2020 Admission Guide

Department of Mathematical Informatics

Graduate School of Information Science and Technology
The University of Tokyo

Master's Programs

Doctoral Programs

Contact
Department Team (Department of Mathematical Informatics),
Academic Affairs Group, Graduate School of Engineering / Information Science and Technology,
The University of Tokyo,
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, JAPAN.
TEL: 03-5841-6889   E-mail: office@office.keisu.t.u-tokyo.ac.jp

Visit
https://www.i.u-tokyo.ac.jp/index_e.shtml

In addition to this brochure, be sure to refer to the Admission Guides of Graduate School of Information Science and Technology, The University of Tokyo.

(I) Master's Program

1. Outline

The selection will be conducted based on the "2020 Admission Guide: Master's Program, Graduate School of Information Science and Technology, The University of Tokyo" (also posted on https://www.i.u-tokyo.ac.jp/), and on this Admission Guide of Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common Guide, so please be sure to refer to the document. This admission guide supplements the above common Guide with explanations regarding examination procedures that are specific to Department of Mathematical Informatics.

Based on the interdisciplinary nature of Department of Mathematical Informatics, this department invites applicants from a wide range of fields, both inside and outside The University of Tokyo, with a fundamental understanding and knowledge of mathematics, informatics, and physics. Examination subjects have been selected to ensure that applicants with diverse backgrounds can take examinations under fair conditions.

2. Preference Card

On the "Preference card (for the Master's Program)" included with this Guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card along with the application documents.

Note: Regarding preferred faculty advisors

Please select your preferred advisors from amongst those in Department of Mathematical Informatics (listed on pages 11-14).

3. Examination Schedule

3.1. General education subjects

Examination date	Location	Examination time	Examination subjects
August 19, 2019 (Monday)	Faculty of Law and Letters Bldg. No. 2, or Faculty of Engineering Bldg. No. 2	10:00 – 12:30	Mathematics

・Details on the Examination location will be delivered to every applicant by postal mail with an examination admission card and posted on the bulletin board at the main entrance to Bldg. No. 6 of the Faculty of Engineering at 9:00 a.m. on the day of the Examination.

・After the Examination is completed, applicants will be provided with information regarding the subsequent Oral Examinations.

3.2. Foreign languages (English)

TOEFL scores will be used to evaluate the applicants' English skills. No written English Examination will be administered. For details, refer to "2020 Guidelines for Submission of TOEFL Test Scores; Graduate School of Information Science and Technology, The University of Tokyo," which is enclosed in the common Admission Guide.

3.3. Specialized subjects

1) Written Examination

For Examinations on Specialized Subjects, applicants shall choose one subject from among the following: "Mathematical Informatics," "Information Physics and Computing," "Computer Science," and "Information and Communication Engineering." Please note that dates, times, and locations differ depending on the subjects.

Specialized subjects	Examination Dates, Times, and Locations	Scope of questions
Mathematical Informatics	August 20, 2019 (Tuesday) 10:00 – 13:00 Faculty of Engineering Bldg. No. 6	Applicants will be required to solve three out of five problems related to mathematical problem-solving methods, including: algebraic methods, analytic methods, geometric methods, discrete methods, stochastic methods, statistical methods, and algorithms, etc.
Information Physics and Computing	Please refer to the "Admission Guide" of Department of Information Physics and Computing.	
Computer Science	Please refer to the "Admission Guide" of Department of Computer Science.	
Information and Communication Engineering	Please refer to the "Admission Guide" of Department of Information and Communication Engineering.	

・Details on the Examination location for "Mathematical Informatics" will be posted on the bulletin board at the main entrance to Bldg. No. 6 of the Faculty of Engineering at 9:00 a.m. one day before the Examination.

・For information on the Examination locations for "Information Physics and Computing," "Computer Science," and "Information and Communication Engineering," please refer to the "Admission Guide" of the department in question.

2) Oral Examination

Oral Examinations are scheduled to be held between 9:00 a.m. and 6:00 p.m. on August 22 (Thursday), 2019. Detailed schedules will be noticed during the Examination period.

4. Important Notes

4.1. Those who are absent from one of the exams (the General education subjects, and the Written and Oral Examinations on the Specialized subjects) are considered to have withdrawn from the entrance exam.

