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[Feature]

Young Researchers and the Research Environment

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Research and Services
Built on Diversity

At the National Institute of Informatics (NII), home of world-class research and academic research support services, diversity is a source of innovation, with collaboration between researchers and interns who are young, veteran, women, and from other countries.
In today's rapidly changing society, and particularly in the field of informatics, young people appear to be drifting away from science. We asked Vice Director-General YASUURA, Hiroto about the current situation and future for young researchers at NII.

Vice Director-General;
Chief Cyber Science Infrastructure Director, NII; &
Professor Emeritus, Kyushu University

YASUURA, Hiroto

Interviewer
YAMAMOTO, Kayoko
Editorial Writer, Nikkan Kogyo Shimbun

NII researchers support Japan's universities and research institutes

—— You have been involved in training up young researchers not just at NII, but at Kyushu University and JST (Japan Science and Technology Agency). First of all, how do you feel about the situation surrounding young researchers?

In Japan as a whole, fewer students are aspiring to become researchers these days. Of course this is true in every field, not just informatics. However, numbers are increasing in other OECD (Organization for Economic Co-operation and Development) member nations like the US, European countries, and China—it is only Japan that is seeing a decrease. So, I feel this is something we should be very worried about.

—— I believe you are Chief Cyber Science Infrastructure Director at NII. How are you involved with young researchers at NII?

Infrastructure refers to "academic information infrastructure." NII is an inter-university research institute for informatics, and is unique in that it performs two key roles: research and services. The pillars of our services are the communication platforms and data platforms linking all areas of academic research throughout Japan. Together with the computational platforms, we refer to these as "academic information infrastructure."

Although I am Chief Director, I leave the details of individual services and technologies up to the younger professors and researchers. One of my roles is to consider how to improve the working environment and career opportu-

nities for young people.

—What kind of researchers belong to NII?

First, there are professionals on the research side, conducting research in a broad range of fields from fundamental theory of informatics to cutting-edge topics like AI, big data, and IoT. There are also researchers on the services side, providing a variety of services like building and operating our academic information infrastructure, academic content, and service platforms, which are vital to research and education in universities and research institutes all over Japan, such as the SINET academic information network.

—— As an inter-university research institute, NII connects and supports Japanese universities and research institutes, is that right?

Yes. There are 17 inter-university research institutes in Japan. One of their roles is to provide research resources owned by the institution, such as large-scale equipment, to national, public, and private universities and other

research institutions. For example, accelerator research facilities can be used jointly by researchers in specialist fields. But NII also provides the infrastructure that contributes to all academic fields. We are responsible for connecting different academic fields, and even society as a whole.
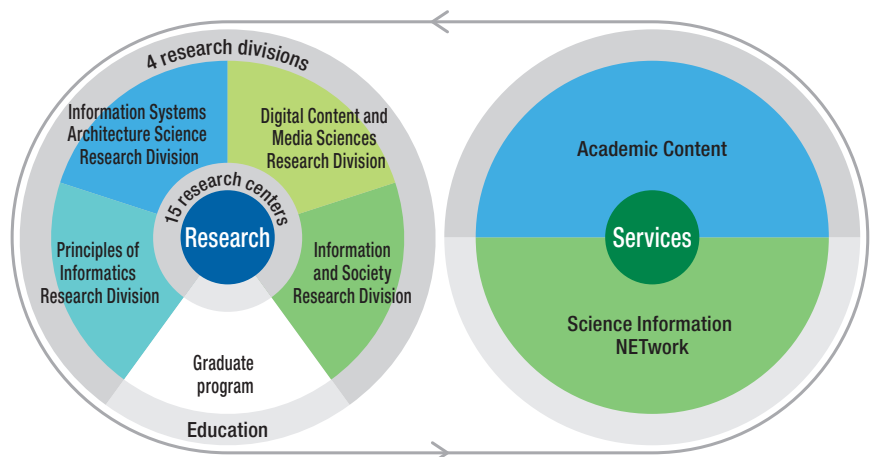
In that sense, professionals working at NII need to have the ability to talk to people in any field. Particularly on the services side, it could involve communication with professionals in all kinds of areas, from life sciences to fundamental physics to social sciences. Even on the research side, when AI and computers change the world, it will involve social systems.

So although NII is a research institute for informatics, you shouldn't think of it as limited to, for example, computer science or information science.

NII has the potential to accept researchers from any specialist area.

Diverse researchers with backgrounds in physics, life sciences,

We need human resources with the ability to talk to people in any field.

Synergy between research and services

4 research divisions

- Information Systems Architecture Science Research Division
- Digital Content and Media Sciences Research Division
- Principles of Informatics Research Division
- Information and Society Research Division

15 research centers

Research

Graduate program

Education

Services

Academic Content

Science Information NETwork

Entering an era when diversity is a strength

and social sciences work at NII.

A melting pot of diverse, international talent

— So people from diverse backgrounds work at NII, not just those with an informatics background. How does NII evaluate and employ young researchers?

NII is recognized worldwide as one of the few Japanese top research institutions in the field of informatics. On the research side, people of any age are evaluated and employed based on their research results and published papers, which is a common standard of evaluation for researchers.

On the services side, evaluating human resources and building career paths is not so simple, because the work involves special services to support academia in Japan as a whole. Communication platforms and information platforms are vital parts of the infrastructure, which means they are subject to close scrutiny if anything goes wrong, just like electricity and water supplies. It's important to bear in mind that

this work involves launching unprecedented new services that Japan needs.

And of course, the most talented people tend to get snapped up by private sector companies. We need to find people who are excited about getting involved in creating large-scale systems at NII. I want to put in place a proper system of evaluation for researchers who have chosen to work here.

— Tell us about the current situation of researchers at NII.

First, we have a total around 80 full-time teaching staff—professors, associate professors, and assistant professors—in both open-term and fixed-term positions. Around 60 of them are on the research side and around 20 on the services side. In addition, there are around 120 researchers on fixed-term contracts for specific projects. Many of these are young researchers, but there are also veterans employed as Project Professors.

A unique feature of NII is our International Internship Program. Through this program, NII accepts a large number of Masters

and PhD students from MOU partner institutions such as universities in other countries. We usually have over 100 interns from 35 countries and regions, on 3- to 6-month internships, depending on the project. Whenever I get into an elevator at NII, I always seem to meet at least one overseas student. Young Japanese researchers often comment that they get inspiration from this rich international environment. This might be because NII is quite a compact research institute, mainly located within a single building at the National Center of Sciences in Chiyoda-ku, Tokyo, so we often see each other. I feel this is a benefit that sets NII apart from large-scale research institutes.

In terms of gender, I think about 20% of our researchers are women. This is a high proportion compared to other universities in the field of informatics, but we would like to increase it further. There used to be a misconception that women were not good with computers, but today's children are growing up as digital natives, so

the situation will change sooner or later.

