2023 Admission Guide
Department of Mathematical Informatics
Graduate School of Information Science and Technology
The University of Tokyo

Master’s Program
Doctoral Program

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

to refer to the admission guide of the Graduate School of Information Science and Technology and the admission guide of each department.

In addition to this brochure, be sure to refer to the admission guide of the Graduate School of Information Science and Technology, the University of Tokyo.
(I) Master’s Program

1. Outline

Selection will be conducted based on the “AY 2023 Admission Guide: Master’s Program, Graduate School of Information Science and Technology, The University of Tokyo” (posted on https://www.i.u-tokyo.ac.jp/edu/entra/entra_e.shtml), and on this admission guide of the 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 that document. This admission guide supplements the above common guide with explanations regarding examination procedures that are specific to the Department of Mathematical Informatics.

Based on the interdisciplinary nature of the 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

Find the “Preference card (for the Master’s Program).pdf” on the department webpage, fill in your preferences with regards to faculty advisors, etc., and submit the card at the time of application.

Note: Regarding preferred faculty advisors, select your preferred advisors from amongst those in the Department of Mathematical Informatics (listed on pages 11-14).

3. Examination Subjects

3.1. Document screening

Document screening will be conducted based on the submitted documents. Regarding the notification of the screening results, refer to the admission guide of the Graduate School of Information Science and Technology.

Applicants are required to submit essays at the time of application, following “Document Screening Assignment (for Master’s Program)” on page 10 of this guide.

3.2. General education subjects

We will conduct a mathematics examination. The examination will be conducted only for applicants who have passed the document screening. Refer to the admission guide of the Graduate School of Information Science and Technology for details.

3.3. Foreign language (English)

TOEFL scores will be used to evaluate the applicants’ English skills. For details, refer to “Guidelines for Submission of TOEFL Scores (for AY2023 Entrance Examinations)” which is provided on the webpage of the Graduate School of Information Science and Technology.

3.4. Specialized subjects and oral examination

The examinations will be conducted only for applicants who have passed the document screening and taken the written examinations of the general education subjects.

1) Written Examination

For examinations on the 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.

<table>
<thead>
<tr>
<th>Specialized subjects</th>
<th>Examination Dates, Times, and Locations</th>
<th>Scope of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Informatics</td>
<td>August 22, 2022 (Monday) 10:00 – 13:00</td>
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<tr>
<td></td>
<td>Faculty of Engineering Bldg. No. 6</td>
<td>Applicants will be required to solve three out of five problems related to</td>
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<tr>
<td></td>
<td></td>
<td>mathematical problem-solving methods, including: algebraic methods, analytic</td>
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<tr>
<td></td>
<td></td>
<td>methods, geometric methods, discrete methods, stochastic methods, statistical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>methods, and algorithms, etc.</td>
</tr>
<tr>
<td>Information Physics and Computing</td>
<td>Please refer to the “Admission Guide” of Department of Information Physics and Computing.</td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td>Please refer to the “Admission Guide” of Department of Computer Science.</td>
<td></td>
</tr>
<tr>
<td>Information and Communication Engineering</td>
<td>Please refer to the “Admission Guide” of Department of Information and Communication Engineering.</td>
<td></td>
</tr>
</tbody>
</table>

- Applicants will be directly notified details for the examination location for “Mathematical Informatics” by August 17 (Wednesday), 2022.

- Those who are transferred to the online version of the written examinations of the general education subjects will also be transferred to the online version of the written examinations of the specialized subjects. The online version of the written examinations of the specialized subject is conducted only for those who are transferred to the online version of the written examinations of the general education subjects. Those who hope to be transferred should carefully read the “Admission Guide” of the Graduate School of Information Science and Technology, and submit the indicated form.

- For information on the examination locations for “Information Physics and Computing,” “Computer Science,” and “Information and Communication Engineering,” refer to the “Admission Guide” of the department in question.

2) Oral examination

The oral examination will be held online between August 25 (Thursday) and August 26 (Friday), 2022. Examinees will be directly notified regarding the instructions of the oral examination in early August.

The oral examination will be conducted only for applicants who have taken the written examinations for both general education subjects and specialized subjects. Examinees will be directly notified regarding the detailed schedule of the oral examination by noon of August 17 (Wednesday), 2022.

4. Important Notes

4.1. Those who are absent from one of the exams (the general education subjects, written examination on specialized subjects, and the oral examination) will be considered to have withdrawn from the entrance examination.

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 wishing to enter the school in October who have not graduated from university by September 2022 are required to confirm their eligibility with the Department Team (the Department
of Mathematical Informatics), Academic Affairs Group, the 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 
Enterprise Examinations,” which is included on page 8 of this Guide.

