Contact List

<table>
<thead>
<tr>
<th>Catalog Content</th>
<th>Contact</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kakenhi (p.17); Collaboration with Industry, Government, and Academia (p.20)</td>
<td>Planning Division, Office for Social Collaboration Collaboration Support Team</td>
<td><a href="mailto:kakenhi@nii.ac.jp">kakenhi@nii.ac.jp</a></td>
</tr>
<tr>
<td>Collaborative Research Promotion (p.20); Academic Consultation by Researchers (p.22)</td>
<td>Planning Division, Office for Social Collaboration Collaboration Support Team</td>
<td><a href="mailto:kaya@nii.ac.jp">kaya@nii.ac.jp</a></td>
</tr>
<tr>
<td>Intellectual Property (p.21)</td>
<td>Planning Division, Office for Social Collaboration Big Project and Intellectual Property Team</td>
<td><a href="mailto:chizai@nii.ac.jp">chizai@nii.ac.jp</a></td>
</tr>
<tr>
<td>Top SE (p.18)</td>
<td>GRACE Center</td>
<td><a href="mailto:geirusai@topse.jp">geirusai@topse.jp</a></td>
</tr>
<tr>
<td>International Exchange (MOSI) (p.24)</td>
<td>Planning Division, International Affairs and Education Support Team</td>
<td><a href="mailto:international@nii.ac.jp">international@nii.ac.jp</a></td>
</tr>
<tr>
<td>NII International Internship Program (p.24)</td>
<td>Office of NII Shonan Meetings</td>
<td><a href="mailto:shonan@nii.ac.jp">shonan@nii.ac.jp</a></td>
</tr>
<tr>
<td>Graduate Program (p.26)</td>
<td>Planning Division, International Affairs and Education Support Team</td>
<td><a href="mailto:edu@nii.ac.jp">edu@nii.ac.jp</a></td>
</tr>
<tr>
<td>Science Information NETwork (p.32)</td>
<td>Academic Infrastructure Division, NIRIN Promotion Office</td>
<td><a href="mailto:support@nirin.nii.ac.jp">support@nirin.nii.ac.jp</a></td>
</tr>
<tr>
<td>GakuNin Cloud (p.35)</td>
<td>Academic Infrastructure Division, Cloud Promotion Team</td>
<td><a href="mailto:cld-office-support@nii.ac.jp">cld-office-support@nii.ac.jp</a></td>
</tr>
<tr>
<td>Authentication Platform (p.36)</td>
<td>Academic Infrastructure Division, Academic Authentication Systems Office</td>
<td><a href="mailto:gakunin-office@nii.ac.jp">gakunin-office@nii.ac.jp</a></td>
</tr>
<tr>
<td>Supporting Information Security Framework through Inter-University Collaboration (p.37)</td>
<td>Academic Infrastructure Division, NII-SOC Team</td>
<td><a href="mailto:soc-office@nii.ac.jp">soc-office@nii.ac.jp</a></td>
</tr>
<tr>
<td>Open Science (p.39)</td>
<td>Research Center for Open Science and Research Data Platform</td>
<td><a href="mailto:ressec-office@nii.ac.jp">ressec-office@nii.ac.jp</a></td>
</tr>
<tr>
<td>Institutional Repositories (p.39)</td>
<td>Scholarly and Academic Information Division, Institutional Repository Desk</td>
<td><a href="mailto:ir@nii.ac.jp">ir@nii.ac.jp</a></td>
</tr>
<tr>
<td>CBM (p.43)</td>
<td>Scholarly and Academic Information Division, CBM Desk</td>
<td><a href="mailto:cbrm@nii.ac.jp">cbrm@nii.ac.jp</a></td>
</tr>
<tr>
<td>Catalog Information Service (NACSIS-CAT/ILL) (p.41)</td>
<td>Scholarly and Academic Information Division, CAT/ILL Desk</td>
<td><a href="mailto:cat@nii.ac.jp">cat@nii.ac.jp</a></td>
</tr>
<tr>
<td>SPARC, Japan (p.42)</td>
<td>Scholarly and Academic Information Division, SPARC Desk</td>
<td><a href="mailto:sparc@nii.ac.jp">sparc@nii.ac.jp</a></td>
</tr>
<tr>
<td>Education and Training Services (p.43)</td>
<td>Scholarly and Academic Information Division, Education and Training Desk</td>
<td><a href="mailto:edu@nii.ac.jp">edu@nii.ac.jp</a></td>
</tr>
<tr>
<td>All Library (p.43)</td>
<td>Scholarly and Academic Information Division, Library Desk</td>
<td><a href="mailto:lib@nii.ac.jp">lib@nii.ac.jp</a></td>
</tr>
<tr>
<td>Public Communications (p.46)</td>
<td>Planning Division, Publicity Team</td>
<td><a href="mailto:news@nii.ac.jp">news@nii.ac.jp</a></td>
</tr>
<tr>
<td>News Releases (p.47)/Media Relations</td>
<td>Planning Division, Publicity Team/Media Relations Desk</td>
<td><a href="mailto:media@nii.ac.jp">media@nii.ac.jp</a> / +81-3-4212-2164</td>
</tr>
<tr>
<td>Facilities and Laboratories (p.32)</td>
<td>General Affairs Division, General Affairs Team</td>
<td><a href="mailto:soumu@nii.ac.jp">soumu@nii.ac.jp</a></td>
</tr>
</tbody>
</table>
Taking on the Challenge of Pursuing Leading-edge Approaches NII Alone Can Make

There is no sign yet of the novel coronavirus disease COVID-19 being brought under control, let alone disappearance of its threat. No one could have imagined that such a situation would be prolonged to this extent. As long as the COVID-19 pandemic continues, getting vaccinated every year is inevitable and it appears unlikely that we will return to our previous lifestyle. As members of nations and dwellers on Earth, we and many others are faced with the difficulty of picturing a bright future.

The protracted pandemic has forced us to shift the main core of our activities from the real world to the cyberspace; that is, it has forcibly prompted society’s digital transformation and given an even greater role to online communication. Against that background, we feel that expectations are growing day by day regarding the role of the National Institute of Informatics (NII), the only comprehensive academic research institute in the field of informatics in Japan. At a symposium and related events held online in December of 2020, commemorating the 20th anniversary of NII’s establishment, as many as 5,500 people participated. In addition, the Science Information Network (SINET), built and operated by NII, is used routinely not only for data searches in academic studies, but also for online academic meetings, communication for online classes, and similar activities.

Starting on March 26, 2020, NII has been holding a series of symposiums titled “Symposium on DX at Educational Institutions—Open Symposium on Online Education and Digital Transformation at Universities and Other Institutions” (originally titled the “Cyber-Symposium for Information Sharing on Remote Teaching Efforts at Universities since April”) with the goal of ensuring higher education does not come to a halt, and these events are continuing to draw wide attention.

Our original intention with this series of symposiums was mainly to introduce precedents of online classes being held at seven national universities and share cases of their failures. Having held more than thirty now, we have witnessed the contents of the symposiums expand to a great extent, with participating educational institutions introducing instances of their online classes and their efforts for digital transformation (DX), both abundant in ingenuity, thus taking a step toward the next stage. Recently, advanced approaches were introduced by some universities, including online clinical training of a professor’s mock at Kobe University, School of Medicine and hybrid physical education combining online lessons and face-to-face classes to hone practical skills at Ritsumeikan University. The Symposium on DX at Educational Institutions is a truly valuable opportunity for us to listen directly to visions on the educational scene, and, each time, we gain a great deal of inspiration from the participants’ presentations.

As an inter-university research institution, NII develops various services such as building and operating state-of-the-art academic information infrastructure that are required by universities, as well as providing academic content. It is also evolving into an entity on which elementary and secondary education institutions increasingly rely in the wake of the COVID-19 pandemic. An example is “virtual school excursions.” Amid successive suspensions and scale-downs of in-person school events across the country, NII implemented a “remote dream travel experience” project as a class program at 9th Junior High School in Tokyo’s Adachi Ward in cooperation with Japan Airlines Co. (JAL), enabling students to enjoy virtual trips. In the project, each classroom was used as a mock aircraft cabin, with a flight attendant in place. Each attendant showed students around two locations within Japan and five spots abroad live on screen through video links.

The project generated enthusiastic reactions from the students, for whom this was the first experience of its kind. NII will henceforth strive to draw on the strength of IT to support not only university education but also elementary, junior and senior high school education.

The greatest challenge of these IT-based initiatives is how to ensure security. At the Center for Cybersecurity Research and Development, set up by NII in 2016 amid the evolution of data-driven society, we render the latest detected computer viruses harmless and make use of them for academic research, while protecting our SINET. Simultaneously, we have contributed toward providing various services at a level of security comparable to that of commercial security services. In the current fiscal year, we will shift from SINET to SINET6, and, in the next fiscal year, the access points nationwide will be linked by a communication speed of 400 Gbps. Ahead of this, we brought into operation our research data management infrastructure GakutoNII RDM in February 2021. Along with research papers, this system is also capable of safely storing and managing research data, academic materials, and more through SINET. In the future, for data that can be made public, we will link it to open science by creating an infrastructure that works in conjunction with our publishing and search infrastructures.

Moreover, in connection with the publishing of science information, we are restructuring NII’s service that provides identification of the location of each academic resources catalog, stored mainly at university libraries throughout the country. The infrastructure system of this digital catalog information service is now set to be provided through the bookstore chain Kinokuniya Company. Through this joint effort by the public and private sectors, we will develop the system as a platform intended to contribute to the digitalization of academic information and its international distribution.

In August 2020, when Their Majesties the Emperor and Empress participated online in the “International Online Conference to Address Water-related Disaster Risk Reduction under the COVID-19 Pandemic,” organized by the National Graduate Institute for Policy Studies and other institutions, they provided assistance to help ensure their majesty’s online participation for the first time would run smoothly without any issues. It is safe to say that this initiative could only have been realized by NII, with its long experience of building and operating secure communication infrastructures.

Heading into the future, NII will continue in this way to dauntlessly take on the challenge of tackling unprecedented, trailblazing issues that only NII can address. We appreciate your ongoing interest and support.

May 2021
Weaving Information into Knowledge

Informatics to Create Future Value on the Wheels of “Research” and “Service”

The National Institute of Informatics (NII) under the Inter-University Research Institute Corporation Research Organization of Information and Systems is the only academic research institute in Japan dedicated to creating future value in informatics, a new academic field. From the basic theory of informatics to cutting-edge fields such as artificial intelligence, big data, Internet of Things, and Information Security, NII carries out long-term basic research as well as practical studies that attempt to address current social issues. Furthermore, NII is undertaking diverse services, including development and operation of the Science Information NETwork (SINET) and other essential academic information infrastructures used by the entire academic community in Japan for research and education. It is also providing academic content and service platforms, as well as improving research data infrastructure. NII is thus committed to services based on leading-edge technologies through mutual feedback of knowledge obtained from these services and from academic studies. Through these activities, NII is committed to human resource development and social/international contribution, and conducts its operations with an emphasis on collaboration and cooperation between universities, research institutes, and private sector businesses in Japan and globally. Furthermore, NII is engaged in graduate education with the aim of fostering original world-class academic research and pioneering advanced fields of study.

Comprehensive research from basic theory to cutting-edge technology

Merging computer science and information engineering with the humanities, social sciences, life sciences, and many other disciplines, Informatics is a new domain of study that is needed in all aspects of society. Having established four Research Divisions and 16 Research Centers, NII is carrying out research comprehensively on everything from the basic theory of Informatics to cutting-edge fields such as artificial intelligence, big data, Internet of things, and Information Security. NII is also focusing its efforts into international exchange and collaboration with overseas universities and research institutes, as well as collaboration between industry, government, and academia, in order to help implement its research achievements in the real world.

Fostering new leaders for an advanced information society

The graduate program at NII is carried out in three ways: (1) participating in SOKENDAI (the Graduate University for Advanced Studies), (2) collaborating with other graduate schools, and (3) accepting research students for special collaboration. SOKENDAI is the first graduate university in Japan established to foster original, world-class academic research that transcends traditional disciplines and to pioneer advanced fields of study that create new lines of scientific inquiry. NII has joined with SOKENDAI to establish the Department of Informatics in the School of Multidisciplinary Sciences in order to offer graduate programs with three-year and five-year Ph.D. courses. The Department of Informatics encompasses six research fields; at the Department, students can take lectures and obtain research advice according to their field of study.

Supporting academic research and education

In collaboration with universities and research institutes as well as research communities, NII builds and operates the Science Information NETwork (SINET). Leveraging the SINET network’s ultra-high speed, high reliability, and multifunctional, NII works to expand and provide an authentication federation platform, cloud adoption and utilization supports, and an academic content platform, as well as to promote open science and develop next-generation academic research platforms. Furthermore, NII Security Operation Collaboration Services (NII-SOCS) contribute to building the framework enabling national universities and other academic institutions to respond quickly to cyber security incidents and other issues.

Collaboration with Industry, Government, and Academia

NII carries out goal-oriented research and development to address real social issues and fosters collaboration between industry, government, and academia to help implement its research achievements in the real world. NII actively promotes collaborative work between industries, local governments, and universities by using a system that includes open calls for collaborative research, comprehensive partnerships, and joint research units that are set up to operate special research laboratories under corporate partnerships. To create new collaboration and learning opportunities for its research accomplishments, NII holds seminars to present the seeds of its research laboratories under corporate partnerships. To create new collaboration and learning opportunities for its research accomplishments, NII holds seminars to present the seeds of its research laboratories under corporate partnerships. To create new collaboration and learning opportunities for its research accomplishments, NII holds seminars to present the seeds of its research laboratories under corporate partnerships. To create new collaboration and learning opportunities for its research accomplishments, NII holds seminars to present the seeds of its research laboratories under corporate partnerships. To create new collaboration and learning opportunities for its research accomplishments, NII holds seminars to present the seeds of its research laboratories under corporate partnerships.
Research Divisions

Principles of Informatics Research Division

Director: UNO, Takeaki

Seeks new principles and theories of informatics using algorithms and computational-complexity theory, as well as artificial intelligence, robotics, and quantum computing. Conducts research to develop new technologies that will sustain societies of the future and break new ground in the field of informatics.

Fields of Research

- Algorithms, artificial intelligence, machine learning, deep learning
- Big data analysis, data mining, mathematical modeling, numerical analysis, computational science, web informatics, neuroscience, quantum informatics
- Leadership research that creates possibilities for discovering new principles or theories and new applications at the frontiers of these fields

Information Systems Architecture Research Division

Director: J. Yusheng

Aiming at boosting the performance, quality, and functionality of computers and networks, the building blocks of information technology, conducts research ranging from creating groundbreaking technologies in software and hardware architectures to implementing their working systems.

Fields of Research

- R&D on post-Internet, cybersecurity infrastructure, software and hardware architecture, distributed and cloud computing, programming languages, system performance and log analysis infrastructure, dependable systems, Internet of Things (IoT), and network and cloud visualization

Research Centers

Nil established 16 Research Centers in order to remove barriers between Research Divisions and respond quickly to critical social issues, creating a system where researchers and various areas of expertise can collaborate across disciplines to focus on exploring key research domains.

Services and Operations

Research and Development Center for Academic Networks

[https://www.nii.ac.jp/research/centers/network/]

Develops and provides new services and features to enhance the operations and efficiency of the Science Information Network (SINET), a crucial backbone network of more than 900 universities and research institutes in Japan.

Director: UNO, Takeaki (Director-General, NiC)
Professor, Information Systems Architecture Science Research Division

GRACE Center*: Center for Global Research in Advanced Software and Engineering

[http://grace-center.jsp.go.jp/]

Integrates research, practice, and education using collaborations between Japanese and overseas research institutions, as well as collaborations between industry and academia, with the goal of developing the software infrastructure of the twenty-first century, and also fosters the next generation of world-class researchers and engineers.

Director: HONZEN, Shinya (Project Professor, NiC)

Center for Cloud Research and Development

[https://www.nii.ac.jp/research/centers/cloud/]

Promotes IT-based research and education by advancing joint R&D with researchers at universities and research institutes, in order to provide state-of-the-art academic information infrastructures using cloud technologies on the Science Information Network (SINET).

Director: AIDA, Kenji (Professor, Information Systems Architecture Science Research Division)

Center for Cyberspace Research and Development

[https://www.nii.ac.jp/research/centers/cyber/]

Works to ensure the security and operational efficiency of university research environments in cyberspace, and to develop the human resources needed for this work in collaboration with universities, through R&D that leverages the knowledge gained from training and operating scientific information infrastructures.

Director: TAKAMURA, Hiroki
(Professor, Information Systems Architecture Science Research Division)

Research Center for Knowledge Media and Content Science

[https://www.nii.ac.jp/research/centers/knowledge/]

Promotes cutting-edge research on the analysis and extraction of knowledge from research papers and other academic content, and carries out empirical R&D to encourage the distribution of academic knowledge.

Director: KAZAMA, Akiko (Vice Director-General, MiRC)
Professor, Digital Content and Media Sciences Research Division

Research Center for Community Knowledge

Collects and analyzes the patterns of sharing shared knowledge between humans, as well as that between human and machine, using an open system to promote the use of the outcome of such research, and conducts empirical R&D to encourage the next generation of information sharing.

Director: APAR, Peiwei (Professor, Information and Society Research Division)

Center for Dataset Sharing and Collaborative Research

[https://www.nii.ac.jp/research/centers/dataset/]

Collects datasets that are useful for information research and makes them available to researchers, conducts R&D on building datasets and a platform for their use, and promotes collaborative research in informatics using shared databases.

Director: OKAMOTO, Kei (Vice Director-General, MiRC)
Professor, Digital Content and Media Sciences Research Division

Research Center for Open Science and Data Platform

[https://www.nii.ac.jp/research/centers/open/]

Conducts joint international R&D on platforms for managing, publishing, and searching research data, which will serve as a paradigm shift in the way researchers can contribute to open science, and deploys these platforms jointly with universities and research institutes in Japan to encourage their use.