Amid a frenzy of interest in the potential and threats of generative AI

—— In wider society, there is a frenzy of interest in the potential and threats of ChatGPT and other generative AI systems using large language models. Do you think more young people will become interested in informatics?

I think so. Generative AI is available online in formats that anyone can use, so its use is expanding rapidly. This will be further accelerated by the ideas of young people, being used in all kinds of ways for art, design, and new forms of expression, which will change the world.

In light of this, I feel that informatics is a field where young people can play a more active role than other academic fields due to the baseline of research constantly changing.

—— It sounds like it would actually be harder for a single-minded type of person, which is the traditional idea of a researcher.

I am Program Director of JST's support program for young researchers. One of our goals is to equip them with various skills, aside from research ability: skills that transcend a specific field like conversational skills, communication, leadership, and management. We hone these skills using training exercises, such as getting the trainees to explain their research to 30 fellow trainees from different fields. I think these skills overlap with the qualities that NII is looking for in researchers.

—— Do you have a message for young researchers of the future?

To improve our data platform services, I feel that we need more private companies to provide new services. This is because around 700 of the 1,000 institutions that NII deals with are thought to lack information specialists, such as universities specializing in the humanities.

I think a new market will emerge to support this. A single university may not be able to afford to employ an information specialist, but if a company provides support services to 50 or more universities, it would significantly keep the cost down.

Young people who have gained experience in academic information infrastructure at NII could move to these companies and lead digital transformation (DX) in other fields, like medicine and law. I hope we will see an active back-and-forth of human resources between NII and the private sector in this way, and that such an exchange will transform the structure of Japanese society. NII is truly a melting pot for young people from various backgrounds, both on the research and services sides. In this era where diversity is a strength, I would like to support them by creating an environment at NII to help them achieve their potential.

Research and education staff

Percentage of female researchers
- Women 19% (37)
- Men 81% (155)

Percentage of non-Japanese researchers
- Non-Japanese 21% (40)
- Japanese 79% (152)
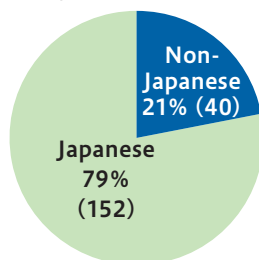
Percentage of young researchers
- Under 40 36% (70)
- 40 or over 64% (122)

As of May 1, 2022, NII employs a total of 192 full-time and part-time teaching staff and specially appointed researchers. This includes professors, associate professors, assistant professors, research assistants, project professors, project associate professors, project assistant professors, and project research assistants.

A Word from the Interviewer

What struck me was that Vice Director-General YASUURA has a wealth of experience, having served as Chief Information Officer at Kyushu University for 12 years. Research institutes tend not to be as conscious as universities of measures to support young people, and leaving researchers to their own devices can certainly lead to creativity. But I hope that Vice Director-General YASUURA will find ways to help young people reach their full potential, based on new needs and how society works.
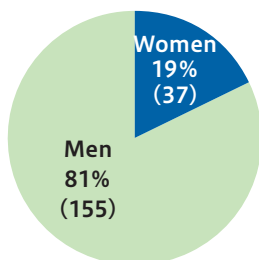
**YAMAMOTO, Kayako**
Editorial Writer,
Nikkan Kogyo Shimbun

Masters from Tokyo Institute of Technology.
Joined the Nikkan Kogyo Shimbun as a reporter specializing in science, technology and industry-academia collaboration. PhD from Tokyo University of Agriculture and Technology.
Part-time lecturer at Tokyo Institute of Technology; special advisor to the president of the University of Electro-Communications; visiting professor at Tokyo City University. Publications include "Life Planning Guide for Women in Science."
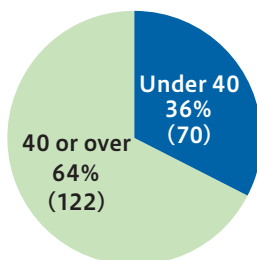
Exploring the Boundless Horizons of Multilingual Speech Synthesis

Project Assistant professor,
Digital Content and Media Sciences
Research Division, NII

COOPER, Erica

Speech synthesis technology is a rapidly evolving field. Project Assistant Professor Erica COOPER is working on multilingual speech synthesis for low-resource languages and language families. She gives an overview of this work and tells us about her research activities, goals, and research environment.

A future where anyone can create synthetic speech

——Could you provide an overview of what you are working on at NII?

My research focuses on speech synthesis, specifically targeting low-resource languages. During my doctoral work, I specialized in text-to-speech synthesis for low-resource languages, aiming to create speech synthesizers for underrepresented languages. Traditional speech synthesis involves extensive recording sessions in controlled environments, but we explored the use of conversational and noisy data. At NII, I have extended this work to multi-speaker synthesis, addressing challenges with smaller datasets through transfer learning from speaker recognition models.

Currently, I am collaborating on a project with the National Research Council in Canada and the University of Edinburgh, focusing on building speech synthesis technologies for the Indigenous languages of Canada. Additionally, my research delves into the evaluation of speech synthesis models, a complex task due to the diverse ways speech can be generated. We conducted extensive listening tests and organized the Voice-MOS Challenge, a competition to improve automatic evaluation methods for synthesized speech. This multifaceted research aims to enhance communication, preserve languages, and make speech synthesis much more accessible.

——What are some of your research goals?

In the short term, my focus is on the evaluation project. While it might not have an immediate impact on society, it directly benefits speech synthesis researchers by making experiments quicker and easier. Currently, commercial text-to-speech systems sound good, but they require substantial data, only support a limited number of languages, and have a neutral style. My long-term goal, inspired by my PhD work, is to democratize speech synthesis. I envision a future where anyone, even those speaking underrepresented languages, can create a synthesizer effortlessly. Picture this: someone sits down with their laptop, records a few minutes of their voice, and builds a high-quality synthesizer for their language without needing extensive data or computational resources. This goal represents a fundamental shift, where speech synthesis becomes accessible, versatile, and inclusive for people worldwide.

Making speech synthesis systems more accessible

——Could you elaborate on the overall importance of your research?

The research delves into language independence in speech synthesis, questioning traditional factors like language families. We are exploring what aspects of spoken languages are universally applicable and what sets

them apart. This broader perspective allows us to create adaptable speech synthesis systems, bridging gaps between languages more effectively. Highly accessible speech synthesis technology can also empower people to explore more creative applications. However, concerns like deepfakes and misuse require ongoing research for mitigation. The potential creative uses are vast and unpredictable, highlighting the need for accessibility and openness.

—— Can you share any insights or discoveries from the blending of disciplines in your work?

The beauty of this field lies in its multidisciplinary nature. It dynamically combines elements of linguistics, signal processing, machine learning, and programming, creating a rich tapestry of knowledge. In the past, linguistic preprocessing was intricate, involving detailed rules and components. However, the advent of neural network-based approaches, especially end-to-end models, has significantly streamlined the process. These modern methods permit greater flexibility, enabling the synthesis of speech from raw character inputs, making the technology more adaptable to different languages.

