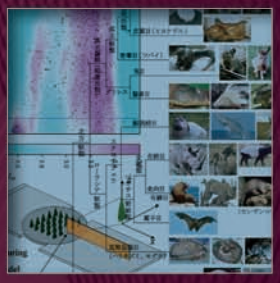
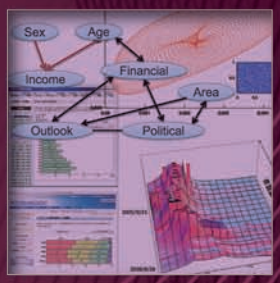
Research Organization of Information and Systems

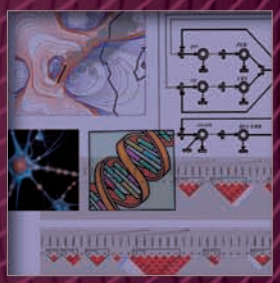
The Institute of Statistical Mathematics

2010-2011

ISM







CONTENTS

Message from Director-General

In October 2009, the Institute of Statistical Mathematics relocated to a new campus in Tachikawa City, leaving the Minami-Azabu area of Minato-ku which was our base for more than half a century. In June 2010, we officially opened the Akaike Guest House, giving us the facilities to host joint research projects involving stays. The relocation fulfills a decision that was made more than two decades ago in 1988. Every one of us is looking forward to further building on our research, as we set out with a sense of renewed purpose to fulfill our vital mission as an inter-university research institute.

In April 2010, the Institute of Statistical Mathematics entered its second medium-term period since being incorporated into the Research Organization of Information and Systems, which has launched its activities under a new medium-term plan and targets. As a member of the Research Organization of Information and Systems, we have set out to form a Network Of Excellence (NOE) for integrated risk science, survey science, next-generation simulation science, statistical machine learning, and service science, in order to establish new methodologies in these fields and serve as hubs for interdisciplinary interaction. We have also launched a project to foster statistical thinking, recognizing that the development of human resources with statistical thinking and research coordination skills is essential for the future advancement of science in Japan, and of society.

Rapid advancements in information and communications technologies are greatly transforming our society and scientific research. The use of large-scale data will play a key role in the advancement of science and technology and in society moving forward. There is an urgent need to establish a data-centric science, which is regarded as a fourth scientific methodology. The Institute of Statistical Mathematics will endeavor to meet the needs of the times by further advancing our joint research systems and activities under the strategic research centers, while securing the success of our two new projects. We look forward to your continued understanding and support for our activities.

Genshiro Kitagawa
Director-General
The Institute of Statistical Mathematics

Institute Overview

Basic Research

Department of Statistical Modeling

The Department of Statistical Modeling conducts research on the modeling of causally, temporally and/or spatially interrelated complex phenomena, including intelligent information processing systems. It also conducts researches on model-based statistical inference methodologies.

Spatial and Time Series Modeling Group
The Spatial and Time Series Modeling Group works on modeling and inference for the statistical analysis of time series, spatial, and space-time data, and on their applications to prediction and control.

Intelligent Information Processing Group
The Intelligent Information Processing Group works on concepts and methods for the extraction, processing and transformation of information in intelligent systems, motivated by an active interest in practical problems in engineering and science.

Graph Modeling Group
The Graph Modeling Group works on analyses of the data generated by systems with a graph structure and on the modeling required in order to reconstruct the original system.

Department of Data Science

The Department of Data Science aims to develop research methods for surveys, multidimensional data analyses, and computational statistics.

Survey Research Group
The Survey Research Group focuses on research related to statistical data collection and data analyses.

Multidimensional Data Analysis Group
The Multidimensional Data Analysis Group studies methods for analyzing phenomena grasped on multidimensional space and ways for collecting multidimensional data.

Computational Statistics Group
The Computational Statistics Group studies sophisticated uses of computers in statistical methodology such as computer-intensive data analyses, computational scientific methods and statistical systems.

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 theory, and the practice of statistics in science.

Mathematical Statistics Group
The Mathematical Statistics Group is concerned with aspects of statistical theory and probability theory that have statistical applications.

Learning and Inference Group
The Learning and Inference Group develops statistical methodologies that enable researchers to learn from data sets and to properly extract information through appropriate inference procedures.

Computational Mathematics Group
The Computational Mathematics Group studies computational algorithms together with mathematical methodologies used for statistical modeling in the sciences.

Research Support

Center for Engineering and Technical Support

The Center for Engineering and Technical Support assists the development of statistical science by managing the computer systems used for statistical computing, facilitating public outreach, and supporting the research activities of both staff and collaborators.

Computing Facilities Unit	The Computing Facilities Unit is in charge of managing computer facilities, software for research, networking infrastructure and network security.
Information Resources Unit	The Information Resources Unit is responsible for maintaining an extensive library and an electronic repository, and is in charge of planning statistical education courses to popularize research results.
Media Development Unit	The Media Development Unit is in charge of the publication and editing of research results and is responsible for public relations.

Strategic Research

Prediction and Knowledge Discovery Research Center

The Prediction and Knowledge Discovery Research Center studies the statistical modeling and inference algorithms that can be used to extract useful information from the huge amount of data which complex systems produce, and thus attempts to solve real-world problems in many different scientific domains, especially genomics, earth and space sciences.

Molecular Evolution Research Group

The Molecular Evolution Research Group researches the area of molecular phylogenetics, and seeks to develop statistical methods for inferring evolutionary trees of life using DNA and protein sequences.

Data Assimilation Research Group

The Data Assimilation Research Group aims at developing new, advanced data assimilation techniques to combine different information from dynamical simulation and observation data.

Statistical Seismology Research Group

The Statistical Seismology Research Group is concerned with the evaluation of seismicity anomalies, detection of crustal stress changes, their modeling, and the probability forecasting of large aftershocks and earthquakes.

Statistical Genome Diversity Research Group

The Statistical Genome Diversity Research Group aims to construct novel methodologies for learning and inference from a variety of data sets in the rapidly growing area of bioinformatics.

Risk Analysis Research Center

The Risk Analysis Research Center is pursuing a scientific approach to the study of the increased uncertainty and risk associated with the increasing globalization of the society and economy. The center is also constructing a network for risk analysis in order to contribute to the creation of a reliable and safe society.

Food and Drug Safety Research Group

The Food and Drug Safety Research Group aims to develop the statistical framework and methodology of quantitative risk evaluation for substances ingested by the human body.

Environmental Risk Research Group

The Environmental Risk Research Group studies the statistical methodologies related to environmental risk and environmental monitoring.

Financial Risk and Insurance Research Group

The Financial Risk and Insurance Research Group explores the use of statistical modeling methods to quantify the risks involved with financial instruments and insurance products.

Research Group for Reliability and Quality Assurance of Service and Product

The Research Group for Reliability and Quality Assurance of Service and Product aims to increase the safety of products and services by developing statistical methods that contribute to quality assurance and reliability and by promoting the adoption of these methods in the industrial world.

Research Innovation Center

The objective of this center is to establish innovative research in statistical mathematics to keep up with new trends in the academic and real world. The center carries out original research projects, ranging over both pure and applied frontiers.

Social Survey Information Research Group

The Social Survey Information Research Group collects several social survey results with the goal of assembling them to develop a statistical methodology to describe the social world.

Functional Analytic Inference Research Group

This group aims to develop nonparametric methodology for statistical inference using reproducing kernel Hilbert spaces given by positive definite kernels, and to apply these techniques to causal inference problems.

Advanced Monte Carlo Algorithm Research Group

The Advanced Monte Carlo Algorithm Research Group aims to develop Markov Chain Monte Carlo and Sequential Monte Carlo algorithms and study their applications.

Random Number Research Group

This group carries out research into random number generation, including hardware random number generators, and testing randomness with methods such as time series analysis.

Speech and Music Information Research Group

The Speech and Music Information Research Group investigates novel information retrieval methods using machine learning from time series data, including speech, music, and brain data.

Optimization-based Inference Research Group

Optimization-based Inference Research Group focuses on optimization methodology as a fundamental tool for computational inference and aims to develop new inference techniques in statistical applications.

Molecular Evolution Research Group

Molecular Evolution and Biodiversity

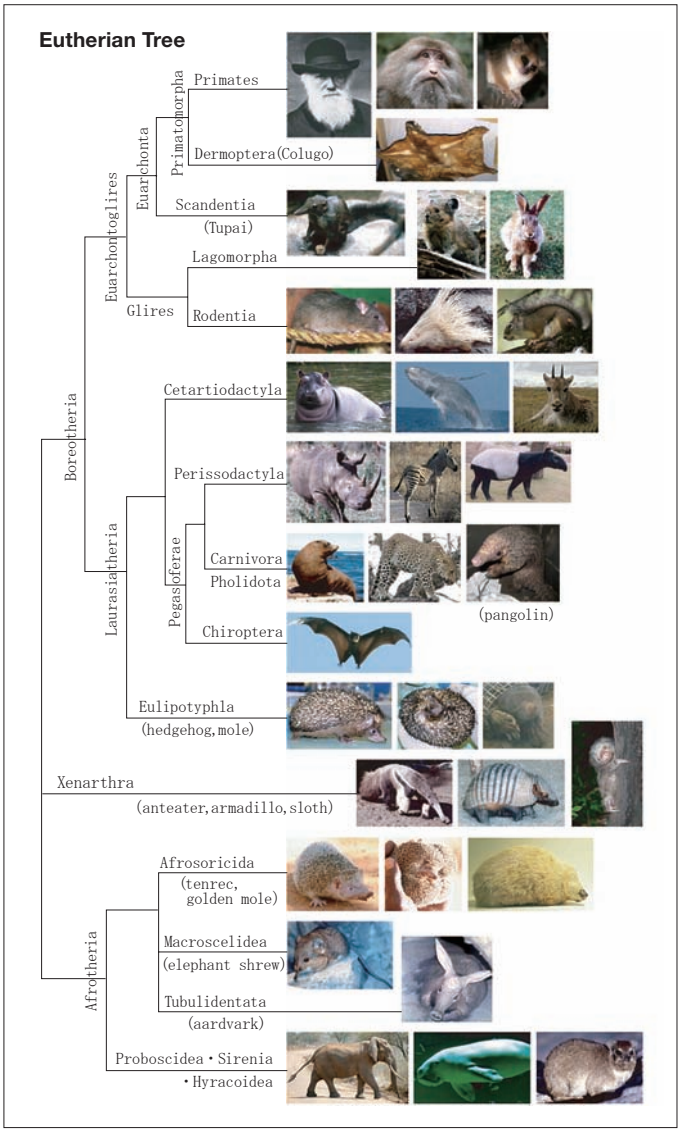
Molecular phylogeny

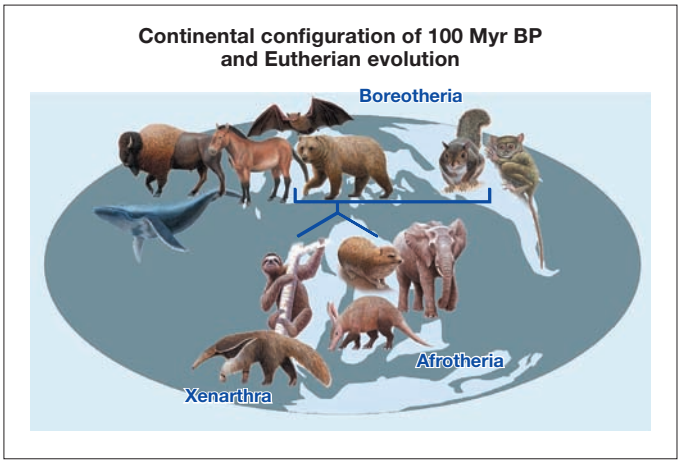
The aim of this project is to understand the biodiversity on Earth from various view points from the molecular level to the ecological level. An evolutionary view is indispensable in the integrative understanding of the biodiversity, and the methods for inferring molecular phylogeny are essentially important. In this project, we are developing models of nucleotide and amino acid substitutions during evolution and methods for phylogenetic inference based on maximum likelihood. It is not necessarily easy to know the phylogenetic tree correctly even if genome-scale data become available, because a wrong tree may be supported strongly in the presence of bias in inferring the tree.