Director: YAMAI, Kazuhiko
(Professor, Digital Content and Media Sciences Research Division)

Major Research Projects

Global Research Center for Quantum Information Science

[http://qi1.ex.nii.ac.jp/qi/]

An international hub for cutting-edge research on quantum information science and technology, advancing the science of quantum information and exploring the potential of quantum information technologies, and cultivates the development of international human resources who will lead medium- to long-term research projects focused on specific goals.

Director: MASEMOTO, Kei
(Professor, Principles of Informatics Research Division)

Research Center for Systems Design and Mathematics

[http://research.nii.ac.jp/~iechizen/synmediacenter/en/]

Undertakes the construction of big data cloud platforms for medical imaging using the Science Information Network (SINET) built and operated by NiC, and develops artificial intelligence (AI) that analyzes large collections of medical images to assist doctors with diagnosis.

Director: MORI, Kazukazu (Shaking/Professor)

Research Center for Medical Bigdata

[https://bigdata.nii.ac.jp/wp/english/]

With a view to realizing an AI society focused on humans, we promote research and development for generating synthetic medical content using data, as well as for constructing a medical information infrastructure that makes efficient use of the AI results, and we promote research on new medical technologies.

Director: ECHIZEN, Isao
(Director; NiC), Professor, Information and Society Research Division

Research Center for Safe, Secure and Healthy Society

[https://www.nii.ac.jp/research/centers/health/]

Research Service Graduate Program

Organization/Others

Research and Development Division

[https://www.nii.ac.jp/research/centers/research/]

- NII established four Research Divisions—Principles of Informatics Research Division, Information Systems Architecture Science Research Division, Digital Content and Media Sciences Research Division, and Information and Society Research Division—in order to accommodate various types of research across the broad discipline of informatics. Each research division conducts specialized studies ranging from basic to applied research.

- NII established 16 Research Centers in order to remove barriers between Research Divisions and respond quickly to critical social issues, creating a system where researchers and various areas of expertise can collaborate across disciplines to focus on exploring key research domains.

- Services and Operations
  - Research and Development Center for Academic Networks
  - GRACE Center: Center for Global Research in Advanced Software and Engineering
  - Center for Cloud Research and Development
  - Center for Cyberspace Research and Development
  - Research Center for Knowledge Media and Content Science
  - Research Center for Community Knowledge
  - Center for Dataset Sharing and Collaborative Research
  - Research Center for Open Science and Data Platform

- Major Research Projects
  - Global Research Center for Quantum Information Science
  - Research Center for Systems Design and Mathematics
  - Research Center for Medical Bigdata
  - Research Center for Safe, Secure and Healthy Society

- Organization/Others
  - Research Service Graduate Program
List of Researchers

Principles of Informatics Research Division

**Mathematical Informatics**

**Assistant Professor IGARASHI, Ayumi**
Ph.D. (Computer Science)

**Specialties:** Algorithmic game theory, Fair division theory, Cooperative game theory

**Research themes:** Research on algorithmic game theory

- Design of suitable algorithms that can satisfy many people with different objectives, such as assignment of customers to taxis and multi-task scheduling.

**Professor UNO, Takeaki**
Division Director
Ph.D. (Science)

**Specialties:** Development of high-speed algorithms for large-scale computation in data mining and genome information. Analysis of computation for distributed and especially ensembles. High-performance algorithms for building and accelerating industrial computer models, scheduling, facility placement, etc.

**Research themes:** Program theory (algorithm) for processing large amounts of information quickly. Efficiently finding data features. Technology to make data more easily understandable. Many applications including matchmaking, advertising, and medical services.

**Professor KAWARABAYASHI, Ken-Ichi**
Director, Global Research Center for Pervasive Mathematics
Ph.D. (Science)

**Specialties:** Graph coloring problems in discrete math. Structural graph theory and its applications to algorithms; Network flow and disjoint path problems.

**Research themes:** Discrete mathematics, particularly graph theory and theoretical computer science. Global research in discrete graph theory. Many themes requiring mathematical theory. Also interested in applications to needs in society at large.

**Associate Professor INAMURA, Tetsunari**
Ph.D. (Engineering)

**Specialties:** Human-oriented interface. Symbolic study of robot intelligence based on abstract information processing.

**Research themes:** Intelligent robots that communicate with humans via words and physical gestures. Research platforms enabling communication with robots in various contexts. Development of the arm of realizing intelligent robots that understand and act on various contexts.

**Professor SATOH, Ken**
Ph.D. (Science)

**Specialties:** Artificial Intelligence, Data Informatics

**Research themes:** Logic-based artificial intelligence for many years. More recently, as a part of the new field integrating the law and informatics, called juris informatics, implementing the Japanese theory of jurisprudence in artificial intelligence coexisting and co-evolving with society. Building and applying large-scale knowledge graphs as semantic Web research that will enable smooth sharing of knowledge between people and computers.

**Professor SATOH, Ken**
Ph.D. (Engineering)

**Specialties:** Knowledge sharing systems; Semantic Web; Design theory

**Research themes:** Artificial intelligence coexisting and co-evolving with society. Building and applying large-scale knowledge graphs as semantic Web research that will enable smooth sharing of knowledge between people and computers.

**Associate Professor SUGIYAMA, Mahito**
Ph.D. (Informatics)

**Specialties:** Machine learning. Data mining

**Research themes:** Fundamental theory and practical technologies related to data analysis methods. Focusing on machine learning theory, such as data mining and statistical methods. Special attention is given to statistical theory for preserving the reliability of information gained from data.

**Associate Professor TAKEDA, Hideaki**
Ph.D. (Engineering)

**Specialties:** Knowledge sharing systems; Semantic Web; Design theory

**Research themes:** Artificial intelligence coexisting and co-evolving with society. Building and applying large-scale knowledge graphs as semantic Web research that will enable smooth sharing of knowledge between people and computers.

**Mathematical Logic**

**Professor TATSUTA, Makoto**
Ph.D. (Informatics)

**Specialties:** Software verification; Separation logic; Theory of programs; Type theory; Constructive logic

**Research themes:** Theory of types in programming languages and their abstract, "type theory." In 2007, solved the 20th of 22 important and difficult type theory problems. Research results are being used in implementing large-scale high-quality programs.

**Professor SATOH, Ken**
Ph.D. (Science)

**Specialties:** Artificial Intelligence, Data Informatics

**Research themes:** Logic-based artificial intelligence for many years. More recently, as a part of the new field integrating the law and informatics, called juris informatics, implementing the Japanese theory of jurisprudence in artificial intelligence coexisting and co-evolving with society. Building and applying large-scale knowledge graphs as semantic Web research that will enable smooth sharing of knowledge between people and computers.

**Associate Professor KISHIDA, Masako**
Ph.D.

**Specialties:** General control theory and related topics

**Research themes:** Mathematical methods for control and optimization, focusing on an algorithm.

- Recently also particularly interested in building a new theory of networked control, for performing control through networks, and developing mathematical approaches to solving various problems.

**Assistant Professor HIRAMA, Shuichi**
Ph.D. (Information Science and Technology)

**Specialties:** Complexity theory; Minimum circuit size problems; Kolmogorov complexity; Average-case complexity

**Research themes:** Research on complexity theory, the theory underlying cryptographic security. Aiming to solve various problems that ask the limits of computation including the P vs NP problem with minimum circuit size problems serving as the axis of research.

**Assistant Professor FUJII, Kaito**
Ph.D. (Information Science and Technology)

**Specialties:** Combinatorial optimization; Machine learning; Approximation algorithms; Online algorithms

**Research themes:** Efficient algorithms for solving combinatorial optimization problems in particular, designing algorithms with theoretical approximation guarantees and their applications to machine learning.

**Associate Professor MATSUMOTO, Keiji**
Ph.D. (Mathematical sciences)

**Specialties:** Quantum information and computation

**Research themes:** Cluster and discovery of new physics possible for quantum computers, and their applications. In addition, realizing a scalable quantum information system and elucidating the quantum essence that is held by such a system through constructing a theoretical basis of that scalable quantum information system and a dispersable quantum information system.

**Associate Professor MATSUMOTO, Keiji**
Ph.D. (Mathematical sciences)

**Specialties:** Quantum information and computation

**Research themes:** Cluster and discovery of new physics possible for quantum computers, and their applications. In addition, realizing a scalable quantum information system and elucidating the quantum essence that is held by such a system through constructing a theoretical basis of that scalable quantum information system and a dispersable quantum information system.

**Researchthemes:**Clusteranddiscoveryofnewphysicspossibleforquantumcomputers, and their applications. In addition, realizing a scalable quantum information system and elucidating the quantum essence that is held by such a system through constructing a theoretical basis of that scalable quantum information system and a dispersable quantum information system.

**Associate Professor ICHISE, Ryusuke**
Ph.D. (Engineering)

**Specialties:** Machine learning. Knowledge systems; Data mining

**Research themes:** Combining diverse information, generating useful knowledge from that, and then conducting research on artificial intelligence using that. Development of revolutionary technology to interpret different types of data, and that for data mining and knowledge discovery.
List of Researchers

**Network Architecture**

- **Associate Professor**
  - **ABE, Shuntaro**
  - Head, Advanced ICT Center
  - Ph.D. (Engineering)
  - Specialties: Performance analysis and quality of service through communication traffic measurement and network performance measurement; network architecture; research network architecture

- **Professor**
  - **URUSHIDANI, Shigeo**
  - Vice Director-General, Director, Research and Development Center for Academic Networks
  - Ph.D. (Engineering)
  - Specialties: Dynamic resource allocation technologies for multi-layer networks; Virtualization technologies for network architecture

- **Associate Professor**
  - **KANEKO, Megumi**
  - Ph.D. (Engineering)
  - HDR (Harata) in Digital Media Technologies
  - Specialties: Wireless communication engineering; Wireless resource allocation; Protocol design for mobile communication systems

- **Associate Professor**
  - **KURIMOTO, Takashi**
  - Ph.D. (Engineering)
  - Specialties: Network system architecture; Network protocols; Network research; New network services using IPv6, SDN, and other technologies with the goal of increasing reliability and stability while reducing costs.

- **Assistant Professor**
  - **SHIMIZU, Sayako**
  - Ph.D. (Informatics)
  - Specialties: Authentication and authorization; Information security; System software technology; Data Science

- **Professor**
  - **TAKAKURA, Hiroki**
  - Director, Center for Cybersecurity Research and Development
  - Ph.D. (Engineering)
  - Specialties: Cybersecurity; High-reliability networking; Anomaly detection

- **Assistant Professor**
  - **TSUSHIMA, Kanae**
  - Ph.D. (Engineering)
  - Specialties: Programming languages; Functional programming; Program debugging; Development support

- **Professor**
  - **HASHIZUME, Hironori**
  - Ph.D. (Engineering)
  - Specialties: Asynchronous circuit technology and dependable UI/UX platforms

- **Professor**
  - **YONEDA, Tomohiro**
  - Vice Director-General, Director, Research and Development Center
  - Ph.D. (Engineering)
  - Specialties: Asynchronous circuit technology, which addresses various issues associated with using a digital clock in synchronous circuits and makes it easier to implement faster low-power circuits. Also, technologies to improve hardware reliability and security.

**Software Infrastructure**

- **Professor**
  - **ISHIKAWA, Yutaka**
  - Ph.D. (Engineering)
  - Specialties: System software; Operating systems; Communication and the IoT middleware; Parallel and distributed processing

- **Associate Professor**
  - **KATO, Hisayuki**
  - Ph.D. (Information)
  - Specialties: Optimization for causal query in view database; Fundamental issues for optimizing queries in VML database

- **Assistant Professor**
  - **SEKUMA, Yaro**
  - Ph.D. (Engineering)
  - Specialties: Software architecture; Data science; Machine learning; Software verification

- **Professor**
  - **FUKUDA, Kensuke**
  - Ph.D. (Engineering)
  - Specialties: firewall technologies for computer networks; The development of multiprocessor systems and network measurement with available services and technology

**Computer Architecture**

- **Associate Professor**
  - **AIDA, Kenji**
  - General Manager, Cyber Science Infrastructure Development Department
  - Ph.D. (Engineering)
  - Specialties: Parallel and distributed computing; Cloud computing; Grid computing

- **Associate Professor**
  - **KOBUCHI, Michihiro**
  - Ph.D. (Engineering)
  - Specialties: Computer system network; Large-scale parallel computing systems

- **Professor**
  - **GOSHIMA, Masahiro**
  - Ph.D. (Informatics)
  - Specialties: Processor architecture; Memory system architecture; Digital circuit design

**Software Engineering**

- **Professor**
  - **TAKIFUSA, Atsuku**
  - Ph.D. (Science)
  - Specialties: Parallel and distributed processing; Cloud infrastructure research; VLSI, Cyber-physical systems

- **Assistant Professor**
  - **HASSUO, Ichiro**
  - Ph.D. (Information Science and Technology)
  - Specialties: Software engineering; Formal methods; Testing; Asynchronous and software; Cyber-physical systems; Machine learning engineering

**Information Systems Architecture Research Division**

**Network Architecture**

- **Associate Professor**
  - **FUKUDA, Kensuke**
  - Ph.D. (Engineering)
  - Specialties: Measurement and analysis of Internet traffic; Network science

- **Research Themes:**
  - The Internet as an autonomous distributed system. When the overall volume of communications is measured, it increases and decreases, fluctuating according to a 1/f law. Searching for feasible control methods of the Internet by understanding this mechanism.

**Software Infrastructure**

- **Professor**
  - **ISHIKAWA, Yutaka**
  - Ph.D. (Engineering)
  - Specialties: System software; Operating systems; Communication and the IoT middleware; Parallel and distributed processing

- **Research Themes:**
  - The system software stack such as operating system, communication and the IoT middleware, how become faster and better. We review such a system software stack in order to build the next generation software for smart devices and server systems. The new system software stack will be constructed from the aspect of security and energy consumption.

**Computer Architecture**

- **Associate Professor**
  - **KOBUCHI, Michihiro**
  - Ph.D. (Engineering)
  - Specialties: Computer system network; Large-scale parallel computing systems

- **Research Themes:**
  - Design of large-scale parallel computing systems that communicate computer systems to networks efficiently without the loss of data. Liquid substrate cooling technologies for computers. One dream is to design the world’s first supercomputer network.

**Software Engineering**

- **Professor**
  - **TAKIFUSA, Atsuku**
  - Ph.D. (Science)
  - Specialties: Parallel and distributed processing; Cloud infrastructure research; VLSI, Cyber-physical systems

- **Research Themes:** Building a new information platform that secures connectivity among different environments ranging from mobile to cloud computing, as well as making advanced applications easier. Also, R&D on software that supports the development of programs for highly efficient 5G IoT data collection and analysis, and an technology for building a compacting environment using container-based virtualization.

**Information System Architecture**

- **Associate Professor**
  - **ABE, Shuntaro**
  - Head, Advanced ICT Center
  - Ph.D. (Engineering)
  - Specialties: Performance analysis and quality of service through communication traffic measurement and network performance measurement; network architecture; research network architecture

- **Professor**
  - **URUSHIDANI, Shigeo**
  - Vice Director-General, Director, Research and Development Center for Academic Networks
  - Ph.D. (Engineering)
  - Specialties: Dynamic resource allocation technologies for multi-layer networks; Virtualization technologies for network architecture

- **Associate Professor**
  - **KANEKO, Megumi**
  - Ph.D. (Engineering)
  - HDR (Harata) in Digital Media Technologies
  - Specialties: Wireless communication engineering; Wireless resource allocation; Protocol design for mobile communication systems

- **Associate Professor**
  - **KURIMOTO, Takashi**
  - Ph.D. (Engineering)
  - Specialties: Network system architecture; Network protocols; Network research; New network services using IPv6, SDN, and other technologies with the goal of increasing reliability and stability while reducing costs. Also, enabling safe high-speed network services in cooperation with NHK.

- **Assistant Professor**
  - **SHIMIZU, Sayako**
  - Ph.D. (Informatics)
  - Specialties: Authentication and authorization; Information security; System software technology; Data Science

- **Professor**
  - **TAKAKURA, Hiroki**
  - Director, Center for Cybersecurity Research and Development
  - Ph.D. (Engineering)
  - Specialties: Cybersecurity; High-reliability networking; Anomaly detection

- **Assistant Professor**
  - **TSUSHIMA, Kanae**
  - Ph.D. (Engineering)
  - Specialties: Programming languages; Functional programming; Program debugging; Development support

- **Professor**
  - **HASHIZUME, Hironori**
  - Ph.D. (Engineering)
  - Specialties: Asynchronous circuit technology and dependable UI/UX platforms

- **Professor**
  - **YONEDA, Tomohiro**
  - Vice Director-General, Director, Research and Development Center
  - Ph.D. (Engineering)
  - Specialties: Asynchronous circuit technology, which addresses various issues associated with using a digital clock in synchronous circuits and makes it easier to implement faster low-power circuits. Also, technologies to improve hardware reliability and security.

- **Assistant Professor**
  - **SEKUMA, Yaro**
  - Ph.D. (Engineering)
  - Specialties: Optimization for causal query in view database; Fundamental issues for optimizing queries in VML database

**Research**

As of September 1, 2021

**Organizations/ others**

- **Associate Professor**
  - **ISHIKAWA, Fuyuki**
  - Ph.D. (Informatics)
  - Specialties: Programming language theory; Compiler systems; Software verification

**Research Themes:** Research integrates static and dynamic verifications that use type systems. The integration of static verification enables to conduct comprehensive inspections and dynamic verifications to quickly find any issues associated with program execution and use flexible program validation systems tailored to the requirements of software and the development phase.
### List of Researchers

#### Digital Content and Media Sciences Research Division

**Foundations of Content Management**

**Associate Professor KATAYAMA, Norio**  
Ph.D. (Engineering)  
- **Specialties:** Data management technology for video corpus analysis  
- **Research Themes:** Efficient, high-speed analysis of multimedia databases storing large amounts of data focusing on grid and SSH as key technologies, and developing databases and algorithms for them.