—— What challenges do you anticipate in achieving your long-term goals?

Current approaches depend on extensive data and computational resources, making them highly inaccessible. By revisiting older techniques and combining them with modern advancements, we can make these technologies more accessible. Pruning large neural network models, adapting them to smaller devices, and using less data are promising directions to ensure broader accessibility.

Interns from around the world make NII an exciting environment

—— What are some unique advantages of conducting research at NII?

At NII, we highly benefit from international collaborations and interns from around the world. This diversity allows us to explore experimental projects, and interns provide valuable contributions to ongoing research. These collaborations have led to numerous publications and continue to open doors for other collaborative efforts.

—— How do the diverse cultural backgrounds of international colleagues and interns impact your research at NII?

The diverse cultural backgrounds of colleagues and interns at NII significantly impact our research dynamic and work environment. Their varied perspectives, experiences, and expertise enrich our collaborative process as well as enhance the depth and creativity of our research endeavors.

—— What do you think would enhance the research environment at NII?

I believe continuous efforts to expand our connections and foster collaborations are crucial. Enhancing these collaborative efforts will undoubtedly elevate our research activities. The strength lies in our diversity, and creating a platform where innovative ideas can flourish. Bringing together individuals from various backgrounds and experiences fosters an environment where new ideas can be explored, tested, and refined, making NII an incredibly exciting and vibrant space for research and innovation.

—— Any final words of wisdom based on your experiences and research at NII?

I would say to young aspiring researchers that there has never been a better time to dive into this field. The possibilities are endless, and the field is extremely accessible now. Don't hesitate—just go for it, experiment, and most importantly, enjoy the process. It is a tremendously exciting and enjoyable journey.
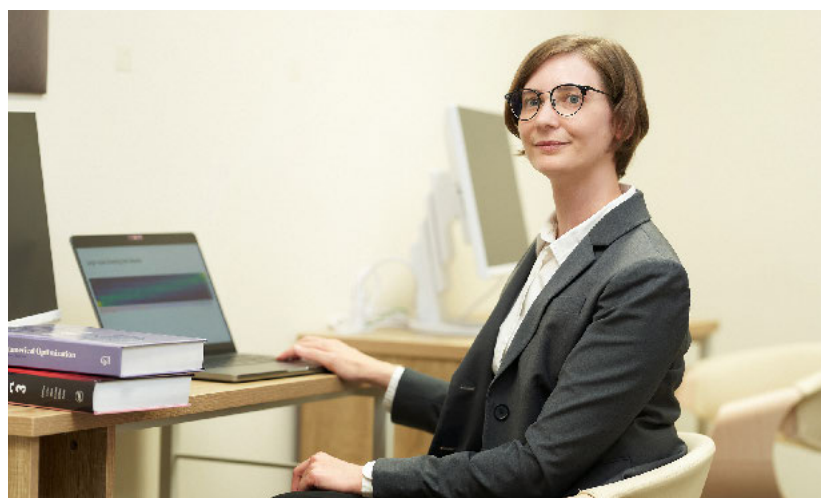
Data Analysis for Efficient Learning SuppAt

Assistant Professor, Information and Society
Research Division, NII

FURUKAWA, Masako

E-learning, learning management systems (LMS), and learning analytics have come into the spotlight in the past few years.Learning data are being harnessed to develop more effective learning resources.We talk to Assistant Professor FURUKAWA, Masako, who is conducting research in this field based on her varied career path.

Learning tailored to the learner's abilities and cultural background

—— Could you first explain your current position at NII and give an overview of your research?

I teach in a research division called the Information and Society Research Division. At the same time, at the Research Center for Open Science and Data Platform (RCOS), one of NII's 15 research centers (as of 2023), I am involved in work with academic platforms for Japanese academic papers and research data.

I joined NII in 2015. I was initially involved in project planning for NII's introductory programming course, producing content for MOOCs (Massive Open Online Courses) and standardizing learning logs. After that, I spent a long time working on a learning analytics platform system. At the same time, I was in charge of building and operating the GakuNin LMS e-learning system, which I am still working on now. Demand for online lectures and remote learning soared during the pandemic, which boosted awareness of this field.

Since 2018, I have been involved in developing teaching materials systems provided on GakuNin LMS, and last year I started working on research data ecosystems.

RCOS was established to promote open science in Japan. As a leader in human resource development platforms, our mission is to develop human resources to use such systems.

—— How did you first get into the research area of e-learning and learning analytics?

As an undergraduate, I majored in Japanese literature, and I wanted to be a Japanese language teacher. I took various credits and qualifications, like library studies, to broaden my horizons as much as possible, and one of those was teaching Japanese as a second language. I had some practical teaching experience and found it very rewarding due to the sincere attitude of the learners (overseas exchange students and non-Japanese residents), but from a teaching viewpoint, I found there were huge differences in learning depending on the individual learner's cultural background and so on, and I felt that a one-size-fits-all approach was not sufficient. I wanted to provide learning support with teaching materials tailored to each learner's abilities and cultural background, and that's how I became deeply involved in e-learning and learning analytics.

During my Master's degree I started producing teaching content for mobile phones, which showed me the future potential in teaching resources for individual delivery. I also realized that we could use learn-

ers' access logs to monitor the learning effectiveness of teaching resources and reflect the results in individual education.

Building a learning management system connecting multiple universities

—— What kind of system is GakuNin LMS?

GakuNin LMS is a Learning Management System (LMS) that provides educational content available at many universities, and has numerous optional functions allowing individual universities to manage learners. "GakuNin" is an abbreviation of the Academic Access Management Federation in Japan, which is made up of the universities that use academic e-resources, the companies and institutions that provide these

resources, and NII. Within this federation, there are various services that can be used with your university's ID and password, one of which is GakuNin LMS.

It was officially launched in June 2021 and is now used by 84 organizations, mainly universities, with over 40,000 users.

The courses currently available through GakuNin LMS are courses on research data management and information security. Optional features for administrators allow them to manage course history for these two types of courses. We are currently testing other features, such as in-house course creation functions, micro-content resource creation functions, and learning analytics functions. We will continue to improve GakuNin LMS and its features for administrators. Rather than simply creating the system, in future we want to respond to feedback from users and work on promoting more effective ways to use the system.

Motivated by the environment that accepts challenges

—— Tell us about the areas where you would like to take on future challenges.

Going forward, I want to use learning analytics to suggest ways to improve education and teaching resources for the systems and resources we have developed and provided, as well as building and enhancing

educational support platforms for inter-university research institutions.

