • Nagoya University • Kyushu University • Kyushu Institute of Technology • University of the Ryukyus • The Institute of Statistical Mathematics • Tohoku University • Yokohama National University • Hokkaido University • Tokyo Institute of Technology • Hiroshima University • Oita University of Nursing and Health Sciences • JAXA's Engineering Digital Innovation Center • Kyoto University • Nara Institute of Science and Technology • Bank of Japan • Japan Broadcasting Corporation • Railway Technical Research Institute • Statistical Information Institute for Consulting and Analysis • Government Pension Investment Fund • Public School

Private universities

• Sapporo Gakuin University • Tokyo Health Care University • Meiji University • Doshisha University • Josai University • Nihon University • Komazawa University • Aichi University of Technology • Tokyo University of Information Science • Shibaura Institute of Technology • Rikkyo University • Waseda University

Foreign universities

• Jahangirnagar University • Victoria University • Massey University • University of Otaga • Statistics New Zealand • University of Rajshahi • University of California, Los Angeles • Asia-Pacific Center for Security Studies Department • Central South University • Hong Kong Baptist University • University of South Carolina • The University of Warwick

Private companies, etc.

• Hitachi, Ltd. Central Research Laboratory • NTT Communication Science Laboratories • Seiwa Kikaku • NLI Research Institute • Mizuho Trust and Banking • Nomura Securities Co., Ltd. • ATR Computational Neuroscience Laboratories • Toyota Motor Corporation, Higashi-Fuji Technical Center • Schlumberger Limited • Macquarie Securities, Japan • Non-Life Insurance Rating Organization of Japan • Barclays Global Investors • Open Technologies Corporation • Yamaha Corporation • Goldman Sachs Asset Management L.P. • CLC bio Japan, Inc. • Bank of Tokyo-Mitsubishi UFJ • Pfizer Japan Inc. • Doctoral Institute for Evidence Based Policy • Sony Corporation • NTTIT Corporation • Sompo Japan Insurance Inc. • Qualicaps Co.,Ltd. • Bridgestone Corporation • Brain Pad Inc. • Sumitomo Chemical Co.,Ltd. • PricewaterhouseCoopers Aarata • Mitsubishi Tanabe Pharma Corporation • Daiichi Sankyo Co.,Ltd. • Shizuoka Cancer Center

Facilities and Equipment

Computational Resources

Since July 2014, the ISM has maintained three different supercomputer systems: the Supercomputer System for Data Assimilation (nicknamed "A"), the Supercomputer System for Statistical Science (nicknamed "I"), and the Communal Cloud Computing System (nicknamed "C"). Those are nicknamed in tribute to a former director general, the late Professor Hirotugu Akaike, who invented the famous model selection criterion AIC. As of July 2015, the system I has just been expanded to have Haswell nodes.

System A is the world's largest shared-memory supercomputer system and consists of two sets of SGI UV 2000 (each 256 nodes of 10-core Xeon E5-4650v2, 64 TB memory). Half of this system is taking part in the high-performance computing infrastructure (HPCI) project.

System I is a large distributed-memory supercomputer that consists of 400 nodes of SGI ICE X with Ivy Bridge and 136 Haswell nodes, having 6,432 cores in total. The system also includes a large-scale shared storage system (2.5 PB disk storage), physical random number generator boards, and a visualization system that supports a maximum resolution of 4,096 × 2,160 and has a 200-inch rear projection screen for 3D visualization.

System C consists of 64 Dell PowerEdge R620 (two 10-core Xeon E5-2680v2, 256 GB memory). This system provides easy-to-use computing environments, such as distributed-memory statistical computing environments and Web servers, running on Apache CloudStack software.

In the main office, the primary local area network (LAN) consists of an Ethernet network using 10GBASE-SR for the main trunk and 1000Base-T for branches. The personal computers in researchers' offices, and systems A, I, and C are all connected to this network. A wireless LAN system is also available in the immediate area of the building occupied by the institute. These LAN systems enable distributed processing and allow computing resources and statistical data to be used effectively. Comprehensive network security methods have been implemented, such as a firewall system, anti-virus software, and an intrusion prevention system. To encourage joint research with researchers both in Japan and abroad, as well as the exchange of e-mails, the network is connected to the Internet through SINET4 (10 Gbps).

