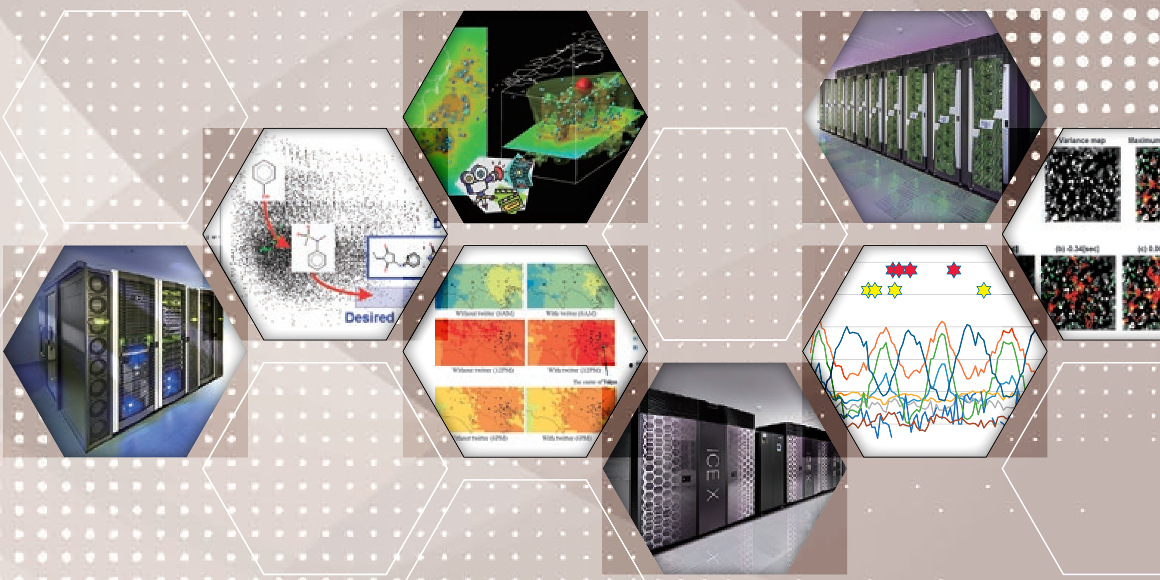
Research Organization of Information and Systems

The Institute of Statistical Mathematics

2016-2017

ISM



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Message from Director-General

The previous fiscal year was one in which the subject of artificial intelligence (AI) created media headlines seemingly every day. In particular, the victory of the Google-developed AlphaGo AI system over an international Go master brought news of rapid progress in AI technology to the general public in a way that was particularly easy to understand. Of course, it was already some 20 years ago, in 1997, that an international chess grandmaster was defeated by the Deep Blue system developed by IBM. The dramatic transformation of the AI environment over the ensuing years can be attributed above all to one single factor: the explosive growth of data. For example, whereas the quantity of genomic sequence data that can be read in one second has increased roughly a millionfold over this interval, the speed of computation — as characterized by Moore's law, the empirical formula describing the evolution of computer performance — has grown "only" by a factor on the order of ten thousand. This *data explosion* is the true breakthrough enabling modern AI technology.

The impact of AI is evident across a vast range of the modern world — from our daily lives in the world around us, to an industrial restructuring that might be termed a fourth industrial revolution, as well as to the front lines of research and development in science and technology — and strategies for making effective, timely, and appropriate use of rapidly growing quantities of data will be the keys to success in the global society of the future. The subject of machine learning, which is responsible for the core functionality of AI systems, shares many aspects of its conceptual structure and theoretical foundations with statistical mathematics. For this reason, four years ago the Institute of Statistical Mathematics (ISM) created the Research Center for Statistical Machine Learning, which quickly began making contributions to relevant fields. This Center is one of five centers promoting the NOE (Network Of Excellence) Project. Moreover, because Japan faces an overwhelming shortage of domestic data-handling professionals, the School of Statistical Thinking was established around the same time as the Center; the establishment of this School demonstrates our focus on training new generations of data scientists by promoting the Project for Fostering and Promoting Statistical Thinking.

During the period covered by the Second Midterm Goals and Plans, which ended in March 2016, we are proud to say that, supported by the dual pillars of our NOE Project and the Project for Fostering and Promoting Statistical Thinking, we accomplished our Second Midterm Goals and more: designing a research network, training young personnel via OJT, advancing the Project for Fostering and Promoting Statistical Thinking, and providing resources for updated and new supercomputers and High Performance Computing Infrastructure (HPCI), among other accomplishments. Moreover, the previous fiscal year was one that witnessed a further entrenchment of our industry/government/academia collaborations. We completed an agreement with Tachikawa City concerning collaboration and cooperation, and participated in the Tachikawa Residents Survey; by assisting with events sponsored by the city, we were able to contribute to the region and to enhance our collaborative relationship with it. In April 2016, the ISM officially entered the period covered by the Third Midterm Goals and Plans. In addition to fostering research activities that encompass both pure and applied work while maintaining a keen awareness of connections to the real world, our objectives include sharing the fruits of our research with industrial, governmental, and academic institutions, as well as local communities throughout Japan, and strengthening the functionality of institutions.

One sometimes comes across news stories rosily predicting that AI will soon solve all societal problems, but the methodology and techniques of today's AI will never lead to solutions for some difficult social problems, such as predicting natural disasters and other massive risk incidents, supporting mental-health care, and offering real, not just virtual, replacements for the knowledge and skill of seasoned professionals in complicated manufacturing processes. We are dedicated wholeheartedly to building a laboratory — based on the foundation of "intelligence" at which statistical mathematics excels, including prediction, discovery, optimization, and control — to meet the needs of academia and society. We ask for a continuation of the support and understanding you have shown the ISM, and, more than ever, for your valuable advice and guidance as we proceed with this endeavor.

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 for 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, and 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 design 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.

Biosignal Processing and Biosystem Modeling Based on Statistical Analysis

Visualization of neuronal and astrocytic activity, and investigation of the functional connectivity among them

Spontaneous rhythmic synchronization of neuron and astrocyte are fundamental brain function for information transfer in the brain. Rhythmic respiratory activity in the brain stem is one of the notable synchronization phenomenon which is worth investigating the synchronization mechanism in the brain. The imaging technique provides rich information on neural and astrocytic activities with large size data sets. However, there is a need for the development of attentive and qualitative analysis methods to distinguish neurons, inspiratory neurons and astrocytes. In this study, we are aiming to develop algorithms to extract the regions of excitatory neurons, inspiratory neurons and astrocytes in the imaging data and statistical method to quantify correlation and causality among them. So far we developed a visualization strategy to distinguish inspiratory neurons and astrocyte using statistical mapping methods (Fig.1).

(Joint research with Hyogo Medical College, Japan, Göttingen University, Germany and Kiel University, Germany)

Development of a robust and simple brain function examination method for iterative measurement

The brain signals during cognitive or occupational tasks have to be iteratively measured to evaluate the recovering process of the cognitive function of the patients with depression before and after medication and occupation therapy. There is a problem, however, that the effect of cure for brain cognitive function cannot always be appropriately diagnosed because of the suppression effect resulted from the acclimatization to repeated presentation of task. In this research, we are aiming to develop a robust and simple brain function examination method against acclimatization to repeated stimulation and effective statistical analysis for detecting brain signals. We have been recording cerebral blood flow using wearable near infrared spectroscopy (NIRS) system during occupation therapy for the patients with depression and pursuing spatio-temporal analysis of the data.

(Joint research with Gunma University, Japan)

Prediction and modeling of prognosis of acute myelogenous leukemia

This project aims to construct an intercellular network model of pathogenesis and its transition of acute myelogenous leukemia based on system theoretical approach, which enable us to interpret known prognostic factor result from inter cellar interaction and predict the effect of chemotherapy and immunotherapy. Currently we are studying a prediction method of the distribution of parameters, such as velocity coefficient, in the differential equation model derived from the assumption that normal T cells increase the number of leukemia cells as positive feedback. For the sake of this purpose, we employ the temporally changing data of the number of normal leukocytes and leukemia cells which was acquired from the patients receiving induction chemotherapy.