Higher education has two main missions: research and education. The job of national research and education networks (NREN) like NII's SINET is to devise ways of supporting these two missions, but until now, NII has mainly focused on supporting research. Looking at trends of educational support in NREN in other countries, many countries are already utilizing information network infrastructures to provide educational support services to universities. In Japan, now that SINET is in place and LMS are becoming widespread, it is now feasible for NII to provide educational support. In future, I would like to explore the potential for NII to provide educational support, and be involved in this.

—— What do you think of the research environment at NII?

What impressed me was that when I said I wanted to try something new, the environment was accepting and supportive. Rather than being immediately refused, I was encouraged to take on challenges.
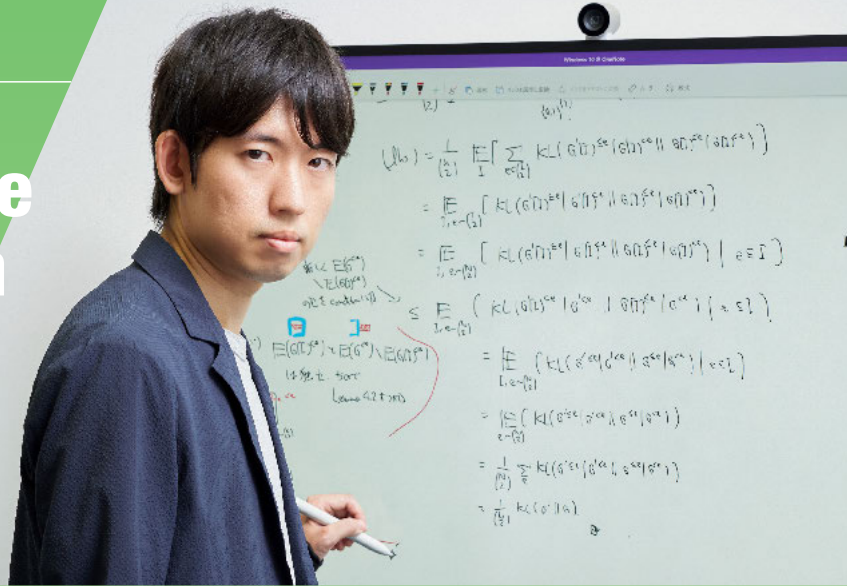
This makes the hurdles higher, but when you want to do something, having the support of those around you is very encouraging. If you find a chance, you can proactively take on challenges. This kind of environment is very attractive.

Proving the Existence of Secure Encryption

Associate Professor, Principles of Informatics Research Division, NII

HIRAHARA, Shuichi

Encryption technology plays a vital role in today's information and communication society. Associate Professor HIRAHARA, Shuichi's research goal is to mathematically prove whether the cryptography currently in use is truly secure. We asked him about the outlook for his research, tackling complex problems alongside the world's top mathematicians.

Is encryption technology really secure?

—What kind of research is complexity theory?

Complexity theory deals with proving the amount of resources (such as computational time and memory storage) required to solve various computational problems. I am currently working on research to conclusively prove that certain computational problems are difficult to solve, which is closely linked with theory of cryptography.

When we shop online or use credit cards at stores in daily life, our payment information is protected using an encryption technology called public-key cryptography. When you enter your credit card number or send your password to the bank, it is encrypted so that it cannot be deciphered if it is intercepted. However, it has not yet been proved whether this public-key cryptography is truly secure. One of the public-key cryptography, RSA cryptosystem, for example, is based on the assumption that prime factorization is difficult to decrypt. My research aims to prove that this prime factorization really is difficult to decrypt.

A typical problem is the P≠NP conjecture. This is one of the Millennium Prize Problems (seven unresolved problems for which the Clay Mathematics Institute in the US offered a US$1 million prize in the year 2000). The P≠NP problem is to prove the existence of problems where it is easy to verify whether a solution is correct, but difficult to solve the problem. This is vital because if this cannot be proved, then cryptography cannot be said to be secure.

—How exactly will you establish the security of public-key cryptography?

In fact, simply solving P≠NP is not enough to ensure the security of public-key cryptography. We need to analyze the computational difficulty from the perspective of average-case complexity.

Average-case complexity refers to the average calculation time of an algorithm. Viewed from the perspective of average-case complexity, the P≠NP conjecture is called the DistNP ⊄ AvgP conjecture. To establish the security of public-key cryptography, we need to solve P≠NP conjecture and then solve that DistNP ⊄ AvgP conjecture.

Several other steps are required to establish the security of public-key cryptography. In 1995, mathematician Russell IMPAGLIAZZO described five possible worlds: Algorithmica, Heuristica, Pessiland, Minicrypt, and Cryptomania. For example, Algorithmica represents our world if P=NP. In this world, all kinds of optimization problems can be solved quickly, but at the same time, any public-key cryptosystem can be easily broken. In contrast, Cryptomania is a world where secure public-key encryption exists. Many research-

Successfully overcoming two barriers at once

Cryptomania
∃ Public-key cryptography
Minicrypt
∃ Secret-key cryptography
Pessiland

Theorem [H. STOC 2021]
If UP is exponentially hard in the worst case, then NP is hard on average

$$\text{DistNP} \nsubseteq \text{AvgP}$$
$$(P \neq NP \text{ on average})$$

$$\text{UP} \nsubseteq \text{DTIME}\left(2^{o(n)}\right)$$

UP (⊆ NP)
Class of problems including prime factorization, etc.

Heuristica

$$P \neq NP$$

Algorithmica

Limit of black-box reduction

Impossibility of hardness amplification

Proof technique: Based on meta-complexity
FOCS'18, ITCS'20, CCC'20, STOC'20, FOCS'20 + α

Meta-complexity is used as a tool, but the result does not depend on meta-complexity.

Hirahara proved a theorem about worst-case and average-case hardness that cannot be proved using existing proof techniques (black-box reduction and hardness amplification).

ers predict that the world we live in is Cryptomania. Solving important open questions one by one to prove the conjecture that our world is Cryptomania will prove the existence of mathematically supported, absolutely secure cryptography.
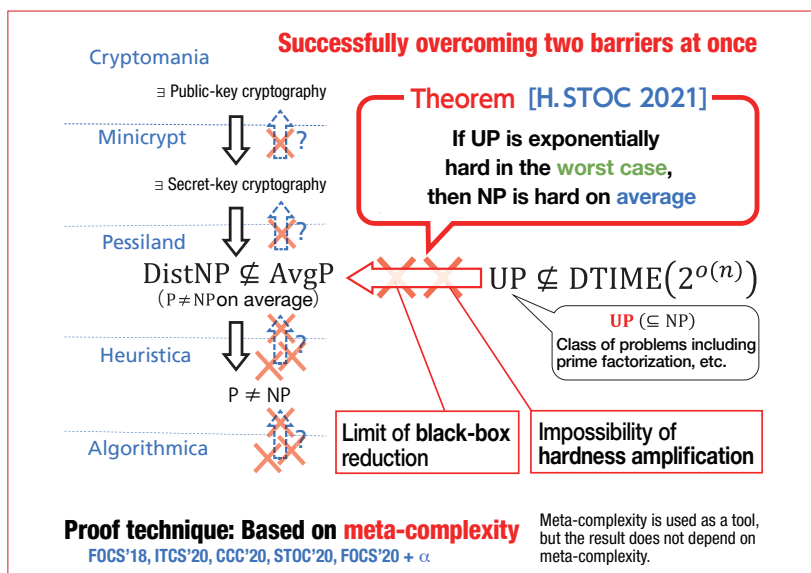
Selected for a top international award in theoretical computer science

—Tell us about your research that was selected as "Complexity result of the year" in 2022.