The Supercomputer System for Data Assimilation (nicknamed A)

The Supercomputer System for Statistical Science (nicknamed I)

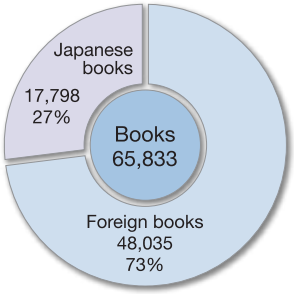
The Communal Cloud Computing System (nicknamed C)

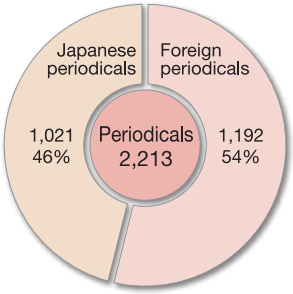
Library and Materials (As of April 1, 2015)

We have a large number of major Japanese/foreign journals covering a wide variety of fields including statistics, mathematics, computer science and informatics. In addition, we also have a large library consisting of books on humanities, social science, biology, medical science, science and engineering.

Besides contributed to Japanese and foreign publications, we also have a collection of journals that we publish ourselves: Annals of the Institute of Statistical Mathematics (English; Springer), Proceedings of the Institute of Statistical Mathematics (Japanese), ISM Survey Research Report (Statistical Researches mainly related to the Japanese National Character), Computer Science Monographs, Cooperative Research Reports (for collaborative research projects), Research Memorandum, ISM Reports on Statistical Computing, and ISM Report on Research and Education.

All materials are properly catalogued and can be searched from the web in order to meet the needs of researchers working in a wide of fields. We also accept photocopy requests.





Finance and Buildings

Administration Subsidy and Others (2014)

Type	Personnel expenses	Non-personnel expenses	Total
Expenditure	663,312	958,199	1,621,511

Unit: ¥1,000

Accepted External Funds (2014)

Type	Subcontracted research	Joint research	Contribution for scholarship	Total
Items	19	13	4	36
Income	124,156	24,600	5,600	154,356

Unit: ¥1,000

Grant-in-Aid for Scientific Research "KAKENHI" (2014)

Research Category	Items	Amount Granted
Grant-in-Aid for Scientific Research on Innovation Areas	2	13,390
Grant-in-Aid for Scientific Research (S)	1	15,990
Grant-in-Aid for Scientific Research (A)	3	26,910
Grant-in-Aid for Scientific Research (B)	9	38,350
Grant-in-Aid for Scientific Research (C)	18	25,522
Grant-in-Aid for Challenging Exploratory Research	6	7,629
Grant-in-Aid for Young Scientists (B)	9	7,039
Grant-in-Aid for Research Activity Start-up	1	1,430
Grant-in-Aid for JSPS Fellows	5	5,589
Total	54	141,849