5. Contact
If you have any questions regarding this admission guide, please contact the Department Team as 
indicated on the cover.

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

1. Outline
Selection will be conducted based on the “AY 2023 Admission Guide: Doctoral Program, Graduate 
School of Information Science and Technology, The University of Tokyo” (posted on https://www.i.u-
tokyo.ac.jp/edu/entra/index_e.shtml), and on this admission guide of the 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 that 
document. This admission guide supplements the above common guide with explanations regarding 
examination procedures that are specific to the Department of Mathematical Informatics.

2. Contact before the Submission of the Applications
Applicants are required to contact the following office prior to the submission of the 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
Find the “Preference card (for Doctoral Program).pdf” on the department webpage, fill in your 
preferences with regard to faculty advisors, etc., and submit the card at the time of application.

4. Documents for the Submission
Applicants are required to write reports on the following themes, complete the checklist on the 
preference card, and submit all reports at the time of application.

Theme:
(1) Summarize your past research achievements and research plans for the Doctoral Program in a 
report in English or Japanese, comprising no more than ten A4-sized pages, including formulas, 
diagrams, etc. Applicants may use any format appropriate for this report.
(2) Provide an English summary of the above report on about one A4-sized 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-sized 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 researches in this field?
(e) How will the results of this research contribute to the field in question?

5. Primary Examinations

5.1. Foreign language (English)

- TOEFL scores will be used to evaluate the applicants’ English skills. For details, refer to “Guidelines for Submission of TOEFL Scores (for AY2023 Entrance Examinations)” which is provided on the webpage of the Graduate School of Information Science and Technology.
- Persons who have completed or are expected to complete a Master's Program in the University of Tokyo 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 on August 23 (Tuesday), 2022. Applicants will be directly notified regarding the detailed schedule and the examination location in early August.
- In the Winter Entrance Examination, the written examination will be held in Bldg. No. 6 of the Faculty of Engineering between February 1 (Wednesday) and February 3 (Friday), 2023. Applicants will be directly notified regarding the detailed schedule and the examination location.
- Those who have difficulty in taking the examinations onsite, including those living outside Japan, could be allowed to be transferred to the online version of the examinations. Those who hope to be transferred should submit the form “AY2023 Entrance Examination of the Graduate School of Information Science and Technology, the University of Tokyo: Transfer Application for the Online Written Examinations” on the webpage of the Graduate School of Information Science and Technology.
- Persons who have completed or are expected to complete a Master's Program of the University of Tokyo may be exempted from the specialized subject written examination. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 9 (Thursday) in the case of the Summer Entrance Examination, and no later than November 22 (Tuesday) 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. Applicants should prepare presentation slides summarizing the descriptions on your past research achievements and future research plans for the Doctoral Program in the above submitted materials.
- In the Summer Entrance Examination, the oral examination will be held online on August 24 (Wednesday), 2022. Applicants will be directly notified regarding the detailed schedule and the
examination instructions in early August.

- In the Winter Entrance Examination, the oral examination will be held online between February 1 (Wednesday) and February 3 (Friday), 2023. Applicants will be directly notified regarding the detailed schedule and the examination instructions.

6. Secondary Examination

In the case of the Summer Entrance Examination, persons who have passed the Primary Examinations shall take the Secondary Examination between late January and mid-February, 2023. Note, however, that persons who wish to enter the school in October and persons who have already completed a master's program by the time of application shall take the Secondary Examination on the same day as the Primary Examinations.

In the case of the Winter Entrance Examination, the Secondary Examination 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 materials), with a summary written in one or two A4-sized pages, to the office by e-mail before the examination date. Applicants will be notified later regarding the schedule and the instructions of the oral examination.

7. Contact

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

(III) Doctoral Program - Special Selection for Professionals [Summer and Winter Entrance Examinations]

1. Outline

Selection will be conducted based on the “AY 2023 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo” (posted on https://www.i.u-tokyo.ac.jp/edu/entra/index_e.shtml), “AY 2023 Admission Guide: Doctoral Program [ Special Selection for Professionals ], Graduate School of Information Science and Technology, The University of Tokyo” and on this admission guide of the 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 those documents. This admission guide supplements the above common guides with explanations regarding examination procedures that are specific to the Department of Mathematical Informatics.

2. Contact before the Submission of the Applications

Applicants are required to contact the following office prior to the submission of the 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
3. Preference Card
Find the “Preference card (for Doctoral Program).pdf” on the department webpage, fill in your preferences with regard to faculty advisors, etc., and submit the card at the time of application.

4. Documents for Submission
In their application documents, applicants shall include the following five items regarding applicants' research and work achievements in a field related to Mathematical Informatics. Applicants must complete the checklist on the preference card, and submit all these documents at the time of application.