4.2. During the Written Examinations, applicants can use only writing instruments (pencils or mechanical pencils; all must be black), pencil sharpeners, erasers, and a clock or watch (that only shows the time; devices with other functions are not allowed). No other instruments can be used.

4.3. Persons who have not graduated from university by August 2019 wishing to enter the school in September are required to confirm their eligibility with Department Team (Department of Mathematical Informatics), Academic Affairs Group, Graduate School of Engineering / Information Science and Technology, The University of Tokyo.

4.4. For other notes, please be sure to carefully read the "Useful information for persons taking the Entrance Examinations (Master's and Doctoral Programs)," which is included on page 7 of this Guide.

5. Contacts

If you have any questions regarding this Application Guide, please contact Department Team as indicated on the cover.

(II) Doctoral Program [Summer and Winter Entrance Examinations]

1. Outline

The selection will be conducted based on the "2020 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo" (also posted on https://www.i.u-tokyo.ac.jp/), and on this Admission Guide of Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common Guide, so please be sure to refer to the document. This admission guide supplements the above common Guide with explanations regarding examination procedures that are specific to Department of Mathematical Informatics.

2. Contact before Submission of Applications

Applicants are required to contact the following office prior to submission of applications and arrange a meeting with their preferred faculty advisor.

Contact:

Department Team (Department of Mathematical Informatics)
Academic Affairs Group
Graduate School of Engineering / Information Science and Technology, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
(TEL: 03-5841-6889, E-mail: office@office.keisu.t.u-tokyo.ac.jp)

3. Preference Card

On the "Preference card (for Doctoral Program)" included in this Guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card along with the application documents.

4. Documents for Submission

Applicants are requested to write reports on the following themes, mark the checklist in the preference card, and submit all of the reports along with the application documents.

Theme:

(1) Summarize your past research achievements and future research plans in a report in English or Japanese, comprising no more than ten A4 size pages, including formulas, diagrams, etc. Applicants may use any appropriate format for this report.

(2) Provide an English summary of the above report on about one A4 size page.

(3) Provide responses to the following questions regarding the content of the above report in English or Japanese, comprising no more than two A4 size pages.

   (a) What is the goal of your research?

   (b) What is the specific content of this research and the methods used?

   (c) What is the current status of this field of research, in Japan and overseas?

   (d) What aspects of this research could be considered new in comparison to past research in this

   field?

   (e) How will the results of this research contribute to the field in question?

5. Primary Examinations

5.1. Foreign languages (English)

・TOEFL scores will be used to evaluate the applicants' English skills. No written English Examination will be administered. For details, refer to "2020 Guidelines for Submission of TOEFL

Test Scores; Graduate School of Information Science and Technology, The University of Tokyo," which is enclosed in the common Admission Guide.

・Persons who have completed or are expected to complete a University of Tokyo Graduate School Master's Program will not be required to submit TOEFL scores.

5.2. Written Examination

・Applicants will take an Examination on the Specialized subject "Mathematical Informatics." Applicants will be required to write descriptive answers to questions that assess specialized academic skills and knowledge.

・In the Summer Entrance Examination, the Written Examination will be held in Bldg. No.6 of the Faculty of Engineering between 10:00 a.m. and 12:00 p.m. on August 19, 2019 (Monday). Details on the Examination location will be posted on the bulletin board at the main entrance to Bldg. No.6 of the Faculty of Engineering at 9:00 a.m. on the day of the Examination.

・In the Winter Entrance Examination, the Written Examination will be held between January 28 (Tuesday) and January 31 (Friday), 2020. Applicants will be notified directly regarding dates, times, and locations.

・Persons who have completed or are expected to complete a University of Tokyo Graduate School Master's Program may be exempted from the Written Examinations on the Specialized subject. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 12 (Wednesday) in the case of the Summer Entrance Examination, and no later than November 25 (Monday) in the case of the Winter Entrance Examination.

5.3. Oral Examination

・Applicants will be required to answer questions on the research plan and other materials submitted in advance.