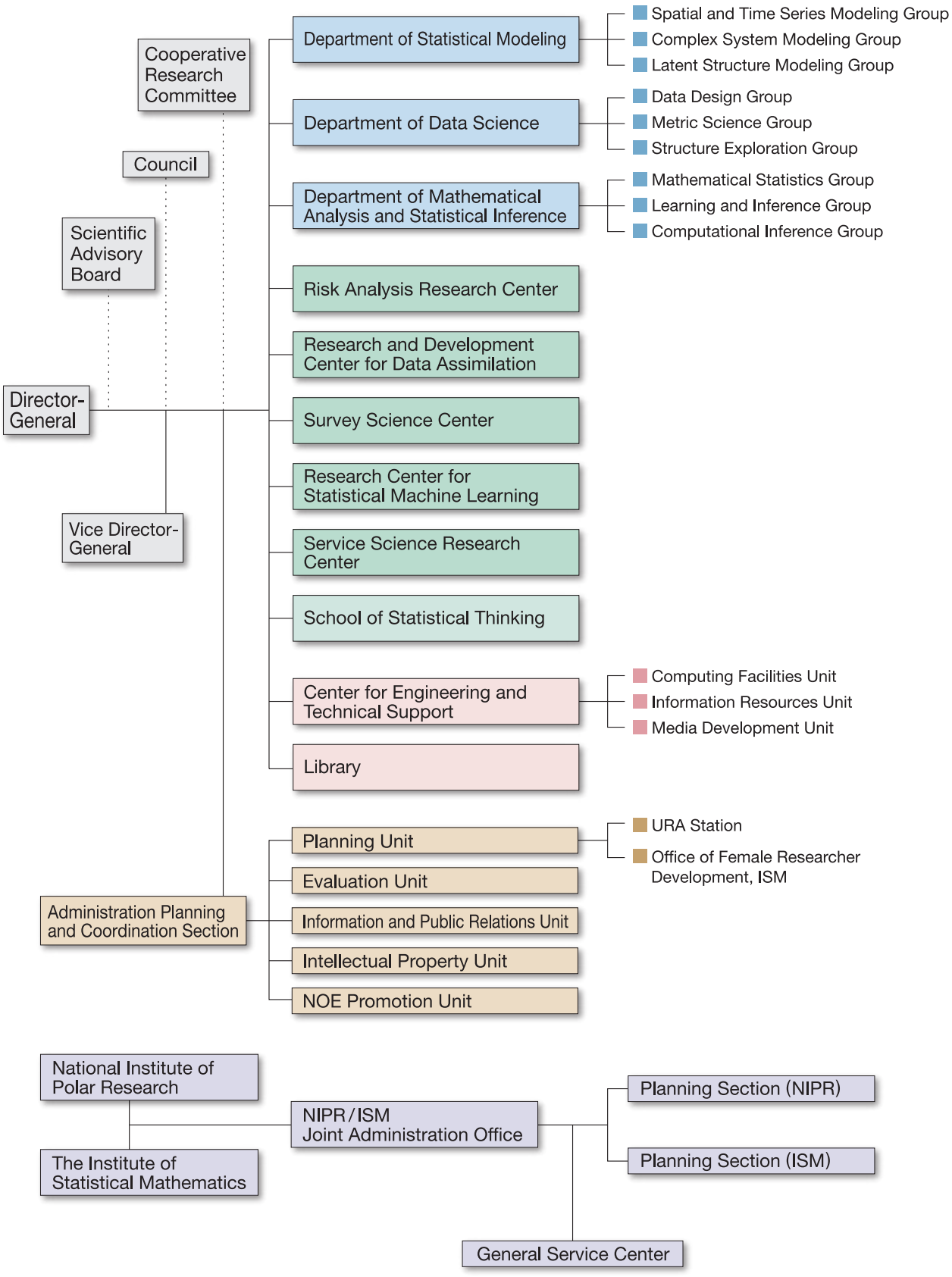
Unit: ¥1,000

Site and Buildings (As of April 1, 2015)

Site Area	62,450m^2
Area for Buildings (total)	16,026m^2

Organization

Organization Diagram (As of August 1, 2015)



Number of Staff (As of April 1, 2015)

Type	Director-General	Professor	Associate Professor	Assistant Professor	Administrative Staff	Technical Staff	Total
Director-General	1						1
Department of Statistical Modeling		7	7	1			15
Department of Data Science		4	8	3			15
Department of Mathematical Analysis and Statistical Inference		7	4	2			13
School of Statistical Thinking				2			2
Center for Engineering and Technical Support						10	10
Administration Planning and Coordination Section					1		1
NIPR/ISM Joint Administration Office					12(27)	1 (2)	13(29)
Total	1	18	19	8	13(27)	11(2)	70(29)

( ) Total number of staff of NIPR/ISM Joint Administration Office.

The number under Technical Staff at the Center for Engineering and Technical Support includes one staff member who retired because of age but was reemployed in a different position.

Staff (As of September 1, 2015)

Director-General	Tomoyuki HIGUCHI

Vice Director-General	Yoshiyasu TAMURA	Vice Director-General	Satoshi ITO	Vice Director-General	Koji KANEFUJI

Department of Statistical Modeling

Director Junji NAKANO

Spatial and Time Series Modeling Group

Prof.	Nobuhisa KASHIWAGI	Prof.	Tomoyuki HIGUCHI	Assoc. Prof.	Jiancang ZHUANG
Assoc. Prof.	Genta UENO	Assist. Prof.	Shinya NAKANO	Project Researcher	Ai KAWAMORI

Complex System Modeling Group

Prof.	Yoshiyasu TAMURA	Prof.	Junji NAKANO	Prof.	Yukito IBA
Assoc. Prof.	Yumi TAKIZAWA	Assoc. Prof.	Fumikazu MIWAKEICHI	Assoc. Prof.	Shinsuke KOYAMA
Assist. Prof.	Ayaka SAKATA	Visiting Prof.	Michiko WATANABE	Visiting Prof.	Kenichi MIURA
Visiting Prof.	Hiroko NAKANISHI	Visiting Assoc. Prof.	Toru ONODERA		

Latent Structure Modeling Group

Prof.	Hiroshi MARUYAMA	Prof.	Tomoko MATSUI	Prof.	Yoshinori KAWASAKI
Assoc. Prof.	Ryo YOSHIDA	Assoc. Prof.	Kazuhiro MINAMI	Project Assist. Prof.	Akira TAMAMORI

Department of Data Science

Director Satoshi YAMASHITA

Data Design Group

Prof.	Takashi NAKAMURA	Prof.	Ryozo YOSHINO	Assoc. Prof.	Naomasa MARUYAMA
Assoc. Prof.	Tadahiko MAEDA	Assoc. Prof.	Takahiro TSUCHIYA	Assist. Prof.	Masayo HIROSE
Visiting Prof.	Takatoshi IMADA				