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 fewer 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 ask them to provide separate evaluations of those achievements. Use the Word file “Recommendation letters (Doctoral Program [Special Selection for Professionals])” on the department webpage, and submit the file following the instructions on the department webpage and on the webpage of the Graduate School of Information Science and Technology.

Note: Items (2) and (3) should be combined on about ten A4-sized 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 examinations below.

5.1. Foreign language (English)
- TOEFL scores will be used to evaluate the applicants’ English skills. For details, refer to “Guidelines for Submission of TOEFL Scores (for AY2023 Entrance Examinations)” which is provided on the webpage of the Graduate School of Information Science and Technology.
- Persons who have completed or are expected to complete a Master's Program of the University of Tokyo 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 on August 23 (Tuesday), 2022. Applicants will be directly notified regarding the detailed schedule and the examination location in early August.

・ In the Winter Entrance Examination, the written examination will be held in Bldg. No. 6 of the Faculty of Engineering between February 1 (Wednesday) and February 3 (Friday), 2023. Applicants will be directly notified regarding the detailed schedule and the examination location.

・ Those who have difficulty in taking the examinations onsite, including those living outside Japan, could be allowed to be transferred to the online version of the examinations. Those who hope to be transferred should submit the form “AY2023 Entrance Examination of the Graduate School of Information Science and Technology, the University of Tokyo: Transfer Application for the Online Written Examinations” on the webpage of the Graduate School of Information Science and Technology.

・ Persons who have completed or are expected to complete a Master's Program of the University of Tokyo may be exempted from the specialized subject written examination. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 9 (Thursday) in the case of the Summer Entrance Examination, and no later than November 22 (Tuesday) 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. Applicants should prepare presentation slides summarizing the descriptions on your past research achievements and future research plans for the Doctoral Program in the above submitted materials.

・ In the Summer Entrance Examination, the oral examination will be held online on August 24 (Wednesday), 2022. Applicants will be directly notified regarding the detailed schedule and the examination instructions in early August.

・ In the Winter Entrance Examination, the oral examination will be held online between February 1 (Wednesday) and February 3 (Friday), 2023. Applicants will be directly notified regarding the detailed schedule and the examination instructions.

・ Applicants should send their Master's theses (or equivalent materials) with their summaries written on one or two A4-sized pages to the office by e-mail before the examination date.

6. Contact

If you have any questions regarding this admission guide, please contact the Department Team as indicated on the cover.
Department of Mathematical Informatics
Useful information for persons taking Entrance Examinations
(The written examinations of the specialized subjects for Master’s and Doctoral Program, onsite)

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 9.

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).

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

3. What to bring
(1) Paper-based Examination Admission Card (printed on A4-sized paper)
(2) Be sure to bring black pencils (or mechanical pencil), erasers, pencil sharpeners (desktop types are not acceptable) 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 desks 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).
Submit essays on the following subjects at the time of application. Prepare your answers by using the template file found on the department webpage. Follow the instructions on the same page in writing your answers. Keep the guidelines about the length of answers, indicated in the parenthesis in each subject.

**Subject 1.** Explain your motivation for applying to our department, after presenting one concrete research topic. The description on the research topic should adequately include explanations on the following three elements: the research background of the topic, its recent progress, and your research idea and plan. (1.5 pages)

**Subject 2.** Select one important tool (e.g., theorem, formula, methodology, and algorithm) that is related to the research topic you presented in Subject 1. About this tool, explain the following aspects in a concrete and precise manner by clarifying the relation to your research topic. (1.5 pages)

1. Mathematical details
2. Significance in mathematical informatics
3. Example(s) of its application

Describe your answer to each of (1), (2), and (3) in a separate section.
**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