Mammalian evolution and continental drift

We are studying such problems inherent in phylogenetic analyses and are investigating new methods to overcome such problems during the process of solving real biological problems, including mammalian evolution and biodiversity of Madagascar. Recent molecular phylogenetics has clarified that Placentalia (eutherian mammals) consists of three groups; i.e., Boreotheria originally from Laurasia, Afrotheria from Africa, and Xenarthra from South America. These groupings are considered to reflect continental separation around 100 MyrBP, but the root of the tree remains ambiguous. We are studying this rooting problem by using genome-scale data.

Jun Adachi





Data Assimilation: Time-dependent Information Fusion from Numerical Simulation and Large-scale Observation

Data Assimilation (DA) is a technique for a synthesis of information from a dynamic (numerical) model and observation data. It is an emerging area in earth sciences, particularly oceanography, stimulated by recent improvements in computational and modeling capabilities and the increase in the amount of available observations. In statistical methodology, DA can be formulated in the generalized state space model, where the system and observation model correspond to large-scale numerical model-based simulations and large-scale satellite- and/or ground-based measurement systems, respectively. Past studies for DA employed a linear Gaussian state space model and applied Kalman filter. The Kalman filter based methods, however, do not allow for the strong nonlinear and/or non-Gaussian disturbance behaviors. Many phenomena in earth sciences tend to be discussed in terms of a complex system in which the nonlinear non-Gaussian fluctuations (disturbances) play an important role. The nonlinear non-Gaussian DA method needs to be developed in an attempt to improve a performance of prediction ability of our environment. We are therefore constructing new computation methods based on the sequential DA methods and conducting five DA projects. One is done with the ensemble Kalman filter that assimilates the TOPEX/Poseidon altimetry to the coupled ocean-atmosphere simulation model. The second DA is done with a particle filter for Tsunami simulation model to correct bottom topography. The third DA project is aimed at finding an uncertainty in sea bottom topography which plays an important role in conducting an ocean tide simulation. The fourth is the DA project to estimate distributions of ring current ions and electric potential in the inner magnetosphere by assimilating the series of the ENA data obtained by the HENA imager on board of IMAGE satellite into a kinetic ring current model (CRCM). The last project is to apply the DA methodology to combine a simulation model with observed data like microarray gene expression data for understanding biological pathways.

Tomoyuki Higuchi

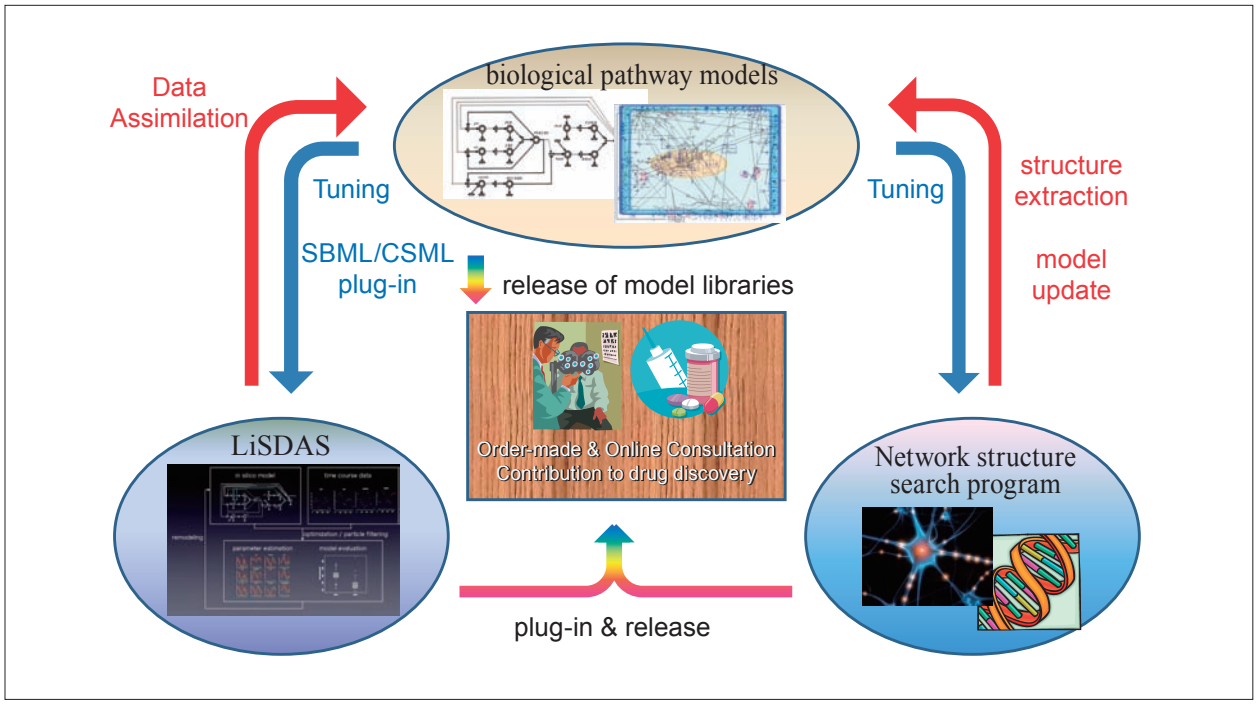


Figure: Schematic illustration that explains aims and objects of our research project: Development of the customized simulation model based on the data assimilation technology.

Statistical Seismology Research Group

Space-time Heterogeneity in Aftershock Activity

For a number of aftershock sequences in and around Japan, we examine de-trended space-time coordinates after fitting the Omori-Utsu occurrence rate to each aftershock sequence. Although the Omori-Utsu decay rate well predicts the trend of mass frequency of whole aftershocks in time, local aftershock occurrences violate the typical Omori-Utsu law more or less, which implies that seismic stress change takes place locally. We investigated how the aftershock occurrences in a local sub-region deviate from the space-time Omori-Utsu function. Space-time coordinates regarding the frequency-linearized time (FL-time) should appear temporally uniform everywhere if the aftershock activity lasts normally.

We are concerned with each of the aftershock shadows and the activated zone. These appear not only post-seismically after the mainshock or after a large aftershock but also pre-seismically precede a large aftershock that triggers significantly many secondary aftershocks. We examined whether the aftershock shadow and activated zone agree with the region of Coulomb-failure-stress (CFS) decrease (stress shadow) or increase, respectively, by assuming an aseismic slip on or down-dip fault of the focal large aftershock or elsewhere. As a result, for each case, we have found a plausible slip that appears to produce stress shadow and increased zone that overlaps the aftershock shadow or activated zone. In order to explain the transient anomalies, we have considered six simulation scenarios using the rate/state-dependent friction law of Dieterich taking account of the fault mechanisms of the mainshocks and large aftershocks. Some aseismic slips revealed recently by GPS observations support the presently discussed space-time anomalies in aftershock activity.

References: Ogata, Y. (2010). Space-time heterogeneity in aftershock activity, *Geophys. J. Int*, 181,1575-1592, doi: 10.1111/j.1365-246X.2010.04542.x.

Yosihiko Ogata

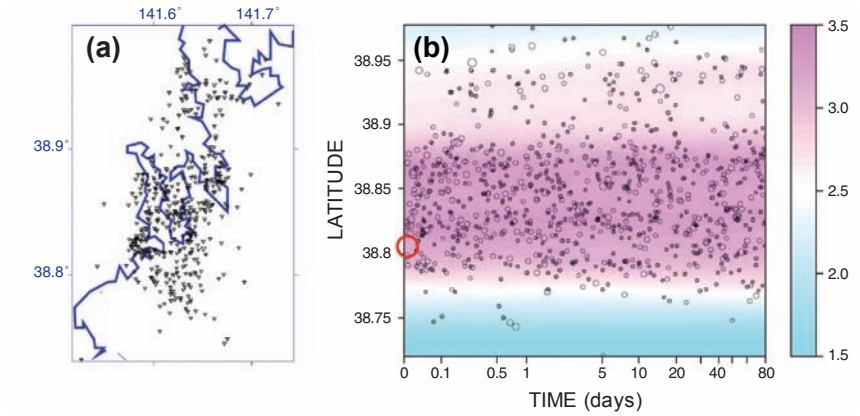


Figure 1:
Aftershock epicenters of the 2003 Sanriku southern coast earthquake (a) and de-trended space-time plot (b).

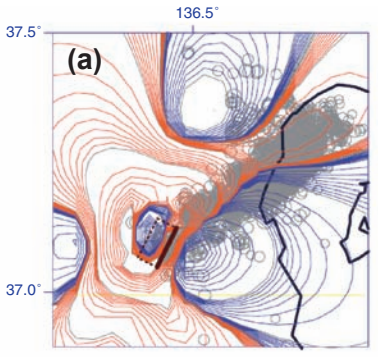
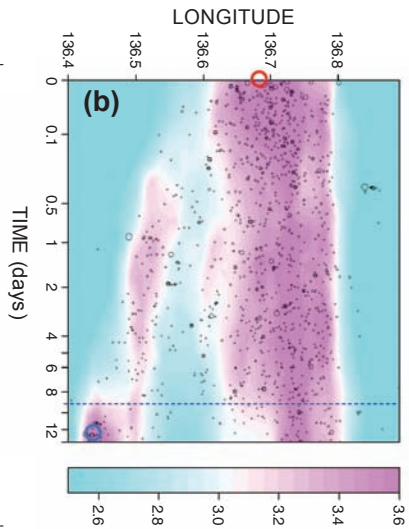


Figure 2:
Aftershock epicenters (a) of 2007 Noto Peninsula earthquake and de-trended space-time plot (b). In addition, panel (a) shows the CFS increments, at the depth of 10 km, where contours of red and blue show positive and negative values, respectively. Here we assume that the majority of the primary aftershocks have the similar angles to the mainshock's. We also assume the stress transfers from a slip preceding the largest aftershock (blue circle in panel b) with the fault model (small rectangle in panel a).



Statistical Genome Diversity Research Group

Two Approaches for Gene Association Study — 2-sample Test and Machine Learning —

2-sample test

Our research group discusses statistical aspects to solve '$p \gg n$' Problem which is caused by human genome diversity. For example, we challenge a problem to predict a phenotype based on gene expression data sets with p gene expressions for n subjects. Typically the phenotype expresses treatment effects, in which an efficient prediction enables to enhancement for personalized medicine. In effect, the prediction for treatment effect based on the measurements for gene expressions of subjects before treatment contributes to fulfillment of personalized healthcare. Presently, there are totally different two approaches. One is to focus on only one signal of gene expression, and test a hypothesis from 2 samples stratified by the binary phenotype. This is reduced by a classical 2-sample test in which, for example, we employ t-statistic or Wilcoxon statistic for the group with treatment effect and the group with no treatment effect. In statistical community there actively discussed several methods to do testing hypothesis controlling false discovery rates. This approach is advantageous over others in the light of confirmatory paradigm. However, the power of prediction is not so expected because it is based only on the information from a single gene.

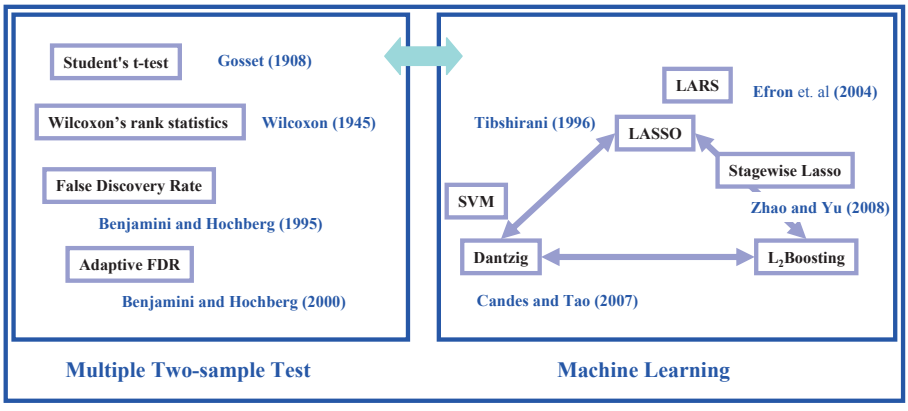
Machine learning

The other approach is to predict the phenotype by combining signals of several gene expressions. In a field of machine learning, there are rapid developments on boosting method, SVM (support vector machine), LASSO (least absolute shrinkage and selection operator) and so on. The key is to select informative genes in p genes for the prediction, however, the problem: $p \gg n$ causes over-learning of such methods before selecting the informative genes. To overcome this difficult aspect, the boosting method is modified by the early stopping rule, and furthermore regularization is added in any stage of the leaning algorithm. In SVM the recursive feature elimination algorithm is widely accepted. Basically LASSO employs L_1 regularization for sparse leaning, in which the original propose is now evolved to MARS, Dantzig selector and other variants. In these years there are published a number of papers that investigates statistical performance including reconciliation between boosting and LASSO (stagewise LASSO). In this way this approach challenges the essential difficulty of variable selection. However, the weak point for overlearning frequently loses the efficient performance. Any approach from machine leaning does not attain the final solution for the problem, $p \gg n$.