I received this award for proving NP-completeness (the hardest unsolved problem of NP) of the partial function variant of the Minimum Circuit Size Problem (MCSP). This research result was also selected by FOCS, the top international symposium on theoretical computer science.

—Will this result help to establish the security of public-key cryptography?

Proving NP-completeness of the partial function variant of the MCSP is a vital step towards proving NP-completeness of the MCSP. If the latter can be solved, we will be able to solve the important unsolved problem of excluding Heuristica, which is one of the steps required to establish the security of public-key cryptography. However, we don't know what kind of proof it will take to rule out Heuristica, so nobody has any idea how long this might take. I hope it will be possible to exclude Heuristica during my lifetime.

Contributing to the future hundreds of years from now

—When did you start thinking about tackling such fiendishly difficult challenges?

I first came across complexity theory during my third year of university. I found out about the Millennium Prize Problems and wondered why some problems were so difficult, which is when I became interested in complexity theory. I have always liked thinking theoretically, so I wanted to take on the challenge of these difficult problems.

After that, I started working on the MCSP from the second year of my Master's. I developed the world's first non-black-box reduction technique and proved that if the NP-completeness of the MCSP can be solved, the worst-case and average-case hardness of NP will be the same (Heuristica can be excluded). For this paper, I became the first Japanese recipient of the Machtey Award (FOCS 2018, Machtey Award for best student paper).

RSA encryption is not likely to be broken any time soon, but if someone secretly proved P=NP somewhere in the world, then worldwide security would collapse. This research is necessary to contribute to the future hundreds of years from now.

**—How do you find the research environment at NII?**

My research is all I think about, so the environment at NII suits me perfectly, as it gives me plenty of time to concentrate on my research. I would like to continue working on unresolved problems and devote myself to research that contributes to the future in some small way.

Aiming for Bug-Free Software

Associate Professor, Information Systems Architecture Science Research Division, NII

SEKIYAMA, Taro
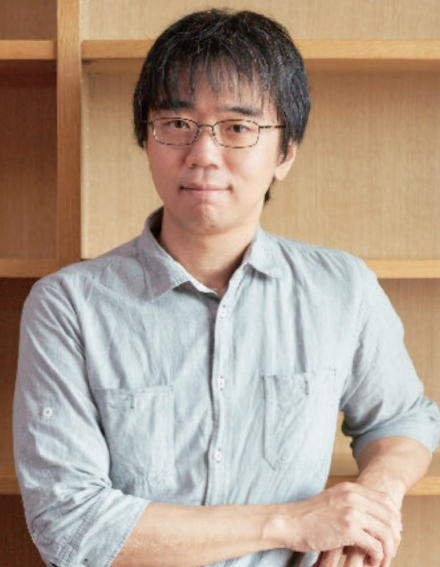
All kinds of devices are controlled by software these days, which means bugs can cause serious problems. Associate Professor SEKIYAMA, Taro is working on software science research, aiming to prevent such problems.

Using programming language theory to verify the security of software

—What kind of research are you doing in the field of software science?

My aim is always to make secure software a reality. If there was a software bug in a self-driving vehicle, for example, it could cause a fatal accident, or a bug in financial software could result in huge amounts of virtual currency being stolen. To prevent such situations, my research aims to use programming language theory to prove that software is bug-free.

Programming language theory is the study of the meaning and computational models of programming languages. This research does not directly produce software that is useful for work or society, but by exploring how to write correct software without any bugs, this research will have a big impact in modern society, where software plays a vital role.

—How do you prove that there are no bugs?

Research in programming language theory is done using mathematical techniques, which means we need to mathematically define what a bug is and how the related program should work. Then we can verify whether the program is working correctly according to these definitions.

One way of detecting bugs in a program is a type system, which assigns various types to expressions and checks whether the values are used correctly. There are two main type systems so far. The first is dynamic typing, which is a method of verifying whether a program is working correctly based on the actual values when the program is executed without determining types in advance. By running the program, it reports any errors discovered. The second is static typing, a method of verifying before the program is executed to ensure that only data of the correct type that matches the format are processed. By performing type checking before running a program, you can ensure that no errors will occur when it is run.

Aiming to develop verification techniques that are easier to use

—Please tell us about the research you are currently working on.

One research project I am working on now is using static typing to guarantee the safety of software that causes so-called secondary effects. Secondary effects are interactions between a program and its external environment, such as the use of memory or storage devices, user input from a keyboard or mouse, or a state where multiple computations are executed that depend on each other (parallel/concurrent computing). Algebra-

ic effects (a way to algebraically define the meaning of secondary effects) are used as a framework to treat these various secondary effects in a unified way. I am researching how to incorporate this into static typing to verify the safety of software that causes various secondary effects.

—I believe you are also researching Zero Trust to protect IoT systems. What are you investigating, specifically?

Conventional security methods set boundaries between the inside and outside of a network, and protect information assets by ensuring they can only be accessed from inside the network. But increasingly, it is not enough to simply set up such boundaries and prevent intrusion from outside. A new approach, called Zero Trust, has emerged. This approach abandons the concept of boundaries and verifies security without trusting anyone who accessed information assets. By bringing software theory and system software together, we aim to achieve secure IoT

systems based on the concept of Zero Trust.

In terms of theoretical research, we aim to combine static verification and runtime verification based on mathematical models of IoT systems. In terms of system software research, we aim to develop execution isolation, automatic detection, and automatic response mechanisms in conjunction with the theoretical results, and demonstrate a Zero Trust IoT system.

Finding mathematical structures to prevent incidents

—What do you find fascinating about research in software science?

I first became interested in software science, and programming language theory in particular, when I read a book about programming language theory recommended by a friend, and found out that it was possible to apply mathematical structures to programs. Humans tend to think that software will just work somehow, but we can find a proper math-

ematical structure and discover its meaning. It's like exploring a jungle where you don't know what's there and finding treasure. I believe such discoveries will make an important contribution to society by stopping computer systems from malfunctioning and preventing incidents in the real world.

—The environment at NII is suited to that kind of research, isn't it?

That's true. Researchers in information sciences are gathered in one building here, so it's easy to find the right person to ask a question. At other universities, research departments in the same field are sometimes located on separate campuses, so I think this is a good environment in terms of being easy to discuss with everyone.