(Joint research with Kanazawa University, Japan)

Fumikazu Miwakeichi

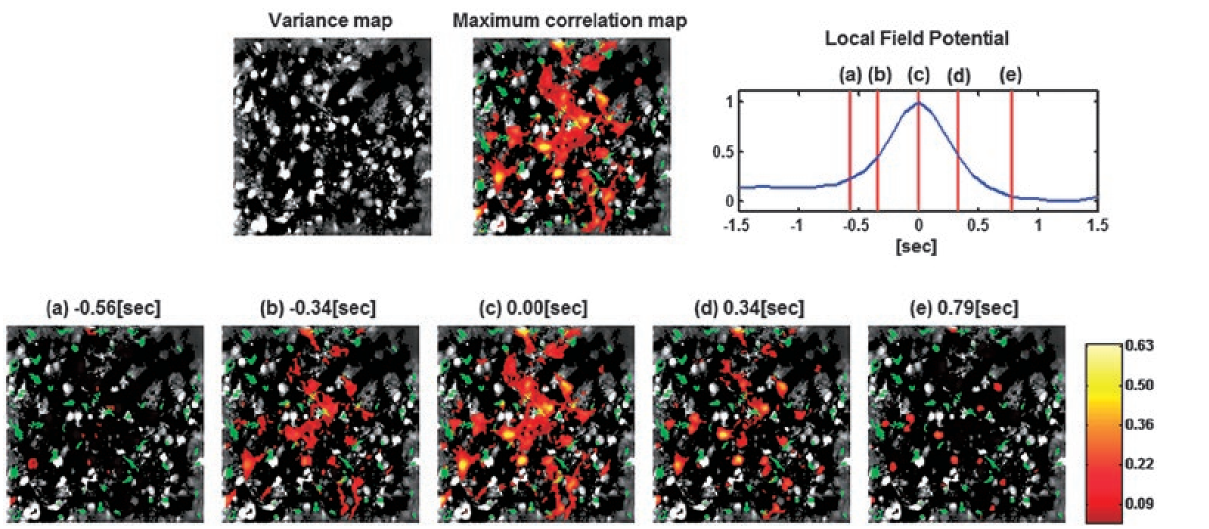


Figure 1: Uniformized variance map of original imaging data (upper left panel). Maximal correlation map and binary RFP image (upper middle paned). The averaged waveform of the inspiratory burst and time points of the representative time frame (upper right panel). Four representative time frames of time-lagged correlation maps (lower panels, thresholded at p=0.05 corrected by Bonferroni method).

Statistical Analysis of Ancient DNA and the History of Life Diversity

Inferring the molecular phylogenies using the maximum likelihood method from DNA of extant species, you can statistically analyze the biological diversity among species. You can also evaluate the biological diversity within species by comparing the orthologous DNA. However, it was not possible to analyze the evolution of the past of biodiversity, including the extinct organisms defunct. In recent years, how to technology and analyzes the data to extract the DNA from such teeth and bones of extinct animals was developed. Analysis of ancient DNA is becoming possible with the current. We statistically analyzed the evolution of the diversity of life.

Analysis of ancient DNA has been difficult

The DNA preservation state of the body is highly dependent on temperature, humidity and the hydrogen ion concentration of the environment. Therefore, ancient DNA research has been mainly deployed in bodies (Mammoth, Neanderthal, etc.) derived from the high latitudes of the low temperature and dry environment. However, in order to study the extinction of biota by humans, it is extremely important to analyze the biota derived from the warm and humid regions. This environment is bad for the preservation of DNA. The amount of DNA is reduced, also fragmented. Studies using this sample are extremely difficult. In addition, the Japanese archipelago is acidic deposition layer by active volcanic activity, research is a very difficult situation.

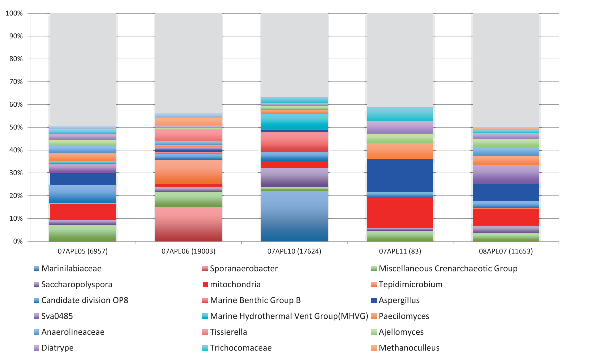


Figure 1: A variety of species groups included in the DNA of fossil samples. Most of the DNA sequences are derived from the contamination of the environment microbes.

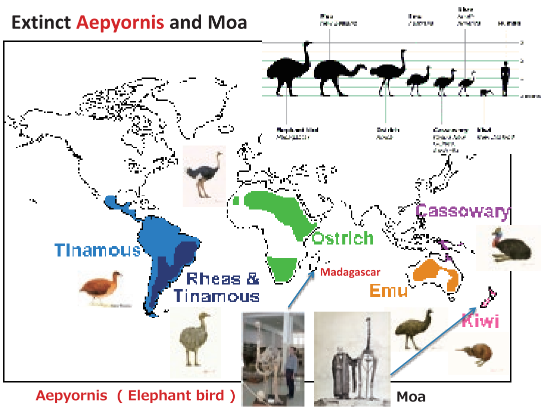


Figure 2: Distribution of ratites. Extinct Aepyornis of Madagascar (Elephant bird) and Moa of New Zealand.

Prevent contamination and discriminant analysis

Analysis of ancient samples is also in the fight against contamination. DNA from ancient organisms is in a poor state of preservation. When you amplify the DNA, another DNA of microbes attached to the sample would be amplified more than that. Further the other DNA of environmental microbes of the laboratory would be amplified more than that too. You must have a technique used to minimize the contamination is. Then, from a large number of the sequences read by the sequencer, to determine the original DNA and another DNA of microbes, the development of statistical methods for more split were important. In this way, we will be able to analyze the biological diversity from a large base sequence derived from ancient organisms.

Phylogenetic analysis of extinct Aepyornis

It was successful in large-scale sequencing at the genomic level of Aepyornis (Elephant bird) of Madagascar under the tropical environment. A comparison of the DNA sequence of the ratites (flightless birds) and other birds, we were able to estimate the branch age and stable phylogeny. This ratites became clear that to maintain monophyly. Aepyornis was found to be most closely related to the kiwi which is small ratites that live in New Zealand. Based on this phylogeny with time axis, it was statistical analysis of morphological data of extant and fossil birds. As a result, we were able to obtain new knowledge about the change of body size and the reproductive strategies that occurred in the course of evolution.

Jun Adachi

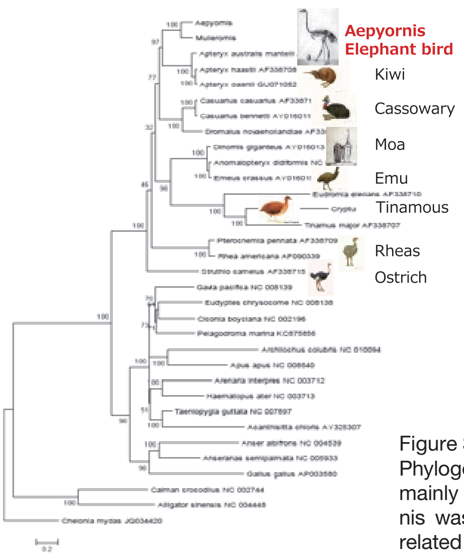


Figure 3: Phylogenetic tree of birds, mainly the ratites. Aepyornis was the most closely related to Kiwi.

Statistical Inference for Stochastic Processes and High-frequency Financial Data Analysis

High-frequency financial data analysis

Statistical analysis with stock price data is one of the most significant studies to forecast and control risks of financial assets. Daily stock price data was usually used for this purpose. On the other hand, there are many studies of statistical analysis of high-frequency financial data such as all intra-day transactions data, as it is getting more available. Such data has second or millisecond time stamps, and therefore it has much more information compared to daily data. High-frequency financial data is modeled by stochastic processes and we can specify risk measures of stocks by using statistical inference theory of stochastic processes.

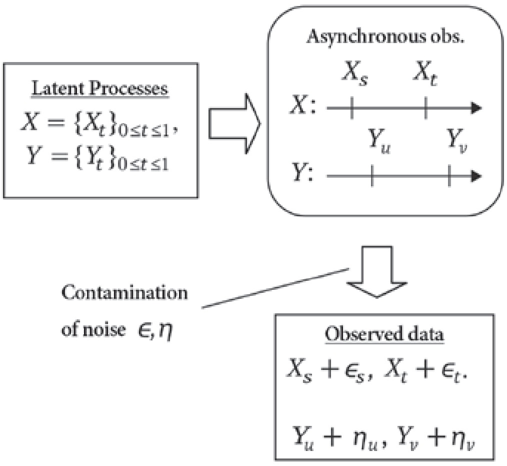


Figure 1: We need a new statistical method to deal with problems of noise and asynchronous observations.

Specific problems of high-frequency financial data

Though the study of statistical inference of stochastic processes has long history, we need recent advanced theories like limit theorems of non-ergodic stochastic processes, to construct models of high-frequency financial data. Moreover, the following two problems of high-frequency data observations make statistical analysis more difficult. The first one is that some empirical facts suggest the existence of additional noise when we model high-frequency data by stochastic processes. The second one is that we observe stock prices when transactions occur. So observation times must be different for different stocks. This makes difficult to estimate covariance and correlation of stocks. To solve these two problems of observations, we need a new statistical method.

Statistical analysis with stock limit order books

We study not only stock transactions data but also limit order book data which is aggregation of sell and buy limit orders of each investor. By analyzing these data, we expect to be able to capture microstructure of stock market more precisely, and be able to model transaction costs. We model limit order books by self-exciting point processes. Such point processes are well studied in the study of earthquake. So collaboration between other departments is expected to develop further studies of limit order books.

Teppei Ogihara

ask	price	bid	ask	price	bid
583	10280			10180	178
582	10270			10170	913
642	10260			10160	881
757	10250			10150	772
685	10240			10140	795
769	10230			10130	843
742	10220			10120	1017
829	10210			10110	679
887	10200			10100	649
1564	10190			10090	580

Figure 2: An example of stock limit order books. ‘ask’ is the total amount of present sell orders for each prices. ‘bid’ is the total amount of buy orders.