2-sample test and machine learning

Our research group discusses a unified approach combining these two approaches. To begin with this we do not get a set of t-values for p single variable analyses, but directly get t-value for a prediction score. In this way we consider t-value for a general prediction score $F(x)$, in which we find the prediction score that has a maximum of t-value in a set of all prediction scores in a booting learning algorithm, called t-Boost. This study has just been started, so that it will provide a good prediction score to implement a personalized medicine. Presently our group proceeds co-operative work with research teams of National Cancer Center and those of Mitsubishi Chemical Holdings.

Shinto Eguchi



Boosting two-sample tests

Food and Drug Safety Research Group

Benefit-risk Balance Evaluation of Food and Drug

■ Mission

Social responsibility of the food and drug safety program in RARC is to design appropriate databases and statistical methods for the benefit-risk balance evaluation of food and drug.

■ Benefit/risk analysis of drugs based on large-scale database

Various large-scale databases have been available for the scientific benefit / risk evaluation and risk management of post-marketing drugs in Europe and North America. In Japan, however, such a large-scale database does not exist. As the first step to improve this situation, we are building original databases using data collected from pre-marketing clinical trials and post-marketing surveillance, and we conduct benefit / risk analyses of drug effect.

■ Genome-wide association study between phenotype and large-scale SNPs data

We study the relationship between effectiveness of treatment for hypertension and about 500,000 SNPs genotype data to find candidate genes for the good selection of drug for hypertension. After a separation of training group or test group from the sample, we examine a genome-wide association test for training group. Then it is gotten Figure 1 shows the loci and LD (D') map with chromosome position and LD blocks on chromosome 2. LD maps have been made using Haploview (Barrett et al., 2005) that is a very popular program in the statistical genetic world. For each LD block, we estimate a penetrance and test the likelihood ratio for SNPs and haplotypes to obtain candidate genes. If results of candidate genes are reproduced in the test group, it may be useful information for good selection of antihypertensive drug.

■ Ad hoc study on a specific drug safety issue

An issue of drug safety often becomes a social concern, and the immediate scientific elucidation is required. An appropriate study design, implementation and statistical analysis are necessary to get an accurate scientific quantitative answer. We participate in an ad hoc study on a specific drug safety issue as experts of statistical science and epidemiology.

Toshiharu Fujita

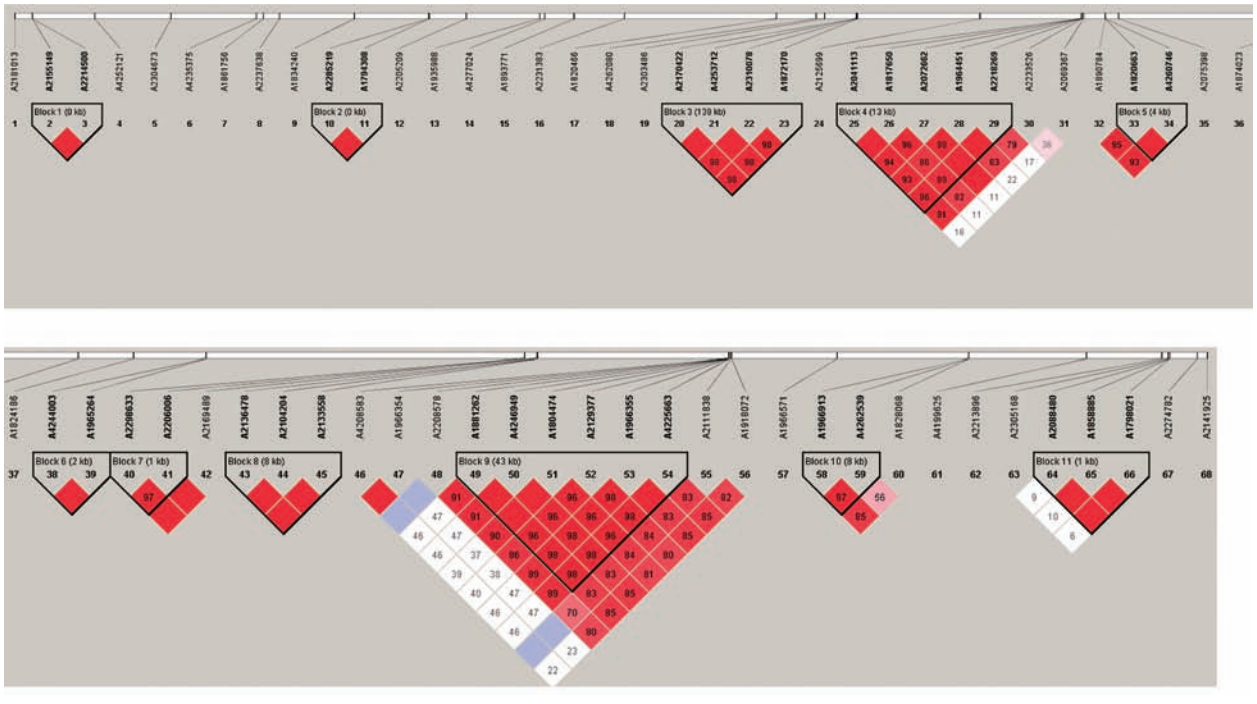


Figure 1: Ldmap(D') and LD blocks on Chr.2 by Haploview

Environmental Risk Research Group

The Effort of the Statistical Science towards Solution of Environmental Problems

■ Mission

A risk analysis research center / environmental risk research section aims at performing the contribution towards solution of the environmental problem which is a modern subject by developing the optimal new statistical methodology for each environmental problem (for example, the problem of dioxin, the problem of global warming, the problem of continuous use of safe water). Moreover, in order to realize this purpose, in cooperation with the community of environmental science, research is carried out including a visiting teacher or a project researcher.

■ Long-term variation of water quality in Tokyo Bay

Although the pollution load flowing into Tokyo Bay has been reduced, red tide still breaks out frequently. Red tide increases the amount of oxygen deficient water mass, and this sometimes causes blue tide. The occurrence of red and blue tides seems to be connected with elevated water temperature and change in salinity of recent date in Tokyo Bay. This study is making a collection of water quality data of Tokyo Bay and is analyzing these data to reveal long-term variation of water quality. (photo 1, photo 2)

Photo 1: Red tide
(The Tokyo Metropolitan Research Institute for Environmental Protection)

Photo 2: Blue tide
(Chiba Prefectural Environmental Research Center)

■ On persistent organic pollutants

To identify the sources of pollution by persistent organic pollutants (POPs), this study is developing statistical methods to make inference on pollution sources besides organizing POPs data. Further, this study is making contribution to the development of technology to reduce the risk of POPs in vegetable farming. (photo 3, Fig 1)

Photo 3: Growing experiment of cucumbers
(Niigata Agricultural Research Institute)

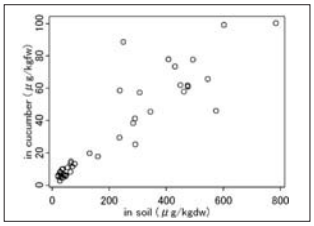


Fig.1: Relation between concentrations of Dieldrin

■ Risk-hedge oriented optimization system against natural and managerial disaster toward sustainable forest resource management

After the Kyoto protocol entered into force, reduction of carbon dioxide in the atmosphere is promised to slow down the degree of global warming. Among the proposed mechanisms under the Kyoto protocol, forest resources are regarded as a source of carbon sequestration, where forestation, deforestation and reforestation are the main human-induced activities. Housing and furniture manufacturing is also contributing to carbon mitigation indirectly. Despite of these facts, unfavorable current economic situation for forestry business discourages forest owners to abandon forestry practice in mountainous regions. Besides, typhoon disaster and snow damage on forest stands is accelerating abandoning phenomena. In our research project, we construct a risk-hedge oriented optimization system toward sustainable forest resource management. In the system, we try to predict events of natural disaster and managerial disaster spatially and temporally, and control themanagement scheme to avoid these disasters with a view of these phenomena. (photo 4, photo 5,Fig 2)

Koji Kanefuji

Photo 4: Scheme to avoid Windstorm in Denmark

Photo 5 : Typhoon damage in Ashoro, Hokkaido

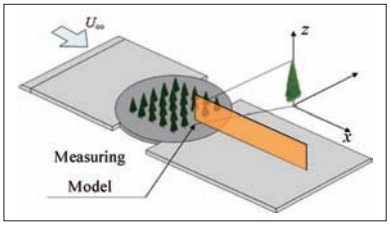


Fig.2 : Experiment for wind tolerance
(Provided by Dr. H. Ishikawa, Tokyo Univ. of Sci.)

Financial Risk and Insurance Research Group

Assessing Credit Risk via Securitized Products

■ Aim of our group

Financial Risk and Insurance Research Group mainly concerns the theory and practice in the quantitative analysis of risks involved with various financial instruments and insurance products from the view point of statistical modeling. Various research projects are under way not only by ISM researchers but by visiting and post doctoral researchers. This article introduces a cooperative research by Dr. Masakazu Ando (Project Researcher), Dr. Hiroshi Tsuda (Visiting Professor), Dr. Yoko Tanokura (Project Researcher), Dr. Seisho Sato (Associate Professor) and Dr. Genshiro Kitagawa (Director General).

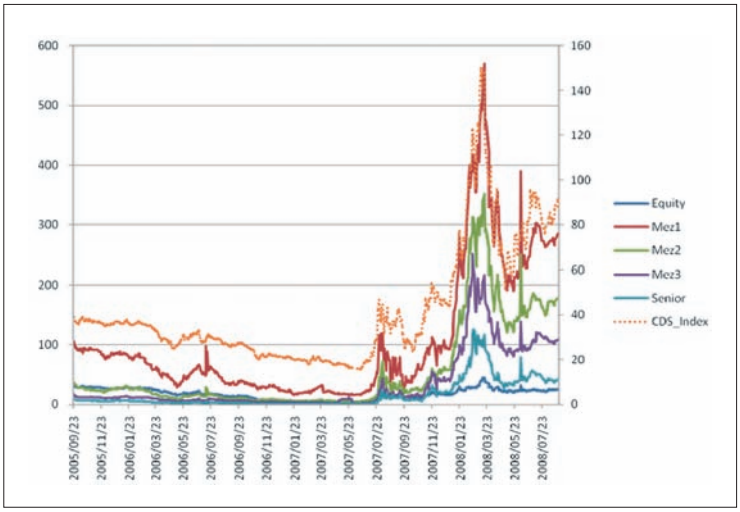


Figure 1: Tranche-wise spread time series of Collateralized Debt Obligation (CDO, left vertical axis) and Credit Default Swap (CDS) Index, right vertical axis. Rise of spreads after the summer of 2007 suggests the heightening of credit risk.

■ Valuation of securitized papers by Copula

There are two mainstreams in modeling credit risk of financial products, one is structural approach, and the other is reduced form approach. The latter is preferred by many practitioners because of its flexibility and facility to include corporate information related to credit risk. Copula is a popular choice among the reduced form approach. Primarily we are concerned with default correlation. The greatest advantage of using copula is that we can configure the joint distribution of risk factors based on univariate marginal distributions of the occurrence time of various default events. On the other hand, we have to specify in advance the probability distribution of default factors as well as the correlation structure of them. Moreover, the most commonly used copula (Gaussian) often does not describe the actual price movement of securitized papers.

■ Dynamic implied Copula approach

These problems have brought a new research direction where, without assuming specific probability distribution, the distribution of the default event occurrence should be implied by the actual traded papers. This enables us to estimate the hazard rates and default correlation that conform to the market price. We extend this approach (so-called implied copula approach) to consider the time transition of hazard rate scenarios, hence introduced dynamic implied copula approach. Now that forecasting future hazard scenarios are available, the risk management based on this model can incorporate the projection of future securitized papers.