Metric Science Group

Prof.	Satoshi YAMASHITA	Assoc. Prof.	Kenichiro SHIMATANI	Assoc. Prof.	Masayuki HENMI
Assoc. Prof.	Ikuko FUNATOGAWA	Assist. Prof.	Nobuo SHIMIZU	Assist. Prof.	Hisashi NOMA

Structure Exploration Group

Prof.	Koji KANEFUJI	Assoc. Prof.	Jun ADACHI	Assoc. Prof.	Manabu KUROKI
Assist. Prof.	Yoo Sung PARK				

Department of Mathematical Analysis and Statistical Inference

Director Satoshi KURIKI

Mathematical Statistics Group

Prof.	Satoshi KURIKI	Assoc. Prof.	Shuhei MANO	Assoc. Prof.	Shogo KATO
Assist. Prof.	Takaaki SHIMURA	Assist. Prof.	Kei KOBAYASHI	Assist. Prof.	Teppei OGIHARA

Learning and Inference Group

Prof.	Shinto EGUCHI	Prof.	Kenji FUKUMIZU	Prof.	Hironori FUJISAWA
Assoc. Prof.	Shiro IKEDA	Assoc. Prof.	Daichi MOCHIHASHI	Project Assist. Prof.	Osamu KOMORI
Visiting Prof.	Ryuei NISHII	Visiting Assoc. Prof.	Yoshiyuki NINOMIYA		

Computational Inference Group

Prof.	Yoshihiko MIYASATO	Prof.	Atsushi YOSHIMOTO	Prof.	Satoshi ITO

Risk Analysis Research Center

Director Satoshi YAMASHITA Vice Director Manabu KUROKI

Prof.	Satoshi YAMASHITA	Prof.	Satoshi KURIKI	Prof.	Shinto EGUCHI
Prof.	Koji KANEFUJI	Prof.	Nobuhisa KASHIWAGI	Prof.	Atsushi YOSHIMOTO
Prof.	Yoshinori KAWASAKI	Assoc. Prof.	Masayuki HENMI	Assoc. Prof.	Manabu KUROKI
Assoc. Prof.	Fumikazu MIWAKEICHI	Assoc. Prof.	Jiancang ZHUANG	Assoc. Prof.	Kenichiro SHIMATANI
Assoc. Prof.	Ikuko FUNATOGAWA	Assoc. Prof.	Shogo KATO	Assist. Prof.	Takaaki SHIMURA
Assist. Prof.	Hisashi NOMA	Assist. Prof.	Teppei OGIHARA	Project Assist. Prof.	Tomoaki IMOTO
Project Assist. Prof.	Yoshitake TAKEBAYASHI	Project Assist. Prof.	Yuta KOIKE	Visiting Prof.	Rinya TAKAHASHI
Visiting Prof.	Yo SHIINA	Visiting Prof.	Manabu IWASAKI	Visiting Prof.	Toshiya SATO
Visiting Prof.	Yoichi KATO	Visiting Prof.	Masaaki MATSUURA	Visiting Prof.	Satoshi TERAMUKAI
Visiting Prof.	Tatsuhiko TSUNODA	Visiting Prof.	Shigeyuki MATSUI	Visiting Prof.	Naoki SAKAI
Visiting Prof.	Mihoko MINAMI	Visiting Prof.	Megu OTAKI	Visiting Prof.	Satoshi TAKIZAWA
Visiting Prof.	Toshihiro HORIGUCHI	Visiting Prof.	Osamu NAGAFUCHI	Visiting Prof.	Naoto KUNITOMO
Visiting Prof.	Toshio HONDA	Visiting Prof.	Hiroshi TSUDA	Visiting Prof.	Sadaaki MIYAMOTO
Visiting Prof.	Michiko MIYAMOTO	Visiting Prof.	Toshinao YOSHIBA	Visiting Prof.	Tadashi ONO
Visiting Prof.	Nakahiro YOSHIDA	Visiting Prof.	Hideatsu TSUKAHARA	Visiting Prof.	Toshio ONISHI
Visiting Assoc. Prof.	Hideki KATAGIRI	Visiting Assoc. Prof.	Koji OKUHARA	Visiting Assoc. Prof.	Hisateru TACHIMORI
Visiting Assoc. Prof.	Makoto TOMITA	Visiting Assoc. Prof.	Takafumi KUBOTA	Visiting Assoc. Prof.	Masakazu FURUKAWA
Visiting Assoc. Prof.	Ryota NAKAMURA	Visiting Assoc. Prof.	Toshikazu KITANO	Visiting Assoc. Prof.	Hisayuki HARA
Visiting Assoc. Prof.	Takashi KAMEYA	Visiting Assoc. Prof.	Yasuhiro KUBOTA	Visiting Assoc. Prof.	Kenichi KAMO