Stochastic Modeling and Probability Forecasting of Seismicity

Probability forecasting of seismicity

Underground faults and stress fields that act on earthquake faults can hardly be observed directly. Forecasting earthquakes are challenging due to the complexity of the heterogeneity tectonic environments from place to place. However, earthquake occurrence is not completely random, and probability forecast is still possible. The space-time ETAS model, which forecasts future earthquake probability based on past seismicity, has been recognized by worldwide researchers as a standard statistical model for seismicity. Especially for an earthquake prone country like Japan, this model is important in earthquake hazard mitigation. We are developing practicable forecasting system based on the ETAS model for the purpose of earthquake hazard mitigation. For example, we are realizing the real-time probability aftershock forecasts immediately after the main shock (Fig.1).

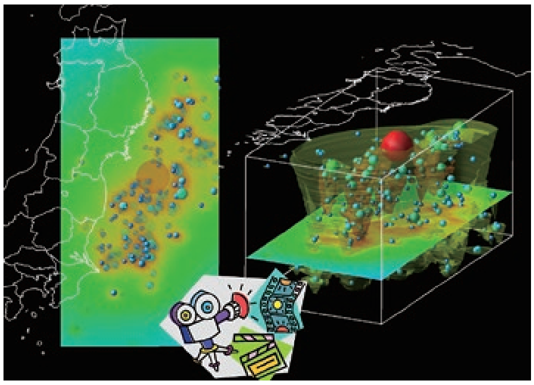


Figure 1: Retrospectively forecasted seismicity before and after the 2011-3-11 M9.0 Tohoku earthquake.

Improving seismicity modeling

In order to improve the forecasting performance and to develop better models for analyzing seismicity, we are working on the development of seismicity models in the following aspects:

(a) Location dependent space-time model for wild and global seismicity. The triggering behaviors between earthquakes vary from place to place, due to different regional and physical characteristics of the earth crust. These differences can be implied by the spatial variation of the ETAS model parameters and can be evaluated by a Bayesian method with smoothness priors are employed on the model parameters or by the maximum weighted likelihood estimates (Fig.2).

(b) High resolution 3D modeling. Incorporating hypocenter depths into seismicity modeling provides the potential for forecasting seismicity with higher resolution and gives better seismic hazard estimation than those of 2D modeling.

(c) Incorporating with more detailed earthquake information, including fault geometry and focal mechanisms. For example, the earthquake rupture geometry is incorporated in the ETAS model. By this newly extended model together with the stochastic reconstruction method, we can make inversion of the earthquake rupture geometry through seismicity (Fig.3).

(d) Incorporating with more relevant geophysical observations. With rapid development of observation technologies, more and more observational data are accumulated. The improvement moves beyond using only observed seismicity, and attempts to find correlations between seismicity and precursory non-seismic observations, including crustal deformation, underground water level, gravity, etc., with a potential outcome of improved earthquake forecasting models. For example, we have found that background seismicity rate of the ETAS model for the swarm activities in the Izu volcanic region is systematically synchronized with the volumetric strain changes recorded at a nearby observatory.

Jiancang Zhuang

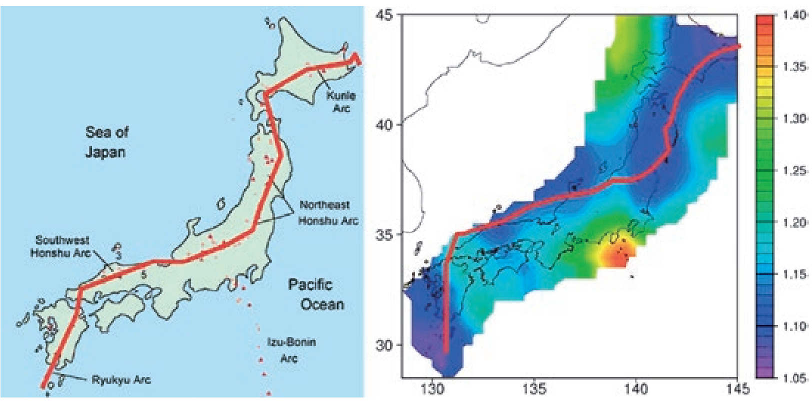


Figure 2: Spatial variation of the *p*-values of the ETAS model (left panel) and distribution map of the volcanic arcs in Japan (right panel).

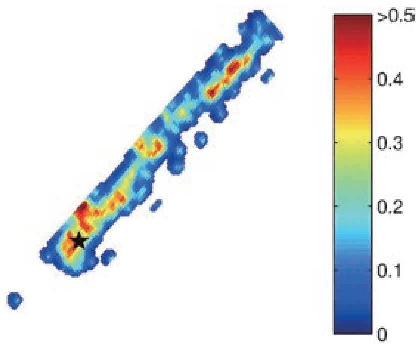


Figure 3: Earthquake rupture inverted based on triggered seismicity. Red color represents that more earthquakes are directly triggered by the main shock.

Towards Data-driven Materials Discovery

With state-of-the art technologies in data science, we aim to discover novel functional materials. Target materials include drugs, dyes, solvents, polymers, polymeric composites, nanostructured materials. With the comprehensive technologies of machine learning, such as Bayesian modeling, kernel methods, natural language processing, sparse learning, optimization theory, we create the fundamental methodology and research infrastructures of Materials Informatics.

■ Materials Research by Information Integration Initiative (MI²I)

Materials Informatics is an emerging cross-disciplinary field aimed at combining materials science and data science. The Materials Genome Initiative (MGI), announced by President Obama in 2011, was designed to create infrastructures that accelerate the pace of discovery and deployment of new materials for innovative products twice as fast. The MGI white paper has stated Materials Informatics as the key to achieving dramatic rationalization of time and costs in developments. In Japan, the Japan Science and Technology Agency (JST) launched the Materials Research by Information Integration Initiative (MI²I) at National Institute for Materials Science (NIMS) in 2015. The Institute of Statistical Mathematics has been designated to be a recommitment site of MI²I as the central institute of data science in Japan.

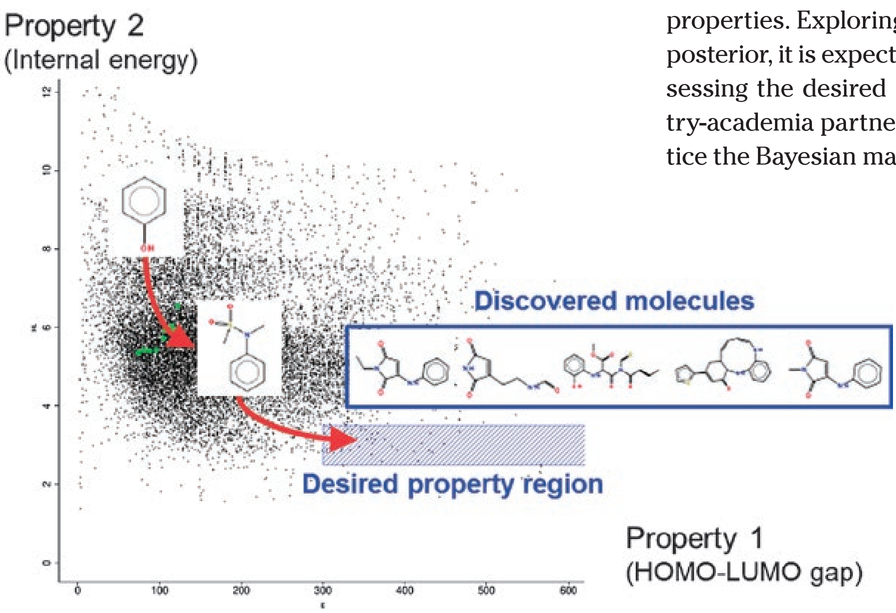


Figure 1:
Snapshot of altered molecular structures through Bayesian molecular design calculation.

■ Role of data science in material discovery and development

The design space of materials developments is considerably high-dimensional. For instance, the chemical space of organic compounds consists of 10^{60} potential candidates. The challenge is to discover novel and promising materials from the huge space that exhibit desirable material properties. In the traditional procedure, computational chemistry methods, such as the first principles calculation, have been put at the central analytic tool. Scientists hypothesize material structures based on experience and intuition, and properties of the designed materials are assessed computationally and experimentally. The data-centric approach has been paid much attention as a promising alternative that can promote enormous savings on time and costs in the laborious and time-consuming trial-and-error procedure.

■ Bayesian approach to data-driven materials discovery

One of our research goals is to create a novel material design method by the integration of machine learning and quantum chemistry calculation. The method begins by obtaining a set of machine learning models to forwardly predict properties of input material structures for multiple design objectives. These models are inverted to the backward model through Bayes' law. Then we have a posterior probability distribution which is conditioned by desired properties. Exploring high probability regions of the posterior, it is expected to identify new materials possessing the desired target properties. Under industry-academia partnerships, we are putting into practice the Bayesian material design method.

Ryo Yoshida

Survey Science Center

Research on Survey Methodology and Planning of Cooperative Training Survey

Process of social survey and research on survey methodology

The Institute of Statistical Mathematics (ISM) has been conducting many social surveys for more than sixty years. One purpose of these surveys is to study public opinions in Japan. Another important purpose is to study survey methodology.