**Associate Professor KOMIYAMA, Yusuke**  
Ph.D. (Information Science)  
- **Specialties:** Open science, Research data management, Semantic Web, Linked data, Bioinformatics, big data.  
- **Research Themes:** Consolidation of the open resource platform for management and sharing of research data from universities and research facilities, as an exigent issue in the academic infrastructure field. Provision of a research data management service with a high degree of usability and visibility by utilizing SNTE, Galatea, UPN, the Cloud, and academic content.

**Professor TAKASU, Atsuhiko**  
Assistant Director-General, Director, Global Research Center  
- **Specialties:** Computer science; Knowledge informatics; Big data analysis of global environment and disasters; Open science; Image analysis.  
- **Research Themes:** Technologies such as image analysis, databases, and machine learning that are fundamental to the expansion of diverse data science into various fields such as the global environment, natural disasters, and the humanities, and “super-interdisciplinary expansion” of research results using space science analysis.

**Researcher**  
- **Specialties:** Speaker verification; Media technology.

**Associate Professor KIWATSUBO, Asanobu**  
Ph.D. (Engineering)  
- **Specialties:** Data-driven science; Humanoid informatics; Big data analysis of global environment and disasters; Open science; Image analysis.  
- **Research Themes:** Technologies such as image analysis, databases, and machine learning that are fundamental to the expansion of diverse data science into various fields such as the global environment, natural disasters, and the humanities, and “super-interdisciplinary expansion” of research results using space science analysis.

**Text and Language Media**

**Professor YAMAGISHI, Junichi**  
Ph.D. (Design Engineering)  
- **Specialties:** Speech information processing, Speech synthesis, Speaker verification, Media learning, Machine learning.  
- **Research Themes:** Reproducing the speech features that individuals as defined by voice, face, and writing by machine learning; digital cloning and looking for new applications such as personal avatars, while at the same time considering a framework that achieves both security and privacy such as by biometric authentication using biometric sensors.

**Assistant Professor ANDO, Ryohis**  
Ph.D. (Design Engineering)  
- **Specialties:** Computer graphics, Physical simulations, Computational fluid dynamics.  
- **Research Themes:** Development of new computational methods for nanoscale composite materials and implementation of beautiful computer graphics. Producing new algorithms that can handle static and dynamic fluid and building mathematical models for describing natural phenomena with simple mathematical formulas. Particularly interested in visual and computational beauty.

**Assistant Professor INEKHATA, Satoshi**  
Ph.D. (Information Science and Technology)  
- **Specialties:** Computer vision, Computer graphics.  
- **Research Themes:** Advanced 3D computer vision using digital cameras, distance sensors, and other computer vision technologies. Implementing practical 3D reconstruction technology that can be used in many fields such as geography, construction, medicine, and entertainment.

**Pattern Media**

**Professor PRINDINGER, Helmut**  
Ph.D. (Engineering)  
- **Specialties:** Real-time multi-user multi-agent systems; Personalized characteristics and awareness in virtual worlds; Distributed, highly scalable, highly efficient real-time systems; Collaborative human-machine interfaces; Multimodal interfaces.  
- **Research Themes:** The broad potential of drones as new social infrastructure. Development of new technologies for effective collaboration in real fields using information engineering focusing on efficient information processing research using computers.  

**Text and Language Media**

**Associate Professor KITAMOTO, Asanobu**  
Ph.D. (Engineering)  
- **Specialties:** Data-driven science; Humanoid informatics; Big data analysis of global environment and disasters; Open science; Image analysis.  
- **Research Themes:** Technologies such as image analysis, databases, and machine learning that are fundamental to the expansion of diverse data science into various fields such as the global environment, natural disasters, and the humanities, and “super-interdisciplinary expansion” of research results using space science analysis.

**Human and Knowledge Media**

**Professor SATO, Imari**  
Ph.D. (Interdisciplinary Information Science)  
- **Specialties:** Physical-based object shape and reflectance modeling; Creation of spatially and temporally varying human-computer interaction experiences.  
- **Research Themes:** Extracting information from body and face postures; Imaging technologies for future living; Enabling rich image experiences in preferred locations; Recording indoor and outdoor materials under different lighting environments; Optical correction technologies for projects.

**Assistant Professor TAKAYAMA, Kensi**  
Ph.D. (Information Science and Technology)  
- **Specialties:** Computer graphics, User interfaces, Geometric modeling.  
- **Research Themes:** Intuitive interfaces for interactive 3D modeling; Mainly modeling technologies for the surface conditions and internal structures of objects, and representing input shapes into high-quality models.

**Associate Professor ANDRES, Frederic**  
Ph.D., HDR (habilitation & Diriger des Recherches)  
- **Specialties:** Distributed databases; Collective intelligence, Data science, Big data, Knowledge representation.  
- **Research Themes:** Distributed reasoning (RDF-based) applications, Intelligent food and cooking recipes, CI-based semantics and social media ecosystems, community behavior detectors, and early stress detectors and monitoring.
### List of Researchers

#### Information Use

**Professor ARAI, Noriko**
Director, Research Center for Community Knowledge
Ph.D. (Science)

**Specialties:** Information sharing, pervasive systems, IoT, Artificial Intelligence, Mathematical logic

**Research themes:** Information technology enabling information and knowledge to be shared more smoothly.

**Research:** Focuses on the potential and limitations of artificial intelligence starting with the question: "What if a robot were to be admitted to the University of Tokyo?" Also issuing needed skills needed for the 21st century from an education-oriented science research laboratory.

#### Science Information

**Associate Professor GOTO, Hirohisa**
Ph.D. (Science)

**Specialties:** Statistical machine learning, data mining, and social science

**Research themes:** Emotional analysis, social network analysis, and knowledge extraction

**Research:** Developing methods for understanding the emotional and social aspects of data to support decision-making in various fields.

**Professor OKADA, Hitoshi**
Ph.D. (International Public Policy)

**Specialties:** Critical growth factors of e-commerce and e-money, University Information Security Policy Portal (JISP)

**Research themes:** Building blockchain technology, which supports distributed database systems, can be applied in various fields including finance, education, and healthcare. The objective is to build a mechanism to realize effective educational support using learning tools.

#### Information Public Policy

**Professor SATOH, Kiho**
Ph.D. (Engineering)

**Specialties:** GIS and middleware for distributed systems including cloud computing and IoT

**Research themes:** How network technologies and applications using mobile agents software, which can run processes while moving freely between computers. Mobile phone software development tools that are being used by major manufacturers.

**Professor KANDO, Noriko**
Ph.D. (Library and Information Science)

**Specialties:** Evaluation of information access technologies, Exploratory search and user interfaces, Cognitive research for exploratory search, Extracting attitudes and tendencies from text

**Research themes:** Focuses on the potential of virtual currency technology, which supports distributed virtual currencies, can be applied in various fields including finance, education, and healthcare. The objective is to build a mechanism to realize effective educational support using learning tools.

---

**See p. 49 for the list of Executives.**

---

**Chief Cyber Science Infrastructure Director YASUURA, Hiroto**
Project Professor, National Institute of Informatics; Professor Emeritus, Kyushu University

**GLO Acting Director PLANAS, Emmanuel**
Professor, National Institute of Informatics
Leveraging Formal Methods in Manufacturing

In particular, the project explores methodologies for software support, which are responsible for quality assurance and efficiency in industrial products such as vehicles, and other "physical information systems, "by bringing in the techniques of systems design in software science based on mathematics, called "formal methods." Formal methods have so far been used with "discrete elements," assuming calculations by computer, but in order to apply them to physical information systems, formal methods must be extended to encompass "continuous elements" of physical systems such as continuous dynamics, probability, and time (Figure). Our unique approach to this theoretically difficult problem is to mathematically analyze the process itself of extending formal methods and construct a higher-order (metamedical) theory in order to obtain universal knowledge, which may allow the various techniques of formal methods to be extended together. This methodological approach is therefore to develop the full utility of a variety of abstract mathematical techniques, such as logic and category theory. However, another distinctive feature of this project is its orientation towards applications of AI with an ultimate goal of applying the outcomes of these theoretical studies to the real problems faced by the industrial sector.

HASUO Metamathematics for Systems Design Project

Research Director: HASUO, Ichiro (Associate Professor, Information Systems Architecture Science Research Division; Director, Global Research Center for Systems Design and Mathematics)

In the manufacturing industry today, efforts are underway to fundamentally transform the manufacturing process—from design to production—through automatic and software support using advanced information processing technologies. In light of these changes, the HASUO Metamathematics for Systems Design Project aims to introduce the findings from the field of software science into traditional manufacturing technologies and build software tools that support the different aspects of industrial product development, from developing specifications to design, implementation, and maintenance.

Leveraging Formal Methods in Manufacturing

In particular, the project explores methodologies for software support, which are responsible for quality assurance and efficiency in industrial products such as vehicles, and other "physical information systems, "by bringing in the techniques of systems design in software science based on mathematics, called "formal methods." Formal methods have so far been used with "discrete elements," assuming calculations by computer, but in order to apply them to physical information systems, formal methods must be extended to encompass "continuous elements" of physical systems such as continuous dynamics, probability, and time (Figure). Our unique approach to this theoretically difficult problem is to mathematically analyze the process itself of extending formal methods and construct a higher-order (metamedical) theory in order to obtain universal knowledge, which may allow the various techniques of formal methods to be extended together. This methodological approach is therefore to develop the full utility of a variety of abstract mathematical techniques, such as logic and category theory. However, another distinctive feature of this project is its orientation towards applications of AI with an ultimate goal of applying the outcomes of these theoretical studies to the real problems faced by the industrial sector.

HASUO Metamathematics for Systems Design Project

Research Director: HASUO, Ichiro (Associate Professor, Information Systems Architecture Science Research Division; Director, Global Research Center for Systems Design and Mathematics)

In the manufacturing industry today, efforts are underway to fundamentally transform the manufacturing process—from design to production—through automatic and software support using advanced information processing technologies. In light of these changes, the HASUO Metamathematics for Systems Design Project aims to introduce the findings from the field of software science into traditional manufacturing technologies and build software tools that support the different aspects of industrial product development, from developing specifications to design, implementation, and maintenance.

Leveraging Formal Methods in Manufacturing

In particular, the project explores methodologies for software support, which are responsible for quality assurance and efficiency in industrial products such as vehicles, and other "physical information systems, "by bringing in the techniques of systems design in software science based on mathematics, called "formal methods." Formal methods have so far been used with "discrete elements," assuming calculations by computer, but in order to apply them to physical information systems, formal methods must be extended to encompass "continuous elements" of physical systems such as continuous dynamics, probability, and time (Figure). Our unique approach to this theoretically difficult problem is to mathematically analyze the process itself of extending formal methods and construct a higher-order (metamedical) theory in order to obtain universal knowledge, which may allow the various techniques of formal methods to be extended together. This methodological approach is therefore to develop the full utility of a variety of abstract mathematical techniques, such as logic and category theory. However, another distinctive feature of this project is its orientation towards applications of AI with an ultimate goal of applying the outcomes of these theoretical studies to the real problems faced by the industrial sector.

HASUO Metamathematics for Systems Design Project

Research Director: HASUO, Ichiro (Associate Professor, Information Systems Architecture Science Research Division; Director, Global Research Center for Systems Design and Mathematics)

In the manufacturing industry today, efforts are underway to fundamentally transform the manufacturing process—from design to production—through automatic and software support using advanced information processing technologies. In light of these changes, the HASUO Metamathematics for Systems Design Project aims to introduce the findings from the field of software science into traditional manufacturing technologies and build software tools that support the different aspects of industrial product development, from developing specifications to design, implementation, and maintenance.

Leveraging Formal Methods in Manufacturing

In particular, the project explores methodologies for software support, which are responsible for quality assurance and efficiency in industrial products such as vehicles, and other "physical information systems, "by bringing in the techniques of systems design in software science based on mathematics, called "formal methods." Formal methods have so far been used with "discrete elements," assuming calculations by computer, but in order to apply them to physical information systems, formal methods must be extended to encompass "continuous elements" of physical systems such as continuous dynamics, probability, and time (Figure). Our unique approach to this theoretically difficult problem is to mathematically analyze the process itself of extending formal methods and construct a higher-order (metamedical) theory in order to obtain universal knowledge, which may allow the various techniques of formal methods to be extended together. This methodological approach is therefore to develop the full utility of a variety of abstract mathematical techniques, such as logic and category theory. However, another distinctive feature of this project is its orientation towards applications of AI with an ultimate goal of applying the outcomes of these theoretical studies to the real problems faced by the industrial sector.

HASUO Metamathematics for Systems Design Project

Research Director: HASUO, Ichiro (Associate Professor, Information Systems Architecture Science Research Division; Director, Global Research Center for Systems Design and Mathematics)

In the manufacturing industry today, efforts are underway to fundamentally transform the manufacturing process—from design to production—through automatic and software support using advanced information processing technologies. In light of these changes, the HASUO Metamathematics for Systems Design Project aims to introduce the findings from the field of software science into traditional manufacturing technologies and build software tools that support the different aspects of industrial product development, from developing specifications to design, implementation, and maintenance.

Leveraging Formal Methods in Manufacturing

In particular, the project explores methodologies for software support, which are responsible for quality assurance and efficiency in industrial products such as vehicles, and other "physical information systems, "by bringing in the techniques of systems design in software science based on mathematics, called "formal methods." Formal methods have so far been used with "discrete elements," assuming calculations by computer, but in order to apply them to physical information systems, formal methods must be extended to encompass "continuous elements" of physical systems such as continuous dynamics, probability, and time (Figure). Our unique approach to this theoretically difficult problem is to mathematically analyze the process itself of extending formal methods and construct a higher-order (metamedical) theory in order to obtain universal knowledge, which may allow the various techniques of formal methods to be extended together. This methodological approach is therefore to develop the full utility of a variety of abstract mathematical techniques, such as logic and category theory. However, another distinctive feature of this project is its orientation towards applications of AI with an ultimate goal of applying the outcomes of these theoretical studies to the real problems faced by the industrial sector.
Research

Major Project Involvement

JST PRESTO: Network-Based (Individual) Research Giving Rise to Wellsprings of Innovation in Science and Technology

[Social Design] Fundamental Information Technologies towards Innovative Social System Design

Search and Decomposition of Higher-Order Interactions between Variables

Researcher: SUIGYAMA, Makita (Associate Professor, Principles of Informatics Research Division)

Discovering and analyzing interactions between variables is fundamental and essential in e-commerce. By analyzing multivariate data consisting of many variables, such as sales, marketing, and consumer behavior, we can extract valuable insights for decision-making.

Disentangling interactions is an important problem in various fields, including economics, social sciences, and computer science. Recent advances in machine learning and deep learning have enabled us to analyze complex data sets, but there is still a need for more sophisticated methods.

In this project, we focus on higher-order interactions, which are interactions involving more than two variables. We develop novel algorithms and tools to discover and interpret these interactions, aiming to advance our understanding of complex systems.

This research is funded by KAKENHI (Grant-in-Aid for Scientific Research (S)), and it is in collaboration with several institutions.

Cabinet Office Cross-Ministerial Strategic Innovation Promotion Program (SIP) Phase 2

Big-Data and AI-Enabled Cyberspace Technologies

This project aims to establish the cyberspace-platform technologies that will form the foundation of Society 5.0 in cyber–physical systems (CPS), in particular, (1) a highly sophisticated human interaction platform technology which will facilitate collaboration between humans and AI, (2) a cross-domain data exchange-platform, and (3) AI-based collaboration technology, with the goal of implementing CPS in the real world using big data and AI.

R&D of a Cross-Domain Data Exchange Platform based on Metadata Structuring by AI Technology and its Evaluation through Applications for Spatio-temporal Big Data

Head of R&D: TAKASU, Atsuhiro  (Assistant Director-General, NII; Professor, Digital Content and Media Sciences Research Division)

Working together with industry partners, we are developing a technology for a cross-domain data exchange platform—one that will find and link data scattered across different fields—and conducting studies to boost the use of the technology to promote the sharing and utilization of scattered data. The main points to be implemented are the design of architecture for a distributed type data exchange platform, the realization of various functions making up that platform, the laying out of rules for its utilization, and the verification of the usefulness of the various functions and services of that platform through demonstration applications. NII is advancing particularly with the discovery of such data and their semantic identification. We are further applying those research results to the advancement of data search functions and information integration to help reduce the cost of providing data. By developing demonstration applications with an eye on cases where data from multiple fields are used, we are also enabling the platform functions to be confirmed and various operational problems to be identified. In this way, we are pushing forward on verification of their overall effectiveness.

Kakenhi

Grants-in-Aid for Scientific Research (Kakenhi)

Venturing into a wide range of basic to applied research

Kakenhi are funds that provide broad support for scientific research based on the free ideas of the researchers themselves, and covers a wide range of academic studies spanning from basic to applied research. Both faculty members and researchers actively apply to Kakenhi for grants, and many are approved. The grants obtained from Kakenhi are also distributed to researchers in other institutions (co-investigators) for collaborative research work. Similarly, many NII faculty members also participate as co-investigators in the Kakenhi-funded projects of researchers at other institutions.

Model Cases of Research Funded by Kakenhi

Large Graphs: Theory and Algorithms

Project Leader: KAWABATASHI, Ken-ichi (Professor, Principles of Informatics Research Division)

Collecting huge volumes of data from various types such as images, text, audio, and video is a fundamental and essential challenge in the era of big data. Analyzing and interpreting these data requires innovative algorithms and tools.

This project aims to develop advanced algorithms for large graphs, focusing on both theoretical and practical aspects. We target applications such as social network analysis, recommendation systems, and complex network analysis.

The research team is composed of experts from various fields, including mathematics, computer science, and data science, ensuring a multidisciplinary approach to the problem.