Staff

Risk Analysis Research Center

Visiting Assoc. Prof.	Masashi KONOSHIMA	Visiting Assoc. Prof.	Katsuya TANAKA	Visiting Assoc. Prof.	Takaki IWATA
Visiting Assoc. Prof.	Bogdan Dumitru ENESCU	Visiting Assoc. Prof.	Masakazu ANDO	Visiting Assoc. Prof.	Seisho SATO
Visiting Assoc. Prof.	Yasutaka SHIMIZU	Visiting Assoc. Prof.	Masaaki FUKASAWA	Visiting Assoc. Prof.	Hitoshi MOTOYAMA
Visiting Assoc. Prof.	Yoichi NISHIYAMA	Visiting Assoc. Prof.	Matthew GERSTENBERGER	Project Researcher	Takao KUMAZAWA

Research and Development Center for Data Assimilation

Director Tomoyuki HIGUCHI Vice Director Yoshiyasu TAMURA

Prof.	Tomoyuki HIGUCHI	Prof.	Yoshiyasu TAMURA	Prof.	Junji NAKANO
Prof.	Yukito IBA	Assoc. Prof.	Genta UENO	Assoc. Prof.	Ryo YOSHIDA
Assist. Prof.	Shinya NAKANO	Visiting Prof.	Takashi WASHIO	Visiting Prof.	Shinichi OTANI
Visiting Assoc. Prof.	Kazuyuki NAKAMURA	Visiting Assoc. Prof.	Hiromichi NAGAO	Visiting Assoc. Prof.	Hiroshi KATO
Visiting Assoc. Prof.	Osamu HIROSE	Visiting Assoc. Prof.	Hiroshi YAMASHITA	Project Researcher	Yuya ARIYOSHI
Project Researcher	Kazue SUZUKI				

Survey Science Center

Director Ryozo YOSHINO

Prof.	Ryozo YOSHINO	Prof.	Takashi NAKAMURA	Assoc. Prof.	Tadahiko MAEDA
Assoc. Prof.	Takahiro TSUCHIYA	Assist. Prof.	Yoo Sung PARK	Project Assist. Prof.	Yusuke INAGAKI
Visiting Prof.	Toru KIKKAWA	Visiting Prof.	Yoshimichi SATO	Visiting Prof.	Masato YONEDA
Visiting Prof.	Shintaro SONO	Visiting Prof.	Kazufumi MANABE	Visiting Prof.	Fumi HAYASHI
Visiting Prof.	Masahiro MIZUTA	Visiting Assoc. Prof.	Takahito ABE	Visiting Assoc. Prof.	Wataru MATSUMOTO
Visiting Assoc. Prof.	Koken OZAKI	Visiting Assoc. Prof.	Tadayoshi FUSHIKI	Visiting Assoc. Prof.	Hiroko TSUNODA
Visiting Assoc. Prof.	Taisuke FUJITA	Project Researcher	Kosuke NIKAIDO	Project Researcher	Noriko MIWA

Research Center for Statistical Machine Learning

Director Kenji FUKUMIZU Vice Director Tomoko MATSUI

Prof.	Kenji FUKUMIZU	Prof.	Tomoko MATSUI	Prof.	Shinto EGUCHI
Prof.	Yoshihiko MIYASATO	Prof.	Satoshi ITO	Assoc. Prof.	Shiro IKEDA
Assoc. Prof.	Daichi MOCHIHASHI	Assoc. Prof.	Shinsuke KOYAMA	Assist. Prof.	Kei KOBAYASHI
Project Assist. Prof.	Song LIU	Visiting. Prof.	Takashi TSUCHIYA	Visiting. Prof.	Masataka GOTO
Visiting. Prof.	Koji TSUDA	Visiting Assoc. Prof.	Yuji SHINANO	Visiting Assoc. Prof.	Shaogao LU
Visiting Assoc. Prof.	Arthur GRETTON	Visiting Assoc. Prof.	Ruriko YOSHIDA	Project Researcher	Ikumi SUZUKI
Project Researcher	Mikio MORII				

Service Science Research Center

Director Hiroshi MARUYAMA

Prof.	Hiroshi MARUYAMA	Prof.	Tomoyuki HIGUCHI	Prof.	Tomoko MATSUI
Prof.	Junji NAKANO	Assoc. Prof.	Manabu KUROKI	Assoc. Prof.	Kazuhiro MINAMI
Assist. Prof.	Nobuo SHIMIZU	Visiting Prof.	Yoichi MOTOMURA	Visiting Prof.	Shusaku TSUMOTO