Yoshinori Kawasaki

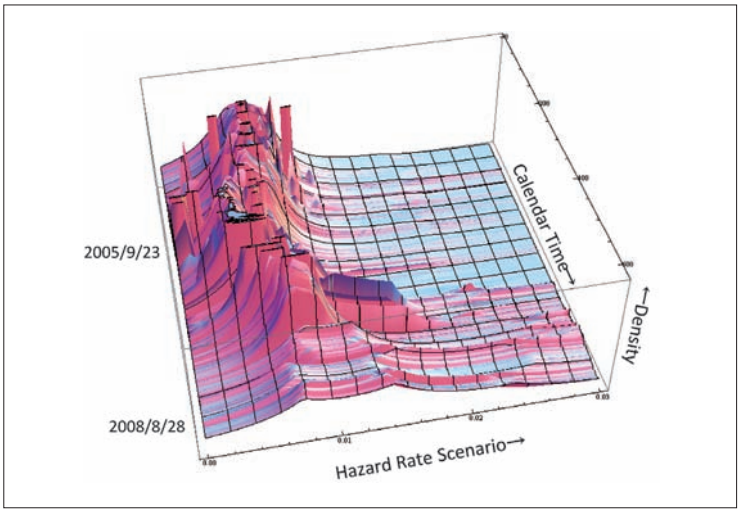


Figure 2:
Estimated probability distributions of hazard rate scenarios from the price of CDO papers in US market. Right-hand side in hazard scenario axis corresponds to heightened credit risk case. The probability of high risk scenario is mushrooming as time approaches to the summer of 2008.

Research Group for Reliability and Quality Assurance of Service and Product

Research for Quality Assurance of Product and Service

■ Outline of research

Quality engineering (Taguchi methods) is a technical methodology devised more or less independently by Genichi Taguchi over half a century for the purpose of making systematic improvements to quality. A key technique of Taguchi methods is parameter design, which is known to reduce the "variability" of characteristics at the product design and development stages, and there have been many reports of successes in manufacturing industries such as the automotive and electrical industries as part of the establishment of Quality-Japan.

But although the development of theoretical methodologies for parameter design in Taguchi methods is being actively pursued overseas as an extension of statistical quality control (SQC) or statistical science, in Japan it has only been researched to a limited extent. Therefore this study aims to devise a statistical methodology for quality engineering by clarifying the points of similarity between the design of experiments according to Fisher and Taguchi.

■ Systems of parameter design and new approach to the analysis of SN ratio

In SQC, based on experimental data on the quality characteristics of materials, mechanical equipment, products and the like, techniques such as the QC tools, Fisher's design of experiments method and regression analysis are used to ascertain the current situation, investigate the causes and analyze the important factors. On the other hand, Taguchi methods treat the causes of variation in the customer usage conditions, environmental conditions and the like as noise factors, and aim to discover the conditions that make the effects of these factors as small as possible. In parameter design, inevitable errors resulting from noise factors are normally larger than the random errors dealt with by SQC, so more effort is put into the descriptive statistics approach rather than into postulating probability distributions. However, it is possible to take a statistical approach by introducing noise factors into the model as parameter factors, and considering the probability distribution of SN ratios as a statistical quantity, thereby enabling a discussion of statistical inference.

■ Improvement of MT system by kernel method

In the discrimination of non-defective products from defective in the field of quality control, non-defective is assumed to be homogeneous group, from request to meet the specification. On the other hand, defectives is not considered to be samples from specific population because defectives occurred from various causes.

The discrimination to this type data is called non-symmetric discrimination problem and MT (Mahalanobis Taguchi) system is the representative non-symmetric discrimination method developed by Dr. Genichi Taguchi. MT system discriminates based on mahalanobis distance from unit space which is assumed to be homogeneous group.

While kernel method is recently noted in machine learning field and it can construct flexible decision boundary through mapping data to high-dimensional feature space. In this research, we approached from machine learning method and proposed two methods. One is the non-symmetric discrimination method where One-class SVM is applied to unit space.

■ Effectiveness of statistical simulation in development and design

The advancement of development and design processes through the effective utilization of statistical simulation is vital in achieving guaranteed high quality manufacturing. Particularly in the field of automotive development and design, there is a need to change over from methods involving evaluation based on the prototyping and testing of actual products to predictive evaluation-based methods employing highly precise CAE (Computer-Aided Engineering) analysis. Therefore, the author has proposed and is demonstrating the effectiveness of a highly precise CAE analysis approach utilizing SQC Technical Methods (Moutain-Climbing Methods for Problem Solving), which constitute the core principles of Science SQC (New Quality Control Principle).

Figure 1 below illustrate working examples, with figure 1 showing an optimal CAE anti-vibration design approach for door outer mirrors [a1]. Such use of statistical simulation has enabled the practical application of predictive evaluation-based approaches by reducing the discrepancies in results obtained from testing of actual products and CAE analysis to one tenth (1-2%) of previous calculations (10-20%).

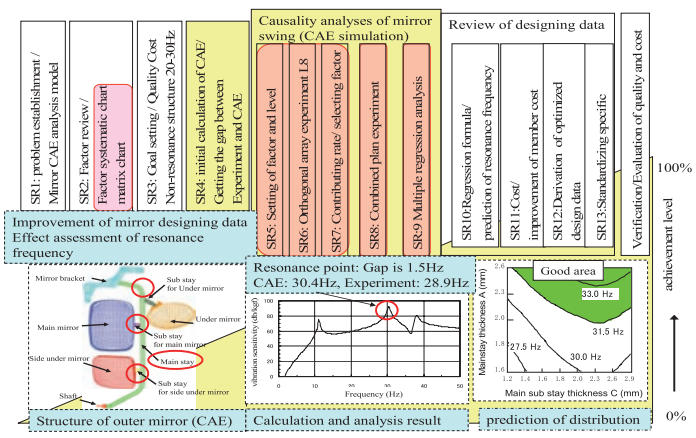


Figure 1: Optimal CAE anti-vibration design approach for door outer mirrors

Toshihiko Kawamura

Social Survey Information Research Group

Building a Database of Social Survey Results

■ Objective of the Social Survey Information Research Group

The Social Survey Information Research Group of the Research Innovation Center has been collecting social survey results with the aim of building a database of social surveys. A single survey provides limited information, particularly in the recent deteriorated survey environment. Multidimensional analysis using various types of social surveys is essential for comprehending the complicated aspects of modern society. This research group studies the methodologies for building a database and develops statistical methods for analyzing data. The group also intends to make the database available for public use.

■ A comprehensive report of a survey on the Japanese national character

The core data used to develop the database is obtained from a survey on the Japanese national character, which is conducted on a regular basis by the Institute of Statistical Mathematics. This survey has been conducted every five years since the first 1953 survey. The most recent was its twelfth survey and was conducted in the autumn of 2008. The questionnaire items in the survey concerned the attitudes of the participants toward life, environment, religion, politics, race, the Japanese people, and so forth. The results of this longitudinal survey, which are crucial for evincing the transition of Japanese character, are already available on the Internet. More comprehensive results, including cross-tabulation tables and graphs, are also provided on the Internet.

■ Database of related surveys

The survey on the Japanese national character is by no means the only survey conducted by the Institute. Various interrelated comparative surveys and experimental surveys have also been conducted. One of them is public opinion survey in Tokyo conducted since 1953 to 1982. The results of these surveys are also included in the database and made accessible to the public one at a time. The potential users of this database, including not only researchers but also the general public, will be able to analyze the data from various perspectives.

Takahiro Tsuchiya

Figure : Browsing survey results on the web

Functional Analytic Inference Research Group

Kernel Method: Nonlinear Data Analysis with Efficient Computation

What is the kernel method?

The kernel method is a recent methodology for analyzing data having a complex structure. The basic idea is to use a feature map of data into a high-dimensional functional space to extract the high order moments of the data, without pursuing complex modeling. The similar, traditional ways of extracting nonlinearity by power series expansion or basis function expansion have a problem of computational explosion for high-dimension data. The kernel methods avoid this problem by using the clever device of "positive definite kernel", which computes the inner product of the high dimensional functional space by simply evaluating the kernel values. This gives an efficient method for incorporating high order moments of data. In addition, another strong point of the kernel method is that it provides a seamless methodology for non-vectorial data such as network data and symbol sequences like texts.

Nonparametric data analysis with positive definite kernels

The kernel method was first developed as "kernelization" of existing linear methods: support vector machine and kernel principal component analysis are among such examples. More recently, however, it has been recognized that the kernel method provides a new approach to nonparametric statistical inference: by the ability of representing probabilities with the mean of the feature map, the basic statistics such as mean and covariance of the feature maps can derive various nonparametric methods of data analysis. Our group has been making central contributions in this line of research. By using characterization of conditional independence with kernels, we have been applying the methodology to various problems including dimension reduction in regression, causal network learning, and inference of nonlinear dynamics. We are also carrying out projects on theoretical foundations of the kernel method and approximation of the large matrix computation.

International research network

Our group has active collaboration networks with researchers in the world, in particular, with top researchers in Max Planck Institute (Germany), University of California, Berkeley and San Diego, and Carnegie Mellon University. We have given tutorials in various international conferences such as Machine Learning Summer School 2007 (Germany) and International Conference on Machine Learning 2008 (Finland), and have been working as one of the research centers of this area.

Kenji Fukumizu

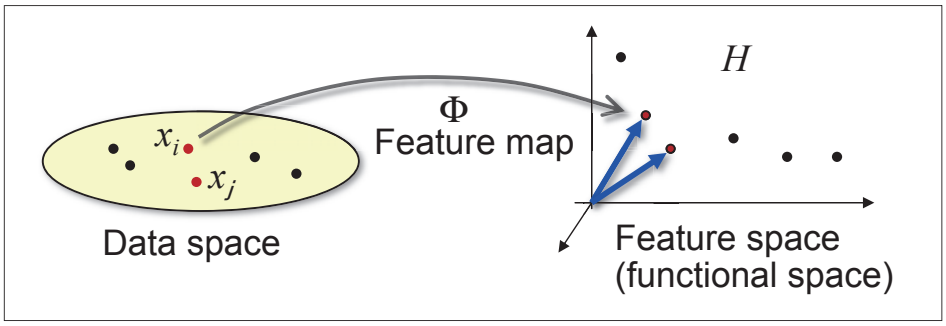


Figure 1: Feature map of kernel method

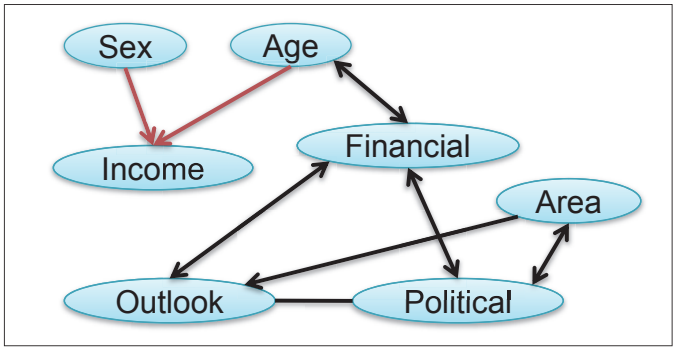


Figure 2: An example of causal network learning by the kernel method

Advanced Monte Carlo Algorithm Research Group

Rare Event Sampling by Markov Chain Monte Carlo

Our research focuses on the development of novel and nonstandard applications of Markov Chain Monte Carlo algorithm (MCMC). MCMC was introduced in physics in the 1950s by Metropolis and coworkers and proved to be a useful tool in the field of Bayesian modeling in 1990s. MCMC is, however, a general strategy for sampling multivariate distributions with unknown normalization constants and can in principle be applied to many other problems.

Here we discuss rare event sampling (i.e., sampling from the tails of the given distribution) problem as an example of the promising application fields of MCMC. (Fig.1) By using MCMC, especially with its variants "Replica Exchange Monte Carlo" and "Multicanonical Sampling", we can generate samples of very small probability, say, 10^{-15}, or even 10^{-100}, under a given model, and calculate its probability correctly. Today's most powerful computer can never achieve such an ultimate precision with naïve random sampling.