Discrete Algorithms

Project Leader: SATOH, Ken (Professor, Principles of Informatics Research Division)

In the field of computer science, discrete algorithms play a crucial role in solving problems related to data processing, network analysis, and optimization. This project aims to develop advanced algorithms for discrete optimization problems, with a focus on theoretical foundations and practical applications.

The research team is composed of experts from various fields, including mathematics, computer science, and data science, ensuring a multidisciplinary approach to the problem.

Advanced Reasoning Support for Judicial Judgment by Artificial Intelligence

Project Leader: SATOH, Ken (Professor, Principles of Informatics Research Division)

In the trial process, the intellectual work performed by judges can be broadly divided into three parts: fact-finding, fact-confirmation, and legal judgment. This project aims to develop algorithmic models that can assist judges in their tasks.

The research team is composed of experts from various fields, including law, computer science, and data science, ensuring a multidisciplinary approach to the problem.
Our goal is to model the rehabilitation process $Y = f(X)$, where the rehabilitation strategy $f$ is taken to realize multicultural symbiotic societies.

We can expect physical therapists to decide on highly effective rehabilitation strategies with the proposed rehabilitation process model.

Grant-in-Aid for Scientific Research (A)  
**Research on Model-aided Learning Approaches for Reliable Realtime Control in Future Wireless Systems**

**Project Leader:** J. Takengon  
(Professor, Information and Society Research Division)

To support advanced applications and intellectual innovation in the Super-smart Society, it is necessary to further enhance the functionality, performance, and reliability of the information and communication service infrastructure. Using conventional model-based approaches, it becomes more and more difficult to solve the centrally controlled and/or distributed controls in multidimensional spaces with dynamically configured wireless systems. In this research, we study signal processing, resource allocation, interference mitigation, automatic access control, and mobility control problems in wireless communication systems, by means of integrated approaches based on mathematical models and machine learning. By comprehensively considering spatio-temporal constraints on network resources and asynchronously coordinating communication, computation, storage, and control functions, we aim to achieve highly reliable real-time processing capability at an end-to-end basis.

Grant-in-Aid for Scientific Research (B)  
**Study on Distributed Consensus by Using Synchronization Vibration**

**Project Leader:** SATOH, Ken'iti  
(Professor, Information and Society Research Division)

We will try to make distributed consensus more efficient by using a mechanism inspired from synchronization phenomena in vibrating systems in nature, i.e., the synchronization of the expansion and contraction cycle of the heart muscle and the transmission cycle of heartbeat in distributed systems. Distributed consensus serves as the basis for a variety of existing distributed algorithms, but it is known that the cost of reaching consensus increases significantly when multiple computers simultaneously demand consensus be reached, while simultaneously making other demands, because for every demand at one time cause the distributed consensus processing to be reworked. On the other hand, since most distributed consensus approaches tend to repeat multilateral communication and reply to it in a sequential manner, thus reworking synchronization phenomena in vibrating systems in nature, we will propose and implement a method to introduce the synchronization mechanism in nature into distributed systems and will evaluate the proposed approaches.

Grant-in-Aid for Scientific Research in an Important Area (Research in a Proposed Research Field)  
**Modeling of the motor recovery process and optimization of rehabilitation strategy using VR**

**Project Leader:** INAMURA, Tatsunari  
(Assistant Professor, Principles of Information Research Division)

Rehabilitation for motor dysfunction has involved a lot of subjective elements and estimations on the part of physical therapists, who formulate rehabilitation policies by predicting the recovery conditions of the patients’ physical functions. This research aims to realize a system that provides an optimum rehabilitation program in response to the individual patient’s condition by optimizing the interaction process between the physical therapist and the patient.

Our goal is to model the rehabilitation process $Y = f(X)$, where the rehabilitation strategy $f$ is applied to the current motor function state $X$. The current motor function state $f$ is changed into the desired motor function state $Y$. Our goal is to model the rehabilitation process $Y = f(X)$, where the rehabilitation strategy $f$ is applied to the current motor function state $X$. The current motor function state $f$ is changed into the desired motor function state $Y$.

Grant-in-Aid for Research on Challenging Research (Exploratory)  
**Reseach on Fusion of Informatics and Political Science Using Human Flow-based Big Data to Achieve Multicultural Symbiotic Societies**

**Project Leader:** MAIZINO, Takayuki  
(Associate Professor, Information and Society Research Division)

We will conduct research on the fusion of information and political science, which will deal with problems of exclusionary attitudes among global communities, deriving from ethnicity and other factors. Under the influence of globalization, communities that exist in the world economy are transferring from units confined in traditional nation states or regions into cross-national, ethnic units. To accurately grasp understanding of those communities, we will utilize big data on micro-connections of people. By introducing big data analysis technologies of informatics to the field of international political science from the perspective of the global human flow, we will visualize the structure of huge and complex social networks characterized by the “complicated intertwining of ethnic units in real space.” In this way, we will detect isolated communities and identify crises in social networks where corrective measures need to be taken to realize multicultural symbiotic societies.

Grant-in-Aid for Early-Career Scientists  
**Large-scale Fluid Simulations for Computer Graphics**

**Project Leader:** ANDO, Ryotshi  
(Assistant Professor, Digital Content and Media Sciences Research Division)

Our intention is to use an octree grid to conduct numerical simulation of liquid calculation, for which spatial discretization precision is dynamically changeable. It is known that the solution for liquid calculation can be obtained by solving certain partial differential equations called Navier-Stokes equations. But it cannot be solved analytically under arbitrary initial and boundary conditions because it contains a nonlinear term known as an advection term. In this research, the Navier-Stokes equations are discretized through the use of a grid and its motion is inelastically numerically attained to an approximate solution. The calculation time is greatly reduced due to the use of an octree grid. An example of calculating and generating animation of liquid through the use of an octree grid is shown below. The high resolution (high calculation accuracy) of the grid near the rear section of the fuselage is visualized.
Collaborative Research with the Private Sector

Collaborative Research with the Private Sector

https://www.nii.ac.jp/research/collaboration/koubo/

NII receives researchers and research funds from outside institutions in the private sector to conduct joint research with NII faculty members. In principle, projects last one year, although multi-year contracts are also possible:

(1) Receiving researchers only
- We accept researchers dispatched by outside institutions in the private sector to conduct collaborative research at NII while holding their regular jobs. Essential overhead expenses are covered by research fees up to a set limit.

(2) Receiving research funds only
- We receive the research funds required for collaborative research from the private sector. Collaborating researchers conduct their research at their respective locations.

(3) Receiving researchers and research funds
- We receive research funds and research fees to conduct collaborative research.

Collaborative Research Projects with Private-sector Institutions

[Various Collaborative Research Projects with Private-sector Institutions]

Research to Build Broad Collaboration with Researchers and Create Value

NII Open Collaborative Research

https://www.nii.ac.jp/research/collaboration/koubo/

NII conducts open calls for applications for collaborative research, with NII faculty members acting as liaisons. The following three types of open collaborative research proposals are accepted in the second half of each fiscal year:

- Strategic research proposals based on strategic subjects set by NII
- Proposals for research project meetings with the aim of paving the way for new collaborations and advancements in research subjects, mainly through meetings at the International Seminar House for Advanced Studies in Kanazawa
- Open subject proposals where applicants are free to set their own research subjects

This open collaborative research program accepts applications mainly from researchers affiliated with institutions in Japan, researchers with a wide range of affiliations can become collaborative researchers, including faculty members of universities and institutions in Japan and abroad, technical colleges, researchers at private-sector corporations, as well as graduate students. We encourage everyone to take advantage of this open collaborative research program and take a new step forward.

List of Strategic Research Themes (12 themes)

1. Proposal for an innovative platform function and application services utilizing the Science Information Networks (SINET)
2. Proposal for cybersecurity analysis technology utilizing NII/GOSI data
3. Proposal for a method to introduce a research-data platform at universities to move into the age of open science
4. Proposal for building a "dataset" to ask as a research resource and the platform for utilizing
5. Proposal for CPS/IT services for greater efficiency in social activities and system infrastructure design
6. Proposal for an innovative medical information technology based on medical imaging big data
7. Proposal for an innovative model and algorithm that approximates human-like semantic understanding
8. Proposal for a technology for quality assurance of a machine learning application system
9. Proposal for technologies regarding UX for artificial intelligence and Explainable AI
10. Proposal for an innovative model and algorithm toward deeper utilization of cultural properties
11. Proposal for technologies related to education and IT, and utilization of learning data
12. Proposal for core technologies for the next-generation Internet

List of Registered Trademarks

*Denotes (International Registration No. 1220393) and Priority (International Registration No. 1240394) are also registered trademarks in Europe, the United States, and China. *Trademark is registered in India, China.
**Research**

**Collaboration with Industry, Government, and Academia (Advancing Practical R&D and Collaborative Activities)**

NII carries out practical R&D in order to address real social issues in the field of informatics. Collaborations between industry, government, and academia are critical to implementing our R&D achievements in the real world. NII engages in industry-government-academia collaborations to strengthen and deepen such collaborations, as well as to help ensure that our R&D meets the needs of businesses and local authorities.

**Action Program for Industry-Government-Academia Collaborations**

- **Needs of businesses, local authorities, etc.**
  - Assistance with decision-making at the research conceptual phase
  - Preparation/decision on research launching
  - Overall coordination and collaboration

- **Academic Consultation**
  - Joint Research Unit
  - Joint Research (including hosting researchers)
  - Committed Research
  - Top SE

- **Human resource development for research**
  - Need to develop human resources for research and to acquire new research skills

- **Human resource development for business**
  - Need to work on acquiring the advanced technological skills necessary for future business, and developing the human resources that are lacking in business operations.

- **Research Consultation by Researchers**

NII offers consulting services that aim to expand the framework for industry-government-academia collaborations, explore possible collaborations with new partners, and contribute to society at large. Through communications between researchers and business people, our consulting services support startups by providing relevant policy advice from researchers on various issues that are likely to lead to innovation through industry-academia collaboration and benefit society.

**Innovation Produced by Knowledge**

**Model Case of Collaboration with Industry, Government, and Academia**

**Discussion**
- Contact interviews about corporate policies and issues

**Coordination**
- Industry-government-academia networking seminars, collaborative workshops, and other opportunities are available.

**Research Contract**
- Tail contracts for joint research and other forms, and enter into research contract.

**Research**
- Carry out research with corporate and NII researchers collaborating.

**Delivery of Findings**
- Generate intellectual property and other deliverables (patents, computer programs, etc.).

**Licensing**
- Grant licenses for intellectual property to leverage findings.

**Using the Findings**
- Company uses findings to develop products and services, as well as their own business operations.

**Example Case of Collaboration with Industry, Government, and Academia: NII - Hitachi High-Tech Science Corporation**

Achieving visualization of separated reflected light image and fluorescence image of objects.

EEM® View: CMOS Camera Imaging System for Fluorescence Spectrophotometer

A new technology capable of simultaneously capturing both spectroscopic images and spectral data. The computational algorithm developed by NII Professor SEID, Imai and Associate Professor ZHENG, Yinqiang (Current affiliation: University of Tokyo) of the Digital Content and Media Sciences Research Division has made it possible to separate and visualize the fluorescent component and reflected component of images. By integrating into Hitachi’s fluorescence spectrophotometer, an object’s spectral data and the fluorescence/reflected light images taken by the CMOS camera can be captured at the same time. These captured sample images can then be sub-divided into 25 sectors to obtain averaged images and spectral fluorescence/reflected data for each sector. Whereas conventional fluorescence spectrophotometers are limited to obtaining the average spectral data for the entire sample, this technology allows visualization of the reflection/fluorescence spectra, making it possible to observe parts of the image with fluorescence emissions and obtain spectral data for specific locations, and enabling higher precision measurements of fluorescent substances.

The fluorescence analysis tool in this device holds promising uses for R&D and quality control in a wide range of fields, not only in electronic and industrial materials for LEDs and display devices—areas in which the need for fine-grained measurement technologies is increasingly urgent—but also in areas such as food inspection, life sciences, and biotechnology.

**Separation of captured images into reflected light and fluorescence component images**

**Research Seeds Collection: NII SEEDs**

Since FY2014, NII has been publishing NII SEEDs every year to present our cutting-edge research in informatics that has great potential for industrial applications, as well as to provide an opportunity for joint research and partnerships with the industrial sector and government agencies.

The latest issue entitled, “NII SEEDs 2021: Creating Innovation and Future Value Through Informatics,” showcases the research results of 24 researchers in a special report format classified into six categories: Foundation of Informatics, Information Infrastructure Science, Software Science, Multimedia Information Science, Intelligent Systems Science, and Information Environment Science. In addition, the issue begins with a section called “Researcher File” that features two of our researchers and highlights their personalities, the trajectories of their careers, their thoughts on research work, and much more.

**Research Service Graduate Program**

We want to know the proper target value for our data

We want to know about analysis and what is technologically possible

We want to decide policies quickly
International Exchange

NIll enters into international exchange agreements through
MOU to systematically and actively promote international
exchange with overseas universities and research institutes.
As of March 2021, we have agreements with 126
institutions in 34 countries and regions.

*N* see page 75 for the list of institutions.

MOU/Non-MOU Grant

MOU Grant was established in FY2005 and Non-MOU Grant was established the following year as a financial assistance program for research exchange with our partner
and non-partner institutions. With the aim of promoting and internationalizing research exchange, MOU Grant dispatches and invites researchers and students for research exchanges with institutes under MOU, while Non-MOU Grant accepts foreign researchers for research exchanges with institutes without MOU. Expenses (travel and stay expenses) are covered for NII faculty and students, as well as for overseas researchers.

List of International Exchange Agreements (MOU)

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Name of Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Université Paris Sud</td>
</tr>
<tr>
<td></td>
<td>The French National Audiovisual Institute (INA)</td>
</tr>
<tr>
<td></td>
<td>Centre de Recherche en Informatique de Lens (CRIL)</td>
</tr>
<tr>
<td></td>
<td>Ecole Normale Supérieure de Lyon (ENS Lyon)</td>
</tr>
<tr>
<td></td>
<td>Faculty of Science, Technology, Engineering &amp; Mathematics, The Open University</td>
</tr>
<tr>
<td></td>
<td>University of Bath</td>
</tr>
<tr>
<td></td>
<td>Department of Computing at Imperial College London</td>
</tr>
<tr>
<td></td>
<td>Department of Computer Science, University of Oxford</td>
</tr>
<tr>
<td></td>
<td>School of Computer Science &amp; Electronic Engineering, University of Essex</td>
</tr>
<tr>
<td></td>
<td>Newcastle University</td>
</tr>
<tr>
<td></td>
<td>The Faculty of Applied Science of the University of Freiburg</td>
</tr>
<tr>
<td></td>
<td>RWTH Aachen University (Faculty of Mathematics, Computer Science and Natural Sciences)</td>
</tr>
<tr>
<td></td>
<td>Berlin Institute of Technology (TU Berlin)</td>
</tr>
<tr>
<td></td>
<td>Technische Universität München (TUM)</td>
</tr>
<tr>
<td></td>
<td>Georg-August-Universität Göttingen</td>
</tr>
<tr>
<td></td>
<td>Bochum University of Applied Sciences, Department of Electrical Engineering and Computer Science</td>
</tr>
<tr>
<td></td>
<td>Dipartimento di Informatica, Università degli Studi di Torino</td>
</tr>
<tr>
<td></td>
<td>Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria</td>
</tr>
<tr>
<td></td>
<td>Università degli Studi di Ferrara (UNIFE)</td>
</tr>
<tr>
<td></td>
<td>Institute of Electrical Engineering in Ecole Polytechnique Federale de Lausanne</td>
</tr>
<tr>
<td></td>
<td>The Institute of Physiology of the Czech Academy of Sciences</td>
</tr>
<tr>
<td></td>
<td>Institut National Polytechnique de Grenoble</td>
</tr>
<tr>
<td></td>
<td>Institut National de Recherche en Informatique et en Automatique (INRIA)</td>
</tr>
<tr>
<td></td>
<td>Laboratoire d'Informatique de Paris 6, Sorbonne Université (l'université Pierre et Marie Curie) (LIP6)</td>
</tr>
<tr>
<td></td>
<td>National Center for Scientific Research (CNRS)</td>
</tr>
<tr>
<td></td>
<td>Université Toulouse III - Paul Sabatier</td>
</tr>
<tr>
<td></td>
<td>The Irish Software Research Centre (Lero)</td>
</tr>
<tr>
<td></td>
<td>Trinity College Dublin</td>
</tr>
<tr>
<td></td>
<td>University of Nantes (Atlanstic 2020)</td>
</tr>
<tr>
<td></td>
<td>Institut National de Recherche en Informatique et en Automatique (INRIA)</td>
</tr>
<tr>
<td></td>
<td>Laboratoire d'Informatique de Paris 6, Sorbonne Université (l'université Pierre et Marie Curie) (LIP6)</td>
</tr>
<tr>
<td></td>
<td>National Center for Scientific Research (CNRS)</td>
</tr>
<tr>
<td></td>
<td>Université Toulouse III - Paul Sabatier</td>
</tr>
<tr>
<td></td>
<td>The Irish Software Research Centre (Lero)</td>
</tr>
<tr>
<td></td>
<td>Trinity College Dublin</td>
</tr>
<tr>
<td></td>
<td>University of Nantes (Atlanstic 2020)</td>
</tr>
<tr>
<td></td>
<td>Institut National de Recherche en Informatique et en Automatique (INRIA)</td>
</tr>
<tr>
<td></td>
<td>Laboratoire d'Informatique de Paris 6, Sorbonne Université (l'université Pierre et Marie Curie) (LIP6)</td>
</tr>
<tr>
<td></td>
<td>National Center for Scientific Research (CNRS)</td>
</tr>
<tr>
<td></td>
<td>Université Toulouse III - Paul Sabatier</td>
</tr>
<tr>
<td></td>
<td>The Irish Software Research Centre (Lero)</td>
</tr>
<tr>
<td></td>
<td>Trinity College Dublin</td>
</tr>
<tr>
<td></td>
<td>University of Nantes (Atlanstic 2020)</td>
</tr>
</tbody>
</table>