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Research Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsuyoshi Takagi</td>
<td>Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Kunihiko Sadakane</td>
<td>Professor</td>
<td>(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. (2) Applications of those theories to efficient big data processing such as genome information, geographic information, and secure computation.</td>
</tr>
<tr>
<td>Takayasu Matsuo</td>
<td>Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Fumiyasu Komaki</td>
<td>Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Akiko Takeda</td>
<td>Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Kenji Yamanishi</td>
<td>Professor</td>
<td>(1) Theory of machine learning: an information-theoretic or statistical approach to machine learning. (2) Data science: anomaly detection, change detection, network mining, latent dynamics. (3) Big data analysis: security, marketing, traffic risk analysis, medical data analysis, economic data analysis. (4) Symptomatics—Science of early warning signals of anomalies.</td>
</tr>
<tr>
<td>Satoru Iwata</td>
<td>Professor</td>
<td>(1) Discrete optimization: Design of efficient 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.</td>
</tr>
<tr>
<td>Hiroshi Hirai</td>
<td>Associate Professor</td>
<td>(1) Discrete optimization: multicommodity flow, facility location, network design, etc. (2) Discrete mathematics: finite metric spaces, polyhedral combinatorics, graph theory, and their applications.</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Research Areas</td>
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<tr>
<td>Shin-ichi Tanigawa</td>
<td>Associate Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Kazuhiro Sato</td>
<td>Lecturer</td>
<td>(1) Applications of optimization theory to control systems theory: Riemannian optimization, proximal algorithm, submodular optimization. (2) Applications of control systems theory to optimization theory: distributed optimization, accelerated gradient method, passivity. (3) Data-driven modeling for controlling systems: machine learning, optimization, numerical analysis.</td>
</tr>
<tr>
<td>Takashi Kohno</td>
<td>Professor [IIS]</td>
<td>(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.</td>
</tr>
<tr>
<td>Tetsuya Kobayashi</td>
<td>Associate Professor [IIS]</td>
<td>(1) Theory for biological systems: dynamical system, stochastic process, large deviation, thermodynamics, chemical reaction network. (2) Theory for biological information processing systems: searching, information coding, recognition, control, learning, and evolution. (3) Systems biology: bioinformatics, data analysis, and modeling of biological phenomena.</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Research Areas</td>
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<tr>
<td>Yoshihiro Kanno</td>
<td>(Professor)</td>
<td>(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.</td>
</tr>
<tr>
<td>Tomonari Sei</td>
<td>(Professor)</td>
<td>(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.</td>
</tr>
<tr>
<td>Teppei Oghara</td>
<td>(Associate Professor)</td>
<td>(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.</td>
</tr>
<tr>
<td>Ryohei Hisano</td>
<td>(Lecturer)</td>
<td>(1) Learning on networks (temporal, heterogeneous information, knowledge graph). (2) Empirical research on social and economic networks (transaction patterns, detecting malicious nodes, systemic risk). (3) Reliability of information (news, financial reports). (4) Big data analysis (data science, complexity science): financial markets, block chain, marketing.</td>
</tr>
<tr>
<td>Yasushi Kawase</td>
<td>(Project Associate Professor)</td>
<td>(1) Discrete optimization: Design of algorithms for online optimization problems, robust optimization problems, etc. (2) Algorithmic game theory: Design and analysis of mechanisms in strategic behavior.</td>
</tr>
<tr>
<td>Hiromichi Nagao</td>
<td>(Associate Professor)</td>
<td>(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.</td>
</tr>
<tr>
<td>Hiroshi Kori</td>
<td>(Professor)</td>
<td>(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.</td>
</tr>
<tr>
<td>Yuki Izumida</td>
<td>(Lecturer)</td>
<td>(1) Nonequilibrium physics: nonequilibrium thermodynamics and statistical mechanics, stochastic thermodynamics, nonequilibrium theory of life phenomena, fusion study of nonlinear dynamics and thermodynamics (dynamical modeling of engines, energy harvesting technologies). (2) Nonlinear physics: coupled oscillators, synchronization phenomena, bifurcation analysis, noise and stochastic resonance phenomena, complex systems, etc.</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Research Areas</td>
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</tr>
<tr>
<td>Gouhei Tanaka</td>
<td>Project Associate Professor</td>
<td>(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.</td>
</tr>
<tr>
<td>Andrea Benucci</td>
<td>Professor</td>
<td>(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.</td>
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</table>

Faculty members marked with ※ are not accepting students for 2023.

[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. [RIISE] means members belonging to the Research Institute for an Inclusive Society through Engineering. [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. [IRCN] means 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 webpages.
### Required Documents (Department of Mathematical Informatics)

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<tr>
<th>Documents to be Submitted</th>
<th>Master’s Course</th>
<th>Winter Examination</th>
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<tbody>
<tr>
<td>Preference Card (for Master’s Program)</td>
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<td>Who to Submit</td>
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<tr>
<td>Document Screening Essays (for Master’s Program)</td>
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<td>Transfer Application for the Online Written Examinations</td>
<td>Those who request the online examinations for the general education subjects and specialized subjects written examination</td>
<td>Who to Submit</td>
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<tr>
<td>Preference Card (for Doctoral Program)</td>
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<td>(1) Research achievement &amp; plans (written in Japanese or English, no more than 10 A4-sized pages)</td>
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<tr>
<td>(3) Responses to questions (a)–(e) regarding (1) (written in Japanese or English, no more than 2 A4-sized pages)</td>
<td>All Applicants</td>
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<td>Doctoral Course &lt;Special Selection for Professionals&gt;</td>
<td>Preference Card (for Doctoral Program)</td>
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