・In the Summer Entrance Examination, the Oral Examination is held in Bldg. No. 6 of the Faculty of Engineering on August 19 (Monday) or 23 (Friday), 2019. Applicants will be notified directly regarding dates, times, and locations.

・In the Winter Entrance Examination, the Oral Examination will be held between January 28 (Tuesday) and January 31 (Friday), 2020. Applicants will be notified directly regarding dates, times, and locations.

6. Secondary Examinations

In the case of the Summer Entrance Examinations, persons who have passed the Primary Examinations shall take the Secondary Examinations between late January and mid-February, 2020. Note, however, that persons who wish to enter the school in September and persons who have already completed a master's program by the time of application shall take Secondary Examinations on the same day as the Primary Examinations.

In the case of the Winter Entrance Examination, the Secondary Examinations will be conducted on the same day as the Primary Examinations.

The Oral examination will be conducted in the secondary examination. Applicants should send their Master's theses (or equivalent material), with its summery written in one or two pages (in A4 size) to the office by e-mail before the examination date. Applicants should bring printed their theses and its summary on the examination date. Applicants will be notified later regarding dates, times, and locations.

7. Contacts

If you have any questions regarding this Application Guide, please contact Department Team as indicated on the cover.

（Ⅲ）Doctoral Program - Special Selection of Working Students [Summer and Winter Entrance Examinations]

1. Outline

The selection will be conducted based on the "2020 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo" (also posted on https://www.i.u-tokyo.ac.jp/), "2020 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo [Special Selection of Working Students]" and on this Admission Guide of Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common Guides, so please be sure to refer to the documents. This admission guide supplements the above common Guides with explanations regarding examination procedures that are specific to Department of Mathematical Informatics.

2. Contact before Submission of Applications

Applicants are required to contact the following office prior to submission of applications and arrange a meeting with their preferred faculty advisor.

Contact:

Department Team (Department of Mathematical Informatics)
Academic Affairs Group
Graduate School of Engineering / Information Science and Technology, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
(TEL: 03-5841-6889, E-mail: office@office.keisu.t.u-tokyo.ac.jp)

3. Preference Card
On the "Preference card (for Doctoral Program)" included in this Guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card along with the application documents.

4. Documents for Submission

In their application documents, applicants shall include the documents consisting of the following five items regarding the applicant's research and work achievements in a field related to Mathematical Informatics. Applicants must mark the checklist in the preference card, and submit all of these documents along with the application documents.

(1) List of achievements

Provide a list of academic papers, patents, products, and other examples of the applicant's achievements. In the case of collaborative achievements involving several persons, clearly indicate the part and the weight of the applicant's contributions.

(2) Outline of main achievements

Select three or less main achievements from the above list, and provide an outline of these achievements.

(3) Research plan

Provide a detailed description of the applicant's plan for research to be conducted in the Doctoral Program.

(4) Materials related to main achievements

These materials may include reprints (or copies) of academic papers, detailed descriptions of patents, or product pamphlets.

(5) Recommendation letters

Select two individuals with a clear understanding of the applicant's achievements, and have them provide separate evaluations of those achievements by filling in the specified form found at

(https://www.i.u-tokyo.ac.jp/edu/course/mi/pdf/gyouseki.doc). Evaluations should be sealed before being submitted.

Note: Items (2) and (3) should be combined on about ten A4 size pages.

5. Selection Methods

A few students will be selected based on research achievements and work achievements in fields related to Mathematical Informatics, and also on the selection below.

5.1. Foreign languages (English)

・TOEFL scores will be used to evaluate the applicants' English skills. No written English Examination will be administered. For details, refer to "2020 Guidelines for Submission of TOEFL Test Scores; Graduate School of Information Science and Technology, The University of Tokyo," which is enclosed in the common Admission Guide.

・Persons who have completed or are expected to complete a University of Tokyo Graduate School Master's Program will not be required to submit TOEFL scores.

5.2. Written Examination

・ Applicants will take an Examination on the Specialized subject "Mathematical Informatics." Applicants will be required to write descriptive answers to questions that assess specialized academic skills and knowledge.

・ In the Summer Entrance Examination, the Written Examination will be held in Bldg. No.6 of the Faculty of Engineering between 10:00 a.m. and 12:00 p.m. on August 19 (Monday), 2019. Details on the Examination location will be posted on the bulletin board at the main entrance to Bldg. No.6 of the Faculty of Engineering at 9:00 a.m. on the day of the Examination.