Social surveys mainly consist of two processes, as is depicted in Fig.1. One is the process of sampling (right hand side), and the other is the process of measurement (left hand side), Each step in Fig.1 has its own theme to be studied.

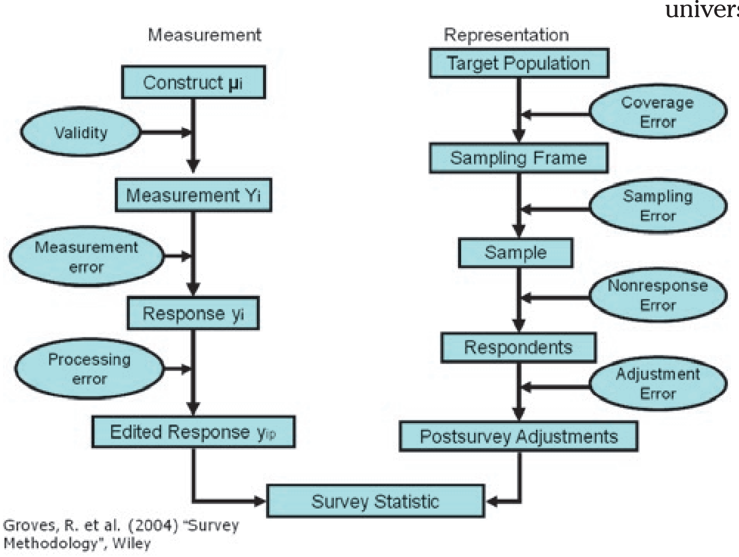


Figure 1: Process of social survey and subject of research on survey methodology.

Figure 2: CAPI system used in SSP2015 Survey. Two tablets for interviewer and respondent were used. For the first time in Japan, nationwide survey was administered by this mode.

Practice of survey research by ISM

Formerly ISM's surveys were administered by ourselves with the support from many universities, employing students as par-time interviewers. But this tradition has been lost since 1990's, entrusting most of the survey operation to survey company. Worsening survey circumstances did not allow us to carry out our survey with non-professional interviewers. This also means that we have gradually lost opportunities for research on survey methodology.

Planning of collaborative training survey

More recently, social science departments of many universities have undergone curriculum reformation which places more emphasis on survey practice. In line with this trend, Survey Science Center (SSC) decided to administer what we call "Collaborative Training Survey" under close cooperation with university departments, in which we offer faculty members and students opportunities to participate in real-life surveys.

For example, we conducted a nationwide "SSP-I Survey" in 2010 with Osaka University. In 2011 and 2014, ISM and National Institute for Japanese Language and Linguistics carried out a language survey in Tsuruoka City in Yamagata Prefecture, which has been a cooperative project of the both institute since 1950. In 2015 visiting professor Toru Kikkawa of SSC and myself developed a new-type CAPI (Computer Assisted Personal Interview; See Fig.2) system and utilized it in a nationwide survey called "2015 Survey on Stratification and Social Psychology" (SSP2015 Survey). Students and young researchers from several universities as well as members of SSC participated in these surveys.

Future plan

We are planning to continue this survey practice for the coming years, with the support of visiting professors from outside the institute. The goal of this activity is to broaden the basis of research on survey methodology by fostering more survey professionals.

Tadahiko Maeda

Urban Temperature Analysis Using Participatory Sensing Data "Tweets" — Toward Improvement of Urban Intelligence —

Recently global warming amplifies the risk factors for extreme weather event. The problem of urban heat-waves becomes serious. In order to deal with the problem, it is first important to accurately capture urban temperatures. Although urban temperatures are periodically observed in several monitoring stations, the stations are sparsely distributed and the time interval is coarse. In this study, we investigated a method of interpolating urban temperatures observed sparsely by utilizing "heat-tweets" which are densely tweeted in urban areas and include words related to heat.

Dependence between heat-tweets and temperature observations

Here we studied dependence between heat-tweets and temperature observations at the monitoring stations by using a copula model and confirmed the usability of heat-tweets for temperature interpolation. The intensity of each heat-tweet is estimated by using a generalized additive model and a logistic model with some additional information such as distances from main stations, park and river, daytime and nighttime population densities and land-use categories. Table 1 lists lower and upper tail dependences between temperature/change in temperature and heat-tweet intensity. The upper tail corresponds to the case in which the temperature is high, the change in temperature is large and the heat-tweet intensity is high and the lower tail corresponds to the opposite case. It is generally considered that the heat-tweet intensity is high when the temperature is high. However, we found that in the upper tail where heat waves were serious, the change in temperature is especially related to the heat-tweets.

	Lower tail	Upper tail
Temperature	0.40	0.00
Change in temperature	0.20	0.23

Table 1: Dependence between temperature/change in temperature and heat-tweets.

Interpolation of temperatures using S-BLUE

We used S-BLUE (spatial best linear unbiased estimation) framework to combine temperature data and heat-tweets and reconstruct an efficient spatial-temporal temperature field for intra-urban resolutions. The framework involves Gaussian process and non-linear influence on temperature data and heat-tweets is well modeled. Figure 2 shows the interpolated temperatures using S-BLUE. It is shown that densely distributed heat-tweets in the central area successfully capture temperature-related information that could not be captured by monitored temperatures.

Research Center for Statistical Machine Learning
Urban Intelligence Research Project
Tomoko Matsui

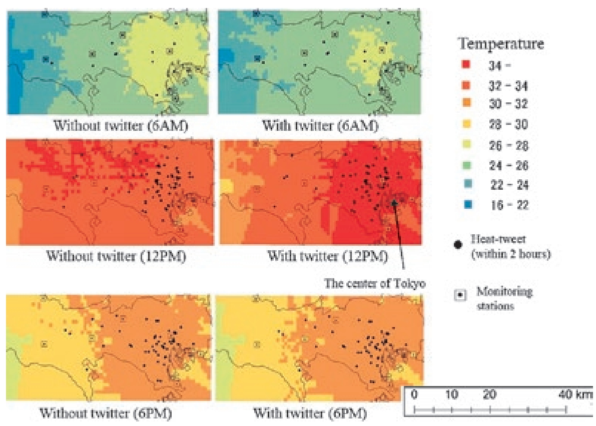


Figure 2: Interpolated temperatures at 06:00, 12:00, and 18:00 on August 25, 2012 using S-BLUE with (right) and without (left) heat-tweets.

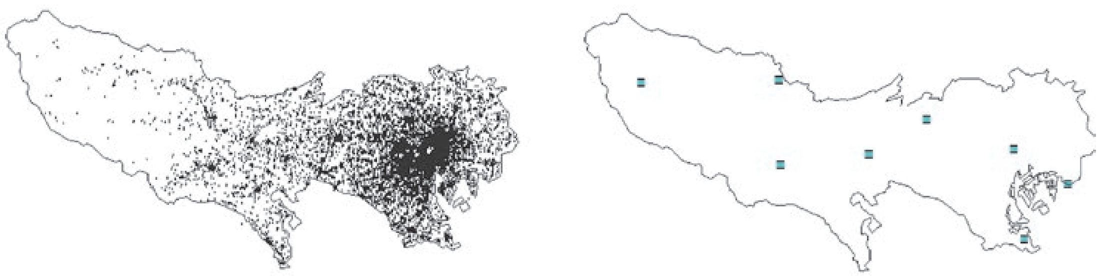


Figure 1: Tweets in August, 2012 in Tokyo (left) and JMA monitoring stations (right).

* This work is collaboratively conducted with Dr. Yoshiki Yamagata, Dr. Daisuke Murakami (NIES) and Dr. Gareth W. Peters (UCL).

Machine Failure Prediction Based on Big Data

Sensor networks are being introduced into the manufacturing industry, often referred to as *Industrie 4.0* or *IoT (Internet of Things)*. Sensor-generated data are analyzed using the big data technologies and provide opportunities for new applications such as production automation, yield optimization, and failure analysis. The Service Science Research Center at ISM is collaborating with a manufacturing company and trying to apply statistical tools to machine failure prediction and spare part logistics optimization based on the prediction. Following the best practices of data analytics in industries, we apply the framework of *descriptive, predictive,* and *prescriptive* data analytics.

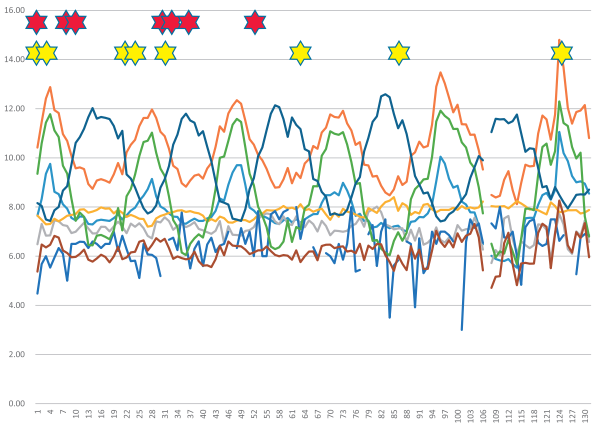


Figure 1: Sensor data and failure event for a particular unit.

