# The Institute of Statistical Mathematics

**ACTIVITY REPORT** 

2019.4 - 2021.3

Tokyo, Japan

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Activity Report 2019.4 - 2021.3



Tokyo, Japan

October 2021 Center for Engineering and Technical Support The Institute of Statistical Mathematics Research Organization of Information and Systems Inter-University Research Institute Corporation

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Introduction to the <b>Department of Statistical Science</b> ,	
School of Multidisciplinary Sciences, SOKEND	AI
(The Graduate University for Advanced Studie	es)

#### Foreword

The Institute of Statistical Mathematics (ISM) was established in June 1944 as a research institute under the direct control of the Ministry of Education. Subsequently, it was reorganized as the National Inter-University Research Institute in 1985 and then as the Inter-University Research Institute in 1989. Then, it became part of the Inter-University Research Institute Corporation, Research Organization of Information and Systems (ROIS) in 2004. However, since its establishment, the ISM has inherited the culture of statistical mathematics research with an awareness of the contact with reality and the field, which will undoubtedly continue to be the basis of our research and educational activities.

The "theory and application of statistics for the purpose of clarifying and designing phenomena and behavior" is the "statistical and mathematical sciences" studied at the ISM. In order to fulfill the role demanded by society, all of us at the ISM are striving to carry out our own research, while keeping in mind the importance of the field.

In this "data-driven era" of great social change, there is a growing interest in methodologies for effectively utilizing data, and "data science," which encompasses a variety of mathematical disciplines related to data, such as statistics, machine learning, and optimization, is becoming increasingly important. At the same time, the demand for expert personnel with statistical skills who can handle data appropriately, as well as the systems and organizations to train them, is also increasing significantly.

The ISM established the School of Statistical Thinking in 2011, and has designed and served various programs in the "Project for Fostering and Promoting Statistical Thinking" for developing professionals who would be leaders in the data-driven era. The ISM is also striving to develop statistical experts needed by each university and is forming a consortium for this purpose.

The novel coronavirus (COVID-19) pandemic has been ongoing for more than a year, and the ISM was quick to launch the "Novel Coronavirus Response Project" last year. All of us involved in this project are working hard to establish core technologies that will provide effective evidence for new infectious diseases.

Of course, it is of utmost importance to contribute to the academic community of statistical science, data science, and mathematical science by further refining and deepening the basic science of statistics and mathematics, which has been our primary mission since our establishment. In addition, data and statistical and mathematical methods are "tools" that connect various academic fields and people. It is also important to use these "tools" to expand our research to as many people as possible in a comprehensive and efficient manner.

For a long time, the ISM has been disseminating the "NOE Project" to promote cooperation with industry-government-academic sectors and create "Good Practice" systematically in forming research networks. The ISM is now planning to create networks in "Statistics" to formulate broadly in "Data Science" for much.

The ISM cordially asks for your continued support and cooperation in such research educational activities.

Hiroe Tsubaki Director-General

October 2021

#### Organization Diagram (As of April 1, 2021)





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### Organization

Since its foundation as the one and only national institute for statistical science in Japan, the Institute of Statistical Mathematics (ISM) has continued to exert a prominent influence on the study and research of statistical science. The ever-increasing needs for statistical methods and ideas in various fields of science and technology led ISM to reorganize itself in 1985 as an inter-university research institute that puts a major emphasis on research collaboration with all science disciplines.

In April 2004, ISM began a new chapter as a member of the Research Organization of Information and Systems (ROIS), Inter-University Research Institute Corporation, which includes three other institutes: the National Institute of Polar Research (NIPR), National Institute of Informatics (NII), and National Institute of Genetics (NIG). In October 2009, ISM moved to Tachikawa and started its activities. It shares the new building with NIPR and the National Institute of Japanese Literature (NIJL).

At present, ISM consists of three departments, four research centers, a school, a support center, a planning section, a council, and committees. All ISM activities are guided by the leadership of the director-general and three vice-director-generals. The Council of ISM implements any necessary recommendations. The Cooperative Research Committee organizes and facilitates collaborative research projects developed between staff at ISM and collaborators in other academic agencies. The Managing Committee of the School of Statistical Thinking, established in 2016, makes suggestions regarding projects of fostering statistical thinking.

Three research departments, the Department of Statistical Modeling, the Department of Statistical Data Science, and the Department of Statistical Inference and Mathematics, form the active core of ISM with its 43 academic staff and carry out research on either statistical theory or its application to other fields of science and industry. The Department of Statistical Modeling and its three groups study statistical modeling aspects in various fields. In the three groups of the Department of Statistical Data Science, efforts are concentrated on data collection and handling. The three groups of the Department of Statistical Inference and Mathematics are specifically concerned with the fundamental aspects of statistics.

The four strategic research centers—Risk Analysis Research Center, Research Center for Statistical Machine Learning, Data Science Center for Creative Design and Manufacturing, and Research Center for Medical and Health Data Science—were established in 2005, 2012, 2017, and 2018, respectively, as main bodies for establishing the Network of Excellence (NOE) and performing project research on specific topics. The Risk Analysis Research Center studies many risk-related topics, such as food, drug, clinical trials, suicide, environment, resource management, finance, insurance, earthquake, and genome information. The Research Center for Statistical Machine Learning aims to support the research community of the field as an activity of the NOE projects and produce influential research works by carrying out various research projects with domestic and international collaborations. The Data Science Center for Creative Design and Manufacturing aims to motivate advanced technologies in the field of data science and foster scientific methodologies for creative design and manufacturing. The Research Center for Medical and Health Data Science aims to facilitate statistical data science research that covers medical studies, drug developments, health care, and public health. More detailed descriptions of the objectives of each department and center are presented in the next chapter. The information covers research subjects and staff interests, considering the physical sciences, life sciences, social sciences, and cultural sciences.

The School of Statistical Thinking, established in 2012, performs the project of fostering and promoting statistical thinking. As data produced in various fields of the real world become very large and complex, people who can discover important knowledge buried in such data are strongly required. ISM has



provided several tutorial courses and supports to disseminate statistical thinking for a long time. The school integrates and expands such activities and provides a place to learn statistical thinking.

The Center for Engineering and Technical Support was established in 2006 to help the activities of the Japanese statistical science community by providing adequate computational and informational resources. The center has 11 technical staff that works on special jobs, including computer systems maintenance, journal editing, and bibliographical services. ISM has a supercomputer system and a library of books and journals, not only in pure statistics but also in fields of specific interest to researchers (e.g., physics, genetics, and social sciences).

The institute also devotes itself to educating young statisticians. As a constituent of the Graduate University for Advanced Studies, SOKENDAI, ISM offers graduate programs leading to a Ph.D. degree in the Department of Statistical Science, School of Multidisciplinary Sciences (See Supplement on page 99).

(The number of staff mentioned above refers to the full strength on April 1, 2021.)

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### Departments, Centers and Research Staff

#### **Department of Statistical Modeling**

The Department of Statistical Modeling works on the modeling of phenomenal structures related to numerous factors, and it conducts research on model-based statistical inference methodologies. The department aims to contribute to the development of cross-field modeling intelligence via investigation of the modeling methods for prediction&control, complex structures, and data assimilation.

#### Prediction and Control Group

The Prediction and Control Group works on the development and evaluation of statistical models, which function effectively in terms of predicting and controling phenomena, decision making, and scientific discoveries. These efforts involve data analysis and modeling related to phenomena that vary across time and stpace.

— Staff —

Yoshinori KAWASAKI, Prof. Yoshihiko MIYASATO, Prof. (Vice Director-General) Atsushi YOSHIMOTO, Prof. Jiancang ZHUANG, Assoc. Prof. Yumi TAKIZAWA, Assoc. Prof. Fumikazu MIWAKEICHI, Assoc. Prof.

- Time series modeling with smoothed prior distribution
- · Research on control of multi-agent system
- + Discrete optimization model development for ecosystem service evaluation
- Statistical seismology
- Network structure estimation by causal analysis

- Information extraction and prediction from high frequency observation time series
- + Study of nonlinear  $H_{\scriptscriptstyle \infty}$  control based on inverse optimization
- Development of an eco-adaptive decision support system for resource management
- Biosignal spatiotemporal analysis

Complex System Modeling Group

The Complex System Modeling Group conducts studies in order to discover the structures of complex systems, such as nonlinear systems and hierarchical networks, through statistical modeling. For these purpose, the group also considers Monte Carlo simulations, discrete mathematics, and computer science.

— Staff —

Tomoko MATSUI, Director, Prof. Yukito IBA, Prof. Hideitsu HINO, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Kazuhiro MINAMI, Assoc. Prof. (-2020.3.31) Shinsuke KOYAMA, Assoc. Prof. Kengo KAMATANI, Assoc. Prof. (2020.10.1-) Momoko HAYAMIZU, Assist. Prof. (-2020.3.31)

- Bayesian modeling and MCMC data analysis
- Privacy protection for big data
- Modeling and statistical analysis of complex systems using stochastic processes and random fields
- Development of active learning and statistical anomaly detection methods and its application to natural science and industry
- Statistical security analysis of anonymous data
- Development of applications with MCMC and sequential Monte Carlo methods
- Geometric analysis of machine learning and statistical algorithms
- Structural modeling of biological phenomena using graphs
- Research on discrete geometry and its application to extract graph structure from distance data
- Urban intelligence

· Statistical analysis of speech and image data

#### Data Assimilation Group

The Data Assimilation Group works on the development of data assimilation techniques, which are procedures aimed at combining information derived from large amounts of observations and a numerical simulation model. By developing computational algorithms and high-performance parallel computing systems, the group aims to build a next-generation simulation model that can predict the future in real time.