With this approach we can solve various interesting problems. For example, we can sample very rare errors in an information processing systems and access its probability. Also, we can find tiny regular orbits in chaotic systems (Fig.2). For network design problems, we can generate graphs called "expander" or "Ramanujan graph" (Fig.3), which have nice properties, *e.g.,* efficient communication and fast diffusion on them. An advantage of MCMC is that it can generate not only a sample that optimizes a given criterion, but also a number of samples with optimal or suboptimal properties; we can also calculate probabilities of obtaining objects with these properties.

Because our problems are highly cross-disciplinary, collaboration with specialists of each field is important. We are exploring frontiers of MCMC with scientists at Univ. Tokyo, Hokkaido Univ., Osaka Univ., and Kyoto Univ..

Yukito Iba

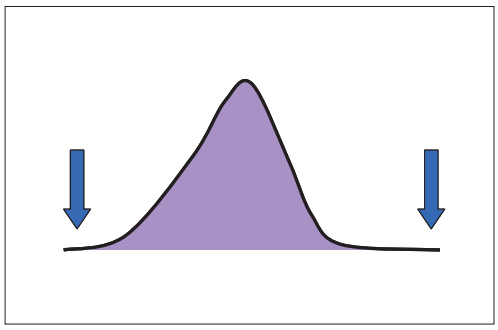


Figure 1: Rare event sampling.

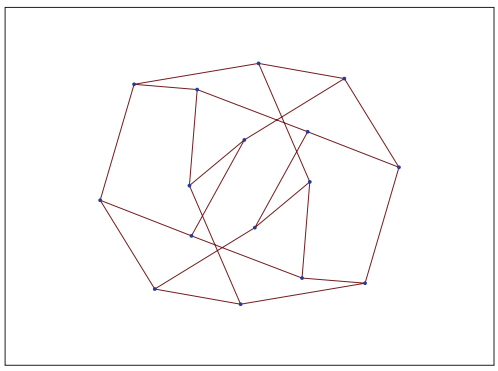


Figure 3: An example of Ramanujan graph found by multicanonical Monte Carlo.

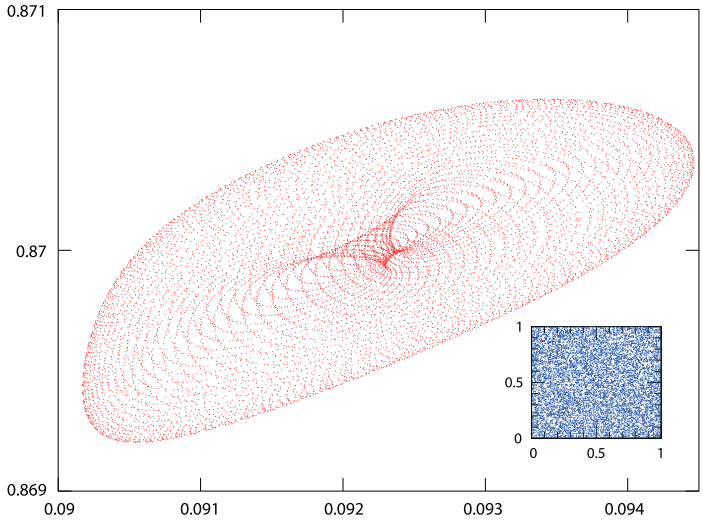


Figure 2: A tiny torus found by multicanonical Monte Carlo; the torus is embedded in a chaotic sea shown in the inset panel.

* Fig.2 is reproduced by courtesy of Mr. Akimasa Kitajima (Osaka University).

Fig.3 is reproduced by courtesy of Mr. Nen Saito (Osaka University).

Random Number Research Group

A New Hardware Random Number Generator

Random number

Random number is defined a sequence of random variables. We think binary random variables with equal probability. It is easy to understand that we can generate this random numbers from a result of finite number of honest coin tossing.

Random number generator

We call methods to generate random numbers random number generators. The random number sequence generated by a computer is called pseudo random numbers. On the other hand the random number sequence generated by a physical phenomenon is called physical random numbers. In general pseudo random numbers has uniform distribution on [0, 1). There are linear congruential method, M-sequence, Mersenne Twister and so on. The most popular phenomenon which is used for a hardware random number generator is thermal noise of electronic circuit. Recently chaos phenomenon of semiconductor laser is used for a hardware random number generator.

Hardware physical random number generator

Random numbers are used for Monte Carlo method, MCMC, bootstrap and so on. Large-scale computations are necessary to large-scale problems. Large numbers of random numbers are necessary to large-scale computations. It seems that we cannot do this computation by only one CPU. Parallel computations can bring us some results. There are many researches of methods for parallel pseudo random number generation. We, however, recommend to use a hardware random number generator for parallel computing.

Hardware random number generation

At the Institute of Statistical Mathematics, "Supercomputer system for Statistical Science" was replaced in January, 2010. New hardware random number generation system is shown in Fig. 1. Generation speed is more than 400MB/s and this speed is the fastest among hardware random number generators which utilize thermal noise of electronic circuit for noise source. Results of statistical test are very excellent. We want to say that users can use this equipment without worry. The other two hardware random number generators have been introduced. Three generators are now available through our portal site.

Yoshiyasu Tamura

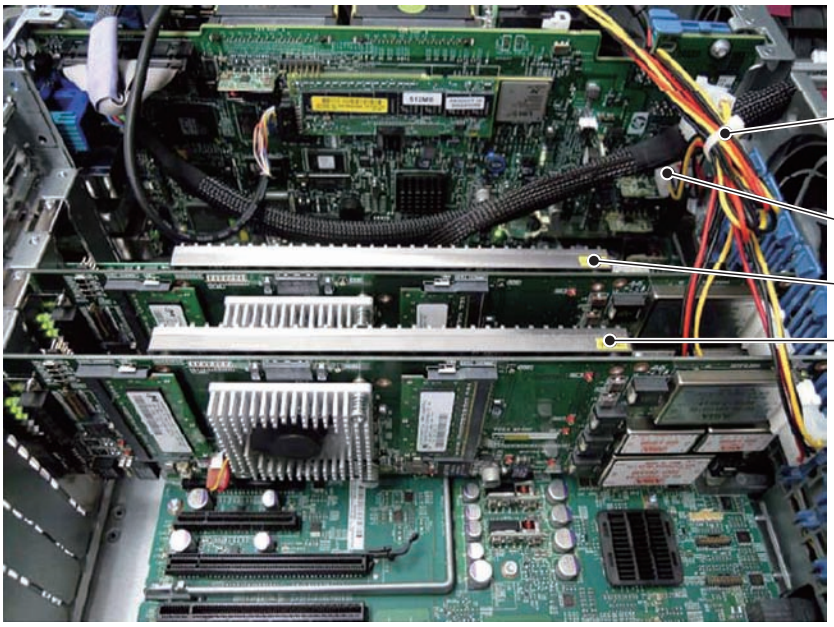


Figure: Hardware Random Number Generation System

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 Netherland (Amsterdam)	May 10, 1989 -
Statistical Research Center for Complex Systems, Seoul National University	The Republic of Korea (Seoul)	October 17, 2002 -
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 -

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

2004	2005	2006	2007	2008	2009
108	124	122	120	138	154

Fields of Research Collaboration

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

ISM Fields

Number	Fields	Number	Fields
a	Spatial and time series modeling	f	Computational statistics
b	Intelligent information processing	g	Mathematical statistics
c	Graph modeling	h	Learning and inference
d	Survey research	i	Computational mathematics
e	Multidimensional data analysis	j	Others

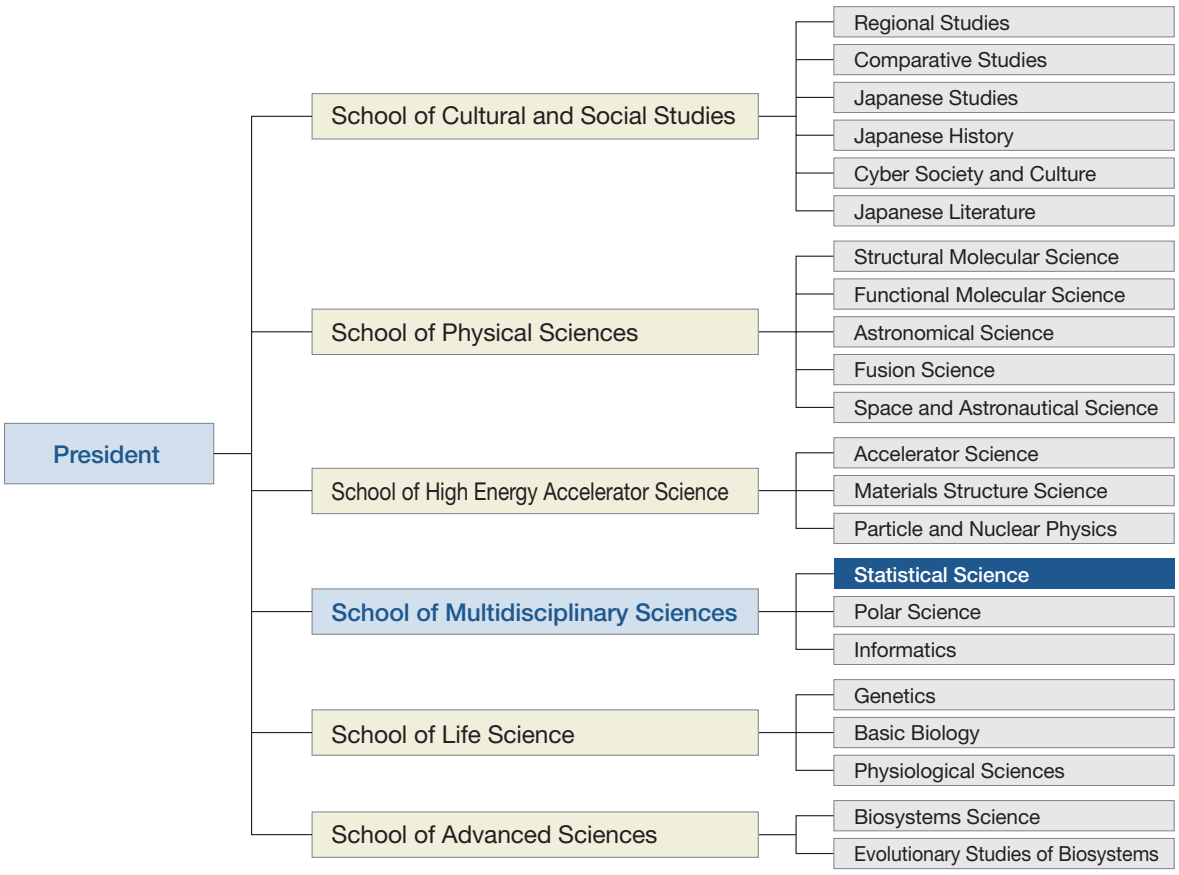
Major Research Fields

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	Others	Other research fields

Graduate School Program

Organization

The Institute of Statistical Mathematics is one of the platforms of 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 created 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 modeling, forecasting, inference and designing of data-gathering systems 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.
- The library holds an extensive collection of books and journals, being one 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 course are as follows:
  Completion of at least 40 credits while a graduate student of five years, or completion of at least 10 credits while a doctorate student of three years who graduated 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, 2010)

* 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.