Another unique aspect of NII is that individual researchers can research independently, rather than professors, associate professors, and assistant professors working together on a single research project, like in a typical university. It also is an environment where you can concentrate on your research. Having said that, I think it is more interesting, especially for young researchers, to actively seek out collaborations with other researchers, as it can broaden the scope of research. I am currently involved in three projects as comprehensive software research at NII, and I am learning a lot from various professors.

Improving Research and Education with Advanced Authentication Technology

Assistant Professor, Information Systems Architecture Science Research Division, NII

SHIMIZU, Sayako

The Academic Access Management Federation (GakuNin) is made up of universities that use and institutions that provide academic e-resources. Assistant Professor SHIMIZU, Sayako explores cutting-edge authentication and approval technologies. We asked her about her research topics, future challenges, and the significance of her research.

Enhancing GakuNin and making it more accessible

——Could you first explain your current position at NII and give an overview of your research?

I teach in the Information Systems Architecture Science Research Division, and I am also involved in work with the Academic Authentication Systems Office in the Academic Infrastructure Division, which is one of the service divisions. At NII, there are people researching topics related to NII's services, and people pursuing their own research themes, not necessarily connected to services. I am one of the former.

My research topic is looking at next-generation authentication systems, which relates to the services provided by the Academic Authentication Systems Office.

At NII, working with many universities and partner institutions, we build and run the Academic Access Management Federation (GakuNin), an authentication framework allowing users to access information services using an account issued by their university or organization.

I am working on next-generation authentication systems based on GakuNin, particularly investigating IdP (Identity Provider) hosting services to extend advanced authentication technology to more educational and research institutions. I am also looking at improving group management functions to make authentication more efficient.

——Tell us about the aims of your research based on GakuNin.

GakuNin is a federation made up of the universities that use academic e-resources, and organizations like publishers that provide such services. People belonging to universities that are part of GakuNin can access many services using a single ID issued by their university. There are currently around 300 institutions taking part. With new next-generation academic research platforms to promote the utilization, distribution, and management of research data, now that advanced certification is required, it is becoming mandatory for all educational and research institutions to join GakuNin. I want to support as many institutions as possible taking part. With the new data science infrastructure, there are more situations where we want to encourage others to join GakuNin, including those that could not participate in the past, not just educational and research institutions.

For example, there are many cases where university researchers conduct joint research with corporate researchers. But there is a lot of variation in how different institutions issue and manage IDs. This means it is not possible to treat them in the same way as

universities, which have a certain degree of uniformity.

The aim of my research is to improve authentication functions to deal with cases like this. I'm talking about authentication here, but authentication doesn't just mean simply confirming that a person is who they say they are. From the service perspective, there is also authorization to confirm this person is allowed to use this function. I am investigating whether we can make systems operate even more efficiently by successfully merging authentication and authorization.

Lightening the load for university systems administrators

—— What is the hardest part of your research, and what is the most rewarding?

This is somewhat separate from research and development, but it's very difficult to summarize the differences in policies between different universities and institutions. If you research and create a system, you need to decide on an operational policy when it is put into practical use. But with a system designed for multiple universities and research institutions, there are differences in how IDs are managed. We incorporate all these opinions into the system, but it takes time to compile them all, and unexpected issues often crop up.

To take part in GakuNin, each institution needs to set up an IdP server. Universities often don't have the necessary budget or human resources, so this poses a barrier. The question of how NII can provide support in such cases is a major issue at present.

The benefit of GakuNin is being able to access services of different institutions, not just your own university, with a single ID. The scope of this will expand in future, so I think this will become an even greater benefit. That's what makes it so meaningful to be involved in this research.

—— What motivates you to continue your research despite all the challenges?

Before I came to NII, I worked as a technician at a university's IT center. Looking at it from the perspective of a former university employee, if there were services available from NII without requiring complicated administration on the university side, I would be keen to use them. Because I have experienced being on the system user side, I am motivated by a desire to provide services to educational and research institutions in order to reduce the workload of system administrators within those institutions.

Providing services to address common issues

—— Tell us what makes your research at NII worthwhile.

When I worked at a university, my job involved building services that could be used at just that university, which of course limited what could be done. In reality, many universities have the same needs and the same concerns. Precisely because NII is an inter-university research institute, we can provide services in response to these common issues, which I find rewarding to be involved in. Also, as researchers at NII work on all kinds of research, I have extremely interesting and stimulating opportunities to communicate with researchers from other fields.

Supporting Cutting-Edge Research Behind the Scenes

Planning Team, Planning Division,
General Affairs Department, NII

ASAKAWA, Daiki

Behind the scenes of cutting-edge research in informatics, administrative staff play a vital role in getting the administrative work done.We asked ASAKAWA, Daiki, a young member of the administrative staff, what kind of administrative work they do to support research.

—— Tell us about the work of the administrative staff at the National Institute of Informatics (NII).

Within the organization of NII, there are two administrative departments: the Cyber Science Infrastructure Development Department and the General Affairs Department. Of NII's two roles, research and services, the Cyber Science Infrastructure Development Department is mainly responsible for the services side. I belong to the General Affairs Department, which is made up of the Planning Division, General Affairs Division, and Budget & Accounts Division. As well as organizational management work including general affairs, human resources, finances, and accounting, like a normal company, we also do work concerned with supporting researchers, such as compiling research results, organizing research meetings, and dealing with research collaborations with universities in Japan and other countries. NII also runs a graduate program for human resource development as part of the Graduate University for Advanced Studies (SOKENDAI), so we also support students studying informatics.

—— What is the role of the Planning Team, Planning Division?

Our major tasks are evaluation work and implementing the Administrative Council and Advisory Board. Evaluation work involves compiling research evaluations from laboratories in response to requests from academic degree awarding organizations or the Ministry of Education, Culture, Sports, Science and Technology. The Administrative Council discusses important matters related to the running of NII, such as selection of teaching staff and joint research plans. We are in charge of everything from coordinating the schedule to preparing paperwork for Administrative Council meetings. The Advisory Board is when experts from Japan and other countries give their opinions about NII's research in response to consultations from the Director General. We are in charge of supporting the researchers taking part in the Advisory Board. Overall, much of our work involves collaboration between laboratories within NII and external organizations.

Providing the best environment to researchers, in touch with cutting-edge research

—— How did you come to work at NII?

You can take a recruitment exam for the Inter-University Research Institute Corporation with the same subjects as the civil service exam. I went to an information session about the Research Organization of Information and Systems (ROIS), which is where I first found out about NII. I was interested in the job and decided I wanted to work at NII. Although I majored in Economics at university, I have always liked computers and had an interest in informatics, including studying programming at university, so I was

delighted when I was assigned to NII. I joined NII as a new graduate and now, as of 2023, I am in my second year. At the beginning I had no idea what I was doing, but now I understand the work as a whole, so I am able to think for myself and do my job.