— Staff —

Genta UENO, Prof. Shinichi, OHTANI, Visiting Prof. Masako KAMIYAMA, Visiting Prof. Tadahiko SATO, Visiting Prof. Kazuyuki NAKAMURA, Visiting Prof. Kazuyuki NAKAMURA, Visiting Prof. Tomoyuki HIGUCHI, Visiting Prof. Shinya NAKANO, Assoc. Prof. Shinya NAKANO, Assoc. Prof. Masaya SAITO, Project Assoc. Prof. (-2020.3.31), Visiting Assoc. Prof. (2020.4.1-) Yosuke FUJII, Visiting Assoc. Prof. Hiromichi NAGAO, Visiting Assoc. Prof. Hiroshi KATO, Visiting Assoc. Prof. Shunichi NOMURA, Assist. Prof. Takashi YAMAMOTO, Project Assist. Prof. (-2020.3.31)

- Model integration by particle filtering
- Development of data assimilation system in geosciences
- Development and application of data assimilation based on high-dimensional system models
- Data analysis based on state-space models
- · Inverse estimation of crustal deformation based on seismic activity
- State-space modeling of insurance data
- Theory and prediction of point-process models

#### **Department of Statistical Data Science**

The Department of Statistical Data Science conducts research on data design methods aimed at managing uncertainty and incompleteness of information, quantitative methods for evidence-based practice, and related data analysis methods. Moreover, the department investigates methods for inferring the latent structures in target phenomena from observation data.

#### Survey Science Group

The Survey Science Group promotes research on the design of statistical surveys, development of statistical analysis methods on survey data, privacy protection in official statistics, and their applications. By exploring complex phenomena in various fields, the group also aims to contribute to practical applications in academia and policy-making through social surveys.

— Staff —

Ryozo YOSHINO, Prof. (-2019.9.30) Kazuhiro MINAMI, Prof. (2020.4.1-) Takatoshi IMADA, Visiting Prof. Toru KIKKAWA, Visiting Prof. Yoshimichi SATO, Visiting Prof. Wataru MATSUMOTO, Visiting Prof. Kazufumi MANABE, Visiting Prof. Masahiro MIZUTA, Visiting Prof. Tadahiko MAEDA, Assoc. Prof. Yoo Sung PARK, Assoc. Prof. Koken OZAKI, Visiting Assoc. Prof. Taisuke FUJITA, Visiting Assoc. Prof. Yusuke INAGAKI, Project Assist. Prof. (-2020.6.30), Visiting Assoc. Prof. (2020.8.1-) Kiyohisa SHIBAI, Project Assist. Prof. Anh LE DUC, Project Assist. Prof. Naoko KATO-NITTA, Project Assist. Prof. (2019.11.1-)

- Social research methods and data analysis
- · Data science for Behaviormetric study of civilizations
- · Theory and applications of latent variable models
- Research on nonsampling errors in surveys

- · Analysis of longitudinal and repeated cross-sectional surveys
- Statistical research on the Japanese national character
- Sampling theory and its applications
- · Methodology of cross-national comparative survey
- · Theory and applications of multilevel modeling
- · Organizational behavior based on multilevel analysis
- Theory of small area estimation and its applications

#### Metric Science Group

The Metric Science Group conducts research aimed at identifying and evaluating statistical evidence through the quantification of phenomena that have not been measured thus far as well as through the efficient extraction of information from large databases. The group investigates related methods and develops methods for analyzing the collected data. By working on applied research in various fields of real science, the group aims to advance practical, applied, and statistical mathematical research based on evidence.

— Staff —

Satoshi YAMASHITA, Prof. (Vice Director-General) Koji KANEFUJI, Director, Prof. Yoichi ITO, Prof. (-2020.3.31) Shigeyuki MATSUI, Prof. (2020.7.1-) Ikuko FUNATOGAWA, Assoc. Prof. Hisashi NOMA, Assoc. Prof. Nobuo SHIMIZU, Assist. Prof.

- Evaluation methodology for financial statistic models
- Valuation of market risk and credit risk
- Statistical analysis in clinical trials of pharmaceutical drugs
- Design and analysis of clinical studies for personalized medicine
- Methodology of clinical researches for developing predictive medicine
- Methodology of study designs and statistical methods for epidemiologic researches
- Theory of semiparametric inference and its application
- · Foundation of meta-analysis and its application
- Design for long-term ecological study
- Missing data analysis

- Symbolic data analysis
- Longitudinal data analysis

#### Structure Exploration Group

The Structure Exploration Group conducts research on statistical science aimed at inferring the latent "structure" behind various target phenomena in biology, physics, and social science based on observational data. The group focuses on machine learning, Bayesian reasoning, experimental design methods, and spatial-temporal analysis methods to investigate micro/meso/macroscopic and spatial-temporal dynamic structures in target phenomena.

#### — Staff —

Ryo YOSHIDA, Prof. Jun ADACHI, Assoc. Prof. Kenichiro SHIMATANI, Assoc. Prof. Stephen WU, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Daisuke MURAKAMI, Assist. Prof.

- · Statistical methods to establish environment standards
- Reliability theory based on life-span models
- Environmental statistics
- · Causal data analysis for advanced business modeling
- Statistical causal inference
- Graphical modeling
- Modeling of molecular evolution
- · Maximum likelihood inference of molecular phylogeny
- Comparative analysis of genome structure
- Theoretical biology and bioinformatics
- · Analysis of educational and psychological assessment data
- Latent variable models for social sciences
- Decoding of algebraic geometric codes
- Methodology for collecting and publishing information relating to statistical science

#### **Department of Statistical Inference and Mathematics**

The Department of Statistical Inference and Mathematics carries out research into general statistical theory, statistical learning theory, optimization, and algorithms for statistical inference.

Mathematical Statistics Group

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

— Staff —

Satoshi KURIKI, Director, Prof. Yoshiyuki NINOMIYA, Prof. Shuhei MANO, Assoc. Prof. Akimichi TAKEMURA, Visiting Prof. Nobuaki HOSHINO, Visiting Prof. (2020.4.1-) Shogo KATO, Assoc. Prof. Takaaki SHIMURA, Assoc. Prof. Keisuke YANO, Assoc. Prof. (2020.4.1-)

- Additive processes
- Algebraic statistics
- · Analysis of multivariate data and contingency tables
- · Change-point analysis
- Directional statistics
- Extreme value theory
- Heavy-tailed distributions
- · Integral-geometric approach to random field theory
- Statistical inference and statistical decisions
- Multiple comparisons
- · Statistical inference based on graphical models
- Stochastic modeling of data with combinatorial structures

#### Learning and Inference Group

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

— Staff —

Shinto EGUCHI, Prof. (-2020.3.31) Kenji FUKUMIZU, Prof. Hironori FUJISAWA, Prof. Daichi MOCHIHASHI, Assoc. Prof. Masayuki HENMI, Assoc. Prof. Ayaka SAKATA, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Masaaki IMAIZUMI, Assist. Prof. (-2020.3.31)

#### — Subjects —

- Approximate Bayesian method
- Approximation theory on graph
- Bioinformatics
- Genome statistics
- Information geometry
- Nonparametric Bayesian method
- Robust statistics
- Semiparametric inference
- Sparse modeling
- Statistical inference based on positive semidefinite kernel
- Statistical inference for observational studies
- Statistical learning theory
- · Statistical methods of topological data analysis
- Statistical natural language processing
- Statistical singular model
- Stochastic inference

#### Mathematical Optimization Group

The Mathematical Optimization Group focuses on mathematical theory and practical applications of optimization and computational algorithms together with underlying numerical or functional analysis and discrete mathematics. — Staff —

Satoshi ITO, Prof. (Vice-Director General) Shiro IKEDA, Prof. Eitarou AIYOSHI, Visiting Prof. Kazuo MUROTA, Visiting Prof. (2020.4.1-) Mirai TANAKA, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Bruno Figueira LOURENÇO, Assoc. Prof. (2020.4.1-)

— Subjects —

- · Algorithms for nonconvex optimization
- Applications of mathematical optimization
- Conic optimization
- · Convex optimization in measure spaces
- · Mathematics and computational complexity analysis of convex optimization
- Mathematics of clinch and elimination
- Systems design under uncertainty

#### **Risk Analysis Research Center**

Risk Analysis Research Center is pursuing a scientific approach to the uncertainty and risks in society which have increased with the growing globalization of society and the economy, and also the center is constructing a network for risk analysis with the goal of contributing to create a reliable and safe society.

Data Infrastructure for Risk Analysis

To generate data-centric risk sciences this group will construct data bases for risk analysis by collecting relevant data and their linkage. The project will further investigate quality management of risk data and supply secured and efficient data editing environment to researchers where they can safely analyze anonymized information on individuals.

— Staff —

Satoshi YAMASHITA, Director, Prof. (Vice-Director General) Kazuhiro MINAMI, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Sadaaki MIYAMOTO, Visiting Prof. Shinsuke ITO, Visiting Prof. Takahiro HOSHINO, Visiting Prof. (-2020.3.31) Shigeyuki MATSUI, Visiting Prof. Hitoshi MOTOYAMA, Visiting Prof. Kazuyuki SUZUKI, Visiting Prof. (2020.7.1-) Motoi OKAMOTO, Project Assoc. Prof. Takafumi KUBOTA, Visiting Assoc. Prof. Isao TAKABE, Visiting Assoc. Prof. (2019.10.1-) Junchao ZHANG, Project Assist. Prof.

#### Mathematical Analysis of Risk

To quantify the risk factors such as natural disasters, severe diseases and accidents, we need to formalize their stochastic behaviors, and make statistical inferences based on their tail distributions. As such, we study the extreme value theory, copula model and multiple comparisons from the mathematical and computational viewpoints. To promote the activity of this research community, we organize the annual cooperative research symposiums "Extreme value theory and applications" (since 1994) and "Infinitely divisible processes and related topics" (since 1992), and other occasional international symposiums.