Summary

Field	Feature	v1	v2
data	c104	0.673862	-0.673862
data	c057	0.671868	-0.671868
data	c072	0.569770	-0.569770
data	c090	0.500268	-0.500268
data	c099	0.474981	-0.474981
data	c061	0.378716	-0.378716
data	c103	0.353483	-0.353483
data	c045	0.302954	-0.302954
data	c047	0.302954	-0.302954
data	null	0.293912	0.384721
data	c029	0.293763	-0.293763
data	c058	0.284123	-0.284123
data	c012	0.280445	-0.280445

Figure 2: Prediction model based on machine learning.

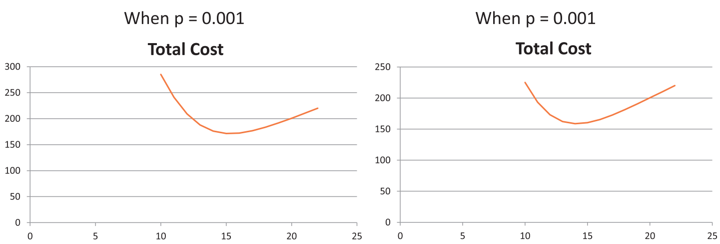


Figure 3: Optimization of part logistics.

Descriptive data analytics

Descriptive data analytics is to explain what happened in the past from observed sensor data. Primary tools for descriptive data analytics include visualization, clustering, and data mining. Figure 1 plots sensor data (colored lines) over a time period and failure events (yellow stars for minor failures and red ones for severe failures) for a specific machine unit. Similar plots can be drawn for different units. Looking at these data, we can build a hypothesis that certain sensor data may be capable of predicting future failure events.

Predictive data analytics

Predictive data analytics is to build a mathematical model that predicts future events based on the available data. Figure 2 shows machine learning results using sensor data of a few days prior to a predicted failure. The bar graphs represent the contributions of the sensors for this prediction.

Prescriptive data analytics

Good prediction alone does not automatically produce good business results. Prediction must be translated into business decisions. Prescriptive data analytics is to help business decisions to maximize the utility (such as profit), often by applying optimization technologies. In our case, the prediction model can be used for optimize spare parts allocation across multiple depots so that necessary parts are available when a failure occurs. The utility function is the sum of the benefit of cost reduction because of the parts availability and the additional cost because of the misprediction. Figure 3 shows how prediction accuracy affects the optimum stock of parts based on this model.

Through the project, we learned that (1) data preparation takes a large amount of time, and (2) the three phases of data analytics are not always staged, but more short cycles of these three aspects of data analytics need to be repeated over the period of the project. This project has been conducted as a Research Collaboration Start-up Program of the Project for Fostering and Promoting Statistical Thinking.

Hiroshi Maruyama

NOE (Network Of Excellence) Project

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

Research and Educational Activities as a Biaxial Structure

The Institute of Statistical Mathematics (ISM) pursues research and education along the two lines of basic research, and 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 tenure research staff in ISM 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 ISM, project professors/researchers (post-doctoral 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 up the School of Statistical Thinking as a school for professional development, which also serves multiple programs of the project for fostering and promoting statistical thinking. In the 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, was well as various other 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".

NOE (Network Of Excellence) Project

In accordance with the second medium-term plan of Research Organization of Information and Systems (ROIS), ISM's parent organization, ISM had set as a goal the establishment of NOEs (Networks Of Excellence) in statistical mathematics. With the formation of an NOE in each of five research fields — "Risk Research", "Next-Generation Simulation", "Survey Science", "Statistical Machine Learning", and "Service Science" — we have been conducting joint research activities that serve to deepen collaborative relationships with other institutes, both within Japan and overseas, for these last six years. The aim of this proj-

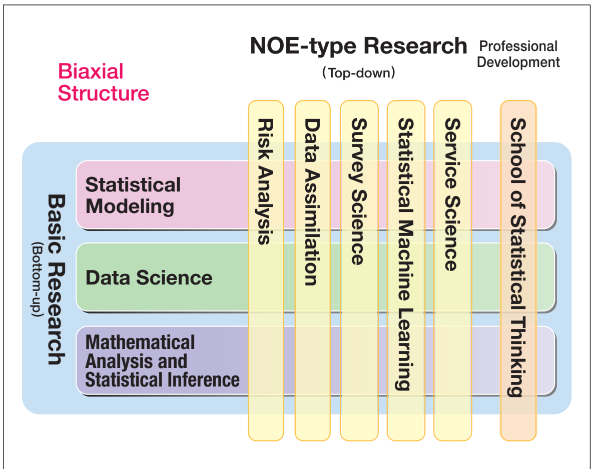


Figure 1: Biaxial structure for research and education

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
Special Advisor, 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, 2016)

ect 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 the NOE Promotion Unit, under the unified project guidelines decided by the Managing Committee of NOE Project. At the same time, advice is also taken from the members of the Advisory Board of NOE Project (see Table 1), made up of experts from the industrial, academic, and government sectors.

Future Conception of NOE Activities

The NOE Project, which is made possible by ISM’s special 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. ISM decided to continue to promote this NOE Project during the third medium-term plan of ROIS, which has gone into effect as of April 2016.

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 the number of MOUs is increasing year by year, including MOUs which transit multiple NOE research fields. The goal of ISM is general research in statistical mathematics, which is in demand by various research fields, both in the humanities and science. ISM has to respond flexibly to requests from each community and contribute to them. ISM plans to reorganize its research structure and projects. With its’ focus on methodology, ISM continues to plan research in each of the five NOE research fields. Furthermore, with all research activities concentrated under the umbrella of the 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 the present state of the NOE Project. For more up-to-date information, please visit the website.

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

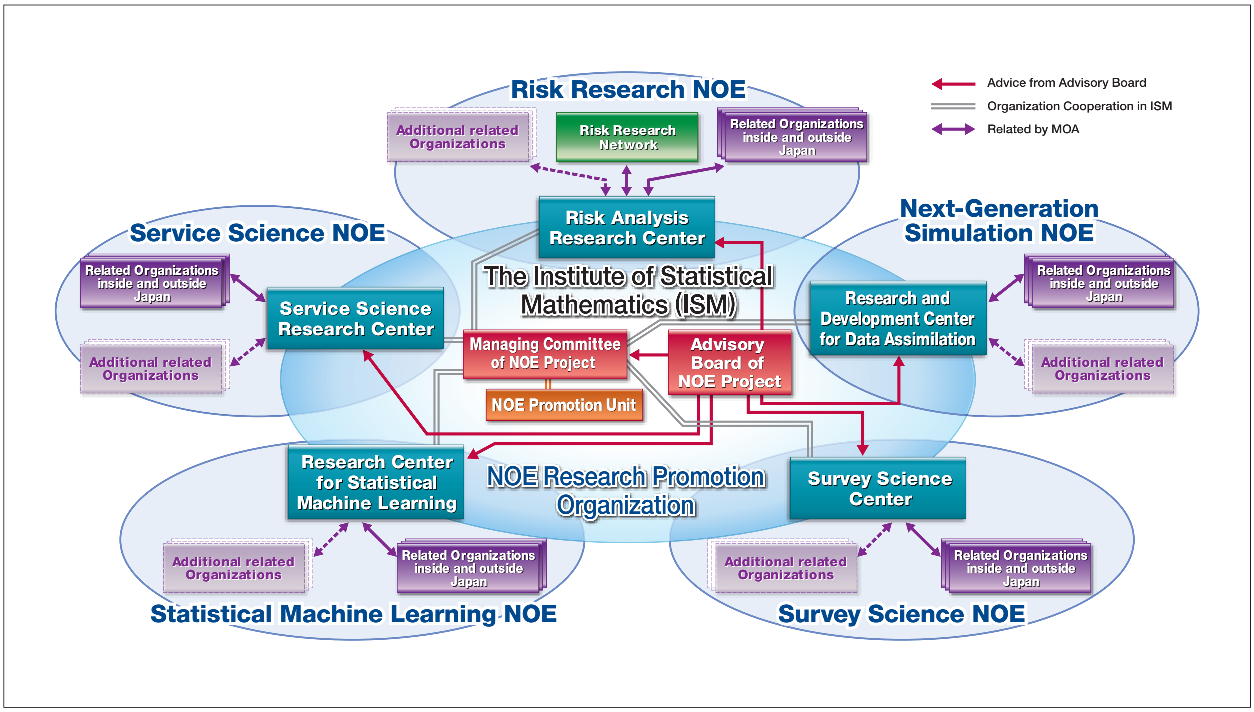


Figure 2: Relationship diagram of NOE (Network Of Excellence)

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 already been providing a consultation service for statistical science, but 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 non-experts. Expert statisticians affiliated with the Institute give them advice on statistical modeling, data analysis, and research. Some cases have developed 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 members of public organizations, university professors, or students. The Institute accepts about 40 cases annually, some of which benefit society in diverse ways.