—— What do you find rewarding in your job as an administrative staff member?

In terms of NII's work, I am proud to support important, groundbreaking informatics research and researchers. Also, I find out about all kinds of research through evaluation work, and I get the opportunity to listen to actual research presentations while organizing research meetings, so I can naturally acquire valuable knowledge. In my actual work as a member of the Planning Team, the most memorable thing I have done is supporting overseas researchers when they came to Japan for the Advisory Board. It was hard because immigration procedures were rather complicated at that time due to COV-

ID-19 restrictions, but I successfully supported the researchers during their week-long stay, taking their wishes into account, which gave me a great sense of achievement.

—— How is the work environment?

I have only experienced work in the Planning Team, so people in other departments might have different impressions, but there is flexibility in the way we work, so I feel it is a pleasant environment to work in.

—— Are there any issues or challenges in your work at present?

Most departments are going digital, but there are some departments that still work on paper, so things can take time. Many of the external organizations that we work with—universities and government offices—are still paper-based too, so progress is often slow. I realize it is difficult for reasons of accounting and so on, but I think organizations should go digital as quickly as possible to save labor and improve efficiency.

Building up experience, meeting expectations

—— Does working as an administrative staff member require any important knowledge, skills, or experience?

Rather than specific knowledge or skills, I am reminded every day of the importance of being able to work as a team. In administrative work, as well as working closely with researchers and supporting research activities, we need to help each other within the whole department to produce better results. Because our work involves collaborating with external organi-

zations, it is essential to be aware of how to communicate with people.

Although NII is an informatics research institute, you don't have to be a specialist in informatics to work in an administrative role. I started from zero myself, but the field of informatics is developing at a rapid pace. If you stay tuned to news related to informatics on a daily basis, you get a sense of the connection between research and the real world, which will motivate you in your work.

—— What kind of environment do you think is needed for young employees to thrive?

Currently, there is not much in the way of new employee training for new graduates, so I would like to see more training opportunities. In administrative work, it is easier if you can see the bigger picture, not only your own department but also the work of other departments and the research done at each research institute. It also helps to see the significance of your part, so I think new starters would be able to get on with the job more smoothly if there were opportunities to learn about the overall organization when they first join.

When I joined NII, my boss was very passionate about education and training. Even during the period when we were advised to work from home, my boss would come to the office on the same days as me in order to give me as much guidance as possible, saying "I want to cultivate human resources to lead NII in the future." I will continue to do my best to meet those expectations.

TAKEFUSA, Atsuko
Professor, Information Systems
Architecture Science Research
Division, NII
Head of Cloud Promotion Office
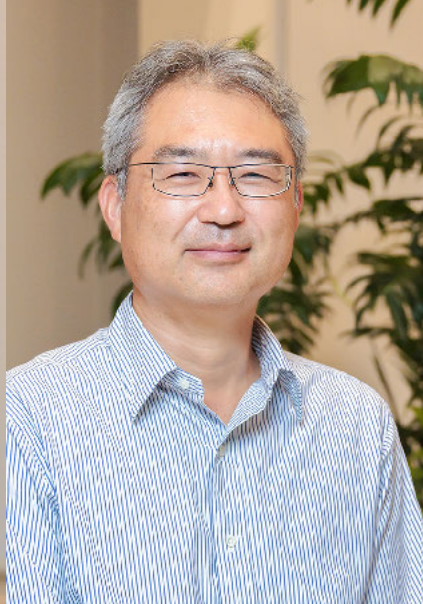
KURIMOTO, Takashi
Professor, Information Systems Architecture
Science Research Division, NII
Deputy Director, Research and Development
Center for Academic Networks

KOMIYAMA, Yusuke
Associate Professor, Digital Content and
Media Sciences Research Division, NII
Deputy Director, Research Center for
Open Science and Data Platform

Academic Information Platforms Supporting Research and Society

The academic information infrastructure provided by the National Institute of Informatics (NII) is an "academic research platform" built around the SINET network and NII RDC research data platform, including cloud environment, authentication, and security features. TAKEFUSA, Atsuko; KURIMOTO, Takashi; and KOMIYAMA, Yusuke, talk about their involvement in this infrastructure that aims to become a knowledge base for research and education at Japan's universities and research institutes.

Academic information infrastructure is a lifeline

—Let's get straight to the point. What kind of academic information infrastructure does NII provide?

KURIMOTO: NII creates and provides the information infrastructure necessary for research and education for the entire academic research community. SINET6 and NII RDC are at the core of this infrastructure. It is a multifaceted and comprehensive academic information infrastructure including a network environment, cloud capabilities, and distribution of research data.

TAKEFUSA: We also provide an integrated authentication system for universities and research institutes, and services aimed at building the foundation for information security systems through collaboration between universities.

—What place does this academic information infrastructure provision have within NII's activities?

KURIMOTO: NII has two main roles: research and services. Operating the academic information infrastructure comes under services. This includes a number of services that people like researchers, university stu-

dents, and PhD students use directly or indirectly on a daily basis: the SINET network that connects universities, GakuNin Cloud to support universities and research institutes to adopt cloud computing, the CiNii system of publishing and accessing academic information, and so on.

KOMIYAMA: Even people who are usually unaware of information technology use university IT centers and library services on a daily basis. I mainly work with IT centers, but I am also involved with the department that works with university libraries. In the future, university li-

braries will not just be a place to borrow and read books and materials, but are also expected to play an important role in collecting and distributing data, promoting open science, and acting as a driving force for academic research in Japan.

What makes working on an information platform so interesting?

—This work will profoundly affect society, through universities and research institutes. What are each of you working on, specifically?

TAKEFUSA: Regarding cloud computing, I am currently involved in the GakuNin Cloud Service, which supports cloud adoption at universities and research institutions, and the SINETStream software project to support the development of wide-area data collection and analysis programs. Rather than creating the infrastructure itself, these are services to support users in utilizing the infrastructure. Previously, most universities and research institutes would build IT systems using computers managed within the organization, but there is a move towards the cloud, as it is more stable and easier to use. GakuNin Cloud provides help with decisions about cloud adoption, a portal service to make cloud services easier to use, and tools and information to help users harness cloud computing in research and education.

Currently, universities have growing requirements for online content, like online lectures and training. NII listened to universi-ties that use online systems for lectures and created proce-dures showing how to easily construct an online education system, which universities are actually using. We listen directly to users' problems and difficul-ties, and use this feedback to improve procedures and share best practice between universi-ties. Students in humanities subjects have started to learn programming recently, with pro-gramming language education delivered online, so demand is diversifying.