Service Science Research Center

Visiting Prof.	Nobuhiko TERUI	Visiting Prof.	Yoshiki YAMAGATA	Visiting Prof.	Tadahiko SATO
Visiting Assoc. Prof.	Tsukasa ISHIGAKI	Visiting Assoc. Prof.	Yukihiko OKADA	Visiting Assoc. Prof.	Eiji MOTOHASHI
Visiting Assoc. Prof.	Toshihiko KAWAMURA	Visiting Assoc. Prof.	Haruhisa FUKUDA		

School of Statistical Thinking

Director Yoshinori KAWASAKI Vice Director Jun ADACHI

Prof.	Hiroshi MARUYAMA	Prof.	Satoshi ITO	Prof.	Yukito IBA
Assoc. Prof.	Naomasa MARUYAMA	Assist. Prof.	Teppei OGIHARA	Assist. Prof.	Ayaka SAKATA
Assist. Prof.	Masayo HIROSE	Adjunct Professor	Yasumasa BABA	Adjunct Professor	Makio ISHIGURO
Adjunct Professor	Kunio SHIMIZU	Project Assist. Prof.	Kei TAKAHASHI	Project Assist. Prof.	Keiichi FUKAYA
Project Assist. Prof.	Kaname MATSUE	Project Assist. Prof.	Toshiya KAZAMA	Project Researcher	Naoki KAMIYA

Project Researchers

Project Assoc. Prof.	Roberto Sebastian LEGASPI	Project Assist. Prof.	Kazuhiko SHIBUYA	Project Researcher	Tomoya TANJO

Center for Engineering and Technical Support

Director Yoshinori KAWASAKI Vice Director Jun ADACHI
Deputy Manager Yuriko WATANABE Senior Specialist Saeko TANAKA

Head of Computing Facilities Unit	Kazuhiro NAKAMURA	Head of Information Resources Unit	Saeko TANAKA
Head of Media Development Unit	Akiko NAGASHIMA		

Library

Head Yoshinori KAWASAKI

Administration Planning and Coordination Section

Director Tomoyuki HIGUCHI

Head of Planning Unit	Satoshi ITO	Head of Evaluation Unit	Yoshiyasu TAMURA
Head of Information and Public Relations Unit	Koji KANEFUJI	Head of Intellectual Property Unit	Hiroshi MARUYAMA
Head of NOE Promotion Unit	Satoshi ITO		

URA Station

Leader	Kozo KITAMURA	Subleader	Motoi OKAMOTO
Research Administrator	Keisuke HONDA	Research Administrator	Yoko OGAWA

Office of Female Researcher Development, ISM

	Koji KANEFUJI		Yoo Sung PARK
	Kozo KITAMURA		

Staff

NIPR/ISM Joint Administration Office

Director of NIPR/ISM Joint Administration Office Kazuhiko HASEGAWA　　Director of General Service Center Katsunori NOZUMI

Planning Section (ISM)

Head of Planning Section Toyoharu HAYASHIDA

Deputy Head	Kazuhiko GOTO	Deputy Head	Yutaka ONO	Specialist	Fumio SUTO
Team Leader	Koji MORITA	Team Leader	Hiroaki ARAI	Team Leader	Ichiro KAWAJI

Planning Section (NIPR)

Head of Planning Section Michiaki NAKANO

Deputy Head	Koji SAKAMOTO	Team Leader	Kazuhisa OSHITA	Team Leader	Masaki ONIZAWA

General Service Center

Deputy Head	Motokazu TOYODA	Deputy Head	Tomohiko MIYAUCHI	Team Leader	Yoshihiro YAMADA
Team Leader	Yumiko OKAWA	Team Leader	Kentaro TSUJII	Team Leader	Susumu YAMAGUCHI
Team Leader	Kenichi SHIOBARA	Specialist	Hitoshi HIRAYAMA		

Council of The Institute of Statistical Mathematics (As of April 1, 2015)