— Staff —

Satoshi KURIKI, Prof. Yoshiyuki NINOMIYA, Prof. Rinya TAKAHASHI, Visiting Prof. Yo SHIINA, Visiting Prof. Toshinao YOSHIBA, Visiting Prof. Hisayuki HARA, Visiting Prof. Masao UEKI, Visiting Assoc. Prof. (-2020.3.31), Visiting Prof. (2020.4.1-) Hirokazu YANAGIHARA, Visiting Prof. Toshikazu KITANO, Visiting Prof. Shogo KATO, Vice Director, Assoc. Prof. Masayuki HENMI, Assoc. Prof. Takaaki SHIMURA, Assoc. Prof. Masavuki KUMON, Project Assoc. Prof. (2019.11.1-) Teppei OGIHARA, Visiting Assoc. Prof. Xiaoling DOU, Visiting Assoc. Prof. Yuma UEHARA, Project Assist. Prof. (-2020.3.31) Takaaki KOIKE, Project Assist. Prof. (2020.11.1-)

#### Environmental Statistics Project

The impact of human activity on the global environment is increasing. Thus, quantitative methods to accurately take stock of the environmental situation are becoming increasingly important to implement effective measures for the next generation. In this project, we conduct research on statistical analysis methods which form the basis of environmental risk assessments for water, air, and soil, environmental monitoring, setting of environmental standards, and many other activities.

— Staff —

Koji KANEFUJI, Prof. Tomoko MATSUI, Prof. Shuhei MANO, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Mihoko MINAMI, Visiting Prof. Satoshi TAKIZAWA, Visiting Prof. Toshihiro HORIGUCHI, Visiting Prof. Naoki SAKAI, Visiting Prof. Shunji HASHIMOTO, Visiting Prof. Takashi KAMEYA, Visiting Prof. Yoshiki YAMAGATA, Visiting Prof. (2020.4.1-) Kenichiro SHIMATANI, Assoc. Prof. Daisuke MURAKAMI, Assist. Prof.

Risk analysis for resource management Project

Our research focuses on mathematical modeling for prediction and control of natural and socio-economic resource change within deterministic and stochastic frameworks. Through field survey, we conduct research on sustainable renewable resource management as a socio-economic system. One of our current projects concerns risk evaluation and economic analysis of sustainable forest and ecosystem management.

— Staff —

Atsushi YOSHIMOTO, Prof. Tetsuji TONDA, Visiting Prof. Yumi TAKIZAWA, Assoc. Prof. Kenichi KAMO, Visiting Assoc. Prof. Masashi KONOSHIMA, Visiting Assoc. Prof. Keisuke FUKUI, Visiting Assoc. Prof. (2020.4.1-) The risk evaluation, control and management of finance and insurance The aims of this project are to develop the methodology of risk evaluation, risk control and risk management, focusing to financial market, credit risk and macro-economic data.

— Staff —

Satoshi YAMASHITA, Director, Prof. (Vice-Director General) Yoshinori KAWASAKI, Prof. Naoto KUNITOMO, Visiting Prof. Hiroshi TSUDA, Visiting Prof. Toshio HONDA, Visiting Prof. Michiko MIYAMOTO, Visiting Prof. (-2019.4.30) Tadashi ONO, Visiting Prof. Hideatsu TSUKAHARA, Visiting Prof. Satoshi FUJII, Visiting Prof. Takaaki YOSHINO, Visiting Prof. Masakazu ANDO, Visiting Prof. Yasutaka SHIMIZU, Visiting Prof. Masaaki FUKASAWA, Visiting Prof. Nakahiro YOSHIDA, Visiting Prof. Seisho SATO, Visiting Assoc. Prof. Yukihiko OKADA, Visiting Assoc. Prof. Junichi TAKAHASHI, Visiting Assoc. Prof. Yuta KOIKE, Visiting, Assoc Prof. Shunichi NOMURA, Assist. Prof. Hideaki NAGAHATA, Project Assist. Prof.

Statistical Seismological Research Project

The statistical seismological research group develops statistical models for quantitative analysis of earthquake occurrence and the relation between seismicity and other phenomena from geophysical or geochemical observations, techniques of probabilistic earthquake forecasting, and methods for evaluating forecasting performance, with applications in earthquake early warning and earthquake insurance. More general types of random events in time and/or space, such as fires, crimes, etc., are also studied, especially, the construction of forecasting models based on our understanding of the mechanisms of these phenomena, as well as their statistical inferences. — Staff —

David Shamus, HARTE, Visiting Prof. (2020.2.10-2020.3.26) Jiancang ZHUANG, Assoc. Prof. Stephen WU, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Bogdan Dumitru ENESCU, Visiting Assoc. Prof. Takaki IWATA, Visiting Assoc. Prof. Kazuyoshi NANJO, Visiting Assoc. Prof. Shunichi NOMURA, Assist. Prof. Yicun GUO, Project Assist. Prof. (-2020.2.7) Ziyao XIONG, Project Assist. Prof. (2020.12.1-)

#### **Research Center for Statistical Machine Learning**

The Research Center for Statistical Machine Learning started in January 2012, aiming at taking charge of advancing the "Statistical Machine Learning NOE", one of the Network of Excellence Establishing Projects, and at being a central research organization in the field of statistical machine learning. The center is carrying out various research projects in the machine learning, as well as contributing the research community through organizing and supporting workshops and seminars for the developing this research field.

- Staff -Kenji FUKUMIZU, Director, Prof. Tomoko MATSUI, Vice Director, Prof. Shinto EGUCHI, Prof. (-2020.3.31) Yoshihiko MIYASATO, Prof. (Vice-Director General) Satoshi ITO, Prof. (Vice-Director General) Shiro IKEDA, Prof. Satoshi KURIKI, Prof. Hironori FUJISAWA, Prof. Kazuhiro MINAMI, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Hideitsu HINO, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Arthur GRETTON, Visiting Prof. Masataka GOTO, Visiting Prof. Yuji SHINANO, Visiting Prof. Takashi TSUCHIYA, Visiting Prof. Katsuki FUJISAWA, Visiting Prof.

Akiko TAKEDA, Visiting Prof. (-2020.3.31) Yoichi MOTOMURA, Visiting Prof. (-2020.3.31) Nobuhiko TERUI, Visiting Prof. (-2020.3.31) Yoshiki YAMAGATA, Visiting Prof. (-2020.3.31) Daichi MOCHIHASHI, Assoc. Prof. Shinsuke KOYAMA, Assoc. Prof. Ayaka SAKATA, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Mirai TANAKA, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Shinichiro GOTO, Project Assoc. Prof. Sayaka SHIOTA, Visiting Assoc. Prof. (2019.11.1-) Tsutomu TAKEUCHI, Visiting Assoc. Prof. Makoto YAMADA, Visiting Assoc. Prof. Eiji MOTOHASHI, Visiting Assoc. Prof. Masaaki IMAIZUMI, Assist. Prof. (-2020.3.31), Visiting Assoc. Prof. (2020.4.1-) Kei KOBAYASHI, Visiting Assoc. Prof. (2020.4.1-) João Pedro PEDROSO, Visiting Assoc. Prof. (-2019.8.30) Tsukasa ISHIGAKI, Visiting Assoc. Prof. (-2020.3.31) Daisuke MURAKAMI, Assist. Prof. Sho SAITO, Project Assist. Prof. Yoh-ichi MOTOTAKE, Project Assist. Prof. Mikio MORII, Project Assist. Prof. (-2019.6.30) Ye CHEN, Project Assist. Prof. (-2020.3.29)

#### Data Science Center for Creative Design and Manufacturing

The Data Science Center for Creative Design and Manufacturing was established in July 2017, aiming at facilitating strategic applications of data science technologies and the creation of ground-breaking methods for manufacturing. The center has put together diverse technologies of data science, including machine learning, Bayesian modeling and inference, and materials informatics. We will demonstrate the next generation of manufacturing technologies through industry-academia collaboration.

Staff —
Ryo YOSHIDA, Director, Prof.
Hironori FUJISAWA, Vice Director, Prof.
Kenji FUKUMIZU, Prof.

Hideitsu HINO, Prof. (2020.4.1-) Shinya NAKANO, Assoc. Prof. Daichi MOCHIHASHI, Assoc. Prof. Stephen WU, Assist. Prof. (-2020.3.31), Assoc. Prof. (2020.4.1-) Terumasa TOKUNAGA, Visiting Assoc. Prof. Chang LIU, Project Assist. Prof. Yoshihiro HAYASHI, Project Assist. Prof. (2020.4.1-) Yuta AOKI, Project Assist. Prof. (2020.7.1-)

#### **Research Center for Medical and Health Data Science**

Research Center for Medical and Health Data Science promotes statistical mathematics and data science research for medicine, drug discovery, health care, and public health in industry, academia, and government. Methodologies of basic mathematics and computer science, artificial intelligence, machine learning, and data analysis, will provide scientific foundations for various research areas in basic, clinical, and social medicine, as well as in the latest medical science fields. The goal is to create foundations for new data science to meet the diverse needs of research. We will also promote nationwide network construction and highly specialized statistical education to strengthen the medical research environment.