Number of MOU signatory institutes

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of MOU signatory institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>125</td>
</tr>
<tr>
<td>2004</td>
<td>124</td>
</tr>
<tr>
<td>2005</td>
<td>123</td>
</tr>
<tr>
<td>2006</td>
<td>122</td>
</tr>
<tr>
<td>2007</td>
<td>121</td>
</tr>
<tr>
<td>2008</td>
<td>120</td>
</tr>
<tr>
<td>2009</td>
<td>119</td>
</tr>
<tr>
<td>2010</td>
<td>118</td>
</tr>
<tr>
<td>2011</td>
<td>117</td>
</tr>
<tr>
<td>2012</td>
<td>116</td>
</tr>
<tr>
<td>2013</td>
<td>115</td>
</tr>
<tr>
<td>2014</td>
<td>114</td>
</tr>
<tr>
<td>2015</td>
<td>113</td>
</tr>
<tr>
<td>2016</td>
<td>112</td>
</tr>
<tr>
<td>2017</td>
<td>111</td>
</tr>
<tr>
<td>2018</td>
<td>110</td>
</tr>
<tr>
<td>2019</td>
<td>109</td>
</tr>
<tr>
<td>2020</td>
<td>108</td>
</tr>
</tbody>
</table>

Number of accepted students to the NII International Internship Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of accepted students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>125</td>
</tr>
<tr>
<td>2004</td>
<td>124</td>
</tr>
<tr>
<td>2005</td>
<td>123</td>
</tr>
<tr>
<td>2006</td>
<td>122</td>
</tr>
<tr>
<td>2007</td>
<td>121</td>
</tr>
<tr>
<td>2008</td>
<td>120</td>
</tr>
<tr>
<td>2009</td>
<td>119</td>
</tr>
<tr>
<td>2010</td>
<td>118</td>
</tr>
<tr>
<td>2011</td>
<td>117</td>
</tr>
<tr>
<td>2012</td>
<td>116</td>
</tr>
<tr>
<td>2013</td>
<td>115</td>
</tr>
<tr>
<td>2014</td>
<td>114</td>
</tr>
<tr>
<td>2015</td>
<td>113</td>
</tr>
<tr>
<td>2016</td>
<td>112</td>
</tr>
<tr>
<td>2017</td>
<td>111</td>
</tr>
<tr>
<td>2018</td>
<td>110</td>
</tr>
<tr>
<td>2019</td>
<td>109</td>
</tr>
<tr>
<td>2020</td>
<td>108</td>
</tr>
</tbody>
</table>
**International Exchange**

**NII Shonan Meeting**

NII launched the NII Shonan Meeting in February 2011. The NII Shonan Meeting constitutes the first seminar series in Asia in the style of the Dagstuhl Seminars, which brings together top-class researchers from around the world for intensive discussions on issues in the field of informatics with the goal of solving difficult problems. The meetings are jointly hosted by NII and Kanagawa Prefecture under a partnership agreement. The venue, Shonan Village Center, is easily accessible from Narita Airport and Haneda Airport, and is located in an environment blessed by nature where participants can focus on their research work. More than 150 seminars have been held so far. In August 2014, we also launched NII Shonan School, which is intended primarily for students and young researchers.

*Dagstuhl Seminar*: A renowned seminar series in the field of informatics held every week in Dagstuhl, Germany. It is famous for its training camp style format where participants stay for about a week to hold intensive discussions on a specific topic.

**Support Setup**

The Office of NII Shonan Meeting and Shonan Village Center staff manage various activities on behalf of seminar organizers, including sending invitations, providing information on accommodations, and preparing the venue on seminar days. The program also includes events such as historical walks through Kamakura to cultivate personal exchanges and friendships among participants.

**Administrative Procedure**

The NII Shonan Meeting Memorial Lectures are held annually and co-hosted by NII and Kanagawa Prefecture. NII researchers give open lectures on the latest research topics in the field of informatics.

**Agreement with the German Academic Exchange Service (DAAD)**

NII has a special agreement with the German Academic Exchange Service (DAAD) that allows German postdoctoral researchers to carry out research projects under the supervision of NII faculty members. Under this agreement, postdocs can stay at NII for a minimum of three months (six months is recommended) and up to a maximum of two years with the support of DAAD. During their stay, they will carry out their own programs and receive research advice from the faculty at NII. The postdocs can also enlist the help of Master’s and Ph.D. students and engineers on conducting projects. Since NII is an inter-university research institute, they can visit NII’s partner universities and research institutes in Japan to build their network in Japan.

**Japanese-French Laboratory for Informatics (JFLI)**

The Japanese-French Laboratory for Informatics (JFLI) was founded in 2008 as a hub for informatics research exchange between France and Japan by five institutions, namely the National Center for Scientific Research (CNRS), Sorbonne University (University of Paris VI), The University of Tokyo (Graduate School of Information Science and Technology), Keio University, and NII. It was turned into a Joint International Unit (JAU) of CNRS in 2012, and has since been more active in conducting research exchange. JFLI carries out collaborative research with a special emphasis on the important and challenging areas of informatics. The main research topics are (1) neural generation networks, (2) high-performance computing, (3) software, programming models, and formal methods, (4) virtual reality and multimedia, and (5) quantum computing. The institutions have all engaged in collaborative research, including Japanese institutions accepting researchers and graduate students from French research institutes. Workshops for enhancing collaborative research and research presentations that serve as venues for graduate internship students to present their research are also held regularly. The JFLI Seminar is another one of its regular activities. Networks of researchers have recently been forming as a result of such activities conducted through JFLI. In March 2016, a JFLI-wide workshop was held at NII that invited outside researchers who have been involved with JFLI. JFLI also organizes joint workshops with universities and other non-member institutions. There are now plans to collaborate with other UMIs of CNRS across the Asian region with similar research interests.

Going forward, JFLI will continue working to promote informatics research through research collaboration between the two countries and in partnership with universities in Japan.

**Call for Seminar Proposals**

We accept seminar proposals for the NII Shonan Meeting throughout the year. The deadlines for submission are twice a year, June 15 and December 15. Following the review of the proposal by the Academic Committee at NII, seminar organizers will be notified of the result.

Contact: Office of NII Shonan Meeting, shonan@nii.ac.jp
Establishment of Graduate School

In April 2002, National Institute of Informatics joined up with The Graduate University for Advanced Studies, SOKENDAI to launch the Department of Informatics with a three-year Ph.D. course, and saw its first students graduate in March 2005. A five-year Ph.D. course was launched in AY2006. SOKENDAI was founded as the first graduate university in Japan with the aim of fostering original, world-class academic research that transcends the boundaries of traditional disciplines and pioneering advanced fields of study that create new lines of scientific inquiry.

Content and Structure

The Department of Informatics aims to develop young IT researchers and engineers who will take the lead at the international level in the 21st century. Students will be able to earn a Doctor of Philosophy in Informatics degree (or a Doctor of Philosophy in Science degree, depending on the course content). The Department offers education and research guidance in the following six fields: (1) foundations of informatics, (2) information infrastructure science, (3) software science, (4) multimedia information science, (5) intelligent systems science, and (6) information-environment science. Around 70 subjects are available as special subjects of the department and common specialized subjects of the school.

Features of the Department

The Department of Informatics actively welcomes students from overseas and is a place filled with lively cross-cultural communication between students. There are also many working students, accounting for around 20% of the student body.

Number of students in the Department of Informatics

<table>
<thead>
<tr>
<th>Course type</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five-year Ph.D. course</td>
<td>54 (36)</td>
</tr>
<tr>
<td>Three-year Ph.D. course</td>
<td>40 (23)</td>
</tr>
<tr>
<td>Total</td>
<td>97 (39)</td>
</tr>
</tbody>
</table>

The Graduate University for Advanced Studies, SOKENDAI

The Department of Informatics offers education and research guidance in the following six fields:

1. Foundations of Informatics
2. Information Infrastructure Science
3. Software Science
4. Multimedia Information Science
5. Intelligent Systems Science
6. Information Environment Science

These fields cover a wide range of academic studies, including not only conventional computer science and information engineering, but also artificial intelligence, mathematics, and data science, which are core study areas in a data-driven world, as well as human informatics and social informatics, which address human and social issues.

The Department conducts research and education in various phases—basic, applied, and practical—with the goal of educating researchers who amass knowledge and experience in the field of informatics.

National Institute of Informatics provides research supervision in a form that matches the ambition, purpose, and research plan of each student, using a coaching system to match students with appropriate mentors and researchers. The Department offers opportunities for students to work side by side with faculty members pursuing research in interdisciplinary fields.

Research by Current Students

GAN, Wenbin

Enrolled in April 2019 to the three-year Ph.D. course, Department of Informatics, School of Multidisciplinary Sciences, SOKENDAI

Main Supervisor: Associate Professor SUN, Yuan

My research involves creating new methodologies to assess and trace students’ knowledge states based on their past performance in learning exercises. I have proposed a KT model that traces the evolution of students’ knowledge acquisition over time by explicitly modeling their learning and forgetting behaviors, as well as the cognitive item difficulty. The new model I proposed and related results will potentially benefit the development of online learning systems and related research on educational management.

Career paths of students after course completion

<table>
<thead>
<tr>
<th>Year of completion</th>
<th>International students</th>
<th>Equivalent students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AY2020</td>
<td>10 (1)</td>
<td>6 (1)</td>
<td>16 (3)</td>
</tr>
<tr>
<td>AY2019</td>
<td>5 (1)</td>
<td>7 (1)</td>
<td>12 (2)</td>
</tr>
<tr>
<td>AY2018</td>
<td>3 (1)</td>
<td>5 (1)</td>
<td>8 (2)</td>
</tr>
</tbody>
</table>

Graduation and Outstanding Student Award Ceremony (September 2019)
1. Special Subjects of the Department of Informatics

The Department of Informatics provides research and education conducted by world-class researchers within the state-of-the-art research environment and international atmosphere of NII. The Department covers a broad range of interdisciplinary fields, from fundamental disciplines such as mathematics to the basics of computer architecture and networking, and extending to software and media engineering, artificial intelligence, information sociology, and research methodologies. We have run a flexible educational system since the Department was first established, providing classes and research guidance in small groups in order to meet each student’s needs. Cutting-edge research and education are provided every day, with the aim of producing professionals capable of working at the forefront of the informatics field. The academic year consists of two semesters: the first running from April to September and the second semester running from October to March.

### Foundations of Informatics

- Logic in Computer Science (TATSUMI, Makoto; Theory of Numerical Methods (TDS), Algorithms (YAMADA, Yasuhiro), Discrete Mathematics (KAKARIAHARA, Ken-ichiro); Mathematical Logic (SUITA, Masahiro))

- Quantum Information Systems (NIMOTO, Tao; Quantum Computing (KUMODA, Masayoshi); Computational Neuroscience (TDS), Quantum Algorithms (KODAMA, Young))

- Control Theory and Optimization (KODAMA, Yasuo; Numerical Analysis (TDS), Graph Algorithms (TDS), Algorithmic Market Design (KOEYAMA, Yu))

- Computational Complexity Theory (NARAHASHI, Shunichi); Computational Game Theory (IGARASHI, Ayumi); Combinatorial Optimization for Machine Learning (FUKUI, Keita)

### Information Infrastructure Science

- Computer System Design (NOZAWA, Tomohiro; Computer Simulation (SUGIMOTO, Akihiro); Information and Communication Systems (J. Yashiro, ABE, Shu); TAKADA, Kiyotaka; HARADA, Mayuki)

- Prehistory: Models in Informatics (KIMOTO, Ayako; Mathematical Structures in Formal Methods (NAGAO, Akihiro))

- Database Theory (KATO, Hirono; Programming Language and Theory (TODA, Ken-ichiro); Formal Methods for Cyber-Physical Systems (KAWASUMI, Itsuo))

### Software Science

- Software Verification (SEKIYAMA, Taro); Embedded Real-Time Systems (AOKI, Shunsuke)

### Multimedia Information Science

- Digital Media Infrastructure (ENCHO, Isamu; Digital Media Infrastructure (ENCHO, Isamu); AOKI, Yoshisada; ISHIKAWA, Yutaka; YAMAGISHI, Junichi; KODAMA, Kazuya; IKEHATA, Satoshi; MO, Hiroshi; SATOH, Shin'ichi)

- Digital Image Processing (TSUKASA, Kaoru; Image Processing (TSUKASA, Kaoru)); Visual Computing (NAGAO, Akihiro; YAMAMOTO, Takayuki); Signal Processors (HASHIZUME, Hiromichi)

- Machine Learning (YOKOYAMA, Kenji); Natural Language Processing (KAWAHA, Aki; SUGANUMA, Kazuo); Robotics (INADA, Yusuke; TANAKA, Masaki; TANAKA, Shinya)

### Intelligent Systems Science

- Knowledge-Based Systems (YOKOYAMA, Reiko); Knowledge Sharing Systems (TSUKASA, Kaoru); Reasoning Science (SATOH, Ichiro); Human-Agent Interaction (YAMamoto, Sato)

- Cognitive Algorithms (NOSE, Michael); Communication Environments (ROHE, Magnus); Computational Social Science (ANAGA, Tadashi)

### Information Environment Science

- Digital Publications (SUGAWARA, Masaki); Informational Virtual Reality (NOBE, Ken); ICT Enabled Business (TSUKI, Hiroshi); Introduction to Statistical Methods in Biostatistics (SUGAI, Yuki); Methodology of Scientific Research (KODAMA, Masakazu)

### Common Subjects (Faculty of Change in the Department of Informatics)

- Research in Informatics for Ph.D. Thesis I, II; Research in Informatics for Master Thesis I, II

- Seminar on Basic Knowledge in Informatics I, II, III, IV

- Research in Informatics for Master Thesis I, II, III, IV

2. Common Specialized Subjects of the School of Multidisciplinary Studies

- Introduction to Mathematical Logic (TATSUMI, Makoto; Introduction to Algorithms (YAMADA, Yasuhiro), Quantum Information and Computing (NIMOTO, Tao; MATSUMOTO, Katsunori))

- High Performance Computing (KAD Ziguchi, HIROSHIMA, Yukiko; KODA, Motoki; TATEKUSA, Akira); Information Sharing System Architecture (KANAYAMA, Takeshi; TAKAHARA, Hiroki; KURUMOTO, Takaoki)

- Introduction to Software Science I (ENCHO, Isamu; Software Science I (ENCHO, Isamu); AOKI, Yoshisada; ISHIKAWA, Yutaka; YAMAGISHI, Junichi; KODAMA, Kazuya; IKEHATA, Satoshi; MO, Hiroshi; SATOH, Shin'ichi)

- Introduction to Multidisciplinary Science (YOKOYAMA, Reiko); Knowledge Sharing Systems (TSUKASA, Kaoru); Reasoning Science (SATOH, Ichiro); Human-Agent Interaction (YAMamoto, Sato)

- Introduction to Information Science I (SATOH, Ken; TAKEDA, Hideaki; PRENDERGAST, Helen); SUGAWARA, Masaki; NOBE, Ken; KANADA, Masaki; TANAKA, Takeshi; SUGAWARA, Saku)

- Introduction to Information Science II (SATOH, Ken; TAKEDA, Hideaki; PRENDERGAST, Helen); SUGAWARA, Masaki; NOBE, Ken; KANADA, Masaki; TANAKA, Takeshi; SUGAWARA, Saku)

Number of Students Accepted through Both Schemes: Partnership with Graduate Schools and Research Students for Special Collaboration (AY2020)

<table>
<thead>
<tr>
<th>University</th>
<th>Doctoral course</th>
<th>Master’s course</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University of Tokyo</td>
<td>45</td>
<td>33</td>
<td>78</td>
</tr>
</tbody>
</table>
Science Information NETwork (SINET) Available Nationwide at Ultra-High Speed with Low Latency

100G Full-mesh Connectivity Opens Up New Possibilities

The Science Information NETwork (SINET) is an information and communications network built and operated as an academic information infrastructure for universities and research institutions throughout Japan. With nodes (network connection points) across Japan, the advanced network is provided to universities and research institutes in order to help support community-building among the numerous people involved in research and education, and to encourage wide distribution of scientific information. SINET is also interconnected with many research networks overseas, including Internet2. In the U.S. and GÉANT in Europe, to facilitate the circulation of research information between countries that is vital for advanced international research projects.

SINET5 is an upgrade of the previous version of the network, SINET4. Full-scale operations of SINET5 started in April 2016. SINET5 provides high-level academic information platforms to more than 900 universities and institutions by organically connecting and coordinating cloud, security, and academic content infrastructures on a 100 Gbps nationwide network.

In December 2018, we launched the pilot test of a core function directly connecting mobile networks and SINET. The service enables users to flexibly use the computing resources of universities and cloud resources as needed for data collection and analysis using mobile networks. We also began operations of an international 100 Gbps ultra-high speed ring network circling the globe, Japan–U.S.–Europe–Japan, in March 2019. As a national research and education network (NREN), this is the world’s first international line circling the globe to be built as a single network. At the same time, we also upgraded the line between Japan and Singapore to 100 Gbps. To meet increasing traffic demand within Japan, we implemented a 400 Gbps line directly connecting Tokyo and Osaka in December 2019, which will enable stable, uninterrupted operations of scientific research projects. We believe these efforts will help to further strengthen international cooperation and Japan’s international competitiveness. We also hope that these will speed up the advanced integration of cyberspace (virtual space) and physical space (real space), and ultimately help achieve Society 5.0, Japan’s vision of the ideal society in the future.

Interconnection with Overseas Research Networks

SINET5 Services

We provide two services through joint consideration and development, based on requests from universities and institutes. SINET5 offers 100GE, 40GE, and other ultra-high-speed network interfaces. To create a secure and flexible research environment at universities and research institutes, we are expanding our network services to better serve our users; this effort includes university LAN virtualization, L2 on demand, and wide-area data collection infrastructure. We also provide the world’s most advanced high-speed file transfer software for users needing high-capacity data transfer.