・ In the Winter Entrance Examination, the Written Examination will be held between January 28 (Tuesday) and January 31 (Friday), 2020. Applicants will be notified directly regarding dates, times, and locations.

・ Persons who have completed or are expected to complete a University of Tokyo Graduate School Master's Program may be exempted from the Written Examinations on the Specialized subject. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 12 (Wednesday) in the case of the Summer Entrance Examination, and no later than November 25 (Monday) in the case of the Winter Entrance Examination.

5.3. Oral Examination

・Applicants will be required to answer questions on the research plan and other materials submitted in advance.

・In the Summer Entrance Examination, the Oral Examination is held in Bldg. No. 6 of the Faculty of Engineering on August 19 (Monday) or 23 (Friday), 2019. Applicants will be notified directly regarding dates, times, and locations.

・In the Winter Entrance Examination, the Oral Examination will be held between January 28 (Tuesday) and January 31 (Friday), 2020. Applicants will be notified directly regarding dates, times, and locations.

・Applicants should send their Master's theses (or equivalent material), with its summery written in one or two pages (in A4 size) to the office by e-mail before the examination date. Applicants should bring printed their theses and its summary on the examination date.

6. Contacts

If you have any questions regarding this Application Guide, please contact Department Team as indicated on the cover.

Department of Mathematical Informatics
Useful information for persons taking Entrance Examinations
(Master's and Doctoral Programs)

1. Examination dates and times

Please refer to the main body of this Guide.

2. Examination locations

University of Tokyo (7-3-1 Hongo, Bunkyo-ku, Tokyo)

Refer to the map on page 8.

By subway:

> Marunouchi Line / Oedo Line: Get off at Hongo Sanchome Station
> Chiyoda Line: Get off at Nezu Station
> Namboku Line: Get off at Todai Mae Station
> Mita Line: Get off at Kasuga Station

By Bus:

> Take Toei Bus No. 43 or 51 to "Todai Seimon Mae" (Main Gate of The University of Tokyo), or Toei School Bus No. 1 or 7 to "Todai Konai" (Campus of The University of Tokyo).

(1) Please check the department bulletin board for information on your own Examination rooms.

(2) Examinees should be in the designated Examination room no later than 15 minutes before the start of Examination. If an examinee is late, the examinee should contact the Examination supervisor.

3. What to bring

(1) Examination admission card

(2) Be sure to bring black pencils (or mechanical pencil), erasers, pencil sharpeners (desktop types are not acceptable) or a knife if you are using black pencils, and a clock or watch (that only shows the time).

Caution: During the Examination period, all mobile phones must be turned off and put away.

4. Items to keep in mind during Examinations

(1) Examinees will not be allowed to leave the examination room after the start of the Examination.

(2) Examinees will not be allowed, in principle, to leave their seats even temporarily. Call the proctor in case feeling sick or needing to use the bathroom facilities during the Examination period.