— Staff —

Yoichi ITO, Director (-2020.3.31), Prof. (-2020.3.31), Visiting Prof. (2020.4.1-) Shigeyuki MATSUI, Visiting Prof. (-2020.6.30), Director (2020.7.1-), Prof. (2020.7.1-) Satoshi YAMASHITA, Prof. (Vice Director-General) Shinto EGUCHI, Prof. (-2020.3.31), Project Prof. (2020.4.1-) Yasuo OHASHI, Visiting Prof. Senichiro KIKUCHI, Visiting Prof. Ken KIYONO, Visiting Prof. Ken KIYONO, Visiting Prof. Tatsuhiko TSUNODA, Visiting Prof. (-2020.3.31) Satoshi TERAMUKAI, Visiting Prof. Hisateru TACHIMORI, Visiting Prof. Toshiya SATO, Visiting Prof. Satoshi HATTORI, Visiting Prof. Manabu IWASAKI, Visiting Prof. (-2020.5.31) Michiko WATANABE, Visiting Prof. Nobuaki NISHIYAMA, Visiting Prof. (2020.4.1-) Atsushi GOTO, Visiting Assoc. Prof. (-2020.3.31), Visiting Prof. (2020.4.1-) Manabu AKAZAWA, Visiting Prof. (2020.12.1-) Hisashi NOMA, Vice Director (-2020.3.31), Assoc. Prof. Ikuko FUNATOGAWA, Vice Director (2020.4.1-), Assoc. Prof. Masayuki HENMI, Assoc. Prof. Fumikazu MIWAKEICHI, Assoc. Prof. Kengo NAGASHIMA, Project Assoc. Prof. Mayumi OKA, Project Assist. Prof. (-2020.4.30), Project Assoc. Prof. (2020.5.1-) Ryoichi KIMURA, Visiting Assoc. Prof. Masataka TAGURI, Visiting Assoc. Prof. Yasunori SATO, Visiting Assoc. Prof. Ryota NAKAMURA, Visiting Assoc. Prof. (-2020.3.31) Kazushi MARUO, Visiting Assoc. Prof. Kunihiko TAKAHASHI, Visiting Assoc. Prof. Naomi TAMURA, Project Assist. Prof. (-2020.6.30)

#### **URA** (University Research Administrator)

ISM assigned URA in the Administration Planning and Coordination Section for promoting and strengthening joint research in mathematical statistics.

- Roles of URA -

- Promotion for research collaborations and interchanges with universities and research institutions
- Support for design and planning of ISM research strategy
- Support for IR (Institutional Research) of universities and research institutions
- Promotion for utilizations of ISM supercomputer systems
- Pre-awards and post-awards
- Public-relations and outreach

#### **School of Statistical Thinking**

The School of Statistical Thinking was established as a center for the

planning and implementation of various programs for professional development and education and training in statistical thinking. In the setting of a joint research facility, the school is working to develop professionals (specialists with broad knowledge and skills, modelers, research coordinators, etc.) equipped with the statistical thinking ability to meet the demands of the "big data era", in which large-scale data sets are utilized for modeling, research coordination, and other applications.

— Staff —

Yoshinori KAWASAKI, Director Satoshi ITO, Prof. (Vice Director-General) Yukito IBA, Vice Director, Prof. Kenji FUKUMIZU, Prof. Yoshiyuki NINOMIYA, Prof. Hideitsu HINO, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-) Shiro IKEDA, Prof. (2020.4.1-) Yoshiyasu TAMURA, Project Prof. Junji NAKANO, Adjunct Prof. (-2019.5.31), Project Prof. (2019.6.1-) Manabu IWASAKI, Project Prof. (2020.6.1-) Kunio TANABE, Project Prof. (2020.11.1-) Kunio SHIMIZU, Adjunct Prof. Nobuhisa KASHIWAGI, Adjunct Prof. Toshifumi IKEMORI, Adjunct Prof. Kenichiro SHIMATANI, Assoc. Prof. Masayuki HENMI, Assoc. Prof. Naoki KAMIYA, Project Assoc. Prof. (-2020.1.31) Osamu KOMORI, Visiting Assoc. Prof. Kei TAKAHASHI, Visiting Assoc. Prof. Shunichi NOMURA, Assist. Prof. Masaaki IMAIZUMI, Assist. Prof. (-2020.3.31) Kohei HATTORI, Assist. Prof (2020.9.1-) Akifumi OKUNO, Assist. Prof. (2020.10.1-) Masato SHIRASAKI, Assist. Prof. (2020.10.1-) Kazuhei KIKUCHI, Project Assist. Prof. (2020.4.1-)

— Activities —

• Open lecture for public: Free and introductory lecture concerning statistical science, once a year in November

- Tutorial courses: Pay courses for various topics in statistical science, about 10 times a year
- Graduate school linkage program: Courses and/or guidances at collaborative graduate schools
- Special collaboration with research students: Guidance given in ISM to graduate students belonging to other universities
- Summer graduate Seminar: Free open lecture for graduate students, once a year in summer
- Open-type professional development program: Support for research meetings and workshops for promoting statistical thinking
- Statistical mathematics seminar: Seminars on new research results by researchers in ISM, once a week on Wednesday afternoon
- Research collaboration start-up: Advises and supports given by researchers in ISM for problems of various fields concerning statistical mathematics
- Researcher exchange promotion program: Support to university researchers who use sabbatical system and study at ISM
- Statistical training for school teachers: Training for school teachers to increase their leadership of statistical thinking

#### **Center for Engineering and Technical Support**

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

— Staff —

Genta UENO, Director, Prof. Kazuhiro MINAMI, Vice Director, Assoc. Prof. (-2020.3.31), Prof. (2020.4.1-)

Computing Facilities Unit

The Computing Facilities Unit is in charge of managing computer facilities and scientific software.

#### Computer Networking Unit

The Computer Networking Unit is responsible for computer networking and its infrastructure, and network security.

#### ■ Information Resources Unit

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

#### Media Development Unit

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

#### **Project Researchers**

Project researchers is the all-inclusive term for post-doctoral researchers participating in specific projects. To name a few, ISM NOE (Network Of Excellence) projects, ROIS-DS (Joint Support-Center for Data Science Research) projects, government-commissioned projects, and the projects funded by independent agencies like JST.

Aoki, Yuta	Kamiya, Naoki	Oka, Mayumi
Chen, Ye	Kato-Nitta, Naoko	Saito, Masaya
Eguchi, Shinto	Kawauchi, Susumu	Saito, Sho
Goto, Shinichiro	Kikuchi, Kazuhei	Shibai, Kiyohisa
Guo, Yicun	Koike, Takaaki	Shinkyu, Akira
Guo, Zhongliang	Kumon, Masayuki	Tamura, Naomi
Hamada, Hiroka	Le Duc, Anh	Tamura, Yoshiyasu
Hamaguchi, Takuo	Liu, Chang	Tanabe, Kunio
Hamura, Yasuyuki	Morii, Mikio	Tanaka, Yasuhiro
Hayashi, Yoshihiro	Mototake, Yoh-ichi	Uehara, Yuma
Hirakawa, Shinya	Nagahata, Hideaki	Xiong, Ziyao
Inagaki, Yusuke	Nagashima, Kengo	Yamada, Hironao
Ito, Tsubasa	Nakano, Junji	Yamamoto, Takashi
Iwasaki, Manabu	Noguchi, Yoh	Zhang, Junchao
Jiang, Yi	Ohkubo, Yusaku	Zheng, Ning

#### **Visiting Professors**

To push forward the frontiers of interaction between statistics and other fields of science, the Institute provides positions for visiting professors.

Each of the Institute's three departments and five centers have invited foreign and Japanese professors from universities and institutes as shown in the list below.

— Foreign Visiting Professors —	_		
Peters, Gareth William	(U. K.)	2019. 6.17 – 2019	. 7.29
Azzaoui, Nourddine	(France)	2019. 6.25 - 2019	. 7.26
Myrvoll, Tor Andre	(Norway)	2019. 7. 8 – 2019	. 8. 2
Septier, François Jean Mi	ichel (France)	2019. 7.16 - 2019	. 8.15
Jimenez-Sobrino, Juan C	arlos (Cuba)	2020. 1.13 – 2020	. 3.31
Shevchenko, Pavel	(Australia)	2020. 2.13 - 2020	. 3.30

— Japanese Visiting Professors —

Aiyoshi, Eitaro	2019. 4. 1 - 2021. 3.31	Ito, Shinsuke	2019. 4. 1 - 2021. 3.31
Ando, Masakazu	2019. 4. 1 - 2021. 3.31	Iwasaki, Manabu	2019. 4. 1 - 2020. 5.31
Dou, Xiaoling	2019. 4. 1 - 2021. 3.31	Iwata, Takaki	2019. 4. 1 - 2021. 3.31
Enescu, Bogdan Dumitru	2019. 4. 1 - 2021. 3.31	Kameya, Takashi	2019. 4. 1 - 2021. 3.31
Fujii, Satoshi	2019. 4. 1 - 2021. 3.31	Kamiyama, Masako	2019. 4. 1 - 2021. 3.31
Fujii, Yosuke	2019. 4. 1 - 2021. 3.31	Kamo, Kenichi	2019. 4. 1 - 2021. 3.31
Fujisawa, Katsuki	2019. 4. 1 - 2021. 3.31	Kato, Hiroshi	2019. 4. 1 - 2021. 3.31
Fujita, Taisuke	2019. 4. 1 - 2021. 3.31	Kikkawa, Toru	2019. 4. 1 - 2021. 3.31
Fukasawa, Masaaki	2019. 4. 1 - 2021. 3.31	Kikuchi, Senichiro	2019. 4. 1 - 2021. 3.31
Goto, Atsushi	2019. 4. 1 - 2021. 3.31	Kimura, Ryoichi	2019. 4. 1 - 2021. 3.31
Goto, Masataka	2019. 4. 1 - 2021. 3.31	Kitano, Toshikazu	2019. 4. 1 - 2021. 3.31
Gretton, Arthur	2019. 4. 1 - 2021. 3.31	Kiyono, Ken	2019. 4. 1 - 2021. 3.31
Hara, Hisayuki	2019. 4. 1 - 2021. 3.31	Koike, Yuta	2019. 4. 1 - 2021. 3.31
Hashimoto, Shunji	2019. 4. 1 - 2021. 3.31	Komori, Osamu	2019. 4. 1 - 2021. 3.31
Hattori, Satoshi	2019. 4. 1 - 2021. 3.31	Konoshima, Masashi	2019. 4. 1 - 2021. 3.31
Higuchi, Tomoyuki	2019. 4. 1 - 2021. 3.31	Kubota, Takafumi	2019. 4. 1 - 2021. 3.31
Honda, Toshio	2019. 4. 1 - 2021. 3.31	Kunitomo, Naoto	2019. 4. 1 - 2021. 3.31
Horiguchi, Toshihiro	2019. 4. 1 - 2021. 3.31	Manabe, Kazufumi	2019. 4. 1 - 2021. 3.31
Hoshino, Takahiro	2019. 4. 1 - 2021. 3.31	Maruo, Kazushi	2019. 4. 1 - 2021. 3.31
Imada, Takatoshi	2019. 4. 1 - 2021. 3.31	Matsui, Shigeyuki	2019. 4. 1 - 2020. 6.30
Ishigaki, Tsukasa	2019. 4. 1 - 2020. 3.31	Matsumoto, Wataru	2019. 4. 1 - 2021. 3.31