Yasushi AKIYAMA	Professor, Graduate School of Information Science and Engineering , Tokyo Institute of Technology
Masahiro MIZUTA	Professor, Information Initiative Center, and Graduate School of Information Science and Technology, Hokkaido University
Shigeru OBAYASHI	Director Institute of Fluid Science Tohoku University
Nakahiro YOSHIDA	Professor, Graduate School of Mathematical Sciences, The University of Tokyo
Nobuhiko TERUI	Professor, Graduate School of Economics and Management, Tohoku University
Ryuei NISHII	Professor, Institute of Mathematics for Industry, Kyushu University
Yoshihiro YAJIMA	Professor, Graduate School of Economics, The University of Tokyo
Shoichi YOKOYAMA	Professor, Department of Linguistic Theory and Structure, National Institute for Japanese Language and Linguistics
Masato OKADA	Professor, Graduate School of Frontier Sciences, The University of Tokyo
Michiko WATANABE	Professor, The Graduate School of Health Management, Keio University
Yoshiyasu TAMURA	Professor (Vice Director-General, ISM)
Satoshi ITO	Professor (Vice Director-General, ISM)
Kouji KANEFUJI	Professor (Vice Director-General, ISM)
Junji NAKANO	Professor (Director of Department of Statistical Modeling, ISM)
Satoshi YAMASITA	Professor (Director of Department of Data Science, ISM)
Satoshi KURIKI	Professor (Director of Department of Mathematical Analysis and Statistical Inference, ISM)
Yoshinori KAWASAKI	Professor (Director of Center for Engineering and Technical Support, ISM)
Nobuhisa KASHIWAGI	Professor (Department of Statistical Modeling, ISM)
Hiroshi MARUYAMA	Professor (Department of Statistical Modeling, ISM)
Ryozo YOSHINO	Professor (Department of Data Science, ISM)
Kenji FUKUMIZU	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)

Cooperative Research Committee (As of April 1, 2015)

Tadahiko SATO	Professor, Faculty of Business Sciences, University of Tsukuba
Akinobu TAKEUCHI	Associate Professor, Faculty of Humanities and Social Sciences, Jissen Women's University
Shigeyuki MATSUI	Professor, Graduate School of Medicine, Nagoya University
Hiroshi YADOHISA	Professor, Faculty of Culture and Information Science, Doshisha University
Kazue YAMAOKA	Professor, Graduate School of Public Health, Teikyo University
Junji NAKANO	Professor (Director of Department of Statistical Modeling, ISM)
Satoshi YAMASHITA	Professor (Director of Department of Data Science, ISM)
Satoshi ITO	Professor (Vice Director-General, ISM)
Shinto EGUCHI	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)

Research Ethics Review Committee (As of April 1, 2015)

Specialist on epidemiology and social research	Kazuo SEIYAMA	Professor, School of Sociology, Kwansei Gakuin University
Specialist on epidemiology and social research	Keiko SATO	Associate professor, Kyoto University Hospital, Institute for Advancement of Clinical and Translational Science Department of EBM Research
Specialist in the field of ethics and law	Hitomi NAKAYAMA	Lawyer, Kasumigaseki-Sogo Law Offices
Person in citizen's position	Yutaka KURIKI	Kindergarten Director and Elementary School Director, KEIMEI GAKUEN
Research education staff of ISM	Takashi NAKAMURA	Professor (Department of Data Science, ISM)
Research education staff of ISM	Koji KANEFUJI	Professor (Vice Director-General, ISM)
Research education staff of ISM	Tadahiko MAEDA	Associate Professor (Department of Data Science, ISM)
Research education staff of ISM	Ikuko FUNATOGAWA	Associate Professor (Department of Data Science, ISM)
Research education staff of ISM	Shuhei MANO	Associate Professor (Department of Mathematical Analysis and Statistical Inference, ISM)

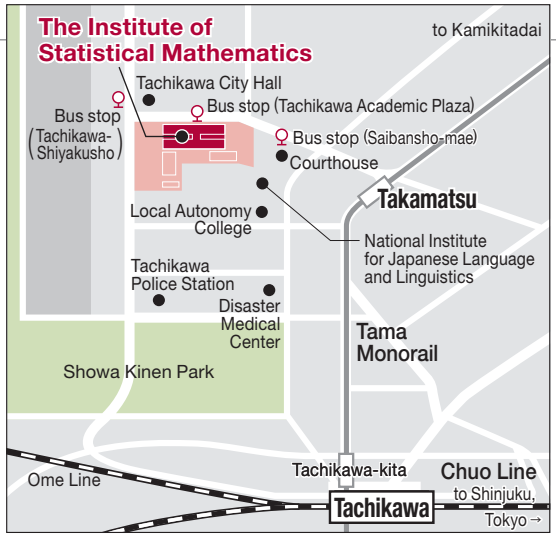
Professor Emeritus (As of April 1, 2015)

Kameo MATUSITA	Sigeki NISIHIRA	Tatsuzo SUZUKI
Giitiro SUZUKI	Ryoichi SHIMIZU	Noboru OHSUMI
Masakatsu MURAKAMI	Kunio TANABE	Tadashi MATSUNAWA
Masami HASEGAWA	Yoshiyuki SAKAMOTO	Takemi YANAGIMOTO
Yoshiaki ITOH	Yasumasa BABA	Katsuomi HIRANO
Masaharu TANEMURA	Makio ISHIGURO	Yosihiko OGATA