■ Doctor's course three years

Year of enrollment	2002	2004	2005	2007	2008	2009	2010
Number of students	1 ①	3 ③	1 ①	4 ②	6 ④	5 ③	3 ③

■ Doctor's course five years

Year of enrollment	2007	2008	2009	2010
Number of students	2	2 ①	1 (1)	2

University Background of Students

National and public universities

• Hokkaido University • Tohoku University (2) • Fukushima University • University of Tsukuba (5) • Saitama University • Ochanomizu University • Hitotsubashi University (5) • Chiba University • The University of Tokyo (14) • Tokyo Gakugei University • Tokyo University of Agriculture and Technology • Tokyo Institute of Technology (2) • Tokyo University of Marine Science and Technology • Nagoya University (2) • Toyohashi University of Technology • Kyoto University (3) • Osaka University • Okayama University • Shimane University (2) • Kyushu University (2) • Oita University • Japan Advanced Institute of Science and Technology, Hokuriku • Osaka City University

Private universities

• Keio University (4) • Chuo University (6) • Tokyo University of Science (5) • Toyo University • Nihon University (2) • Japan Women's University • Hosei University (7) • Waseda University (5) • Nanzan University (1) • Kyoto Sangyo University • Okayama University of Science • Kurume University

Foreign universities

• Aston University • Center for Analysis and Prediction, China Seismological Bureau • Chinese Academy of Sciences, Institute of Applied Mathematics • Jahangirnagar University (2) • Northeastern University, China • Ohio University • Stanford University • The Hong Kong University of Science and Technology • Universidade Eatadual of Campians • University of Colorado at Boulder (2) • University of Dhaka (2) • University of Hawaii • University of Malaya • University of Rahshahi • University of Science and Technology of China

Degrees Awarded

Year	Doctor of Philosophy
1996	3 [1]
1997	1
1998	4 [1]
1999	6
2000	5
2001	5
2002	4
2003	8 [1]
2004	4
2005	4
2006	8 [1]
2007	7 [1]
2008	4 [1]
2009	5 [1]

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

Current Position of Alumni (As of April 1, 2010)

National and public universities, and public organizations

• Obihiro University of Agriculture and Veterinary Medicine, Professor • University of Tsukuba, Professor (2) • University of Hyogo, Professor • Saitama University, Associate Professor • The University of Electro-Communications, Associate Professor • The University of Tokyo, Associate Professor • Kyushu University, Associate Professor • Kyushu Institute of Technology, Associate Professor • The Institute of Statistical Mathematics, Associate Professor • University of Tsukuba, Lecturer • Hokkaido University, Assistant • Chiba University, Assistant • Tokyo Institute of Technology, Assistant • Hiroshima University, Assistant • Kyushu University, Assistant Professor • University of the Ryukyus, Assistant • The Institute of Statistical Mathematics, Assistant Professor (5) • The University of Tokyo, Project Researcher • Tokyo Institute of Technology, Research Fellow • Nara Institute of Science and Technology, Research Fellow • The Institute of Statistical Mathematics, Project Researcher (10) • Bank of Japan, Project Post • Japan Broadcasting Corporation • Financial Services Agency, Financial Research and Training Center, Researcher • The Institute of Statistical Mathematics, JST CREST Research Fellow • JST Basic Research Programs Doctoral Research Fellow • Railway Technical Research Institute, Senior Researcher • Statistical Information Institute for Consulting and Analysis • Government Pension Investment Fund • Public School, Teacher • The Institute of Statistical Mathematics, Research Fellow (2)

Private universities

• Sapporo Gakuin University, Professor • Meiji University, Professor • Doshisha University, Professor • Tokyo Health Care University, Associate Professor • Nihon University, Associate Professor • Tokyo University of Information Science, Lecturer • Josai University, Lecturer • Sapporo Gakuin University, Full-Time Lecturer • Tokyo Women's Medical University, Postdoctoral Fellow

Foreign universities

• Asia-Pacific Center for Security Studies Department, Associate Professor • Central South University, Professor • Hong Kong Baptist University, Lecturer • Jahangirnagar University, Professor • Jahangirnagar University, Associate Professor (2) • Massey University, Research Fellow • The University of Warwick, Research Fellow • University of Otaga, Research Fellow • University of Rajshahi, Associate Professor • University of South Carolina, Research Fellow • Victoria University, Senior Lecturer

Private companies, etc.

• Hitachi, Ltd. Central Research Laboratory, Research Fellow • NTT Communication Science Laboratories, Research Fellow • Seiwa Kikaku • Toyota Motor Corporation, Higashi-Fuji Technical Center, Research Fellow • NLI Research Institute, Chief Researcher • Sankyo Co., LTD. • Mizuho Trust and Banking, Senior Researcher (2) • JP Morgan Trust Bank Limited, Vice President (Hosei University, Part-Time Lecturer) • ATR Computational Neuroscience Laboratories, Research Fellow • Schlumberger Limited • Macquarie Securities, Japan, Quantitative Analyst • Non-Life Insurance Rating Organization of Japan, Staff Member • Open Technologies Corporation • Yamaha Corporation

Tutorial Courses

History

The statistical education program started in 1944, the year that the Institute of Statistical Mathematics was founded, as an education program at the Numerical Computation Training Center of the Science Research Technical Assistant Training Center of the Ministry of Education, located in the Institute. In 1947, the affiliated Statistical Technician Training Center was opened as an educational organization for statistical technicians and instructors, in order to improve the levels of staff training within the statistical organizations of the government and to supply statisticians.

As social needs have changed, the purpose of the education program has gradually shifted away from the initial aim of supplying well qualified statistical technicians for the government, towards statistical education for working people. Tutorial courses were therefore initiated. Later, statistical methods became more widely used across a broad range of fields. Consequently, more extensive and sophisticated statistical education was required. To meet this demand, tutorial courses were expanded to cover a wider range of statistical topics. From 1965 to 1985, six to eight courses were held annually, not only in Tokyo, but also in provincial cities such as Osaka, Okayama and Fukuoka.

In 1985, the Institute was reorganized as a member of the Inter-University Research Institute Corporation, and the affiliated Statistical Technician Training Center was abolished. However, in response to consistent public demand for tutorial courses, the Center for Engineering and Technical Support, together with other departments, ran three to four courses annually. In 2005, the number of courses rose to 13. In 2009, the number of courses was 13.

Courses

The total number of courses held from 1969 to March, 2010 was 259, with a total of 19,138 participants. These courses covered a wide range of fields from basic to applied statistics. The following table lists the courses held in the past 3 years:

Year	Category	Title	Month	Number of participants
2007	Basic course	Introduction to Risk Analysis with R – Application of Tree-based and Nonparametric Modelling –	January	49
	Basic course	Introduction to Survey Data Analysis Using R	February	40
	Basic course	Introduction to Quantitative Methods for Social Sciences	May-July	54
	Basic course	Introduction to Sampling Methods and Sample Surveys	June	50
	Basic course	Elementary Course on Time Series Analysis	July	61
	Basic course	Introduction to Statistics	July	70
	Standard course	Statistics of Extremes	September	61
	Basic course	Introduction to Statistical Data Analysis Focused on Multivariate Analysis	October	47
	Basic course	Quantification Methods for Qualitative Data	October-December	46
	Basic course	Recent Topics on International Standardization of Statistical Methods – Standardization of Sampling Inspection and Statistical Process Management –	November	11
	Basic course	Statistical Quality Control	November	16
	Standard course	Taguchi Methods for Robust Design	November	28
	Standard course	Geometrical Structures Underlying Information Quantities: Mathematics of Kullback-Leibler Information	December	52
2008	Basic course	Statistical Causal Analysis by Structural Equation Modelling	February	58
	Standard course	Regression Models for Count Data and Their Extension	February	63
	Basic course	Data Analysis and Simulation with R	May	69
	Basic course	The Grammar of Science and Descriptive Statistical Methods	June	47
	Basic course	Introduction to Statistics	July	79
	Standard course	Spatial Point Pattern Analysis – Introduction from Biological Examples	August	46

Tutorial Courses

Year	Category	Title	Month	Number of participants
2008	Standard course	Statistics of Extremes	August	48
	Standard course	An Introduction to Statistical Analysis by the Theory of Martingales	September	48
	Basic course	Analysis of Sample Surveys with R	September	41
	Basic course	Introduction to Multivariate Analysis	October	71
	Standard course	Data Assimilation: State Space Model and Simulation	October	72
	Basic course	Quality Control, Quality Engineering (Taguchi Method)	November	17
	Basic course	Introduction to Pharmacoepidemiology	November	71
	Standard course	Understanding of Evolutionary Computation: Statistical Viewpoint	December	56
2009	Standard course	Markov Chain Monte Carlo : Basics and Examples	February	78
	Standard course	Data Assimilation Methodology in Practice	April	77
	Basic course	Introduction to Sampling Methods and Survey Data Analysis	May	71
	Standard course	Introduction to Multivariate Descriptive Data Analysis by R	May	47
	Basic course	Statistical Data Visualization	June	75
	Basic course	Introduction to Pharmacoepidemiology	June	73
	Basic course	Data Analysis for Marketing	June-July	74
	Basic course	Akaike Information Criterion and Statistical Modeling: Introduction from Field Biological Data	July	73
	Basic course	Introduction to Statistics	July	78
	Standard course	Regularization and Estimation – LASSO and Related Topics, Basic Theory and Applications –	August	44
	Basic-Standard course	Elementary of Multivariate Analysis	August	76
	Basic course	Statistics Literacy for the Law Court – For the Base on the Rational Discussion –	November	36
	Basic course	Introduction to Text Mining with R	November	51
2010	Standard course	Markov Chain Monte Carlo : Basics and Examples / 2010	February	97

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

Statistical Mathematics Seminar

The Institute holds a one-hour seminar every Wednesday to showcase the latest studies of our academic staff and guest researchers. The seminar is open to the public. For details, please visit the website of the Institute.
http://www.ism.ac.jp/

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/

Consultation about Statistical Science

The Institute provides a consultation service on statistical science for the general public and researchers as a means of actively sharing the benefits of our research with society. This service operates throughout the year. Please contact the Center for Engineering and Technical Support. The consultation service covers a variety of topic ranging from the basics of statistics to more specialized issues. Half of the advice receivers are from the private sector, and the rest are staff from public organizations, university teachers, and students. Each teacher at the Institute directly takes charge of about 20 specialized cases annually, some of which are publicized at academic conferences, as being of benefit to society.

Annual Research Meeting for 2009

The Annual Research Meeting of the Institute was held on March 18 and 19, 2010. This annual meeting is an opportunity for the Institute's researchers and visiting researchers to present the results of their studies from the previous year. The meeting has been held every year since the foundation of the Institute in 1944. In the early years, as there were few staff members and participants, they were able to have enthusiastic discussions all day long. However, as the number of staff members has increased, the meeting is now held over two days and each presenter is given 12 minutes to report on the results of his/her own research. A wide variety of topics is covered, ranging from statistical contributions to issues facing today's society to more fundamental studies. This year's meeting started with an opening address by Junji Nakano, and greetings from Genshiro Kitagawa. A total of 49 research education staff and 8 visiting researchers then gave their presentations. In addition, a poster session was held by 47 research fellows and graduate students of Sokendai. From 2004, we have begun to compile and distribute proceedings in advance. We also host visitors from other organizations. The program for this meeting is available from the website.

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

Facilities and Equipment

Computation Resources (As of October 1, 2010)

Since January 2010, the Supercomputer System for Statistical Science has been in operation and has analyzed a large volume of statistical data. The main components are a shared memory system (Fujitsu SPARC Enterprise M9000 with 2 nodes, the first with 64 quad-core SPARC64 CPUs and 2 TB of main memory, and the second with 24 quad-core SPARC64 CPUs and 1 TB of main memory), and a distributed memory system (Fujitsu PRIMERGY RX200S5 with 360 nodes, each with 2 quad-core Xeon X5570 CPUs and 48 or 24 GB of main memory. In total, 2880 cores and 12.1 TB of memory are available). The system also includes a large-scale shared storage system (1.37 PB disk storage supported by RAID6), a physical random number generating system (two random number generator boards, each of which can generate random numbers at 400 MB/s) and a visualization system (including a SXRD projector with a maximum resolution of 4,096 × 2,160 and a 200-inch rear projection screen).

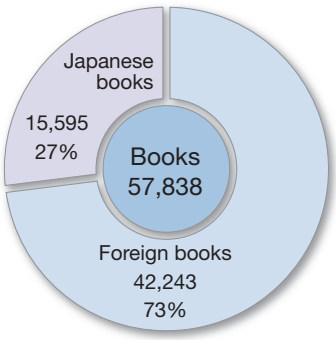
In the new office building, the primary Local Area Network (LAN) consists of an Ethernet network using 10GBASE-SR for the main trunk and 1000Base-T for branches. The personal computers in researchers' offices, the Supercomputer System for Statistical Science are all connected to this network. A wireless LAN system that supports IEEE 802.11a,b,g,n is also available in the area of the building occupied by the institute. These LAN systems enable distributed processing and computing resources and statistical data to be used effectively. Comprehensive network security measures 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 SINET3 (1 Gbps).