Minami, Mihoko	2019. 4. 1 - 2021. 3.31	Takeda, Akiko	2019. 4. 1 - 2020. 3.31
Miyamoto, Michiko	2019. 4. 1 - 2020. 3.31	Takemura, Akimichi	2019. 4. 1 - 2021. 3.31
Miyamoto, Sadaaki	2019. 4. 1 - 2021. 3.31	Takeuchi, Tsutomu	2019. 4. 1 - 2021. 3.31
Mizuta, Masahiro	2019. 4. 1 - 2021. 3.31	Takizawa, Satoshi	2019. 4. 1 - 2021. 3.31
Motohashi, Eiji	2019. 4. 1 - 2021. 3.31	Teramukai, Satoshi	2019. 4. 1 - 2021. 3.31
Motomura, Yoichi	2019. 4. 1 - 2020. 3.31	Terui, Nobuhiko	2019. 4. 1 - 2020. 3.31
Motoyama, Hitoshi	2019. 4. 1 - 2021. 3.31	Tokunaga, Terumasa	2019. 4. 1 - 2021. 3.31
Nagao, Hiromichi	2019. 4. 1 - 2021. 3.31	Tonda, Tetsuji	2019. 4. 1 - 2021. 3.31
Nakamura, Kazuyuki	2019. 4. 1 - 2021. 3.31	Tsuchiya, Takashi	2019. 4. 1 - 2021. 3.31
Nakamura, Ryota	2019. 4. 1 - 2020. 3.31	Tsuda, Hiroshi	2019. 4. 1 - 2021. 3.31
Nanjo, Kazuyoshi	2019. 4. 1 - 2021. 3.31	Tsukahara, Hideatsu	2019. 4. 1 - 2021. 3.31
Ogihara, Teppei	2019. 4. 1 - 2021. 3.31	Tsunoda, Tatsuhiko	2019. 4. 1 - 2020. 3.31
Ohashi, Yasuo	2019. 4. 1 - 2021. 3.31	Ueki, Masao	2019. 4. 1 - 2021. 3.31
Ohtani, Shinichi	2019. 4. 1 - 2021. 3.31	Watanabe, Michiko	2019. 4. 1 - 2021. 3.31
Okada, Yukihiko	2019. 4. 1 - 2021. 3.31	Yamada, Makoto	2019. 4. 1 - 2021. 3.31
Ono, Tadashi	2019. 4. 1 - 2021. 3.31	Yamagata, Yoshiki	2019. 4. 1 - 2021. 3.31
Ozaki, Koken	2019. 4. 1 - 2021. 3.31	Yoshiba, Toshinao	2019. 4. 1 - 2021. 3.31
Pedroso, João Pedro	2019. 4. 1 - 2019. 8.30	Yoshida, Nakahiro	2019. 4. 1 - 2021. 3.31
Sakai, Naoki	2019. 4. 1 - 2021. 3.31	Yoshino, Takaaki	2019. 4. 1 - 2021. 3.31
Sato, Seisho	2019. 4. 1 - 2021. 3.31	Takabe, Isao	2019.10.1 - 2021.3.31
Sato, Tadahiko	2019. 4. 1 - 2021. 3.31	Shiota, Sayaka	2019.11. 1 - 2021. 3.31
Sato, Toshiya	2019. 4. 1 - 2021. 3.31	Harte, David Shamus	2020. 2.10 - 2020. 3.26
Sato, Yasunori	2019. 4. 1 - 2021. 3.31	Fukui, Keisuke	2020. 4. 1 - 2021. 3.31
Sato, Yoshimichi	2019. 4. 1 - 2021. 3.31	Imaizumi, Masaaki	2020. 4. 1 - 2021. 3.31
Sheena, Yo	2019. 4. 1 - 2021. 3.31	Ito, Yoichi	2020. 4. 1 - 2021. 3.31
Shimizu, Yasutaka	2019. 4. 1 - 2021. 3.31	Kobayashi, Kei	2020. 4. 1 - 2021. 3.31
Shinano, Yuji	2019. 4. 1 - 2021. 3.31	Murota, Kazuo	2020. 4. 1 - 2021. 3.31
Tachimori, Hisateru	2019. 4. 1 - 2021. 3.31	Nishiyama, Nobuaki	2020. 4. 1 - 2021. 3.31
Taguri, Masataka	2019. 4. 1 - 2021. 3.31	Saito, Masaya	2020. 4. 1 - 2021. 3.31
Takahashi, Junichi	2019. 4. 1 - 2021. 3.31	Suzuki, Kazuyuki	2020. 7. 1 - 2021. 3.31
Takahashi, Kei	2019. 4. 1 - 2021. 3.31	Inagaki, Yusuke	2020. 8. 1 - 2021. 3.31
Takahashi, Kunihiko	2019. 4. 1 - 2021. 3.31	Yanagihara, Hirokazu	2020. 9. 1 - 2021. 3.31
Takahashi, Rinya	2019. 4. 1 - 2021. 3.31	Akazawa, Manabu	2020.12.1 - 2021.3.31

#### **Visiting Research Fellows**

In addition to visiting professors, the Institute provides research fellowships to researchers in Japan and abroad, from companies as well as from universities. The Institute also provides support for those who are appointed as staff of programs by the Japan Society for the Promotion of Science (JSPS). A list follows showing research fellows received during the period April 2019 to March 2021.

(The list does not show all of the visiting fellows from abroad. Foreign visiting research fellows are listed under "Foreign Visitors" on page 34.

#### — Japanese visiting research fellows —

Baba, Yasumasa	Kobayashi, Megumi	Shimono, Toshiyuki
Bekki, Naoaki	Komatsu, Tatsuya	Shiota, Sayaka
Fukaya, Keiichi	Kumazawa, Takao	Sugasawa, Shonosuke
Funatogawa, Takashi	Maruyama, Naomasa	Takabe, Isao
Hanaizumi, Hiroshi	Masuda, Tomoe	Takahashi, Atumori
Hayamizu, Momoko	Matsu'ura, Mitsuhiro	Takai, Tsutomu
Hayashi, Kenichi	Matsuda, Takeru	Takenouchi, Takashi
Ikebata, Hisaki	Nakamura, Takashi	Tamura, Naomi
Ikemori, Toshifumi	Nakano, Junji	Tanabe, Kunio
Ikoma, Norikazu	Nguyen, Minh Le	Tanaka, Ushio
Imamura, Takeshi	Nishihara, Hidenori	Tanoue, Yuta
Imoto, Tomoaki	Noguchi, Yoh	Toyota, Shoji
Ishibashi, Hideaki	Notsu, Akifumi	Tsujikawa, Misaki
Ishiguro, Makio	Ogata, Yosihiko	Uehara, Yuma
Ishii, Hiromi	Omae, Katsuhiro	Uryu, Hirotaka
Isomura, Tetsu	Otake, Keiko	Watanabe, Hayafumi
Kashiwagi, Nobuhisa	Otani, Takahiro	Yamada, Hironao
Kawamori, Ai	Saito, Yuki	Yamamoto, Takashi
Kawamura, Yumi	Sano, Natsuki	Yanagimoto, Takemi
Kawashima, Takahiro	Segawa, Takahiro	Yokoyama, Masayuki
Kobayashi, Kazuhiro	Shimizu, Kunio	Zamengo, Massimiliano

— Students from graduate school —

Sando, Keishi

Asakura, Koichi

Mikiya, Yuki
### **Professor Emeritus**

Baba, Yasumasa Eguchi, Shinto Hasegawa, Masami Higuchi, Tomoyuki Hirano, Katsuomi Ishiguro, Makio Itoh, Yoshiaki Kashiwagi, Nobuhisa Kitagawa, Genshiro Matsunawa, Tadashi Murakami, Masakatsu Nakamura, Takashi Nakano, Junji Ogata, Yosihiko Ohsumi, Noboru Sakamoto, Yoshiyuki Shimizu, Ryoichi Suzuki, Giitiro Suzuki, Tatsuzo Tamura, Yoshiyasu Tanabe, Kunio Tanemura, Masaharu Tsubaki, Hiroe Yanagimoto, Takemi Yoshino, Ryozo

3

# Research Collaboration

The Institute runs a unique system to promote collaborative research activities between statisticians and scientists in related fields, such as the social sciences, the humanities, life sciences, earth and space sciences and engineering. The system was initiated in 1985 with a special intention, based on past experience of the Institute. Since the genesis of the Institute, one of the basic principles has been to attach greater importance to applications (applied science). The principle came from the appreciation that innovative methodologies and theories of statistics are frequently developed in an effort to solve real life problems.

In the past decades the Institute has maintained research collaborations with universities, governmental organizations, private companies and various organizations domestically as well as internationally. This period produced a lot of useful works, both in theory and application. This tradition of open collaboration with scientists outside the Institute has created a progressive and liberal academic atmosphere which, we believe, has contributed to developing new interdisciplinary research fields in related sciences.

These cooperative research activities were maintained through various research fields at different levels and with various types of collaboration, long before the Institute was reorganized into an inter-university research institute. Many remarkable results have been produced through collaborative research in the last decades. To our regret, however, when joint work is organized by researchers at the individual level, the fruit of the collaborative research tends to be received by the general public as a successful contribution to the science that addressed the problem. Without acknowledgment the true contributions by our statisticians are not credited or noticed. Obviously this tendency comes from the inherently abstract nature of statistics. The statistician's contribution, although essential, is not as easy to explain to the general public as explaining the problem itself in applied science. Accordingly, it seemed that the value and the raison d'être of the statisticians and the Institute was not appreciated as much as other scientists and research institutes in the applied sciences.