Open-type Professional Development Program

This is a spin-out program from ISM cooperative research projects. Establishing a goal is an indispensable element of the proposal of a cooperative research project. On the other hand, such goal setting is irrelevant for a summer school program, study session, or retreat. Since the launch of the School of Statistical Thinking, organizers of such group-oriented study programs can apply to the Open-type Professional Development Program. There are two categories under this program: one is 'workshop' and the other is 'intensive training for young researchers'. For FY 2016, five workshops have been accepted 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/

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 2015 academic year, 14 courses were held and the number of participants was 911. The total number of courses held from 1969 to March, 2016 was 335, with a total of 23,957 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

Innovations in Our Data Science Program and Business-Academia Collaboration

Data Analysis Hackathon

A hackathon is an event where computer programmers and others involved in software development collaborate intensively on software projects. When the projects are data analysis tasks, it is often called a 'data science hackathon' or a 'data analysis hackathon'. ISM hosted a data analysis hackathon in February 2016. Each team consisted of three students, and six teams from five universities participated in this competition. Thanks to a certain entertainment company, about 10 million customer purchase records were available, along with some individual attributes of the customers. Each team was allowed access to a virtual machine prepared in the ISM's on-premise cloud system. Highly proprietary data and essential programming tools were all installed on each cloud instance. After a two-day workout, all teams proposed their new business plans to promote sales in a final presentation session.

Hackathon participants working on data analysis

Virtual machines prepared on the Communal Cloud Computing System

Data Science Research Plaza

Researchers funded by private-sector firms can maintain a desk and phone in the School of Statistical Thinking. This program is subject to fees, and the contract can be renewed annually. Supercomputer access is available to them as long as they submit their proposals to High Performance Computing Infrastructure; see the web site below. A faculty mentor gives advice to the accepted funded researcher so that he or she can freely attend various events, such as seminars, workshops, conferences, and extension courses. After learning the expertise of the ISM research staff, participants in this program are invited to take advantage of paid consultants and funded research collaboration. (http://www.hpci-office.jp/folders/english)

Big Data Innovation Laboratory

In August 2015, ISM together with SAS Institute Japan launched Big Data Innovation Laboratory. This laboratory — actually, it is a service — provides a practice field for big data handling with companies, governmental agencies, and public service organizations. Participants are allowed to use a virtual computer prepared in ISM's on-premise cloud system, where SAS is already installed. Using Hadoop from SAS lowers the hurdle of manipulating the distributed storage middleware for massive data. While they are engaged in hands-on activities, they will develop skills for handling big data. Namely, this is yet another program to increase the number of data scientists. After the trial use, users faced with big data can judge whether or not they should go ahead with investment plans for an information system.

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

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. The program was started as a five-year project and commissioned to The Institute of Statistical Mathematics. The Institute currently manages the following activities along main themes decided by the steering committee under the Program with the aid of nine cooperating institutions.

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 various scientific fields and industries 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 2015, the Program conducted 18 workshops and 5 study groups focusing on various areas.

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 produced a proposal for collaborations between mathematical science and life science. We also began to organize a community in which all researchers can easily access activities not only of mathematicians but also of material scientists, so that research via collaborations between mathematics and materials science can be promoted. In fiscal year 2015, we have also supported a tutorial seminar organized by National Institute of Materials Science. Many people, among them many researchers from various industries participated in this seminar.

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, 2015), 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 among researchers in mathematics and those in 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.

Panel discussion in Science Agora

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
Forest Inventory and Planning Institute of Vietnam	Vietnam (Hanoi)	June 2, 2015
Zuse Institute Berlin	Germany (Berlin)	June 20, 2016
The University of Porto	Portugal (Porto)	June 22, 2016

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

2010	2011	2012	2013	2014	2015
135	172	182	181	177	183

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

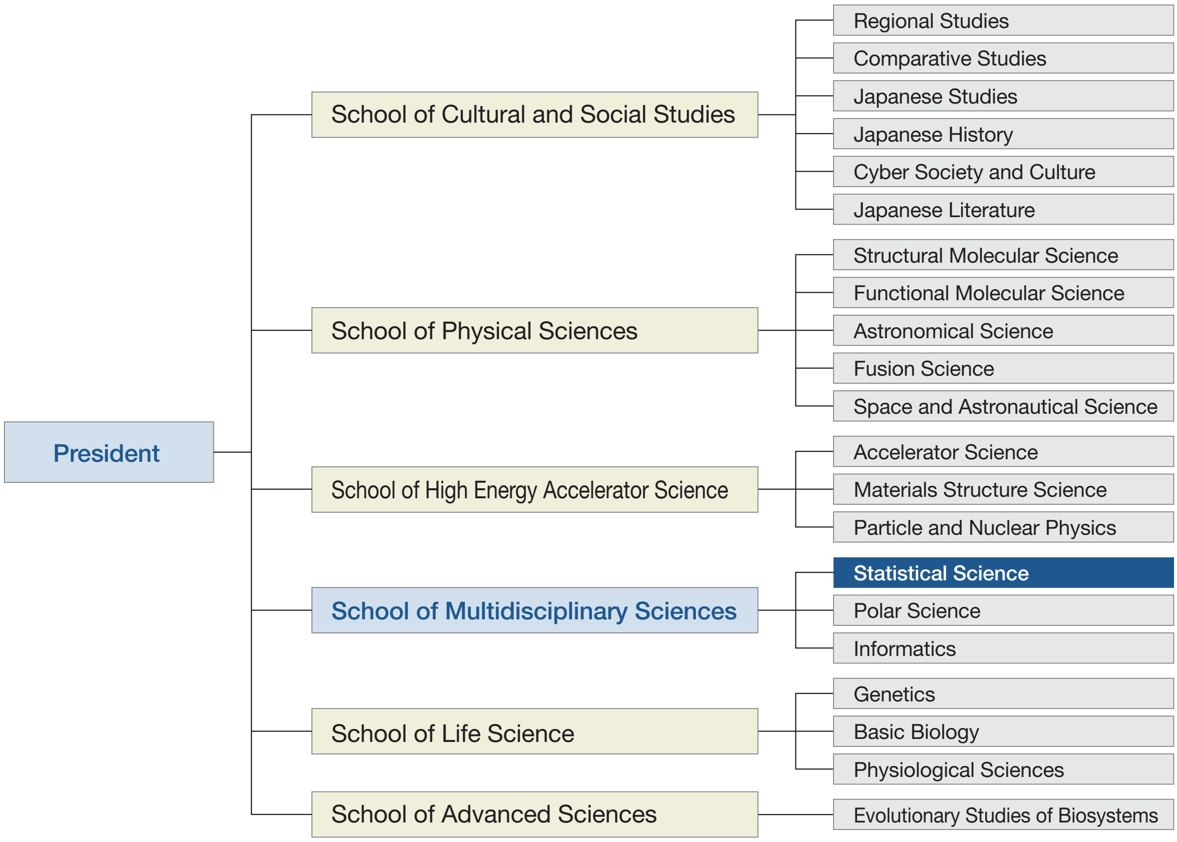
Major Research Fields

Number	Fields	Major Research Domains
1	Statistical mathematics	Mathematical theory of statistics, optimization, etc.
2	Information science	Algorithms, use of computer in statistics, etc.
3	Biological science	Medicine, pharmacy, epidemiology, genetics, etc.
4	Physical science	Space, planet, earth, polar region, materials, etc.
5	Engineering	Mechanics, electronics, control, chemistry, architecture, etc.
6	Human science	Philosophy, art, psychology, education, history, geography, culture, language, etc.
7	Social science	Economics, law, politics, society, management, official statistics, population, etc.
8	Environmental science	Environmental Statistics, Environmetrics, Agricultural Statistics, Land Economics, Landscape Management, Forest Management, 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, 2016)

■ Doctor's course five years

Year of enrollment	2010	2012	2013	2014
Number of students	1	2	2 ①	2

■ Doctor's course three years

Year of enrollment	2011	2012	2013	2014	2015	2016
Number of students	2 ②	2 ①	1 ①	8 ⑤ (1)	2 ②	4 ④

* 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) • Chiba University (1) • Ochanomizu University (1) • National Graduate Institute for Policy Studies (1) • Tokyo Medical and Dental University (1) • Tokyo University of Marine Science and Technology (1) • Tokyo Gakugei University (2) • Tokyo Institute of Technology (4) • The University of Tokyo (10) • Tokyo Metropolitan University (1) • Tokyo University of Agriculture and Technology (1) • Hitotsubashi University (6) • Shizuoka University (1) • Japan Advanced Institute of Science and Technology (1) • Nagoya University (3) • Toyohashi University of Technology (2) • Kyoto University (6) • Osaka City University (1) • Osaka University (2) • 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

• Kitasato University (1) • Keio University (8) • Shibaura Institute of Technology (1) • Chuo University (7) • Tokyo University of Science (6) • Toyo University (1) • Japan Women's University (1) • Nihon University (2) • Hosei University (7) • Waseda University (8) • Nanzan University (1) • Kansai University (1) • Kyoto Sangyo University (1) • Ritsumeikan University (1) • Okayama University of Science (1) • Kurume 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 (2) • University of Rajshahi (2) • Stanford University (1) • Chinese Academy of Sciences, Institute of Applied Mathematics (1) • University of Science and Technology of China (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)

Degrees Awarded

Year	2010	2011	2012	2013	2014	2015
Doctor of Philosophy	7 [1]	4	6 [1]	6	5	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 Sciences • 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 • CPC Clinical Trial Hospital, Medipolis Medical Research Institute • CRD Association • Japan Society for the Promotion of Science

Facilities and Equipment

Computational Resources (As of April 1, 2016)

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 12,864 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.

AIC
ISM Supercomputer Systems

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 SINET5 (40 Gbps).