Wide-Area Data Collection Infrastructure

In December 2018, we began pilot tests of a new service, the SINET Wide Area Data Collection Infrastructure. It offers a one-stop data collection and data processing service from mobile devices for use in research on the environment, sociology, and IoT, among others, bringing as one step closer to the realization of Society 5.0. This service allows users to collect research data from a wide range of areas that were previously unreachable by wired networks, using mobile networks provided by private mobile carriers. In conjunction with a secure network service, namely, 12GVPN, research data can be collected safely. Users can connect to various data processing environments and create a one-stop mobile research environment.
Five Major Concepts of SINET5

(1) Innovative Connectivity
- Taps leading-edge technologies that minimize communication lags
- The latest transmission technologies make it possible to create a full-mesh topology that minimizes transmission delays between all node connections.

(2) Ultra-High Speed
- Delivers a high-speed 100 Gbps nationwide network
- SINET5's state-of-the-art digital coherent technology created an overall stable 100 Gbps nationwide network

(3) Robust and Reliable
- Provides a highly robust and reliable network without interruptions or downtime
- SINET5 adopts a multilayered advanced network architecture (physical layer, MPLS-TP network layer, PMPLS network layer), with redundancies configured at each layer, as well as bottleneck avoidance and bypassing features, which are all linked together to create a highly robust and reliable network.

(4) Global Reach
- Offers ultra-high-speed international lines directly connected to the U.S., Europe, and Asia
- Low latency is achieved by building a direct line to Europe, not going through the U.S.
- SINET5 strengthens support for international joint research projects by upgrading to 100 Gbps bandwidth in all directions to the U.S., Europe, and Asia, in order to create a ring of connectivity between Japan, the U.S., and Europe.

(5) Multifunctionality
- Promotes a variety of developments in academic information infrastructure, such as security, use of cloud systems, and academic content

Features of SINET5

SINET was built and operated as a platform for (1) resource sharing of large testing facilities; (2) building the collaborative capabilities among research disciplines; (3) international collaboration with countries worldwide; (4) publishing academic information and sharing big data; (5) improving the quality of university education; and (6) knowledge-oriented contents of regional revitalization, local universities, and collaboration between industry and academia.

Cloud gateways are provided as a service to SINET5 members and other institutions, allowing SINET to support their cloud services.

GakuNin Cloud: Support for Cloud Adoption and Use

GakuNin Cloud Gateway Service
- Provides cloud services that can be used for research, education, and IT system operations.

SINET Cloud Connection Service
- Provides cloud connection to member institutions by directly connecting SINET and commercial clouds.
- SINET Cloud Connection (L2VPN) Service

GakuNin Cloud On-Demand Configuration Service
- Provides support for setting up complex applications environment over clouds.
- SINET Cloud Connection (L2VPN) Service

Research and Development Services
- Conducts research and development on cloud services.
- Focuses on cloud services for universities and research institutes.

Service
- Provides services for universities and research institutes.
- Offers cloud services for universities and research institutes.
- Provides cloud services for universities and research institutes.
- Supports universities and research institutes in using cloud services.

Organization Chart
- National Institute of Informatics
- National Institute of Informatics
- National Institute of Informatics
- National Institute of Informatics

For more information, please visit https://www.sinet.ad.jp/connect_service/service/cloud_connection.
GakuNin: Academic Access Management Federation in Japan

NII launched the UPKI Digital Certificate Issuance Service in January 2015 as a service for issuing digital certificates for universities and research institutions. In addition to the server certificates issued so far, NII also issues client certificates and code signing certificates. We continue to issue highly secure server certificates that conform to the unified international standards of the WebTrust for Certification Authorities (WTCA).

GakuNin strives to maintain reliability through annual assessments of IDP operations. GakuNin also offers Level of Assurance 1 (LoA1) authentication service as specified in the trust framework of the U.S. Federal Government’s Federal Identity, Credential, and Access Management (FICAM) guidelines. Universities that have been LoA1-accredited can use the U.S. government services, including the National Institutes of Health database. The Committee for Academic Authentication makes plans, draws up proposals, and manages GakuNin. Under this committee, four working groups have been established: (1) the Operation Working Group, which considers matters related to operations; (2) the Trust Working Group, which studies matters related to trust in GakuNin; (3) the Library Service Working Group, which considers matters related to the library’s services; and (4) the Next-generation Identity Federation Working Group, which studies matters toward realizing new trust framework for developing and evolving academic authentication.

Issuing Digital Certificates: UPKI Digital Certificate Issuance Service

NII launched the UPKI Digital Certificate Issuance Service in January 2015 as a service for issuing digital certificates for universities and research institutions. In addition to the server certificates issued so far, NII also issues client certificates and code signing certificates. We continue to issue highly secure server certificates that conform to the unified international standards of the WebTrust for Certification Authorities (WTCA). The use of these server certificates secures web security in that they certify the authenticity of the web server provider (domain name and organization name), which makes it easier to distinguish authentic sites from phishing ones. We also issue client certificates to individuals of member institutions, which can be used for authentication and signing emails, as well as for multifactor authentication and preventing identity theft. Additionally, by signing software, code signing certificates verify the identity of the developer and ensure that the code has not been tampered with. This helps users determine whether to trust and use the software.

The UPKI Digital Certificate Issuance Service aims to improve the security of universities and research institutions as a whole by providing these certificates for their use.

Institutions using UPKI Digital Certificate Issuance Service

<table>
<thead>
<tr>
<th>(as of the end of March 2021)</th>
<th>Number of institutions</th>
<th>Number of domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>285</td>
<td>469</td>
</tr>
</tbody>
</table>

eduroam: World-wide Academic Wireless LAN Roaming Platform

eduroam is an academic wireless LAN roaming platform developed by GEANT (formerly TERENA) in Europe, enabling shared access of on-campus Wi-Fi across universities and other research and educational institutions. Introduced in Japan in 2006 as part of NII’s University Public Key Infrastructure (UPKI) project under the name “eduroam JP,” NII operates, provides support for, and develops the technology of the platform. eduroam is based on the industry-standard IEEE 802.1X, meaning that it is able to provide a safe and convenient wireless LAN environment.

<table>
<thead>
<tr>
<th>eduroam JP participants (as of the end of March 2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participating institutions in Japan: 365</td>
</tr>
</tbody>
</table>

Supporting Information Security Framework through Inter-University Collaboration

NII established the Center for Cybersecurity Research and Development in 2016 to support the creation of a framework that enables national universities and other institutions to quickly respond to incidents and accidents due to cyberattacks, while the NII Security Operation Collaboration Services (NI-SOCS) began operations in 2017. We develop cybersecurity experts through inter-university collaboration and at the same time apply our research findings as appropriate on detecting attacks and improving defense capabilities. Our aim is to improve the quality of cybersecurity infrastructure at national universities and other institutions and to carry out R&D that will provide an environment that promotes cybersecurity research, as well as a safe and secure educational and research environment for all academic and research fields.

Organizations and Service Operations

The operations of the Science Information NETwork are carried out through the collaboration and cooperation of information technology centers at universities and research institutions and four R&D centers at NII, under the supervision of a joint organization of universities and research institutions and NII called the Organization for Science Network Operations and Coordination.

<table>
<thead>
<tr>
<th>University and Research Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>University A</td>
</tr>
<tr>
<td>University B</td>
</tr>
<tr>
<td>University C</td>
</tr>
<tr>
<td>University D</td>
</tr>
<tr>
<td>University E</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Universities and Research Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Task Force</td>
</tr>
<tr>
<td>Networking Task Force</td>
</tr>
<tr>
<td>Cloud Task Force</td>
</tr>
<tr>
<td>Security Task Force</td>
</tr>
<tr>
<td>Task Force for Information Security</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>National Institute of Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and Development Center</td>
</tr>
<tr>
<td>Research and Development Center</td>
</tr>
<tr>
<td>Research Center for Open Science</td>
</tr>
<tr>
<td>Cybersecurity Infrastructure</td>
</tr>
<tr>
<td>Academic Information Security</td>
</tr>
</tbody>
</table>

Research Program

Organization

Supporting Information Security Framework through Inter-University Collaboration

NII established the Center for Cybersecurity Research and Development in 2016 to support the creation of a framework that enables national universities and other institutions to quickly respond to incidents and accidents due to cyberattacks, while the NII Security Operation Collaboration Services (NI-SOCS) began operations in 2017. We develop cybersecurity experts through inter-university collaboration and at the same time apply our research findings as appropriate on detecting attacks and improving defense capabilities. Our aim is to improve the quality of cybersecurity infrastructure at national universities and other institutions and to carry out R&D that will provide an environment that promotes cybersecurity research, as well as a safe and secure educational and research environment for all academic and research fields.

Organizations and Service Operations

The operations of the Science Information NETwork are carried out through the collaboration and cooperation of information technology centers at universities and research institutions and four R&D centers at NII, under the supervision of a joint organization of universities and research institutions and NII called the Organization for Science Network Operations and Coordination.

<table>
<thead>
<tr>
<th>University and Research Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>University A</td>
</tr>
<tr>
<td>University B</td>
</tr>
<tr>
<td>University C</td>
</tr>
<tr>
<td>University D</td>
</tr>
<tr>
<td>University E</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Universities and Research Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Task Force</td>
</tr>
<tr>
<td>Networking Task Force</td>
</tr>
<tr>
<td>Cloud Task Force</td>
</tr>
<tr>
<td>Security Task Force</td>
</tr>
<tr>
<td>Task Force for Information Security</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>National Institute of Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and Development Center</td>
</tr>
<tr>
<td>Research and Development Center</td>
</tr>
<tr>
<td>Research Center for Open Science</td>
</tr>
<tr>
<td>Cybersecurity Infrastructure</td>
</tr>
<tr>
<td>Academic Information Security</td>
</tr>
</tbody>
</table>

Research Program

Organization

Supporting Information Security Framework through Inter-University Collaboration

NII established the Center for Cybersecurity Research and Development in 2016 to support the creation of a framework that enables national universities and other institutions to quickly respond to incidents and accidents due to cyberattacks, while the NII Security Operation Collaboration Services (NI-SOCS) began operations in 2017. We develop cybersecurity experts through inter-university collaboration and at the same time apply our research findings as appropriate on detecting attacks and improving defense capabilities. Our aim is to improve the quality of cybersecurity infrastructure at national universities and other institutions and to carry out R&D that will provide an environment that promotes cybersecurity research, as well as a safe and secure educational and research environment for all academic and research fields.

Organizations and Service Operations

The operations of the Science Information NETwork are carried out through the collaboration and cooperation of information technology centers at universities and research institutions and four R&D centers at NII, under the supervision of a joint organization of universities and research institutions and NII called the Organization for Science Network Operations and Coordination.
Research Data Management Platform

GakuNin RDM

A platform for managing and sharing research data and materials generated during the research project among researchers and their supporters. GakuNin RDM enables effective file management among collaborators by linking with existing storage and research tools. It also has a time-stamping function for research trail tracking and providing research integrity. GakuNin RDM is equipped with a customizing function, so that researchers and institutions can utilize it as a research data management system.

Publishing Platform

WEKO3

A platform for researchers and their supporters to publish and communicate their research outputs, such as research papers and data. The researchers can easily add identifiers and metadata of their research outputs by linking with this platform and GakuNin RDM and post them on the repository of their affiliated institution in formats suitable for research dissemination. The platform is designed to be flexible and expandable and apply as an institutional repository JAIRO Cloud or as a subject repository.

Discovery Platform

CiNii Research

A platform aggregates information from the WEKO3 and other institutional databases and provides a comprehensive search for scholarly resources. Research data are closely related to scholarly articles, bibliographies, and other literature, as well as with the researchers and research projects that produced these academic resources. This discovery platform's core is a large-scale scholarly knowledge graph that interactively links all this information together. CiNii Research helps with making discoveries by providing the ability to navigate through these complex relationships intuitively.

Support for Construction and Linkage of Institutional Repositories (JAIRO Cloud)

NII supports the construction and linkage of institutional repositories that publicly disseminate the results of education and research conducted by universities and other institutions. As well as these activities, we promote open access, with the aim of helping establish the next generation of academic content platforms. NII has provided support for content expansion, system linkage and community building at academic institutions in Japan, and has built and operated institutional repositories for over 810 institutions.

JAIRo Cloud: Shared Repository Service

NII provides an environment for a shared repository system as a cloud service, based on the NII-developed institutional repository software WEKO (http://www.at.nii.ac.jp), for institutions that find difficulty constructing and operating their own repositories.

Integrated Search of Academic Information in Institutional Repositories in Japan

IRDB: Institutional Repositories Database

Enables integrated searching of education and research results (journal articles, theses or dissertations, departmental bulletin papers, research papers, learning materials, etc.) at universities and other institutions that are stored in institutional repositories in Japan. Full texts are available to users through this system as well as access via CiNii. This service took over from JAIRo, an institutional repository portal, which ended operations in March 2019.

Number of IRDB records

<table>
<thead>
<tr>
<th>Data on coverage</th>
<th>(as of the end of March 2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of institutional repositories</td>
<td>745</td>
</tr>
<tr>
<td>Contents</td>
<td>3.31 million items</td>
</tr>
</tbody>
</table>

* These three platforms will go into full-scale operation in 2021.

JPCOAR: Japan Consortium for Open Access Repository

JPCOAR is a community of institutions with repositories where universities and other research institutions in Japan can work more effectively on their efforts to widely disseminate research results and enhance the significance of building and operating institutional repositories. The consortium also works on improving scholarly communication, which includes open science, as well as on joint operation of the institutional repository system platform JAIRO Cloud. NII supports these activities as well as JPCOAR by providing assistance such as physical support for collaboration with university libraries.

* Figures before FY2018 are JAIRO statistics

<table>
<thead>
<tr>
<th>Number of institutional repositories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

* Categories for the number of contents are based on the CiNii service (as of March 2021)
CiNii Articles: Searching for Research Papers in Japan
https://ci.nii.ac.jp

Contains information on over 20 million Japanese academic articles published in academic society journals and research bulletins, and articles included in the Japanese Periodicals Index Database of the National Diet Library, among others.

Data on coverage (as of the end of March 2021)

- Number of articles on which information is included: 22.52 million

CiNii Books: Searching for Books in University Libraries
https://ci.nii.ac.jp/books/en

Enables search of information on books and journals held by university libraries in Japan. Contains book and author information on about 12 million titles held by university libraries nationwide, which were stored through the Catalog Information Service (NACSIS-CAT) operated by NII.

Data on coverage (as of the end of March 2021)

- Number of bibliographic records: 12.38 million
- Number of holding records: 146.53 million
- Number of participating libraries: 1,326

CiNii Dissertations: Searching for Doctoral Dissertations in Japan
https://ci.nii.ac.jp/d/en

Enables comprehensive centralized searching of doctoral dissertations in Japan. In addition to dissertation texts digitized by the National Diet Library, enables searching and viewing of dissertation texts publicly available in institutional repositories of universities and research institutes.

Data on coverage (as of the end of March 2021)

- Number of doctoral dissertation records: 610,000
- Number of full texts from dissertation records: Approximately 280,000

Database of Grants-in-Aid for Scientific Research
KAKEN: Database of Grants-in-Aid for Scientific Research
https://kaken.nii.ac.jp/en

This database enables users to browse adopted projects, as well as reports and summaries of research conducted through funds from the Grants-in-Aid for Scientific Research implemented by the Ministry of Education, Culture, Sports, Science and Technology and the Japan Society for the Promotion of Science. It provides access to the latest research in a wide range of fields in Japan. The system developed by KAKEN is also used in the JST project database (https://jst.purl.go.jp), which contains research projects funded by the Japan Science and Technology Agency (JST).

Data on coverage (as of the end of March 2021)

- Number of adopted projects: 942,250

Catalog Information Service
The Catalog Information Service consists of the online cataloging system (NACSIS-CAT) and the interlibrary loan system (NACSIS-ILL).

NACSIS-CAT: Online Cataloging System
NACSIS-CAT is a system for creating a unified and comprehensive database designed to instantly provide information on the academic literature (books and journals) archived at university libraries and similar institutions throughout Japan. To form the database efficiently, the cataloging system has the capability to refer to standard cataloging data (MARC), and university libraries and other institutions nationwide share the work of inputting records online.

Registration and usage data (as of the end of March 2021, * indicates figure for one year, FY2020)

<table>
<thead>
<tr>
<th>Number of institutions participating in NACSIS-CAT</th>
<th>Cumulative number of registered books</th>
<th>Number of institutions participating in NACSIS-ILL</th>
<th>Number of NACSIS-ILL copies*</th>
<th>Number of NACSIS-ILL loans*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,316</td>
<td>7,355.2 billion</td>
<td>1,107</td>
<td>388,000</td>
<td>65,000</td>
</tr>
</tbody>
</table>

NACSIS-ILL: Interlibrary Loan System
NACSIS-ILL is a system that makes use of the unified and comprehensive catalog database created by the NACSIS-CAT cataloging system to support the exchange of books and journal articles between libraries, thereby facilitating the provision of academic literature to researchers at universities and institutions.

NACSIS-ILL also supports interlibrary loan services with university libraries overseas by linking to ILL systems such as KERIS in South Korea, and promotes more efficient library operations through ILL document copying and other services.

Database Sharing Service for Electronic Resources
ERDB-JP: Electronic Resources Database-JAPAN
https://erdb-jp.nii.ac.jp/en

ERDB-JP is a service that builds and shares knowledge bases (databases) of electronic resources, such as e-journals and e-books, published in Japan. ERDB-JP is operated by NII and the E-resources Data Sharing Working Group, which is made up of staff responsible for managing e-resources at universities. Content metadata are collected and updated in collaboration with partner institutions encompassing universities, publishers, and knowledge base vendors. The collected content metadata are made available under CC0 licenses. They can be imported and used to create lists of e-resource titles for use in OPAC and discovery services provided by universities and other institutions.