Our cooperative research system was initiated on the basis of two understandings. First, this kind of collaborative research activity is beneficial to both statistics and other related sciences. Secondly, statisticians working in such circumstances need recognition, support and encouragement. We hope that the present system will play a vital role to bring "Win-Win" benefits to both statisticians and applied scientists in the related field.

Since 1985 the system has been run by the Cooperative Research Committee, half of whose members are scientists from outside the Institute. Cooperative research projects between statisticians and scientists in related scientific fields are called for each year. More than a hundred projects in applied sciences and statistics are supported each year (see the figure below). In 1998, in order to enlarge the area of collaboration, the Institute relaxed a condition of application for projects which had stipulated that at least one member of the research project should belong to the Institute. The system of cooperation is also open to projects that are planned and accomplished through international cooperation.

Our cooperative research projects are classified into several categories: cooperative user registration, general cooperative research "Type 1", general cooperative research "Type 2", subject-oriented cooperative research, and cooperative research symposium.





4 -

# International Research Exchange

Historically, statistical science has developed in response to the need for statistical ideas and methods to be exploited in other fields of science and industry. Therefore the Institute has established a systematic way to promote cross-disciplinary research projects either at a domestic or an international scale (see the previous chapter).

The Institute has also pushed forward research collaboration with a wide variety of foreign institutions including universities and governmental agencies.

Since 1988, the Institute has entered into special relationship with the following institutes to conduct programs on academic exchange and facilitate joint research projects;

- The Statistical Research Division of the U.S. Bureau of the Census, U.S.A., 1988-
- · Stichting Mathematisch Centrum, Netherlands, 1989-
- Institute for Statistics and Econometrics, Humboldt University of Berlin, Germany, 2004-
- The Steklov Mathematical Institute, Russia, 2005-
- · Central South University, China, 2005-
- · Soongsil University, Korea, 2006-
- · Department of Statistics, University of Warwick, U.K., 2007-
- · The Indian Statistical Institute, India, 2007-
- · Institute of Statistical Science, Academia Sinica, Taiwan, 2008-
- Department of Empirical Inference, Max Planck Institute for Biological Cybernetics, Germany, 2010-
- Department of Communication Systems, SINTEF Information and Communication Technology, Norway, 2012-
- Centre for Computational Statistics and Machine Learning, University College London, U.K., 2012-
- · Department of Electronics and Telecommunications, Norwegian Uni-

versity of Science and Technology, Norway, 2012-

- Department of Probability and Mathematical Statistics, Charles University in Prague, Czech Republic, 2012-
- The Department of Ecoinformatics, Biometrics and Forest Growth of the Georg-August University of Goettingen, Germany, 2012-
- The Korean Statistical Society, Korea, 2013-
- Toyota Technological Institute at Chicago, U.S.A., 2014-
- Mathematical Sciences Institute Australian National University, Australia, 2014-
- · RiskLab ETH Zurich, Switzerland, 2015-
- Institut de Recherche en Composants logiciel et matériel pour l'Information et la Communication Avancee (IRCICA), France, 2015-
- Le laboratoire de mathématiques de l'Universite Blaise Pascal, France, 2015-
- Centre de Rechereche en Informatique, Signal et Automatique de Lille (CRIStAL), France, 2015-
- · University College London (UCL) Big Data Institute, U.K., 2015-
- The Institute of Forestry, Pokhara of Tribhuvan University, Nepal, 2015-
- The Institute of Forest and Wildlife Research and Development of the Forestry Administration of Cambodia, Cambodia, 2015-
- The Chancellor masters and Scholars of the University of Oxford, U.K., 2015-
- Forest Inventory and Planning Institute, Vietnam, 2015-
- The University of Porto, Portugal, 2016-
- Zuse Institute Berlin, Germany, 2016-
- · Natinonal University of Laos, Laos, 2017-
- · Institute of Geophysics China Earthquake Administration, China, 2017-
- · Hong Kong Baptist University, Hong Kong, 2017-
- · University of Malaya, Malaysia, 2017-
- Unversidade de Évora, Portugal, 2017-
- Universität Ulm, Germany, 2017-
- The Korean Association for Survey Research, Korea, 2018-
- The Jean Golding Institute for data-intensive research, University of Bristol, U.K., 2019-
- · Survey Research Center, Sungkyunkwan University, Korea, 2019-
- · University of Lampung, Indonesia, 2019-
- · Department of Earth and Space Sciences, Southern University of Sci-

ence and Technology, China, 2019-

- · Université Bretagne Sud, France, 2019-
- North Carolina State University, U.S.A., 2019-
- National University of Singapore, Singapore and Konrad-Zuse-Zentrum für Informationstechnik Berlin, Germany 2020-
- · Singapore-ETH Centre, Singapore, 2020-
- Department of Actuarial Studies and Business Analytics, Macquarie University, Australia, 2020-

The Institute has also been active in organizing international conferences and workshops. In April 2019-March 2021, 9 international symposia were held under the auspices of the Institute;

- The 4th Eastern Asia Meeting on Bayesian Statistics, EAC-ISBA 2019, July 13-14, 2019
- Workshop on Hawkes processes in data science, August 27, 2019
- Risk and Statistics: 2nd ISM-UUlm Joint Workshop, October 8-10, 2019
- 11th International Workshop on Analysis of Micro Data of Official Statistics, November 28-December 4, 2019
- Workshop on Emerging Themes in Computational Statistics, February 19-20, 2020
- Application of R Software for Statistical and Econometric Analysis in 2020, Indonesia: Level 1, December 21-23, 2020
- AgFReM Research Consortium Online Workshop for Statistical Analysis with R, January 26-27, 2021
- Applied Statistical Analysis with "R" Software for Forestry Studies 2021, February 16-17, 2021
- ANU-ISM Workshop on Data Science, March 24, 2021

The Institute actively encourages researchers to come to talk or give lectures and also to stay for collaboration with the staff. As shown in the list below, the Institute has received 48 visitors from 19 different countries. Of these researchers, 39 entered into a visiting research fellowship including a visiting professorship. Another list follows showing all the colloquia that were given by foreign visitors.

### Foreign Visitors (April 2019-March 2021)

- The asterisk \* before a visitor's name indicates that he/she is a visiting professor or a visiting research fellow.
  Date in the list refers to the period of visiting professorship/research-

From .	Algeria
*Benali, Amel19.11.25-20.1.27	
From A	ustralia
Chen, Feng19.5.21	*Shevchenko, Pavel
*Gerlach, Richard Helmut20.2.16-20.2.25	*Toczydlowska, Dorota 19.6.1-19.8.30
From	China
*Chang, Ying19.12.6-20.1.20	*Liu, Yue
*Chen, Shi19.8.16-19.9.16	Wang, Baoshan19.4.23
*Li, Hoglei19.8.16-19.9.16	*Xiong, Ziyao19.9.1-19.9.24
*Li, Zexiao19.9.17-19.11.17	*Zhang, Bei 19.8.16-19.9.16
*Liao, Yiwun19.10.28-19.11.3	*Zhou, Shiyong19.8.8-19.8.31
From	e Cuba
*Jimenez-Sobrino, Juan Carlos20.1.13-20.3.31	
From	Finland
Karvonen, Toni 19.6.27	
From	France
*Azzaoui, Nourddine19.6.25-19.7.26	*Septier, François Jean Michel 19.7.16-19.8.15
From G	ermany —
Bayona, Jose Antonio 19.8.28	*Kanagawa, Motonobu19.7.4-19.7.21
From	Greece

From Hong Kong — \*Lu, Xiaolei ......19.11.9-19.11.24 

From	Iran
*Hayati, Saeed19.9.3-19.11.1	
From	Italy
*Spassiani, Ilaria19.8.16-19.9.22	*Varini, Elisa 20.1.8-20.1.24
From Net	therlands
*Murakami, Yukihiro20.1.6-20.1.17	
From N	Jorway
*Myrvoll, Tor Andre19.7.8-19.8.2	Schulz, Jörn
From Si	ngapore
Choi, Yunjin19.5.15 *Ying, Chen20.2.25-20.2.26	*Zakiyeva, Nazgul20.2.23-20.2.29
*Pewsey, Arthur	Spain
From 7	"aiwan
*Hwang, Hsien-Kuei19.11.10-19.12.23	
From T	Furkey
*Can, Burcu19.8.13-19.8.26	U
From	U. K
*Copas, John Brian19.4.2-19.4.10	Maher, Stephen J
*Fernandez Aguilar, Tamara Alejandra19.4.2-19.4.14	*Modell, Alexander Donald 19.7.20-19.7.27
*Kanagawa, Heishiro19.4.1-19.4.15	*Peters, Gareth William 19.6.17-19.7.29
*Ibid20.2.18-20.2.21	*Rubin-Delanchy, Patrick Thomas Georges 19.7.13-19.7.27
*Liu, Song19.7.21-19.8.4	*Ton, Jean-Francois 20.2.25-20.7.22
Macrina, Andrea20.3.19	
From T	U.S.A
*Harkonen, Marc19.5.9-19.6.28	
Martinez, Wendy20.1.16	
*Vishwanath, Siddharth19.11.24-20.1.9	

# Colloquia by Foreign Visitors

(2019.4-2021.3)