The Supercomputer System for Data Assimilation (nicknamed A)

The Supercomputer System for Statistical Science (nicknamed I)

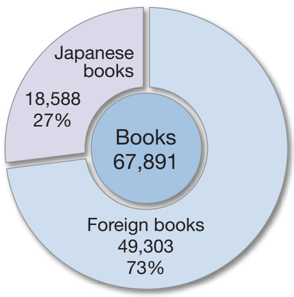
The Communal Cloud Computing System (nicknamed C)

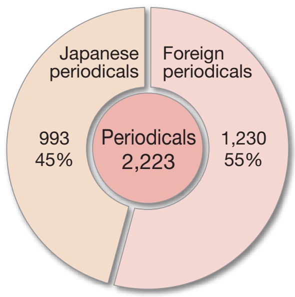
Library and Materials (As of April 1, 2016)

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 (2015)

Type	Personnel expenses	Non-personnel expenses	Total
Expenditure	702,384	861,096	1,563,480

Unit: ¥1,000

Accepted External Funds (2015)

Type	Joint research	Subcontracted research, Trustee business	Contract researchers	Contribution for scholarship	Total
Items	17	20	3	5	45
Income	47,320	160,431	836	5,150	213,737

Unit: ¥1,000

Grant-in-Aid for Scientific Research “KAKENHI” (2015)

Research Category	Items	Amount Granted
Grant-in-Aid for Scientific Research on Innovation Areas	2	12,200
Grant-in-Aid for Scientific Research (S)	—	—
Grant-in-Aid for Scientific Research (A)	2	17,420
Grant-in-Aid for Scientific Research (B)	10	39,650
Grant-in-Aid for Scientific Research (C)	19	25,870
Grant-in-Aid for Challenging Exploratory Research	5	8,580
Grant-in-Aid for Young Scientists (B)	9	9,534
Grant-in-Aid for Research Activity Start-up	4	4,550
Grant-in-Aid for JSPS Fellows	1	780
Total	52	118,604

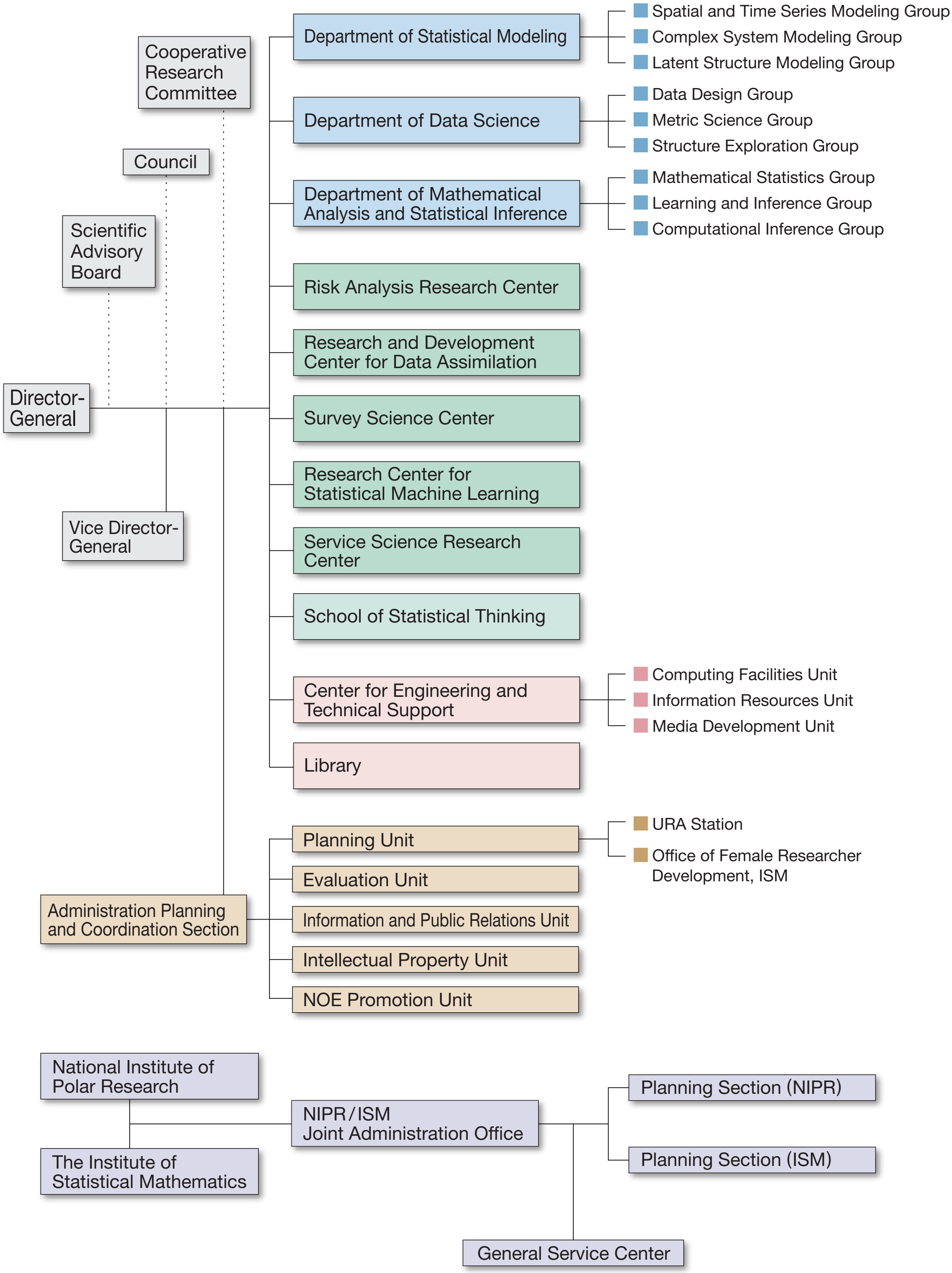
Unit: ¥1,000

Site and Buildings (As of April 1, 2016)

Site Area	$62,450m^2$
Area for Buildings (total)	$16,209m^2$

Organization

Organization Diagram (As of August 1, 2016)



Number of Staff (As of April 1, 2016)

Type	Director-General	Professor	Associate Professor	Assistant Professor	Administrative Staff	Technical Staff	Total
Director-General	1						1
Department of Statistical Modeling		5	8	1			14
Department of Data Science		5	7	3			15
Department of Mathematical Analysis and Statistical Inference		9	3	2			14
School of Statistical Thinking							0
Center for Engineering and Technical Support						10	10
Administration Planning and Coordination Section					1		1
NIPR/ISM Joint Administration Office					13 (31)	1 (2)	14 (33)
Total	1	19	18	6	14 (31)	11 (2)	69 (33)

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

The number under Technical Staff at the Center for Engineering and Technical Support and Administrative Staff at the NIPR/ISM Joint Administration Office include one each staff member who retired because of age but was reemployed in a different position.

Staff (As of August 1, 2016)

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	Assoc. Prof.	Shinya NAKANO		

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 Prof.	Hiroshi MARUYAMA	Visiting Prof.	Makoto SHIMIZU
Visiting Assoc. Prof.	Toru ONODERA	Visiting Assoc. Prof.	Fumitake SAKAORI	Visiting Assoc. Prof.	Yuji MIZUKAMI

Latent Structure Modeling Group

Prof.	Tomoko MATSUI	Prof.	Yoshinori KAWASAKI	Assoc. Prof.	Ryo YOSHIDA
Assoc. Prof.	Kazuhiro MINAMI	Project Researcher	Guo Zhongliang		

Department of Data Science

Director Satoshi YAMASHITA

Data Design Group

Prof.	Takashi NAKAMURA	Prof.	Ryozo YOSHINO	Prof.	Takahiro TSUCHIYA

Assoc. Prof.	Naomasa MARUYAMA	Assoc. Prof.	Tadahiko MAEDA	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	Assoc. Prof.	Hisashi NOMA	Assist. Prof.	Nobuo SHIMIZU
Project Researcher	Ai KAWAMORI				

Structure Exploration Group

Prof.	Koji KANEFUJI	Prof.	Manabu KUROKI	Assoc. Prof.	Jun ADACHI
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.	Teppei OGIHARA	Visiting Prof.	Akimichi TAKEMURA

Learning and Inference Group

Prof.	Shinto EGUCHI	Prof.	Kenji FUKUMIZU	Prof.	Hironori FUJISAWA
Prof.	Shiro IKEDA	Assoc. Prof.	Daichi MOCHIHASHI	Visiting Assoc. Prof.	Syuichi KAWANO