(3) Examination admission cards must be placed on the desk throughout the examination period.
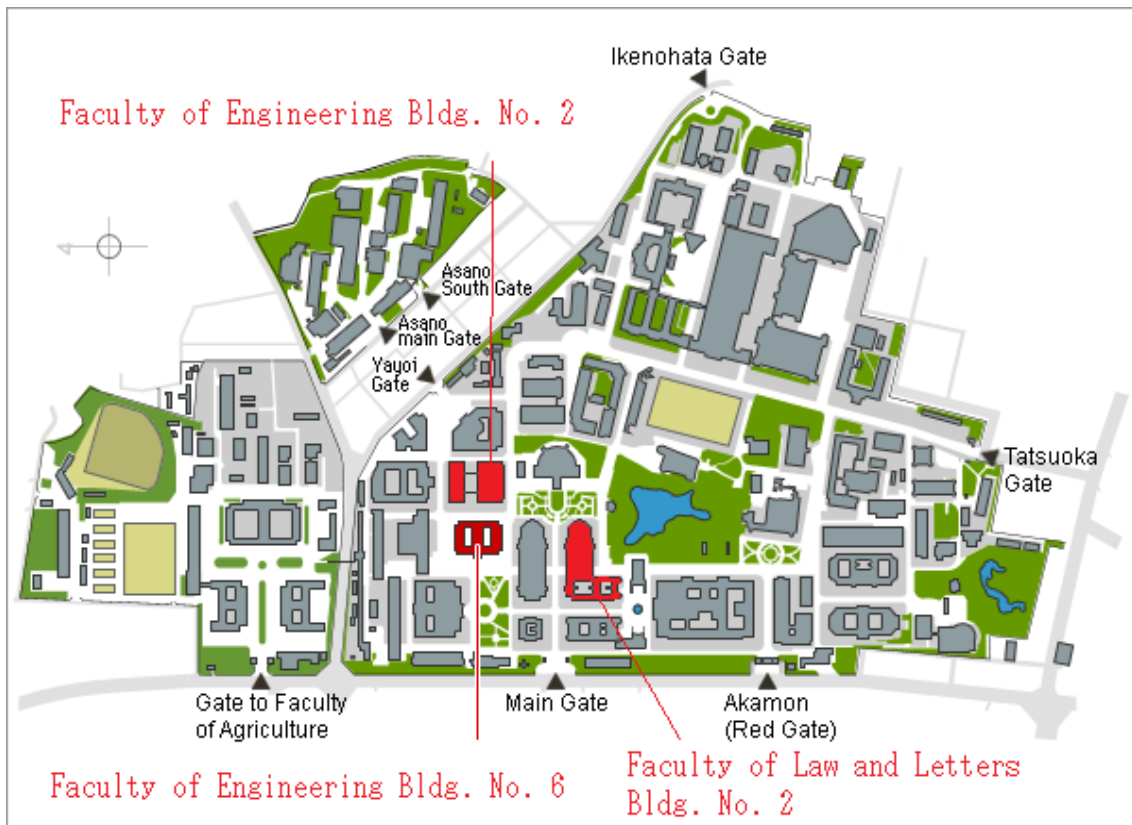
(4) Enter your examinee's number on all answer sheets. Do not write your name. Enter your answers on the designated sheet. If there is not enough space, you may write on the back of the answer sheet.

(5) Examinees are not allowed to take answer sheets and question booklets out of the examination room.

Department of Mathematical Informatics

Map of Examination Location

By subway:

Marunouchi Line / Oedo Line: Get off at Hongo Sanchome Station

Chiyoda Line: Get off at Nezu Station

Namboku Line: Get off at Todai Mae Station

Mita Line: Get off at Kasuga Station

Bus:

Take Toei Bus No. 43 or 51 to "Todai Seimon Mae" (Main Gate of The University of Tokyo), or Toei School Bus No. 1 or 7 to "Todai Konai" (Campus of The University of Tokyo).

[Preference card (for Master's Program)]

Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo

Program	Master's Program		
Examinee's name		*Examinee's number	
Graduated university (Graduate school if applicable)	University:_____Faculty: _____ Department: _____ Graduation date (expected)　　　　year　　　month Graduate School:_____Faculty: _____ Department: _____ Graduation date (expected)　　　　year　　　month		
Contact address during the examination period	Address: TEL: E-mail:		
Names of preferred faculty advisors	Preference 1		
	Preference 2		
	Preference 3		
	Preference 4		
	Preference 5		
	Preference 6		
Specialized subjects to be tested on the Examination	Mathematical Informatics	Information Physics and Computing	Computer Science	Information and Communication Engineering
Do you wish to enter the school in September 2019? (only for Summer Examination)	□ Yes		□ No
Residence Card (Please mark the appropriate item)	□ Retain Status: student／other (　　　　　)		□ Not Retain
Preferred field (Please describe in detail)			
If you have any preferred faculty advisor or preferred fields other than those noted above, please indicate them here.			

・Submit this card along with your application.

・*Leave this box blank.

・Please circle the relevant Specialized subjects to be taken.

・Persons who have not graduated from university by August 2019 wishing to enter the school in September are required to confirm the eligibility with Department Team (Department of Mathematical Informatics), Academic Affairs Group, Graduate School of Engineering / Information Science and Technology, The University of Tokyo, and circle "Yes" in the appropriate column above.