Speaker (Country)	Title	Da	te
Copas, John (U. K.)	Publication bias: a sensitivity model for meta analysis	2019.	4. 8
Wang, Baoshan (China)	Migration of micro-earthquakes during cyclic operation of Underground Gas Storage and the Changdao earthquake swarm	2019.	4.23
Choi, Yunjin (Singapore)	Adaptive community detection via fused l-1 penalty	2019.	5.15
Chen, Feng (Australia)	Direct likelihood evaluation for the renewal Hawkes process	2019.	5.21
Karvonen, Toni (Finland)	Kernel-based numerical integration	2019.	6.27
Schulz, Jörn (Norway)	Statistics in medicine and beyond	2019.	6.28
Kanagawa, Motonobu (Germany)	Convergence guarantees for adaptive Bayesian quadrature methods	2019.	7.16
Peters, Gareth William (U. K.)	Explicit solutions to correlation matrix completion problems for risk and insurance	2019.	7.19
Azzaoui, Nourddine (France)	Dependance structure analysis of some stable processes in spatio-temporal models	2019.	7.19
Septier, François (France)	Bayesian inference for pollutant source reconstruction in built-up environments	2019.	7.19
Can, Burcu (Turkey)	Bayesian models in unsupervised learning of morphology and syntax	2019.	8.19
Li, Honglei (China)	Bayesian assimilation inversion of gravity anomalies and parameters optimization	2019.	8.28
Chen, Shi (China)	A Bayesian approach of network adjustment for campaigned gravity survey: methodology and model test	2019.	8.28

Speaker (Country)	Title	Date
Bayona, Jose Antonio (Germany)	An updated global hybrid earthquake model obtained from the optimal combination of interseismic strain rates and smoothed-seismicity data	2019. 8.28
Maher, Stephen J. (U. K.)	Benders' decomposition: Fundamentals, implementation and applications	2019.12.13
Shinano, Yuji (Germany)	Building optimal solutions to prize-collecting Steiner tree problems on ISM supercomputer	2019.12.13
Chang, Ying (China)	Differences between mantle wedge earthquakes and intraslab intermediate-depth earthquakes from spatial b-value image	2020. 1.14
Martinez, Wendy (U.S.A.)	Analyzing text as data	2020. 1.16
Macrina, Andrea (U. K.)	Modulated information flows on random point fields	2020. 3.19

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# Publications

### Periodicals

One of the driving forces behind the rapid progress of modern science has undoubtedly stemmed from the broad communication of research findings through international journals and reports. For the sake of publicizing its activities throughout academic and industrial circles, the Institute launched *Annals of the Institute of Statistical Mathematics* (AISM) in 1949 shortly after its foundation. Today AISM, distributed by Springer, has a worldwide reputation and is listed in citation review journals.

In the past two years, Volumes 71 to 73 (eleven issues) were published. For paper titles, abstracts, and full texts, visit our website at https://www.ism. ac.jp/editsec/aism/, or at https://springerlink.com/. The aims of AISM are shown in the excerpt below:



AISM aims to provide a forum for open communication among statisticians, and to contribute to the advancement of statistics as a science to enable humans to handle information in order to cope with uncertainties. It publishes high-quality papers that shed new light on the theoretical, computational and/or methodological aspects of statistical science. Emphasis is placed on (a) development of new methodologies motivated by real data, (b) development of unifying theories, and (c) analysis and

improvement of existing methodologies and theories.



The Institute publishes another periodical, *Proceed-ings of the Institute of Statistical Mathematics*. This biannual journal made its first appearance in 1953 and now carries scientific papers and articles on topics of research (in Japanese with abstracts in English). Volumes

67 and 68 (four issues) were published in the past two years. Refer to https://www.ism.ac.jp/editsec/toukei/ for paper titles, abstracts and full texts.

## **Technical Reports**

In addition to the two journals mentioned above, the Institute issues seven technical reports:

- Cooperative Research Report
- ISM Survey Research Report
- Computer Science Monographs
- Research Memorandum
- ISM Report on Research and Education
- ISM Reports on Statistical Computing
- · School of Statistical Thinking Research Report

## A list of the seven reports released from April 2019 to March 2021 follows.



## Cooperative Research Reports

 $\langle$  Reports, in Japanese and English, on the achievements emerging from collabora- $\backslash$  tive research projects in the Institute.  $\rangle$ 

- No.428: Tsuchiya, T., Optimization: Modeling and Algorithm 32. (March 2020)
- *No.429:* Ikoma, N., Comprehension of Intelligence by State Estimation Deepening and Multi-Discipline Collaboration (1). (March 2020)
- *No.430*: Maruyama, N., Development and Popularization of Dynamic Geometry Software GeoGebra (5). (March 2020)

- *No.431:* The Institute of Statistical Mathematics, Research on best practice in teaching statistics Vol. 12. (February 2020)
- *No.432:* Ishii, Y., Ueda, M., Kiyama, N., Insights from Corpus-based Studies and their Significance for Cognitive Linguistics. (March 2020)
- *No.433:* Kitano, T., Extreme Value Theory and Applications (17). (February 2020)
- *No.434:* Shimura, T., Infinitely divisible processes and related topics (24). (February 2020)
- *No.435*: Ishikawa, S., A Statistical Approach to Text Structures. (March 2020)
- No.436: Ishikawa, Y., A Statistical Analysis of Academic Texts in Engineering Fields. (March 2020)
- No.437: Fujieda, M., Expanding ESP Corpus Applications: Language Testing and Writing Support. (March 2020)
- No.438: Tabata, T., Stylometric Approaches to Textual Features. (March 2020)
- No.439: Sakaori, F., Research on Sports Data Analysis: Theory, Methodology, and Applications Vol.7. (March 2020)
- No.440: Tanaka, M., Abstract Report of "Trends in utilization of public-private sector's open data and initiative for human resource development". (March 2020)
- No.441: Kiyono, K., Development of Medical and Health Science Based on Biosignal and Bioimaging Data Analysis II. (March 2020)
- *No.444*: Ishikawa, S., Knowledge and Performance: A Quantitative Analysis of Learners' L2 Use. (March 2021)
- *No.445*: Kitano, T., Extreme Value Theory and Applications (18). (March 2021)
- No.446: Shimura, T., Infinitely divisible processes and related topics (25). (March 2021)
- No.448: Suenaga, K., Research on best practice in teaching statistics Vol. 13. (February 2021)
- *No.449:* Maruyama, N., Development and Popularization of Dynamic Geometry Software GeoGebra (6). (March 2021)
- *No.450:* Fujieda, M., Development and Evaluation of ESP-Corpus-Assisted Tools for Learning and Assessment. (March 2021)

XNo.427, 442, 443, 447 are missing numbers.

#### **ISM Survey Research Report**

/ Technical reports, mostly in Japanese, on the methodology of survey and analysis of measured data. Formerly published as Research Report (No.1-101). Full text can be downloaded from https://www.ism.ac.jp/. Not issued during the period April 2019 to March 2021. //

#### **Computer Science Monographs**

Technical reports in English on computer programs and software for statistical science. Full text and supplementary materials of No.31 onwards can be downloaded from https://www.ism.ac.jp/.

No.35: Ogata, Y., Katsura, K., Tanemura, M., Harte, D. and Zhuang, J., Hierarchical Space-Time Point-Process Models (HIST-PPM): Software Documentation (February 2021)

### **Research Memorandum**

 $\langle$  Technical Reports, mostly in English, that give immediate publicity to research  $\backslash$  findings. The full content of some of them can be downloaded from https://www.ism.ac.jp/.

- No.1209: Mochihashi, D., Unbounded Slice Sampling. (January 6, 2020)
- No.1210: Kumon, M., Invariant Information Geometrical Structures on System Spaces. (February 25, 2020)
- *No.1211:* Koyama, S., and Ishiwata, J., Time Series Modeling of Mud Pulse Telemetry with Multiple Modulators. (June 9, 2020)
- *No.1212*: Ninomiya, Y., Basis of Selective Inference in Propensity Score Analysis. (August 19, 2020)
- No.1213: Takeuchi, K., and Kumon, M., Winning Strategies for Asset Trading Games. (February 22, 2021)
- *No.1214:* Hirose, M., and Mano, S., A Bayesian Construction of Asymptotically Unbiased Estimators. (February 26, 2021)

#### ISM Report on Research and Education

(Reports and documents concerned with education and research.)

- No.47: The Institute of Statistical Mathematics, and Department of Statistical Science, The Graduate University for Advanced Studies (ed.),
   2019 ISM Openhouse Posters and Annual Symposium of the Graduate Students of the Department of Statistical Science. (December 2019)
- No.48: Department of Statistical Science, The Graduate University for Advanced Studies (ed.), Annual Symposium of the Graduate Students of

the Department of Statistical Science, 2019. (February 2020)

- No.49: The Institute of Statistical Mathematics, and Department of Statistical Science, The Graduate University for Advanced Studies (ed.),
   2020 ISM Openhouse Posters and Annual Symposium of the Graduate Students of the Department of Statistical Science. (December 2020)
- *No.50:* Department of Statistical Science, The Graduate University for Advanced Studies (ed.), Annual Symposium of the Graduate Students of the Department of Statistical Science, 2020. (February 2021)

### ISM Reports on Statistical Computing

(Technical reports in Japanese and English that describe management and manipulation of computer systems. Not issued during the period April 2019 to March 2021.

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# Published Papers and Books

Many of the achievements made by the staff of the Institute consist of scientific papers and monographs. Each of the staff has selected works worthy of note out of his/her papers and books published in the period from April 2019 to March 2021, to complete the following list. Also included are works by visiting professors and students.

- Abe, T. and Fujisawa, H.: Multivariate skew distributions with mode-invariance through transformation of scale, *Japanese Journal of Statistics and Data Science*, 2, 529-544, 2019.
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## 7 -

## Tutorial Programs and Consultation

Tutorial courses on statistical science are held for the benefit of researchers, students, and the general public. The levels of courses vary from beginner's level to advanced level. (Includes courses that were canceled while announcing the event.)