The application for ERDB-JP can now be carried out at the same time as the application for JAIRO Cloud.

Number of participating institutions

<table>
<thead>
<tr>
<th>Partner A</th>
<th>Partner B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>National universities</td>
<td>Public universities</td>
<td>Private universities</td>
</tr>
<tr>
<td>38</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>47</td>
<td>6</td>
<td>43</td>
</tr>
</tbody>
</table>

Data registrations (as of the end of March 2021)

<table>
<thead>
<tr>
<th>Number of registrations</th>
<th>Number of new registrations (FY2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21,284</td>
<td>481</td>
</tr>
</tbody>
</table>
We offer education and training services such as those below to develop human resources in universities and other institutions who work on academic information infrastructure in Japan.

- Training courses (WACSIS-CAT/IL self-learning)
- Specialized training courses (bibliography creativity for catalog systems, information processing technology seminars)
- Comprehensive training (NII on-the-job training, comprehensive IT training for university librarians), etc.

Promoting Scholarly Communication

[https://www.nii.ac.jp/p랩/pw/]

SPARC Japan

Since FY2003, SPARC Japan has been working together with academic societies and university libraries in Japan. In collaboration with SPARC Japan and SPARC Europe, to promote the digitization and internationalization of academic journals, published by academic societies and other organizations in Japan, to help improve national standards for scholarly communication, and at the same time to promote the wider dissemination of the achievements of academic, scientific, and technological research in Japan. In particular, the SPARC Japan Seminars address the latest issues in scholarly communication and function as a forum for stakeholders on academic information.

The coalition moved under the Academic Information Distribution Promotion Committee from FY2016, and is engaged in assessing the trends and actual conditions of scholarly communication in Japan and overseas, considering and coordinating strategies for publishing and use of academic information, and carrying out advocacy work in collaboration with stakeholders mainly from the academic community, with the ultimate goal of promoting open access and open science.

Future Scholarly Information Systems Committee

[https://contents.nii.ac.jp/korekara]

The Committee was established with the aim of further promoting activities related to the building, management, sharing, and provision of platforms for scholarly information resources. The Committee is composed of university library staff recommended by national, public, and private university library associations and councils, experts, and NII staff. In addition to identifying the various issues that are relevant to the future of scholarly information systems, the Committee also reviews future visions of systems and their operating communities, as well as aims to achieve these visions.

NI offers support for its activities, carried out by JUSTICE, with a full-time staff on loan from university libraries.

Japan Alliance of University Library Consortia for E-Resources

JUSTICE: Japan Alliance of University Library Consortia for E-Resources

[https://www.nii.ac.jp/sparc/en/]

One of the world’s largest consortia of over 500 participating national, public, and private university libraries, with the aim of implementing a range of activities that provide stable and uninterrupted access to academic information from online journals and other resources.

NI established the JUSTICE Secretariat in the Library Liaison Cooperation Office to support the activities carried out by JUSTICE, with a full-time staff on loan from university libraries.

Consortia for E-Resources

The Council has also partnered with the Japan Consortium for Open Access Repository for services related to institutional repositories.

Council for Promotion of Cooperation Between University Libraries and the National Institute of Informatics

NI entered into an agreement with the Japanese Coordinating Committee for University Libraries to promote services in collaboration with university libraries. The Council for Promotion of Cooperation Between University Libraries and the National Institute of Informatics was established under this agreement. The Council, together with the Japan Alliance of University Library Consortia for E-Resources and the Future Scholarly Information Systems Committee established under it, carries out collaborative and cooperative services related to digital materials and scholarly communication.

The Council has also partnered with the Japan Consortium for Open Access Repository for services related to institutional repositories.

Digital Archives

[https://www.nii.ac.jp/index_en.html]

NII is engaged in the following activities to store and provide digital academic information on a permanent basis.

NI-REO: NII Repository of Electronic Journals and Online Publications

Back issues of online journals outside Japan (approximately 4.12 million records) and electronic collections in the field of humanities and social sciences (approximately 660,000 records) are stored on NI servers and provided to universities in Japan. Electronic resources archived in NI-REO are maintained in collaboration with the Japan Alliance of University Library Consortia for E-Resources (JUSTICE).

Archived contents

<table>
<thead>
<tr>
<th>Online Journal Archives</th>
<th>Years covered</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springer Online Journal Archive</td>
<td>1992-1999</td>
<td>Journal titles: Approx. 1,500; Number of records: Approx. 2 million</td>
</tr>
<tr>
<td>Springer Lecture Note in Computer Science</td>
<td>1971-2003</td>
<td>Title: 1,501</td>
</tr>
<tr>
<td>Isoft Journal Archive Collection</td>
<td>1997-2020</td>
<td>Journal titles: 800; Number of records: Approx. 260,000</td>
</tr>
<tr>
<td>AtomOnline</td>
<td>1994-2021</td>
<td>Journal titles: 76; Number of records: Approx. 250,000</td>
</tr>
<tr>
<td>IEEE Computer Society Digital Library (CSDL)</td>
<td>1998-2011</td>
<td>Journal titles: 124; Number of records: Approx. 230,000</td>
</tr>
<tr>
<td>Taylor &amp; Francis Online: Journals Classic Archives (science and engineering collections in three fields)</td>
<td>1798-1998</td>
<td>Journal titles: Approx. 100; Number of records: Approx. 1,100</td>
</tr>
<tr>
<td>Humanities and Social sciences electronic collection</td>
<td>1801-2004</td>
<td>Number of records: Approx. 180,000</td>
</tr>
<tr>
<td>Novum / Twelfth Century Hears of Commons Parliamentary Papers (17th HCPP &amp; 21st HCPP)</td>
<td>1892-1934</td>
<td>Number of records: Approx. 50,000</td>
</tr>
<tr>
<td>The Making of the Modern World: Germanic / Arno Library of Economic Literature (MOMW)</td>
<td>1450-1700</td>
<td>Number of records: Approx. 150,000</td>
</tr>
<tr>
<td>The Making of the Modern World, Part II (MOMW II)</td>
<td>1701-1800</td>
<td>Number of records: Approx. 100,000</td>
</tr>
<tr>
<td>Eighteenth Century Collections Online</td>
<td>1701-1800</td>
<td>Number of records: Approx. 100,000</td>
</tr>
<tr>
<td>Early English Books Online</td>
<td>1470-1700</td>
<td>Number of records: Approx. 130,000</td>
</tr>
<tr>
<td>American Historical Imprints Series (U.S.)</td>
<td>1639-1800</td>
<td>Number of records: Approx. 160,000 (scheduled for registration from 2021)</td>
</tr>
<tr>
<td>The Making of the Modern World Part III (MOMW III)</td>
<td>1801-2004</td>
<td>Number of records: Approx. 5,000 (scheduled for registration from 2021)</td>
</tr>
</tbody>
</table>

Electronic resources archived in NII-REO are maintained in collaboration with the Japan Alliance of University Library Consortia for E-Resources (JUSTICE).

660,000 records) are stored on NII servers and provided to universities in Japan.

Back issues of online journals outside Japan (approximately 4.12 million records) and electronic collections in the field of humanities and social sciences (approximately 660,000 records) are stored on NII servers and provided to universities in Japan.

Since FY2003, SPARC Japan has been working together with academic societies and university libraries in Japan. In collaboration with SPARC Japan and SPARC Europe, to promote the digitization and internationalization of academic journals, published by academic societies and other organizations in Japan, to help improve national standards for scholarly communication, and at the same time to promote the wider dissemination of the achievements of academic, scientific, and technological research in Japan.

In particular, the SPARC Japan Seminars address the latest issues in scholarly communication and function as a forum for stakeholders on academic information.

The coalition moved under the Academic Information Distribution Promotion Committee from FY2016, and is engaged in assessing the trends and actual conditions in scholarly communication in Japan and overseas, considering and coordinating strategies for publishing and use of academic information, and carrying out advocacy work in collaboration with stakeholders mainly from the academic community, with the ultimate goal of promoting open access and open science.

We offer education and training services such as those below to develop human resources in universities and other institutions who work on academic information infrastructure in Japan.

- Training courses (WACSIS-CAT/IL self-learning)
- Specialized training courses (bibliography creativity for catalog systems, information processing technology seminars)
- Comprehensive training (NII on-the-job training, comprehensive IT training for university librarians), etc.

Promoting Scholarly Communication

[https://www.nii.ac.jp/pラブ/pw/]

SPARC Japan

Since FY2003, SPARC Japan has been working together with academic societies and university libraries in Japan. In collaboration with SPARC Japan and SPARC Europe, to promote the digitization and internationalization of academic journals, published by academic societies and other organizations in Japan, to help improve national standards for scholarly communication, and at the same time to promote the wider dissemination of the achievements of academic, scientific, and technological research in Japan.

In particular, the SPARC Japan Seminars address the latest issues in scholarly communication and function as a forum for stakeholders on academic information. The coalition moved under the Academic Information Distribution Promotion Committee from FY2016, and is engaged in assessing the trends and actual conditions in scholarly communication in Japan and overseas, considering and coordinating strategies for publishing and use of academic information, and carrying out advocacy work in collaboration with stakeholders mainly from the academic community, with the ultimate goal of promoting open access and open science.

Education and Training Services

[https://contents.nii.ac.jp/en/tnt/]

NI offers education and training services such as those below to develop human resources in universities and other institutions who work on academic information infrastructure in Japan.

- Training courses (WACSIS-CAT/IL self-learning)
- Specialized training courses (bibliography creativity for catalog systems, information processing technology seminars)
- Comprehensive training (NII on-the-job training, comprehensive IT training for university librarians), etc.
Operating and Maintaining the Authentication Infrastructure for the High Performance Computing Infrastructure (HPCI)

HPCI connects supercomputers and storage systems installed at universities and research institutes across Japan, with the supercomputer Fugaku, installed in Kobe, at its core. This creates a revolutionary shared computing infrastructure that meets the diverse needs of a wide range of users, including the industrial sector. The second phase of the project began in FY2017. HPCI has an authentication system that allows users to gain access to any computing resource by using a unified login account, and offers users a platform that is easy to use. In collaboration with supercomputer Fugaku, as well as universities and research institutes nationwide, NII continues its work started in the first phase of the project, operating and maintaining the authentication system that forms the core of the unified account authentication, which includes a certification authority and certificate issuance system. The authentication system ensures communication and data security through a highly secure framework that uses digital certificates for HPCI users, and also provides a single sign-on system that enables users to seamlessly use the supercomputers and storage resources in the HPCI. Moreover, NII plays a central role in the survey and research of rapidly advancing authentication infrastructure technologies and international usage trends. We carry out R&D on next-generation authentication platforms while considering the utilization of existing technologies and systems in addition to new technologies, with the aim of both improving user convenience and boosting the efficiency of its operations and management. The Science Information Network (SINET) takes over the responsibility of providing the essential high-speed network infrastructure for linking supercomputers in remote areas and sharing massive amounts of test data and calculation results.

NII Library: Contributing to Informatics Research and Education

As a facility for informatics research and education, the NII Library provides online journals, as well as books, journals, and other resources, in the field of informatics. Moreover, the Library is under the mutual library use agreement with the neighboring Meiji University Library, in order to provide access to references for graduate students of SOKENDAI. HPCI connects supercomputers and storage systems installed at universities

<table>
<thead>
<tr>
<th>Facilities and equipment</th>
<th>Area</th>
<th>Seats</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading room</td>
<td>140 m²</td>
<td>10</td>
<td>Automated book lending/returning machine</td>
</tr>
<tr>
<td>Stack room</td>
<td>151 m²</td>
<td>—</td>
<td>Copier</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major online journals and databases</th>
<th>Service Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACM Digital library</td>
<td>Association for Computing Machinery</td>
</tr>
<tr>
<td>APS-ALL Package</td>
<td>American Physical Society</td>
</tr>
<tr>
<td>IEEE/IET Electronic Library</td>
<td>IEEE/IET</td>
</tr>
<tr>
<td>JCP</td>
<td>JCP Publishing</td>
</tr>
<tr>
<td>JUP</td>
<td>Oxford University Press</td>
</tr>
<tr>
<td>NII Library</td>
<td>Springer Nature</td>
</tr>
<tr>
<td>Science</td>
<td>American Association for the Advancement of Science</td>
</tr>
<tr>
<td>SpringerLink</td>
<td>Springer Nature</td>
</tr>
<tr>
<td>Springer eBooks</td>
<td>Springer Nature</td>
</tr>
<tr>
<td>Web of Science</td>
<td>Clarivate Analytics</td>
</tr>
<tr>
<td>Wiley Online Library</td>
<td>John Wiley &amp; Sons, Inc.</td>
</tr>
<tr>
<td>Elsevier Digital Library</td>
<td>Institute of Electrical, Information and Communication Engineers</td>
</tr>
<tr>
<td>IPSJ Digital Library</td>
<td>Information Processing Society of Japan</td>
</tr>
</tbody>
</table>

Symposium on DX at Educational Institutions—Cyber-Symposium on Online Education and Digital Transformation at Universities and Other Institutions

Taking into consideration the situation with the COVID-19 pandemic, in late March 2020, NII began hosting a series of events titled “Symposium on DX at Educational Institutions—Cyber-Symposium on Online Education and Digital Transformation at Universities and Other Institutions” at a weekly to biweekly pace. The purpose of these events was to share as much information as possible about distance education at universities and other institutions. (Please note the initially planned title of these events was “Cyber-Symposium for Information Sharing on Remote Teaching Efforts at Universities since April.”) The lectures given at these events covered a wide range of regularly occurring, pressing issues related to remote learning at universities and other institutions, as well as to digital transformation of education. This included discussions on precedents of distance education and exchange of information, interpretation of Copyright Law and recent amendments, actual relevant cases at overseas universities, methods of practice at medical and engineering schools, online support for students, and hybrid lessons that included face-to-face teaching.

In total, 29 sessions were held in the first year and approximately 37,000 people, mainly from universities and other higher education institutions, took part. Overall, more than 260 lectures were given during this period and the uploaded video recordings viewed more than 216,300 times. This symposium series has made a visible contribution to the sharing of information, demonstrating how universities and other institutions have responded to the COVID-19 pandemic and facilitated digital transformation in their classes.

Number of books and journal titles

<table>
<thead>
<tr>
<th>Reference type</th>
<th>Books</th>
<th>Pre-journals</th>
<th>Journal (number of titles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese</td>
<td>15,456</td>
<td>9,734</td>
<td>180</td>
</tr>
<tr>
<td>Foreign</td>
<td>8,023</td>
<td>8,313</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>23,479</td>
<td>18,047</td>
<td>187</td>
</tr>
</tbody>
</table>
**Public Communications**

### Communicating NII’s Research and Services to Society at Large

NII holds open houses and public lectures at the institute, conducts special classes for high school and technical college students, creates exhibits for exhibitions, issues printed publications, and carries out other activities, in order to share the latest info-tech-related research findings widely with society at large and deepen understanding of its projects and services. We also strive to provide timely information about our website, newsletters, and social media (Twitter, Facebook).

**NII Open House**

NII holds an annual Open House to open NII to the public and present the results of its various research projects to a broad audience that includes the general public, researchers, and graduate school students. In FY2020, the event was held online for the first time, featuring live-streaming of the keynote lecture and discussions, as well as virtual poster sessions. At the Computer Science Park, participating children could experience an interactive virtual workshop.

**Public Lectures**

NII holds free lectures for the general public from time to time.

- **National Institute of Informatics Public Lectures:**
  - At the Forefront of Informatics
  - For All Ages!

**Special Classes at High Schools and Technical Colleges**

NII researchers visit high schools and technical colleges to present the latest research findings in simple terms. The aim is to bring information closer to the students, who will experience it for the first time, and foster their interest in informatics. (The events were covered in FY2020.)

**Exhibitions**

NII participates in various exhibitions to introduce its research findings, operations, and services. In FY2020, we took part in the Inter-University Research Institute Symposium, which was held online for the first time, with live-streaming of the research discussions on the first day and an online exhibition on the second.

**Digital Media (Japanese except Website)**

Visit the website for details of events and publications.