Computational Inference Group

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

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	Prof.	Manabu KUROKI	Assoc. Prof.	Masayuki HENMI
Assoc. Prof.	Fumikazu MIWAKEICHI	Assoc. Prof.	Jiancang ZHUANG	Assoc. Prof.	Kenichiro SHIMATANI
Assoc. Prof.	Ikuko FUNATOGAWA	Assoc. Prof.	Shogo KATO	Assoc. Prof.	Yumi TAKIZAWA
Assoc. Prof.	Hisashi NOMA	Assist. Prof.	Takaaki SHIMURA	Assist. Prof.	Teppei OGIHARA
Project Assist. Prof.	Yoshitake TAKEBAYASHI	Project Assist. Prof.	Takahiro OTANI	Visiting Prof.	Rinya TAKAHASHI
Visiting Prof.	Yo SHIINA	Visiting Prof.	Manabu IWASAKI	Visiting Prof.	Toshiya SATO
Visiting Prof.	Satoshi TERAMUKAI	Visiting Prof.	Tatsuhiko TSUNODA	Visiting Prof.	Shigeyuki MATSUI
Visiting Prof.	Naoki SAKAI	Visiting Prof.	Mihoko MINAMI	Visiting Prof.	Satoshi TAKIZAWA
Visiting Prof.	Toshihiro HORIGUCHI	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.	Yasuhiro KUBOTA	Visiting Prof.	Yoichi NISHIYAMA
Visiting Prof.	Satoshi FUJII	Visiting Prof.	Takaaki YOSHINO	Visiting Prof.	Masaaki FUKASAWA

Staff

Risk Analysis Research Center

Visiting Prof.	Shusaku TSUMOTO	Visiting Prof.	Masakazu ANDO	Visiting Assoc. Prof.	Hisateru TACHIMORI
Visiting Assoc. Prof.	Makoto TOMITA	Visiting Assoc. Prof.	Takafumi KUBOTA	Visiting Assoc. Prof.	Toshikazu KITANO
Visiting Assoc. Prof.	Hisayuki HARA	Visiting Assoc. Prof.	Takashi KAMEYA	Visiting Assoc. Prof.	Kenichi KAMO
Visiting Assoc. Prof.	Masashi KONOSHIMA	Visiting Assoc. Prof.	Takaki IWATA	Visiting Assoc. Prof.	Bogdan Dumitru ENESCU
Visiting Assoc. Prof.	Seisho SATO	Visiting Assoc. Prof.	Hitoshi MOTOYAMA	Visiting Assoc. Prof.	Kazushi MARUO
Visiting Assoc. Prof.	Masakazu FURUKAWA	Visiting Assoc. Prof.	Ryota NAKAMURA	Visiting Assoc. Prof.	Yasutaka SHIMIZU
Visiting Assoc. Prof.	Yukihiko OKADA	Visiting Assoc. Prof.	Toshihiko KAWAMURA	Visiting Assoc. Prof.	Haruhisa FUKUDA
Project Researcher	Syonosuke SUGASAWA	Project Researcher	Peng HAN		

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
Assoc. Prof.	Shinya NAKANO	Project Assoc. Prof.	Masaya SAITO	Project Assist. Prof.	Wu Stephen
Project Assist. Prof.	Guillaume Lambard	Visiting Prof.	Takashi WASHIO	Visiting Prof.	Shinichi OTANI
Visiting Prof.	Yoichi MOTOMURA	Visiting Prof.	Nobuhiko TERUI	Visiting Prof.	Tadahiko SATO
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	Visiting Assoc. Prof.	Hiroshi FUJISAKI
Visiting Assoc. Prof.	Tsukasa ISHIGAKI	Visiting Assoc. Prof.	Eiji MOTOHASHI	Project Researcher	Yuya ARIYOSHI
Project Researcher	Kazue SUZUKI				

Survey Science Center

Director Ryozo YOSHINO Vice Director Tadahiko MAEDA

Prof.	Ryozo YOSHINO	Prof	Takashi NAKAMURA	Prof	Takahiro TSUCHIYA
Assoc. Prof.	Tadahiko MAEDA	Assist. Prof.	Yoo Sung PARK	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
Visiting Assoc. Prof.	Saeko KIKUZAWA				

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	Prof	Shiro IKEDA
Prof	Satoshi KURIKI	Prof	Akiko TAKEDA	Assoc. Prof.	Daichi MOCHIHASHI
Assoc. Prof.	Shinsuke KOYAMA	Assoc. Prof.	Kazuhiro MINAMI	Project Assist. Prof.	Song LIU
Project Assist. Prof.	Takashi ARAI	Project Assist. Prof.	Mikio MORII	Visiting Prof.	Takashi TSUCHIYA
Visiting Prof.	Masataka GOTO	Visiting Prof.	Katsuki FUJISAWA	Visiting Prof.	Yoshiki YAMAGATA
Visiting. Prof.	Hiroshi KURATA	Visiting Assoc. Prof.	Yuji SHINANO	Visiting Assoc. Prof.	Arthur GRETTON
Project Researcher	Motonobu KANAGAWA				

Service Science Research Center

Director Junji NAKANO

Prof.	Tomoyuki HIGUCHI	Prof.	Tomoko MATSUI	Prof.	Junji NAKANO
Prof.	Manabu KUROKI	Assoc. Prof.	Kazuhiro MINAMI	Assist. Prof.	Nobuo SHIMIZU
Visiting Prof.	Yoichi MOTOMURA	Visiting Prof.	Shusaku TSUMOTO	Visiting Prof.	Nobuhiko TERUI
Visiting Prof.	Tadahiko SATO	Visiting Prof.	Hiroshi MARUYAMA	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.	Satoshi ITO	Prof.	Yukito IBA	Prof.	Nobuhisa KASHIWAGI
Assoc. Prof.	Naomasa MARUYAMA	Adjunct Professor	Makio ISHIGURO	Adjunct Professor	Kunio SHIMIZU
Project Assist. Prof.	Kaname MATSUE	Project Assist. Prof.	Kotaro KAGAWA	Project Assist. Prof.	Syogo MIZUTAKA
Project Assist. Prof.	Naoki KAMIYA	Visiting Assoc. Prof.	Osamu KOMORI	Visiting Assoc. Prof.	Kei TAKAHASHI

Project Researchers

Project Assist. Prof.	Hayafumi WATANABE	Project Assist. Prof.	Takao KUMAZAWA	Project Assist. Prof.	Shizu ITAKA
Project Assist. Prof.	Yusuke INAGAKI	Project Assist. Prof.	Kiyohisa SHIBAI		

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	Satoshi ITO
Head of NOE Promotion Unit	Satoshi ITO		

URA Station

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

Staff

Administration Planning and Coordination Section

Office of Female Researcher Development, ISM

Head of Office of Female Researcher Development,ISM Koji KANEFUJI

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	Masatoshi NAKAMURA	Team Leader	Koji MORITA	Team Leader	Ichiro KAWAJI
Team Leader	Junko MATSUYAMA				

Planning Section (NIPR)

Head of Planning Section Yuki OYAMA

Deputy Head	Motokazu TOYODA	Team Leader	Hiromi OBAMA	Team Leader	Masaki ONIZAWA
Team Leader	Hitoshi HIRAYAMA	Team Leader	Michihito SAKURAI		

General Service Center

Vice Director of General Service Center Tatsuya NAKANO

Deputy Head	Koji SAKAMOTO	Deputy Head	Yutaka ONO	Deputy Head	Tomohiko MIYAUCHI
Team Leader	Yoshihiro YAMADA	Team Leader	Hiroaki ARAI	Team Leader	Kentaro TSUJII
Team Leader	Hiromi KATO	Team Leader	Takuya SAITO	Specialist	Yoriko HAYAKAWA
Specialist	Takeshi KUWAHARA	Specialist	Junichi NAKATA		

Council of The Institute of Statistical Mathematics (As of April 1, 2016)

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
Masayuki UCHIDA	Professor, Graduate School of Engineering Science, Osaka University
Ryuei NISHII	Professor, Institute of Mathematics for Industry, Kyushu University
Yasuhiro OMORI	Professor, Faculty of Economics, University of Tokyo
Shoichi YOKOYAMA	Professor, Language Change Division, 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
Tomoko MATSUI	Professor, Research Organization of Information and Systems
Ryozo YOSHINO	Professor, Research Organization of Information and Systems
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)

Council of The Institute of Statistical Mathematics

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)
Yoshihiko MIYASATO	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)
Kenji FUKUMIZU	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)

Cooperative Research Committee (As of April 1, 2016)

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, 2016)

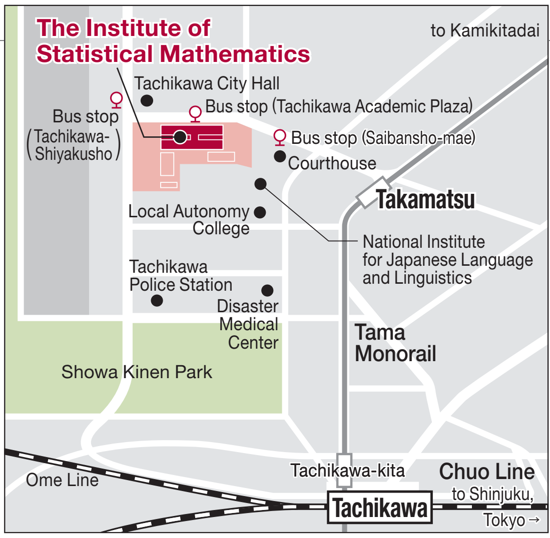
Specialist on epidemiology and social research	Kazuo SEIYAMA	Professor Emeritus, Tokyo University Deputy Director, Research Center for Science Systems of Japan Society for the Promotion of Science
Specialist on epidemiology and social research	Keiko SATO	Associate professor, Kyoto University Hospital, 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, 2016)

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	Hiroe TSUBAKI	

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.



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
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