[Preference card (for Doctoral Program)]

Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo

Program	Doctoral Program		
Examinee's name		*Examinee's number	
Graduated university and graduate school	University:_____Faculty: _____ Department: _____ Graduation date (expected)　　　year　　　month Graduate School:_____Faculty: _____ Department: _____ Graduation date (expected)　　　year　　　month		
Contact address during the examination period	Address: TEL: E-mail:		
Name of preferred faculty advisor			
	(Confirm the following statement and mark the check box.) □ I have made contact and held a meeting with the preferred faculty advisor prior to submission of this application.		
Application Category (Please mark the appropriate item)	□ Summer Examination 　(Do you wish to enter the school in September 2019?　□ Yes　□ No)		
	□ Winter Examination		
	□ Special Selection of Working Students 　(Mark also either Summer Examinations or Winter Examinations.)		
Residence Card (Please mark the appropriate item)	□ Retain Status: student／other (　　　　)		□ Not Retain
Checklist of the documents to be submitted	Doctoral Program	Special Selection of Working Students	
	□ Research achievements & plans □ English summary □ Responses to questions (a)–(e)	□ List of achievements □ Outline of main achievements □ Research plan □ Materials of main achievements □ Recommendation letters	
Preferred field			

・Submit this card along with your application.

・*Leave this box blank.

・Please note that the period for acceptance of applications differs for the Summer Examination and the Winter Examination. Application documents that arrive outside of the respective periods for acceptance of applications shall be deemed invalid.

・Persons who have not earned Master's degree by August 2019 wishing to enter the school in September via the Summer Examination are required to confirm the eligibility with Department Team (Department of Mathematical Informatics), Academic Affairs Group, Graduate School of Engineering / Information Science and Technology, The University of Tokyo, and mark "Yes" in the appropriate column above.

Department of Mathematical Informatics

Graduate School of Information Science and Technology, The University of Tokyo

https://www.i.u-tokyo.ac.jp/edu/course/mi/members_e.shtml

Tsuyoshi Takagi (Professor)	(1) Mathematical Cryptography: Theoretical analysis and efficient implementation of post-quantum cryptography in the era of quantum computers. (2) Applied Cryptography: Security evaluation of Bitcoin system or cryptographic protocols such as SSL/TLS.
Kunihiko Sadakane (Professor)	(1) Algorithms and data structures: theory of algorithms for processing discrete data such as graphs and strings, theory of stream, external, and GPU algorithms, and theory of succinct data structures and graph decomposition. (2) Applications of those theories to efficient big data processing such as genome information and geographic information.
Takayasu Matsuo (Professor)	(1) Numerical algorithm: differential equation, function approximation, numerical linear algebra, tensor. (2) Theoretical numerical analysis: geometric numerical integration, discrete functional analysis, asymptotic behaviors of algorithms. (3) Applications: physical simulation, data analysis.
Fumiyasu Komaki (Professor)	(1) Theoretical statistics: inference theory, prediction theory, Bayesian theory, experimental design, model selection. (2) Statistical modeling: Bayesian networks, graphical models, point processes. (3) Information geometry: differential geometry of statistical inference.
Akiko Takeda (Professor)	(1) Continuous optimization: development of efficient algorithms for solving nonconvex optimization problems, robust optimization problems, etc. (2) Applications of optimization methods to optimization problems in machine learning, energy system. (3) Operations Research.
Kenji Yamanishi (Professor)	(1) Theory of machine learning: an information-theoretic or statistical approach to machine learning. (2) Data science: anomaly detection, change analysis, network mining, latent dynamics. (3) Big data analysis: security, marketing, traffic risk analysis, medical data analysis, healthcare.
Satoru Iwata (Professor)	(1) Discrete optimization: Design and analysis of algorithms for optimization problems related to matroids and submodular functions. (2) Discrete mathematical engineering: Discrete optimization techniques in numerical linear algebra and dynamical systems analysis. (3) Global optimization: Design of efficient algorithms for solving nonconvex optimization problems with geometric backgrounds. (4) Chemo-informatics: Information processing methods for assisting research in chemistry.
Koji Nuida (Associate Professor)	(1) Mathematical Cryptography: construction and security analysis of cryptosystems focusing on mathematical properties. (2) Applied Cryptography: secure computation for privacy-preserving data mining in application areas. (3) Fundamental Mathematics: group theory, discrete mathematics, etc., and cryptographic applications.
Hiroshi Hirai (Associate Professor)	(1) Discrete optimization: multicommodity flow, facility location, network design, etc. (2) Discrete mathematics: finite metric spaces, polyhedral combinatorics, graph theory, and their applications.