Year	Level/ Category	Title	Month	Number of par- tici- pants	
Single	Single Courses				
2019	Basic	Introductory Time Series Analysis us- ing R	June	98	
	Standard	Sparse estimation	July	106	
	Basic	Introduction to Multivariate analysis	August	88	
	Standard	Model Selection Using Information Criteria	November	107	
2020	Standard	For understanding philosophy of statis- tics	January	105	
	Standard	Geographic Information and Spa- tio-Temporal Modeling	February	109	
	Basic	Introductory Time Series Analysis Us- ing R	May	canceled	
	Standard	Sparse estimation	July	canceled	
	Basic	Introduction to Multivariate Analysis	August	canceled	
	Standard	Robust Statistics	November	38	
2021	Basic	Introductory Time Series Analysis Us- ing R (online)	March	125	

Year	Level/ Category	Title	Month	Number of par- tici- pants
Leading DAT (Data Analytics Talents)				_
2019	L-A	Introductory Data Science	September	108
	L-B1	An Introduction to Statistical Modeling	November	47
	L-B2	Machine Learning and Modern Meth- odologies in Data Science	December	47
		Leading DAT Training Course	November -January 2020	63
2020	L-S	Decision Trees and Ensemble Learn- ing: From Basics to Practice	March	canceled
	L-S	Decision Trees and Ensemble Learn- ing: From Basics to Practice (online)	October	61
	L-B1	An Introduction to Statistical Modeling (online)	December	67
		Leading DAT Training Course (half course) (online)	December -January 2021	30

The Institute launched the School of Statistical Thinking in January 2012. Since then, the School has centralized control over the educational programs for the general public except regular courses in SOKENDAI, the Graduate University for Advanced Studies, see Supplement.

Tutorial courses are the most popular among the programs operated by the School. There is consistent demand for non-degree pursuing continuous education from the private sector. Actually around 70% of the total attendants are from private companies. A yearly open lecture is a more accessible half-day program where a timely topic relating to statistical science is explained in plain language.

In FY 2017, the School of Statistical Thinking launched a program called "Leading DAT (Data Analytics Talents)" aimed at training data scientists with the knowledge and skills in statistical mathematics required by modern society. As the program's first projects, we organized two Leading DAT lectures entitled "L-B1: Bayesian Modeling in Practice" and "L-B2: Machine Learning and Modern Methodologies in Data Science." At the same time, we established the Leading DAT Training Course, in which we grant certificates to participants who have

fulfilled the course requirements, including attendance in all lectures and submission of reports. A total of 25 people has been granted the certificate of completion.

Since FY2018, two lectures, L-A and L-S, have been added to the Leading DAT program; "L-A: Introductory Data Science," aims to consolidate the basics of statistics, while "L-S" treats yearly selected topics. The title of L-B1 has been changed to "An Introduction to Statistical Modeling". In FY2020, during the COVID-19 pandemic, we conducted L-B1, L-S, and half of the training course as on-line lectures, which helped us prepare for full line-up on-line Leading DAT scheduled in FY2021.

Former services for consultancy have been renovated as the "Research Collaboration Start-Up" program. A team of experienced emeritus professors and young research fellows give advice and handle nearly 40 cases a year. Some of them have led to the registration for our Cooperative Research Program or funded joint project between the Institute and the client company.

The ISM Summer School program is also integrated as an activity of the School. It was started in FY2006 as a free crash course open to graduate students from all over Japan. The topic of FY2013 was "Information Geometry" which gathered 120 registrations. From FY2014 to FY2019, we provided a program for "Mathematical Modeling for Pandemic Disease" which lasts for 10 consecutive days. Since FY2016, all the lectures were done in English. This program attracts nearly one hundred participants including international students, and surprisingly we find almost no dropouts. The numbers of participants in FY2019 and FY2020 were 89 and 81, respectively.

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## Software Products

The Institute of Statistical Mathematics has published the Computer Science Monographs (CSM) series as a report on software research and development, and has been actively publishing and providing source code. Software such as TIMSAC, which has been well received for many years, is now provided as a package of programming language R, free and open-source software for statistical analysis, through the CRAN (The Comprehensive R Archive Network) site. Currently, most of the following R packages are published on CRAN, and can be downloaded directly from R Gui, RStudio, etc. Other software can be downloaded from the URL described in the access column. Please contact each developer individually for inquiries.

Program	Explanation, etc.	Access
■ timsac (R package)	Package for statistical analysis, predic- tion and control of time series. Com- posed of most programs of TIMSAC (CSM No. 5, 6, 11, 22, 23). Also in- cludes BAYSEA (CSM No. 13) pro- grams.	https://cran.r-project.o rg/web/packages/timsa c/index.html https://jasp.ism.ac.jp/is m/timsac/index_e.html
■ catdap (R package)	Package for categorical data analysis. Automatically selects optimal explana- tory variables for a categorical objec- tive variable.	https://cran.r-project.o rg/web/packages/catda p/index.html https://jasp.ism.ac.jp/is m/catdap/
■ SAPP (R package)	Package for statistical analysis of se- ries of events and seismicity. Com- posed of programs SASE (CSM No.32) and SASeis2006 (CSM No.33).	https://cran.r-project.o rg/web/packages/SAP P/index.html https://jasp.ism.ac.jp/is m/SAPP/index_e.html

## Program developed in ISM

Program	Explanation, etc.	Access
NScluster (R package)	Package for simulation and estimation for Neyman-Scott spatial cluster point process models and their extensions	https://cran.r-project.o rg/web/packages/NScl uster/index.html https://jasp.ism.ac.jp/is m/SAPP/index_e.html
■ TSSS (R package)	Package for statistical analysis, mod- eling and simulation of time series with state space models	https://cran.r-project.o rg/web/packages/TSSS /index.html https://jasp.ism.ac.jp/is m/TSSS/index_e.html
■ spmoran (R package)	Package for estimating spatial additive mixed models and other spatial re- gression models for Gaussian and non-Gaussian data	https://cran.r-project.o rg/web/packages/spmo ran/index.html
■ pimeta (R package)	Package for implementation of predic- tion intervals for random-effects me- ta-analysis	https://cran.r-project.o rg/web/packages/pimet a/index.html
■ scgwr (R package)	Package of programs for linear-time algorithm for empirical Bayes estima- tion of a large-scale geographically weighted regression model	https://cran.r-project.o rg/web/packages/scgw r/index.html
■ GWmodel (R package)	A general-purpose package that pro- vides a wide range of statistical analy- sis methods for geospatial data, in- cluding geographically-weighted re- gression	https://cran.r-project.o rg/web/packages/GWm odel/index.html
■ treefit (R package)	Software for estimating a tree-structured model of cell differen-	https://hayamizu-lab.gi thub.io/treefit-r/
Treefit for Python	tiation from single-cell RNA-seq data	https://hayamizu-lab.gi thub.io/treefit-python/
■ iqspr (R package)	Package for autonomous generation of novel organic compounds with target physicochemical properties	https://github.com/GL ambard/inverse-molec ular-design
■ XenonPy	A Python library that implements a comprehensive set of machine learning tools for materials informatics	https://github.com/yos hida-lab/XenonPy
■ Jasplot	Java library for drawing interactive statistical graphs	https://jasp.ism.ac.jp/ja splot/index.html

Program	Explanation, etc.	Access	
■ SASE Package for point-process ana written in FORTRAN77 (CSM No.		https://www.ism.ac.jp/~ ogata/Ssg/ssg_softwar	
■ SASeis2006	Package for statistical analysis of seismicity written in FORTRAN77 (CSM No. 33)	esE.html	
Ardock	Package for model fitting and inter- pretation of the linear multivariate time series and systems (CSM No. 30)	https://www.ism.ac.jp/i smlib/jpn/ismlib/soft.ht ml#ARdock	
■ DALL	Programs of Davidon's algorithm for log-likelihood maximization written in FORTRAN and C (CSM No. 25)	https://www.ism.ac.jp/i smlib/jpn/ismlib/soft.ht ml#dall	



(Supercomputer)
Supplement

## Introduction to the Department of Statistical Science, School of Multidisciplinary Sciences, SOKENDAI (The Graduate University for Advanced Studies)

"SOKENDAI (The Graduate University for Advanced Studies) is a graduate university with no undergraduate programs that consists of departments housed in affiliated Inter-University Research Institutes and the School of Advanced Sciences attached directly to SOKENDAI. The Inter-University Research Institutes are research centers for joint use by universities throughout Japan in their various research fields. As such, these institutes serve as centers of advanced research in their respective research fields and as nodes of scholarly communication that support international joint research. The School of Advanced Sciences, which is located in Hayama and has no such parent institute, conducts advanced research into the evolution of life and the relationship between science and society."

(from the President's Statement)

SOKENDAI (The Graduate University for Advanced Studies) was thus established in October 1988 with seven institutes as parents. As of April 2021, the University has grown to have 17 parent institutes and 2276 Ph.D. students. The organization is composed of 6 schools that comprise 20 departments and a center. In the Department of Statistical Science, research and educational activities focus on the effective use of data for the realization of rational inferences or predictions, in the same way as in the construction and confirmation of scientific hypotheses. The subject area covers the theory and application of statistical science, such as fundamental statistical theory and statistical methodologies including prediction, data assimilation, survey science, machine learning, risk analysis, optimization, decision making, and control. Since its establishment, 145 Doctors of Philosophy have been conferred by the Department. As of April 2021, the Department has 39 students.



## The Institute of to Kamikitadai **Statistical Mathematics** Tachikawa City Hall O Bus stop (Tachikawa Academic Plaza) Bus stop (Tachikawa-Shiyakusho) Q Bus stop (Saibansho-mae) Courthouse Takamatsu Local Autonomy College National Institute for Japanese Language Tachikawa and Linguistics **Police Station** Disaster Medical Tama Center Monorail Showa Kinen Park Tachikawa-kita Chuo Line Ome Line to Shinjuku, Tachikawa Tokyo →

Access to the ISM

- Tama Monorail
  - -10 min walk from Takamatsu Sta.
- Tachikawa Bus
  - -Tachikawa Academic Plaza bus stop
  - -5 min walk from Saibansho-mae or Tachikawa-
  - Shiyakusho bus stop

## Location of the Institute

Inter-University Research Institute Corporation Research Organization of Information and Systems

THE INSTITUTE OF STATISTICAL MATHEMATICS

including the

DEPARTMENT OF STATISTICAL SCIENCE, School of Multidisciplinary Sciences, the Graduate University for Advanced Studies, Sokendai

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