History

1944	June	Based on a proposal submitted at an academic study conference in December 1943, the organization was founded as an institute under the direct control of the Ministry of Education. This proposal aimed to provide supervision for studies looking into the mathematical principles of probability and their application, and was also intended to facilitate, unify and promote the publication of research results.
1947	April	The affiliated statistical specialists' school was opened.
	May	The Institute was divided into the 1st Research Dept. (fundamental theories), the 2nd Research Dept. (statistical theories for the natural sciences), and the 3rd Research Dept. (statistical theories for the social sciences).
1949	June	The Institute was placed under the control of the Ministry of Education because of the enforcement of the Ministry of Education Establishment Law.
1955	September	Reorganized into the 1st Research Dept. (fundamental theories), the 2nd Research Dept. (natural and social science theories), and the 3rd Research Dept. (operations, research, statistical analysis theories). The laboratory system, comprising 9 laboratories and the research guidance promotion room, was adopted.
1969	October	A new office building was constructed in Minato Ward.
1971	April	The 4th Research Dept. (informatics theories) was instituted.
1973	April	The 5th Research Dept. (prediction and control theories) was instituted.
1975	October	The 6th Research Dept. (statistical theories of human behavior) was instituted.
1979	November	The Information Research Building was constructed.
1985	April	Repositioned as a National Inter-University Research Institute due to the regulation change. The new mission includes providing facilities and skills to other universities, in addition to conducting cutting-edge research on statistical mathematics. Accordingly, the institute was reorganized into four basic research departments (Fundamental Statistical Theory, Statistical Methodology, Prediction & Control, and Interdisciplinary Statistics) and two strategic centers (Statistical Data Analysis Center and Statistical Education & Information Center). The Statistical Technical Training Center was terminated.
1988	October	The Dept. of Statistical Science was instituted in the School of Mathematical and Physical Science, part of the Graduate University for Advanced Studies (SOKENDAI).
1989	June	The Institute was reorganized as an Inter-University Research Institute based on the National School Establishment Law.
1993	April	The Planning Coordination Chief System was instituted.
1997	April	The affiliated Statistical Data Analysis Center was reorganized into the Center for Development of Statistical Computing, and the Statistical Education and Information Center was reorganized into the Center for Information on Statistical Sciences.
2003	September	The Prediction and Knowledge Discovery Research Center was instituted.
2004	April	The Institute was reorganized into the Institute of Statistical Mathematics, part of the Research Organization of Information and Systems of the Inter-University Research Institute based on the National University Corporation Law. The Planning Coordination Chief System was abolished and the position of Vice Director-General was instituted instead. The Dept. of Statistical Science in the School of Mathematical and Physical Science, SOKENDAI, was reorganized. In addition, the Dept. of Statistical Science and the School of Multidisciplinary Sciences were instituted.
2005	April	The research organization was reorganized into three research departments (the Department of Statistical Modeling, the Department of Data Science, and the Department of Mathematical Analysis and Statistical Inference). The affiliated Center for Development of Statistical Computing, the Center for Information on Statistical Sciences, and the Engineering and Technical Services Section were integrated into the Center for Engineering and Technical Support. The Risk Analysis Research Center was instituted.
2006	April	The Administration Planning Coordination Unit was instituted.
2008	April	The Research Innovation Center was instituted. The Administration Planning and Coordination Unit was reorganized into the Administration Planning and Coordination Section (hereafter APCS), within which the Intellectual Property Unit, the Evaluation Unit and the Information and Public Relations Unit were instituted.
2009	January	The Planning Unit was instituted within APCS.
	October	The Institute was moved to 10-3 Midori-cho, Tachikawa, Tokyo.
2010	June	Officially opened the Akaike Guest House.
	July	Reorganized the Administration Office to create the NIPR/ISM Joint Administration Office and launch the General Service Center. The NOE Forwarding Unit (now we call "NOE Promotion Unit") was instituted within APCS.
2011	January	Research and Development Center for Data Assimilation was instituted. Survey Science Center was instituted.
2012	January	Research Center for Statistical Machine Learning, Service Science Research Center and School of Statistical Thinking were instituted.
2014	July	The URA Station was instituted within the Planning Unit.
	December	The Office of Female Researcher Development was instituted within the Planning Unit.

The Institute of Statistical Mathematics



Access to the ISM

◎ Tama Monorail
— 10 min walk from Takamatsu Sta.

◎ Tachikawa Bus
— Tachikawa Academic Plaza bus stop
— 5 min walk from Saibansho-mae or Tachikawa-Shiyakusho bus stop

Research Organization of Information and Systems
The Institute of Statistical Mathematics
10-3 Midori-cho, Tachikawa, Tokyo 190-8562, Japan
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http://www.ism.ac.jp/