Ken'ichiro Tanaka (Associate Professor)	(1) Theoretical Numerical Analysis: numerical integration, function approximation, mathematical analysis of approximation formulas, design of accurate approximation formulas by optimization. (2) Numerical algorithm: accurate computation by variable transformation, fast and accurate computation of integral transforms, fast and accurate methods for functional equations. (3) Numerical methods for finance: option pricing, risk evaluation.
Tomonari Sei (Associate Professor)	(1) Theoretical statistics: inference theory, directional statistics, algebraic statistics, information geometry, Bayesian statistics. (2) Statistical modeling of rare events, time series data, etc. (3) Statistical modeling with optimal transport map.
Taiji Suzuki (Associate Professor)	(1) Machine learning, statistical learning theory: theory of generalization error, deep learning, kernel method, regularization, stochastic optimization. (2) Mathematical statistics, statistical modeling: high dimensional sparse estimation, Bayesian statistics, information geometry.
Shin-ichi Tanigawa (Associate Professor)	(1) Discrete and computational geometry: distance geometry, rigidity theory, matroids, graph embeddings. (2) Applications of discrete optimization techniques: graph algorithms, analysis of discrete engineering structures.
Kumiko Tanaka-Ishii (Professor) [RCAST]	(1) Mathematical informatics of social complex systems: language, communication and financial markets. (2) Mathematical properties of symbolic systems such as long memory, complexity and self-similarity. (3) Time series modeling using deep/machine learning. (4) Universal properties across social complex systems.
※Kazuyuki Aihara (Professor) [IIS]	(1) Bioinformative systems theory: mathematics for AI, mathematical modelling and nonlinear dynamical analysis of neural networks and genetic networks, learning and self-organization theory, and neuroeconomics. (2) Complex systems theory: chaos engineering, chaotic artificial brain, quantum artificial brain, prediction and control of complex systems, combinatorial optimization by nonlinear dynamics, nonlinear analysis of complicated real-world data, mathematical modelling of social and economic phenomena, cancers, and immune systems, econophysics, and mathematical arts.
Takashi Kohno (Professor) [IIS]	(1) Neuromorphic system: designing and construction of artificial system that mimics information processing scheme in nerve system and brain. (2) Modeling nerve system and brain: nonlinear model and bifurcation of neuronal cell, learning rule.
Tetsuya Kobayashi (Associate Professor) [IIS]	(1) Theory for stochastic biological phenomena: stochastic process, stochastic dynamical systems, and stochastic thermodynamics. (2) Systems biology: image analysis, data analysis, and modeling of biological phenomena. (3) Theory for biological information processing systems: searching, information coding, recognition, control, learning, and evolution.
Yoshihiro Kanno (Professor) [MI]	(1) Continuous optimization and applied mechanics: convex optimization, complementarity, duality and their applications to structural optimization, contact mechanics, plasticity, etc. (2) Robust optimization and its applications: Optimization with uncertain data, robust optimization of structures, robustness evaluation of uncertain systems, etc.