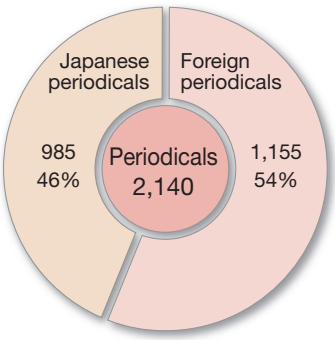
Supercomputer System for Statistical Science

Library and Materials (As of April 1, 2010)

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), 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 (2009)

Type	Personnel expenses	Non-personnel expenses	Total
Expenditure	862,269	1,120,568	1,982,837

Unit: ¥1,000

Accepted External Funds (2009)

Type	Subcontracted research	Joint research	Contribution for scholarship	Total
Items	15	1	5	21
Income	170,060	5,000	3,900	178,960

Unit: ¥1,000

Grant-in-Aid for Scientific Research (2009)

Research Category	Items	Amount Granted
Grant-in-Aid for Scientific Research on Priority Areas	1	1,600
Grant-in-Aid for Scientific Research (A)	5	44,330
Grant-in-Aid for Scientific Research (B)	5	21,710
Grant-in-Aid for Scientific Research (C)	13	17,160
Grant-in-Aid for Young Scientists (A)	1	5,460
Grant-in-Aid for Young Scientists (B)	11	12,480
Grant-in-Aid for Young Scientists (Start-up)	1	1,560
Grant-in-Aid for JSPS Fellows	1	1,100
Total	38	105,400
Grant-in-Aid for Scientific Research, Ministry of Health, Labour and Welfare	1	5,980

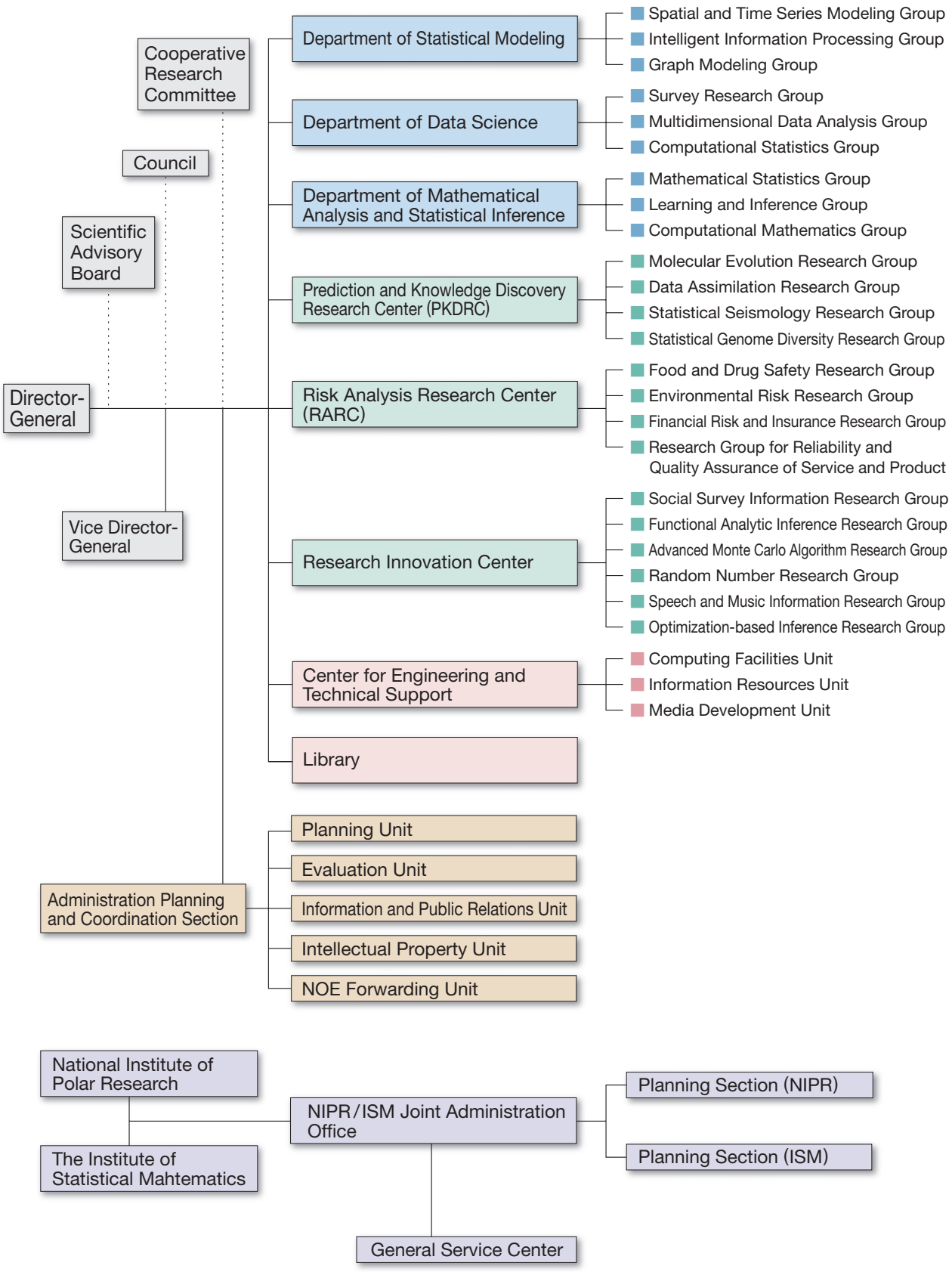
Unit: ¥1,000

Site and Buildings (As of June 1, 2010)

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

Organization

Organization Diagram (As off August 1, 2010)



Number of Staff (As of August 1, 2010)

Type	Director-General	Professor	Associate Professor	Assistant Professor	Administrative Staff	Technical Staff	Total
Director-General	1						1
Department of Statistical Modeling		4	7	5			16
Department of Data Science		8	6	3			17
Department of Mathematical Analysis and Statistical Inference		4	5	6			15
Center for Engineering and Technical Support						9	9
Administration Planning and Cordination Section					1		1
NIPR/ISM Joint Administration Office					12 (26)	1 (2)	13 (28)
Total	1	16	18	14	13 (26)	10 (2)	72 (28)

( ) Total Number of Staff of NIPR/ISM Joint Administration Office

Staff (As of August 1, 2010)

Director-General	Genshiro KITAGAWA				
Vice Director-General	Takashi NAKAMURA	Vice Director-General	Hiroe TSUBAKI	Vice Director-General	Tomoko MATSUI

Department of Statistical Modeling

Director Tomoyuki HIGUCHI

Spatial and Time Series Modeling Group

Prof.	Yosihiko OGATA	Assoc. Prof.	Genta UENO	Assist. Prof.	Shinya NAKANO
Prof.	Tomoyuki HIGUCHI	Assoc. Prof.	Fumikazu MIWAKEICHI	Project Researcher	Toshihiro ABE
Assoc. Prof.	Yoshinori KAWASAKI	Assist. Prof.	Ryo YOSHIDA	Project Researcher	Ken ISHIKAWA
Assoc. Prof.	Kenichiro SHIMATANI	Assist. Prof.	Jiancang ZHUANG		

Intelligent Information Processing Group

Prof.	Tomoko MATSUI	Assoc. Prof.	Yukito IBA	Assist. Prof.	Hiroshi SOMEYA
Prof.	Kenji FUKUMIZU	Assoc. Prof.	Yumi TAKIZAWA	Visiting Prof.	Masataka GOTO

Graph Modeling Group

Assoc. Prof.	Jun ADACHI	Assist. Prof.	Ying CAO	Adjunct Prof.	Masami HASEGAWA

Department of Data Science

Director Yoshiyasu TAMURA

Survey Research Group

Prof.	Takashi NAKAMURA	Assoc. Prof.	Tadahiko MAEDA	Visiting Assoc. Prof.	Wataru MATSUMOTO
Prof.	Ryozo YOSHINO	Assoc. Prof.	Takahiro TSUCHIYA	Project Researcher	Kiyohisa SHIBAI
		Assist. Prof.	Koken OZAKI	Project Researcher	Jun YAMASHITA

Multidimensional Data Analysis Group

Prof.	Toshiharu FUJITA	Prof.	Shigeyuki MATSUI	Project Researcher	Hei CHAN
Prof.	Hiroe TSUBAKI	Assoc. Prof.	Satoshi YAMASHITA		
Prof.	Nobuhisa KASHIWAGI	Assist. Prof.	Toshihiko KAWAMURA		

Staff

Computational Statistics Group

Prof.	Yoshiyasu TAMURA	Assoc. Prof.	Seisho SATO	Visiting Assoc. Prof.	Norikazu IKOMA
Prof.	Junji NAKANO	Assist. Prof.	Nobuo SHIMIZU	Project Researcher	Hayato TAKAHASHI
Assoc. Prof.	Naomasa MARUYAMA	Visiting Prof.	Yuichi MORI		
Assoc. Prof.	Koji KANEFUJI	Visiting Prof.	Kazunori YAMAGUCHI		

Department of Mathematical Analysis and Statistical Inference

Director Shinto EGUCHI

Mathematical Statistics Group

Prof.	Satoshi KURIKI	Assist. Prof.	Shuhei MANO	Assist. Prof.	Kei KOBAYASHI
Assoc. Prof.	Yoichi NISHIYAMA	Assist. Prof.	Takaaki SHIMURA	Assist. Prof.	Shogo KATO

Learning and Inference Group

Prof.	Shinto EGUCHI	Assoc. Prof.	Hironori FUJISAWA	Assist. Prof.	Masayuki HENMI
Assoc. Prof.	Shiro IKEDA	Assist. Prof.	Tadayoshi FUSHIKI	Assist. Prof.	Shinsuke KOYAMA

Computational Mathematics Group

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

Prediction and Knowledge Discovery Research Center (PKDRC)

Director Shinto EGUCHI

Molecular Evolution Research Group

Assoc. Prof.	Jun ADACHI	Assist. Prof.	Ying CAO		

Data Assimilation Research Group

Prof.	Tomoyuki HIGUCHI	Assist. Prof.	Ryo YOSHIDA	Project Researcher	Tomoko IMOTO
Assoc. Prof.	Genta UENO	Assist. Prof.	Shinya NAKANO	Project Researcher	Masaya SAITO
				Project Researcher	Hiromichi NAGAO

Statistical Seismology Research Group

Prof.	Yosihiko OGATA	Visiting Prof.	Shinji TODA	Project Researcher	Ann Anning CHU
Assist. Prof.	Jiancang ZHUANG	Project Professor	Mitsuhiro MATSU'URA	Project Researcher	Katsunori SUGAYA

Statistical Genome Diversity Research Group

Prof.	Shinto EGUCHI	Assoc. Prof.	Hironori FUJISAWA	Visiting Prof.	Masaaki MATSUURA
Prof.	Satoshi KURIKI	Assist. Prof.	Tadayoshi FUSHIKI	Project Researcher	Osamu KOMORI
Assoc. Prof.	Shiro IKEDA	Assist. Prof.	Shogo KATO		

Risk Analysis Research Center (RARC)

Director	Hiroe TSUBAKI	Coordinator	Koji KANEFUJI
Vice Director / Coordinator	Toshiharu FUJITA	Coordinator	Yoshinori KAWASAKI
Coordinator	Shigeyuki MATSUI	Coordinator	Toshihiko KAWAMURA

Food and Drug Safety Research Group

Prof.	Toshiharu FUJITA	Visiting Prof.	Manabu IWASAKI	Visiting Assoc. Prof.	Makoto TOMITA
Prof.	Hiroe TSUBAKI	Visiting Prof.	Toshiya SATO	Visiting Assoc. Prof.	Satoshi AOKI
Prof.	Shigeyuki MATSUI	Visiting Prof.	Yoshimitsu HIEJIMA	Project Assist. Prof.	Takafumi KUBOTA
Assist. Prof.	Takaaki SHIMURA	Visiting Prof.	Yoichi KATO	Project Researcher	Yosuke FUJII
Assist. Prof.	Masayuki HENMI	Visiting Assoc. Prof.	Toshio OHNISHI		