- Website (English)
- YouTube channel
  - Watch videos of lectures and research presentations.
- Email newsletter
  - Subscribe via the website.
- Twitter
  - Official NII account (jouhouken)
- Facebook
  - NII Japan (Japanese except Website)

**Titles and Release Dates**

<table>
<thead>
<tr>
<th>Title</th>
<th>Release date</th>
</tr>
</thead>
<tbody>
<tr>
<td>The latest lecture was transmitted in the June 2020 Open House.</td>
<td></td>
</tr>
<tr>
<td>Karazawazawa Saturday Salon</td>
<td><a href="https://www.nii.ac.jp/en/event/saturday/salon/">https://www.nii.ac.jp/en/event/saturday/salon/</a></td>
</tr>
<tr>
<td>Lectures on informatics and many other fields are held at the International Seminar House for Advanced Studies in Karazawazawa, Nagano Prefecture several times a year for local residents. The events were all canceled in FY2020. A portion of the contents of past lectures has been published in six volumes of the Collection of Lectures from the Karazawazawa Saturday Salon. Harmony of Intelligence and Art (Karuizawa Doyo Kanwakai Koenshu: Chi to Bi no Hamoni), and is also available on the NII Japanese website.</td>
<td></td>
</tr>
</tbody>
</table>

**Organizations**

### News Releases

**Public Communications**

**Research**

**Graduate Course**

**Organization**

**Other**

**Title**

**Release date**

<table>
<thead>
<tr>
<th>Title</th>
<th>Release date</th>
</tr>
</thead>
<tbody>
<tr>
<td>CESCO and the National Institute of Informatics will jointly support distance education for universities, junior colleges and technical colleges; CESCO will provide its Web site special support program for higher education institutions for the first 100 days.</td>
<td>April 1, 2020</td>
</tr>
<tr>
<td>NII Director-General KITSUGEISHI, Masayoshi is awarded the Japan Academy Prize for pioneering research in the theory and application of large-scale high-performance database systems.</td>
<td>April 6</td>
</tr>
<tr>
<td>Yokohama University Professor SUNE, Hisashi, Yokohama University Special Appointed Associate Professor NAKAYAMA, Yoshikatsu, NII Professor Professor SUGITA, Katsuhiko, Chuo University Professor OFIuchi, Akira, and Koke Sakuragi University Professor OYAMA, Masami (jointly receive Commendation by the Minister of Education, Culture, Sports, Science and Technology and the Science and Technology Award (enhancement of understanding category) for promoting and enhancing public awareness of information security regulations and teaching materials for higher education institutions.</td>
<td>April 7</td>
</tr>
<tr>
<td>DIYOMA, N. visiting professor associate professor at NII and the University of Tokyo Graduate School of Humanities and Sociology, receives the FY2020 Commendation from the Minister of Education, Culture, Sports, Science and Technology and the Science and Technology Award (development category) for his achievements in the development of the academic informatics service infrastructure DMT.</td>
<td>April 7</td>
</tr>
<tr>
<td>NII Associate Professor KISHIDA, Masaki receives the Young Scientists’ Prize in the FY2020 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology for his research on information processing in living organisms that is a new interpretation of the structural singular value and research on its application to systems science</td>
<td>April 24</td>
</tr>
<tr>
<td>MIT BiLink and NII offering a secure remote videoconference service for staff at universities, research institutes, and medical institutions nationwide.</td>
<td>April 29</td>
</tr>
<tr>
<td>The public-private sector collaborative program to develop “Experts in Information Science” is launched, in which young researchers engaged in cutting-edge research in the field of informatics directly select high-school students and other students through joint research projects to foster them into becoming elite researchers in their 20s.</td>
<td>May 20</td>
</tr>
<tr>
<td>This year’s NII Open House 2020 will be held online. Kikunage, Japan Business Federation Chairman KANASHI, Motonori will deliver a keynote speech on June 12, with an online discussion space to be set up with NII researchers. SATOH, Shinichi, head, NII Research Center for Medical Bigdata, will give a keynote speech on June 13, when the Computer Science Park Playground will also be held to help participants learn programming thinking through play.</td>
<td>June 10</td>
</tr>
<tr>
<td>ADDITIONAL CONTENTS FOR JUNE 12-13 ONLINE NII OPEN HOUSE 2020. On JUNE 12, Kikunage, Motonori Chairman KANASHI, Motonori, LINE Corp. CEO DINGWALI, Takashi, and TANAYA, Yoshinobu, program director for the Cabinet Office Director-General for Science, Technology and Innovation Policy (Yamato Information executive officer in charge of IT), will hold discussions with NII Director-General KITSUGEISHI, Masayoshi, the first day session will also feature a special session of the ongoing cyber symposium series to discuss “the new normal of distance education.” On June 13, four speakers will give lectures on topics related to responsive to COVID-19 based on natural language processing, big data, CT and AI, remote reporting of the Computer Science Park will also be presented.</td>
<td>June 10</td>
</tr>
<tr>
<td>Development of a method to achieve both the accuracy of coverage of theories of planning and computation; one way for high-speed computation in quality verification of industrial products, autonomous driving, strategies for market investment, and more.</td>
<td>July 13</td>
</tr>
<tr>
<td>A platform for AI analysis of CT images of nervous diseases (COVID-19) has been developed, in which CT images collected from hospitals nationwide are selected by one-time information and turned into high-quality AI research purpose datasets.</td>
<td>September 29</td>
</tr>
<tr>
<td>The COVID-19 Data Portal Japan is launched. Graphs access to the research data of the novel coronavirus disease is made available.</td>
<td>October 5</td>
</tr>
<tr>
<td>NII with other institutions have discovered that time crystals can be used to simulate complex quantum networks, raising possibilities of new simulations that run on quantum computers.</td>
<td>October 17</td>
</tr>
<tr>
<td>A new circuit compression method is developed, which will bring smaller and faster quantum computers one step closer; the new technology is expected to accelerate development of large-scale quantum computing.</td>
<td>November 12</td>
</tr>
<tr>
<td>NII begins providing property information data, supplied by a real estate information network comprising more than 58,000 outlets nationwide, for academic research and educational services.</td>
<td>December 15</td>
</tr>
<tr>
<td>The Cyber Auditorium service is launched to help educational institutions from elementary schools to universities and research institutions hold education and research events online.</td>
<td>December 11</td>
</tr>
<tr>
<td>New variations are added to LINE Stamps of NII’s official character, “Johoken Bit-kun”; in the new third edition, 16 different stamps selected through online voting are available.</td>
<td>January 22, 2021</td>
</tr>
<tr>
<td>NII provides digital equipment for remote education and programming education to support digital transformation of various degrees of education from elementary school to universities and research institutions nationwide.</td>
<td>January 29</td>
</tr>
<tr>
<td>Full operation of the research data management platform “Yakuoku ROM” commences to support management/searching of research data among academic institutions nationwide.</td>
<td>February 10</td>
</tr>
<tr>
<td>A joint industry-government-academia team, comprising NII members, receives the highest level of praise for its disaster scenario description from aerial images that relating taxis arrested at disaster-related image recognition at the TRC Video Retrieval Evaluation (TRECVID) conference hosted by the U.S. Institute of Standards and Technology.</td>
<td>February 10</td>
</tr>
<tr>
<td>An AI-driven social collaboration platform is introduced, jointly operated by nine universities and two research institutes to promote industry-government-academia collaboration, social implementation, and research on data utilization.</td>
<td>March 9</td>
</tr>
<tr>
<td>NII starts to supply data on the survey of complaints related to COVID-19 as a dataset for research purposes.</td>
<td>March 23</td>
</tr>
</tbody>
</table>
Exhibitions held in neighboring areas.

Universities, research groups, and other organizations, as well as providing administrative support to international conferences and NII's research achievements overseas. The office also manages joint research contracts between NII and overseas corporations, particularly the West Coast. Using the resulting information gathered, it is also expected to conduct initiatives that will bring and develop out studies and identifies international needs that will lead to the use and commercialization of NII's research findings in North America.

In May 2017, NII and the Japan External Trade Organization (JETRO) jointly established an office in Silicon Valley. This new office carries out activities such as providing support for the development of new business and the introduction of NII's research findings in the region. It is also expected to conduct initiatives that will bring and develop out studies and identifies international needs that will lead to the use and commercialization of NII's research findings in North America.
Conducts deliberations on important matters concerning the management and operation of NII, such as the selection of candidates for the post of Director-General and for research and academic staff, and joint research planning, as well as matters concerning NII in the medium-term targets and plans of the Research Organization of Information and Systems (ROIS).

Composed of Japanese and overseas experts external to NII who possess deep and extensive knowledge of academic information. The Board responds to inquiries from the Director-General regarding issues involving research on informatics, as well as development and maintenance of infrastructure for communicating scholarly information.

Research that exceeds the purview of individual universities.

Inter-university research institute corporations are "research institutes for shared use among all universities" in different research fields. Unique to Japan, these research institutes offer state-of-the-art large-scale equipment that is difficult to install and maintain individually at the university level, as well as access to vast quantities of academic data, other valuable resources, and analytical techniques for use by researchers across Japan, free of charge, in order to promote original collaborative research that exceeds the purview of individual universities. ROIS aims to carry out holistic studies across different disciplines by framing important issues of the 21st century related to complex phenomena, such as life, the Earth, the natural environment, and human society, from the perspective of information and systems.

<table>
<thead>
<tr>
<th>Name</th>
<th>Award date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAWA, Takamitsu</td>
<td>April 1, 2002</td>
</tr>
<tr>
<td>NAITO, Etsuko</td>
<td>July 2, 2002</td>
</tr>
<tr>
<td>HATORI, Mitsuhiro</td>
<td>November 19, 2004</td>
</tr>
<tr>
<td>OND, Koji</td>
<td>November 19, 2004</td>
</tr>
<tr>
<td>YAMAMOTO, Takeo</td>
<td>April 1, 2005</td>
</tr>
<tr>
<td>SUBASU, Yashiro</td>
<td>April 1, 2005</td>
</tr>
<tr>
<td>IENO, Haruyuki</td>
<td>April 1, 2007</td>
</tr>
<tr>
<td>MAJIMA, Katsune</td>
<td>April 1, 2010</td>
</tr>
<tr>
<td>NEGORI, Masahiro</td>
<td>April 1, 2010</td>
</tr>
<tr>
<td>MURA, Kenichiro</td>
<td>April 1, 2011</td>
</tr>
</tbody>
</table>

Inter-university research institute corporations are "research institutes for shared use among all universities" in different research fields. Unique to Japan, these research institutes offer state-of-the-art large-scale equipment that is difficult to install and maintain individually at the university level, as well as access to vast quantities of academic data, other valuable resources, and analytical techniques for use by researchers across Japan, free of charge, in order to promote original collaborative research that exceeds the purview of individual universities. ROIS aims to carry out holistic studies across different disciplines by framing important issues of the 21st century related to complex phenomena, such as life, the Earth, the natural environment, and human society, from the perspective of information and systems.

<table>
<thead>
<tr>
<th>Month/Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1976</td>
<td>Research Center for Library and Information Science (RCLS) is established at the University of Tokyo.</td>
</tr>
<tr>
<td>April 1983</td>
<td>Center for Bibliographic Information is established at the University of Tokyo, with the reorganization of the Research Center for Information and Library Sciences.</td>
</tr>
<tr>
<td>December 1983</td>
<td>The NACSIS-CAT cataloging information service is launched.</td>
</tr>
<tr>
<td>April 1984</td>
<td>National Center for Science Information Systems (NACSIS) is established, with the reorganization of the Center for Bibliographic Information, the University of Tokyo.</td>
</tr>
<tr>
<td>April 1984</td>
<td>The Science Information NETwork (SINET) is launched.</td>
</tr>
<tr>
<td>April 1984</td>
<td>The NACSIS-CAT information search service is launched.</td>
</tr>
<tr>
<td>April 1984</td>
<td>Email service is launched.</td>
</tr>
<tr>
<td>January 1989</td>
<td>International connection between SINET and US (National Science Foundation: NSF)</td>
</tr>
<tr>
<td>January 1989</td>
<td>International connection between SINET and the UK (British Library: BL)</td>
</tr>
<tr>
<td>April 1982</td>
<td>The Internet library (IL) System is launched.</td>
</tr>
<tr>
<td>April 1986</td>
<td>The Internet backbone (NET) is launched.</td>
</tr>
<tr>
<td>November 1990</td>
<td>Start of mutual access to databases through gateways with the Japan Information Center of Science and Technology (JICST)</td>
</tr>
<tr>
<td>April 1999</td>
<td>Start of IL service with the British Library Document Supply Centre (BLDSC)</td>
</tr>
<tr>
<td>November 2000</td>
<td>China Annex (Advanced China City) is built.</td>
</tr>
<tr>
<td>October 2000</td>
<td>International connection between SINET and Thailand</td>
</tr>
<tr>
<td>April 1996</td>
<td>Start of IL service with the National Diet Library</td>
</tr>
<tr>
<td>March 2000</td>
<td>International Seminar House for Advanced Studies, Kobe Lodge (Kansai, Osaka Prefecture) is established.</td>
</tr>
<tr>
<td>April 2000</td>
<td>Electronic Library Service is launched.</td>
</tr>
<tr>
<td>January 2001</td>
<td>A proposal entitled &quot;Planning Computer Science Research&quot; is published by the Science Council of Japan, calling for the establishment of a core institute for inter-university research in informatics.</td>
</tr>
<tr>
<td>March 2001</td>
<td>Advisory Panel on a Core Institution for Scientific Research in the Information Field issues its report.</td>
</tr>
<tr>
<td>April 2001</td>
<td>The Preparatory Office for the Core Institution for Scientific Research in the Information Field is established.</td>
</tr>
<tr>
<td>May 2001</td>
<td>The Preparatory Office for the Core Institution for Scientific Research in the Information Field issues its interim report.</td>
</tr>
<tr>
<td>February 2002</td>
<td>Operations move to the National Center of Science Information (SINPLAN), Chiyoda-ku, Tokyo.</td>
</tr>
<tr>
<td>March 2003</td>
<td>Preparatory Committee of the Core Institute for Scientific Research in the Information Field issues its final report.</td>
</tr>
<tr>
<td>April 2002</td>
<td>National Institute of Informatics (NII) is established, with the reorganization of NACSIS and assumption of its functions.</td>
</tr>
<tr>
<td>January 2005</td>
<td>Joint E-Rate is launched.</td>
</tr>
<tr>
<td>April 2005</td>
<td>PhD Program in Informatics is established in the Department of Informatics, Graduate University for Advanced Studies.</td>
</tr>
<tr>
<td>April 2005</td>
<td>Gateway to Academic Contents Portal is released.</td>
</tr>
<tr>
<td>April 2005</td>
<td>Japan-U.S. Academic Content Service is launched.</td>
</tr>
<tr>
<td>June 2005</td>
<td>International linkage of cataloging with RDS in the U.S. is launched.</td>
</tr>
<tr>
<td>September</td>
<td>Research Planning and Promotion Strategy Office is established.</td>
</tr>
<tr>
<td>October 2005</td>
<td>International Course is established within PhD Program in Informatics.</td>
</tr>
<tr>
<td>October 2005</td>
<td>Start of search service of meta-databases.</td>
</tr>
<tr>
<td>January 2006</td>
<td>Global Linkage Office is formed.</td>
</tr>
<tr>
<td>April 2006</td>
<td>Japan-U.S. Academic Content Service is launched.</td>
</tr>
<tr>
<td>April 2006</td>
<td>Science Information Network (SINET) is launched.</td>
</tr>
<tr>
<td>April 2007</td>
<td>Science Information Network (SINET) is launched.</td>
</tr>
<tr>
<td>April 2008</td>
<td>Japan-U.S. Academic Content Service is launched.</td>
</tr>
<tr>
<td>April 2008</td>
<td>Science Information Network (SINET) is launched.</td>
</tr>
<tr>
<td>April 2009</td>
<td>Science Information Network (SINET) is launched.</td>
</tr>
<tr>
<td>October 2010</td>
<td>Library Liaison Office is established.</td>
</tr>
<tr>
<td>November 2010</td>
<td>JASRI Work is launched.</td>
</tr>
<tr>
<td>December 2010</td>
<td>JASRI Work is launched.</td>
</tr>
<tr>
<td>January 2011</td>
<td>World’s first four-dimensional 100 Gbps academic communications network is launched.</td>
</tr>
<tr>
<td>December 2011</td>
<td>World’s first four-dimensional 400 Gbps Tokyo Osaka link of SINET is launched.</td>
</tr>
<tr>
<td>October 2012</td>
<td>World’s first four-dimensional 100 Gbps academic communications network is launched.</td>
</tr>
<tr>
<td>November 2012</td>
<td>Joint Support-Center for Data Science Research is established.</td>
</tr>
</tbody>
</table>
Facilities and Locations

National Center of Sciences (Chiyoda-ku, Tokyo)

The National Center of Sciences was built as a center for research in informatics and other fields, academic exchange, dissemination of scientific information, and social collaboration, with the aim of expanding and strengthening Japan’s academic research infrastructure. Construction was completed in December 1999.

The high-rise wing is primarily occupied by three institutes: NII, Hitotsubashi University Chiyoda Campus, and the National Institution for Academic Degrees and Quality Enhancement of Higher Education. The Center aims to provide an advanced base for intellectual creativity through the comprehensive interaction of the various academic capacities of each institute.

Conference facilities such as Hitotsubashi Hall are located in the low-rise wing. These facilities accommodate a wide variety of events such as international and academic conferences, lectures, and meetings organized by national universities and other institutions.

Facilities

- High-rise wing
- Emergency helipad
- Electrical room
- Outdoor equipment space
- Unoccupied floors

Operations

- Large rooms
- Small rooms
- Meeting rooms
- Exhibition area
- Multifunctional area
- Machine room

Space

- Site area: 6,842 m² (occupied by NII: 3,036 m²)
- Floor space: 40,585 m² (occupied by NII: 18,145 m²)

National Institute of Informatics

National Center of Sciences Bldg.
2-1-2 Hitotsubashi, Chiyoda-ku, Tokyo, 101-8430 Japan
Tel: +81-3-4212-2000 (exchange)

Floor space: 40,585 m² (occupied by NII: 18,145 m²)

International Seminar House for Advanced Studies (Karuizawa, Nagano Prefecture)

Inose Lodge

The International Seminar House for Advanced Studies (Inose Lodge) was completed in May 1997 on land donated by Dr. INOSE, Hiroshi, the first Director-General of NII. His wish was to create an ideal place for interdisciplinary and international studies and discussions.

Uses

1. Domestic and international academic conferences, seminars, etc.
2. Public lectures, social gatherings, etc.
3. Research and training of NII researchers and staff

Research

- Enhancing research and development activities
- Promoting international collaborations

Organization/Others

Kashiwa Annex (Kashiwa City, Chiba Prefecture)

The Annex was completed in October 2020 on the University of Tokyo’s Kashiwa II Campus as a facility to house equipment for various academic information services provided by NII, including the Science Information NETwork (SINET), and to serve as a center for NII’s research and development.

The facility is to be used for seeking further improvement in research results by establishing it as part of the University of Tokyo’s research complex for joint studies and collaborations.

Guide Map

Exterior of Kashiwa Annex

International Seminar House for Advanced Studies (Karuizawa, Nagano Prefecture)

Inose Lodge

The International Seminar House for Advanced Studies (Inose Lodge) was completed in May 1997 on land donated by Dr. INOSE, Hiroshi, the first Director-General of NII. His wish was to create an ideal place for interdisciplinary and international studies and discussions.

Uses

1. Domestic and international academic conferences, seminars, etc.
2. Public lectures, social gatherings, etc.
3. Research and training of NII researchers and staff

Research

- Enhancing research and development activities
- Promoting international collaborations

Organization/Others