※Yoshito Hirata (Associate Professor) [MI]	(1) Theoretical developments of nonlinear time series analysis: time series prediction, high-dimensional time series, point processes, recurrence plots, and symbolic analysis. (2) Applications of nonlinear time series analysis: renewable energy, biological phenomena including cancer, brains and neurons, economies, and earthquakes. (3) Mathematical medicine: mathematical modelling of diseases, parameter estimation, and optimal treatment scheduling.
Teppei Ogihara (Associate Professor) [MI]	(1) Stochastic calculus and mathematical statistics: statistical analysis of stochastic processes (diffusion processes, jump diffusion processes, point processes, Malliavin calculus, maximum-likelihood-type estimation, asymptotic efficiency). (2) Statistical analysis of financial data: statistical inference of stock volatility and covariation, high-frequency financial data analysis, minimum variance portfolio.
Takaaki Ohnishi (Associate Professor) [SICT]	(1) Big data analysis on socio-economic phenomena (data science, complex systems science, socio-econophysics): geospatial information of people, shops and facilities, human flows (GPS information), ID-POS, financial market, complex network (international trade, financial correlation), text data etc. (2) Materials informatics: Data-driven materials design. (3) Time series analysis of mouse brain activity (EEG, LFP, sleep stage).
Hiromichi Nagao (Associate Professor) [ERI]	(1) Utilization of big data related to earthquakes: automatic detections of earthquakes based on machine learning, algorithm for hypocenter determinations, algorithm for earthquake and tsunami early warning. (2) Data assimilation: integration of large-scale numerical simulations and massive observation data, sequential Bayesian filters, four-dimensional variation method (fast automatic differentiation method), optimization of observational/experimental design, programming on parallel supercomputers.
Hiroshi Kori (Professor) [Frontier Science]	(1) Nonlinear physics: nonlinear phenomena, synchronization, oscillations, complex systems, pattern formation, dynamical systems, stochastic processes, complex networks. (2) Theoretical biology: modeling of biological phenomena, biological oscillations, neuroscience, collaboration with experimentalists.
Kengo Nakajima (Professor) [ITC]	(1) Parallel Numerical Algorithms: Parallel Linear Solvers (Iterative Methods, Preconditioning), Multigrid Methods. (2) High-Performance Computing (HPC): Parallel Programming Models, Problem Solving Environment (PSE). (3) Scientific Computing: Computational Mechanics, Finite Element Methods (FEM). (4) Large-Scale Data Processing: Adaptive Mesh Refinement (AMR), Visualization.
※Gouhei Tanaka (Project Associate Professor) [Engineering]	(1) Complex systems dynamics: mathematical modeling, complex dynamics analysis, bifurcation phenomena, phase transitions, network robustness, epidemics, power networks, and social phenomena. (2) Energy-efficient information processing: neural computer, learning algorithms, reservoir computing, communication cost minimization, nano/micro systems.
Kantaro Fujiwara (Project Associate Professor) [IRCN]	(1) Computational neuroscience: mathematical modeling of single neuron, neural network modeling, learning, and adaptation. (2) Data analysis in neural systems: theory for neural spike train analysis and its application, prediction, brain network analysis. (3) Biological information processing: pancreatic beta cell modeling, modeling for diabetes.

Andrea Benucci (Professor) [RIKEN CBS]	(1) Computations in biological neural networks: encoding and decoding principles of sensory processing, sensory to decision transformations, linear and non-linear analyses of large-scale neuronal recordings. (2) Dynamical models of neural activity: deep recurrent neural networks (RNN), non-linear analysis of fitted RNN. (3) Predictive modeling and experiments: two-photon imaging, optogenetic perturbations of neural-network dynamics.
Taro Toyoizumi (Professor) [RIKEN CBS]	(1) Computational neuroscience: Neural coding, Bayes theorem, Chaotic neural networks, Mean-field theory. (2) Learning theorem of the brain: Synaptic plasticity, Associative learning, Information-optimization, Signal processing, Critical period. (3) Neural data analysis: Delay embedding theorem, Modeling brain/body/environment interaction.

Faculty members marked with ※ do not accept students for 2020. [RCAST] means members belonging to the Research Center for Advanced Science and Technology. [IIS] means members belonging to the Institute of Industrial Science. [MI] means members belonging to the Mathematics and Informatics Center. [SICT] means members belonging to the Social ICT Research Center. [ERI] means members belonging to the Earthquake Research Institute. [Frontier Science] means members belonging to the Graduate School of Frontier Sciences. [ITC] means members belonging to the Information Technology Center. [Engineering] means members belonging to the Graduate School of Engineering. [IRCN] means faculty members belonging to the International Research Center for Neurointelligence. [RIKEN CBS] means faculty members belonging to the RIKEN Center for Brain Science. For locations of offices of the faculty members, refer to their web pages.