Risk Analysis Research Center

Environmental Risk Research Group

Prof.	Nobuhisa KASHIWAGI	Visiting Prof.	Hidetoshi KONNO	Visiting Assoc. Prof.	Koji OKUHARA
Prof.	Atsushi YOSHIMOTO	Visiting Prof.	Kazuo YAMAMOTO	Visiting Assoc. Prof.	Tomohiro TASAKI
Assoc. Prof.	Koji KANEFUJI	Visiting Prof.	Yoshiro ONO	Project Researcher	Masaki OKUDA
Visiting Prof.	Yukio MATSUMOTO	Visiting Prof.	Mihoko MINAMI	Project Researcher	Masayuki KAGEYAMA
Visiting Prof.	Kunio SHIMIZU	Visiting Assoc. Prof.	Hirokazu TAKANASHI	Project Researcher	Takayuki FUJII

Financial Risk and Insurance Research Group

Assoc. Prof.	Satoshi YAMASHITA	Visiting Prof.	Naoto KUNITOMO	Visiting Assoc. Prof.	Masakazu ANDO
Assoc. Prof.	Seisho SATO	Visiting Prof.	Hiroshi TSUDA	Project Researcher	Kentaro AKASHI
Assoc. Prof.	Yoshinori KAWASAKI	Visiting Prof.	Michiko MIYAMOTO	Project Researcher	Christopher Andrew ZAPART
Assoc. Prof.	Yoichi NISHIYAMA	Visiting Assoc. Prof.	Toshinao YOSHIBA	Project Researcher	Yoko TANOKURA

Research Group for Reliability and Quality Assurance of Service and Product

Prof.	Hiroe TSUBAKI	Visiting Prof.	Sadaaki MIYAMOTO	Visiting Assoc. Prof.	Takahiro HOSHINO
Assist. Prof.	Toshihiko KAWAMURA	Visiting Prof.	Shusaku TSUMOTO	Visiting Assoc. Prof.	Yukihiko OKADA
Visiting Prof.	Kakuro AMASAKA	Visiting Assoc. Prof.	Manabu KUROKI	Visiting Assoc. Prof.	Hideki KATAGIRI
Visiting Prof.	Kazuo TATEBAYASHI				

Research Innovation Center

Director Kenji FUKUMIZU

Social Survey Information Research Group

Prof.	Takashi NAKAMURA	Assoc. Prof.	Tadahiko MAEDA	Visiting Assoc. Prof.	Toru KIKKAWA
Prof.	Ryozo YOSHINO	Assoc. Prof.	Takahiro TSUCHIYA		

Functional Analytic Inference Research Group

Prof.	Kenji FUKUMIZU	Assist. Prof.	Kei KOBAYASHI

Advanced Monte Carlo Algorithm Research Group

Assoc. Prof.	Yukito IBA	Visiting Prof.	Makoto KIKUCHI	Visiting Assoc. Prof.	Koji HUKUSHIMA

Random Number Research Group

Prof.	Yoshiyasu TAMURA	Visiting Assoc. Prof.	Toru ONODERA

Speech and Music Information Research Group

Prof.	Tomoko MATSUI	Assist. Prof.	Shinsuke KOYAMA

Optimization-based Inference Research Group

Assoc. Prof.	Satoshi ITO	Assoc. Prof.	Shiro IKEDA	Assoc. Prof.	Genta UENO

Project Researchers

Project Professor	Ryozo MIURA	Project Researcher	Eiki TANAKA	Project Researcher	Keisuke HAYASHI
Project Researcher	Motoi OKAMOTO	Project Researcher	Xiaoling DOU	Project Researcher	Hitoshi MOTOYAMA
Project Researcher	Satoko SAITA				

Staff

Center for Engineering and Technical Support

Director	Junji NAKANO	Senior Specialist	Saeko TANAKA
Vice Director	Satoshi YAMASHITA	Adjunct Prof.	Yasumasa BABA
Deputy Manager	Yuriko WATANABE	Adjunct Prof.	Makio ISHIGURO

Head of Computing Facilitise Unit	Kazuhiro NAKAMURA	Visiting Prof.	Michiko WATANABE
Head of Information Resources Unit (Concurrent)	Saeko TANAKA	Visiting Prof.	Yoshihiko KONNO
Head of Media Development Unit (Concurrent)	Yuriko WATANABE		

Library

Head Junji NAKANO

Administration Planning and Coordination Section

Director Genshiro KITAGAWA

Head of Planning Unit	Hiroe TSUBAKI	Head of Intellectual Property Unit	Tomoko MATSUI
Head of Evaluation Unit	Takashi NAKAMURA	Head of NOE Forwarding Unit	Genshiro KITAGAWA
Head of Information and Public Relations Unit	Tomoko MATSUI	Visiting Prof.	Takashi NAMESHIDA

NIPR / ISM Joint Administration Office

Director Masaru SHIMODA　　Director of General Service Center Tsugio TOKUTA

■ Planning Section (ISM)

Head of Planning Section Yoshiki HAMA

Deputy Head	Hiroshi YAMAMOTO	Team Leader	Motoyoshi URANO	Team Leader	Akihiko NAKAMURA
Specialist	Fumio SUTO	Team Leader	Hiroaki ARAI		

■ Planning Section (NIPR)

Head of Planning Section Tsuyoshi ABE

Deputy Head	Yasuyuki EDURE	Team Leader	Motokazu TOYODA	Team Leader	Nobutaka IRIE

■ General Service Center

Deputy Head	Takashi KOSAKA	Team Leader	Hiroshi YOSHIOKA	Team Leader	Yoji ISHII
Deputy Head	Koji SAKAMOTO	Team Leader	Tomoe HIRANUMA	Team Leader	Tomoko IIDA
Deputy Head	Toru HAYASHI	Team Leader	Kazuyoshi ASO	Team Leader	Kuniyasu YOKOI

Council of The Institute of Statistical Mathematics (As of April 1, 2010)

Masanori IYE	Professor, Optical and Infrared Astronomy Division, National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Yutaka KANO	Professor, Graduate School of Engineering Science, Osaka University
Toshinari KAMAKURA	Professor, Faculty of Science and Engineering, Chuo University
Koji KURIHARA	Professor, Graduate School of Environmental Science, Okayama University
Kunio SHIMIZU	Professor, Faculty of Science and Technology, Keio University
Kazuo SEIYAMA	Professor, Graduate School of Humanities and Sociology, the University of Tokyo
Makoto TAIJI	Group Director, Computational Systems Biology Research Group, Advanced Computational Sciences Department, Advanced Science Institute, RIKEN
Nobuhiko TERUI	Professor, Graduate School of Economics and Management, Tohoku University
Yoshihiro YAJIMA	Professor, Graduate School of Economics, The University of Tokyo
Takashi WASHIO	Professor, the Institute of Scientific and Industrial Research, Osaka University
Takashi NAKAMURA	Professor (Vice Director-General, ISM)
Hiroe TSUBAKI	Professor (Vice Director-General, ISM)
Tomoko MATSUI	Professor (Vice Director-General, ISM)
Tomoyuki HIGUCHI	Professor (Director of Department of Statistical Modeling, ISM)
Yoshiyasu TAMURA	Professor (Director of Department of Data Science, ISM)
Shinto EGUCHI	Professor (Director of Department of Mathematical Analysis and Statistical Inference, ISM)
Junji NAKANO	Professor (Director of Center for Engineering and Technical Support, ISM)
Satoshi KURIKI	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)
Kenji FUKUMIZU	Professor (Department of Statistical Modeling, ISM)
Yosihiko OGATA	Professor (Department of Statistical Modeling, ISM)
Nobuhisa KASHIWAGI	Professor (Department of Data Science, ISM)

Cooperative Research Committee (As of April 1, 2010)

Akifumi OIKAWA	Professor and Presidential Aide, The Graduate University for Advanced Studies
Hidetoshi KONNO	Professor, Graduate School of System and Information Engineering, University of Tsukuba
Toshimitsu HAMASAKI	Associate Professor, Graduate School of Medicine, University of Osaka
Michiko WATANABE	Professor, Faculty of Economics, Toyo University
Yuichi MORI	Professor, Faculty of Informatics, Okayama University of Science
Ryozo YOSHINO	Professor (Department of Data Science, ISM)
Shinto EGUCHI	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)
Nobuhisa KASHIWAGI	Professor (Department of Data Science, ISM)
Atsushi YOSHIMOTO	Professor (Department of Mathematical Analysis and Statistical Inference, ISM)

Research Ethics Review Committee (As of April 1, 2010)

Specialist on epidemiology and social research	Michio UMINO	Professor Extraordinary, Tohoku University
Specialist on epidemiology and social research	Yoshihiko MIURA	Professor, School of Health and Social Service, Saitama Prefectural University
Person in citizens' position	Yutaka KURIKI	Principal, Tachikawa City Daiichi Elementary School
Specialist in the field of ethics and law	Hitomi NAKAYAMA	Lawyer, Kasumigaseki-Sogo Law Offices
Research education staff of ISM	Takashi NAKAMURA	Professor (Department of Data Science, ISM)
Research education staff of ISM	Hiroe TSUBAKI	Professor (Department of Data Science, ISM)
Research education staff of ISM	Shigeyuki MATSUI	Professor (Department of Data Science, ISM)
Research education staff of ISM	Tadahiko MAEDA	Associate Professor (Department of Data Science, ISM)

Professor Emeritus (As of August 1, 2010)

Kameo MATSUSHITA	Noboru OHSUMI	Yoshiyuki SAKAMOTO	Masaharu TANEMURA
Shigeki NISHIHIRA	Masakatsu MURAKAMI	Takemi YANAGIMOTO	Makio ISHIGURO
Tatsuzo SUZUKI	Kunio TANABE	Yoshiaki ITOH	
Giichiro SUZUKI	Tadashi MATSUNAWA	Yasumasa BABA	
Ryoichi SHIMIZU	Masami HASEGAWA	Katsuomi HIRANO	

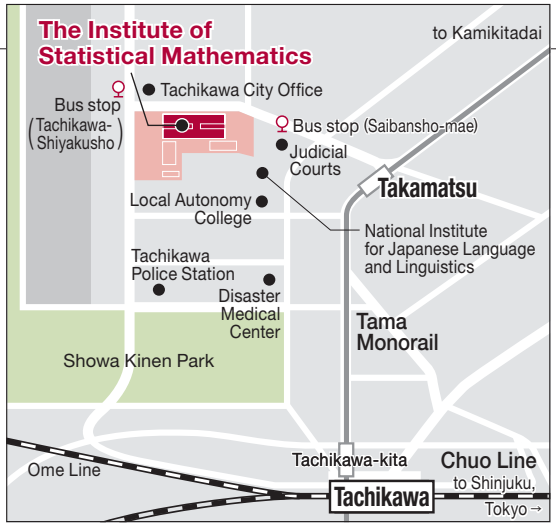
History

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.
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	Reorganized as an Inter-University Research Institute owing to the revision of the Order for the Enforcement of the National School Establishment Law. The revised law required that the Institute would, as an National Inter-University Research Institute, 1) conduct studies on statistical mathematics and its application, 2) provide opportunities for university teachers or other researchers majoring in this field to utilize the facility, and 3) contribute to the development of academic studies in universities. At the same time, the 6 research departments were reorganized into 4 research departments (Fundamental Statistical Theory, Statistical Methodology, Prediction and Control, and Interdisciplinary Statistics). The Statistical Data Analysis Center and the Statistical Education and Information Center were instituted, and the affiliated Statistical Technician Training Center was abolished.
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).
1999	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 in the affiliated facility.
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 affiliated facilities were reorganized as research departments, and the Risk Analysis Research Center was instituted.
2008	April	The Research Innovation Center was instituted in the affiliated facility. The Intellectual Property Unit was instituted.
2009	October	The ISM 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 was instituted within the Administration Planning and Coordination Section.

The Institute of Statistical Mathematics
Research Organization of Information and Systems

10-3 Midori-cho, Tachikawa, Tokyo 190-8562, Japan
Tel: +81-(0)50-5533-8500
Fax: +81-(0)42-527-9302
http://www.ism.ac.jp/

The Institute of Statistical Mathematics



Access to the ISM

◎ Tama Monorail
ca. 10 min walk from Takamatsu Sta.

◎ Tachikawa Bus
ca. 5 min walk from Saibansho-mae or Tachikawa-Shiyakusho bus stop

Research Organization of Information and Systems
The Institute of Statistical Mathematics
10-3 Midori-cho, Tachikawa, Tokyo 190-8562, Japan
Tel: +81-(0)50-5533-8500 Fax: +81-(0)42-527-9302
http://www.ism.ac.jp/