SINETStream is an IoT devel-opment software package that has been developed to support the utilization of mobile SINET. Mobile SINET creates a dedi-cated network within SINET to extend services to mobile net-works. This network allows data collected by IoT terminals to be securely sent to the cloud or to university computers. SI-NETStream is a software pack-age that makes it easier to de-velop IoT-based systems on this network infrastructure. By providing SINETStream, we are supporting users to leverage IoT in various research and ed-ucational fields other than infor-mation. This means university laboratories located far apart can share data obtained from experimental equipment and measurement devices in real time, analyze the data, and share their findings.

KOMIYAMA: This trend towards open science is growing all over the world. I belong to NII's Re-search Center for Open Sci-ence and Data Platform (RCOS) which develops and provides NII

Schematic diagram of NII's Academic Research Platform
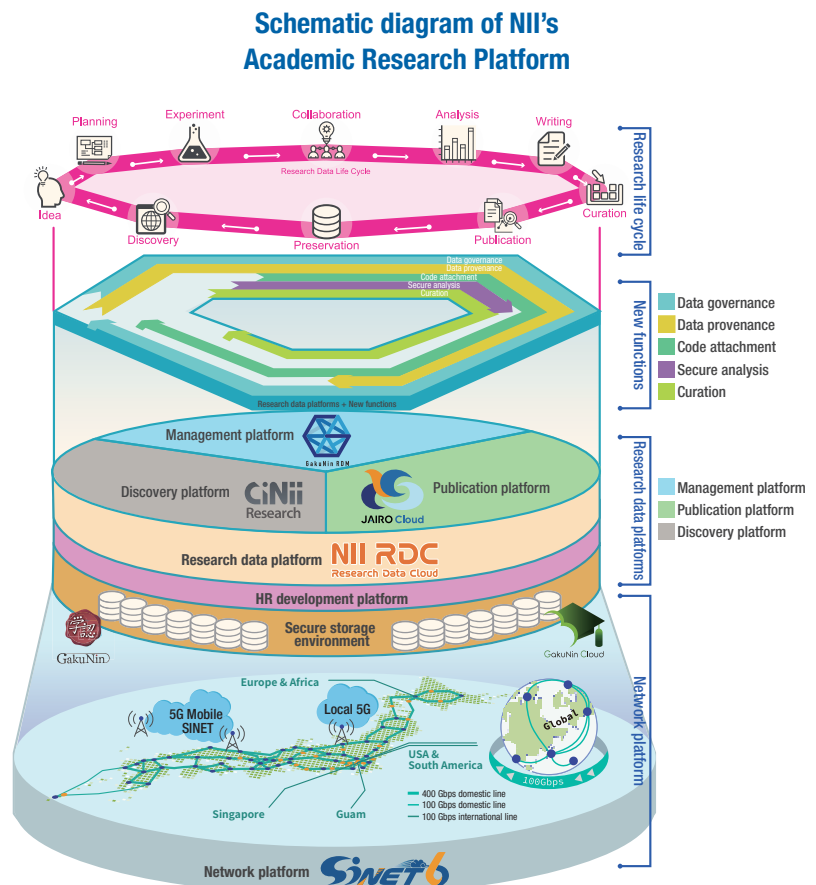
RDC, a service to manage and utilize research data for open science. A key feature of this service is that it is an application available on a web browser, which increases the possibility of using it on any OS or device. From its establishment in 2017 until 2021, RCOS worked on building three platforms: data discovery, data dissemination, and research data management/ sharing, the one I'm working on. Since 2022, we have expanded our scope to strengthening data governance, improving the reproducibility of data analysis, and supporting digital transformation. RCOS has grown from having three platform teams to seven function teams with around fifty members.

The work is very varied: as well as dealing with specialist science and engineering systems like research and development, and writing programs, we deal with public relations and sales. We make the most of diverse individual personalities in the varied tasks involved in building a research platform. Our efforts to develop open science cover every area of research—science, engineering, medicine, information, humanities, and social sciences—making every day interesting.

—The work involves a really diverse range of people. What about you, Dr. Kurimoto?

KURIMOTO: The academic information services provided by NII cover a wide range of contents. I am in charge of the SI-NET network itself.

Network services from telecommunications providers alone are not sufficient for the purposes of academic research. We listen to what researchers at universities and research institutes need, design our own network that meets their needs, procure the equipment required, and combine these to create a network.

We are continually making adjustments while the network is in use, working to make it available to as many researchers as possible.

A job like this, where you can design a network spanning not just Japan but the whole world, is very rare. It's hard work, but very rewarding.

NII's role in our rapidly changing society

—I imagine numerous unforeseen issues must arise in this kind of work. Can you tell us about this?

TAKEFUSA: Recently, of course, the COVID-19 pandemic had major impacts. For a while, all GakuNin Cloud seminars had to be delivered online or on demand. But it is difficult to replace the benefits of taking part in a seminar face to face: the ability to concentrate and the sense of participation. On-demand content offers the advantage that you can watch it any time, but often in the end, you don't get around to watching it. Meeting face to face is

also important to get to know people and form relationships. On the other hand, online meetings are a great way to quickly exchange information with someone far away. It's a matter of trial and error to find the optimal balance when providing a communication environment.

Having said that, the effects of the pandemic did boost digital transformation in society as a whole, including universities, accelerating understanding and utilization of cloud solutions. I am studying every day to make sure this leads to changes for the better.

KOMIYAMA: Speaking of global trends, the situation regarding the publication of academic research has changed significantly in the last few years. For example, in other countries, when publishing a paper in a prestigious academic journal, researchers not only have to pay expensive publication fees, but must also agree to transfer the intellectual property rights to the related data. If you want to use the illustrations used in that paper in a book or another paper, the university or research institution may have to pay to buy back the rights.

I think it is very important for universities and research institutes to be able to manage the rights for intellectual property that they have produced. Looking around the world, intellectual property systems are provided by national federations in some regions, but major academic publishers are sometimes involved in decision-making and administration. This means it cannot be said to be

neutral, and is bound to be influenced by what commercial companies want.

That's why we are aiming to create a system allowing users to search for data relating to papers within a single data platform, leaving the data at the universities and research institutes. This is something that we can do as a national institution, which would be impossible for a private company.

Data curators play a crucial role in this issue. The role of a data curator is to provide additional information to publish research results and organize the data, as you might say the role is "information connoisseur." Many issues are still under discussion, concerning how to organize research data, provide additional information, and input it into the storage provided by NII RDC. University libraries could take on this role in the future.

KURIMOTO: In terms of my work, we have expanded SINET lines in response to demand. The whole of Japan is now linked with 400 Gbps lines, and we plan to increase that to 800 Gbps between Tokyo and Osa-ka, where there has been an increase in the amount of data transmitted.

Demand is increasing exponentially, but it is not easy to increase network capacity at the same pace. But if we don't increase it, users will soon experience slower internet speeds. We believe it is important to strengthen the network in line with demand.

Of course, we are working on developing and providing new network services too, not just increasing capacity. We have introduced a new service to protect web servers from attacks, for example. A server within SINET automatically analyzes communications to detect attacks, and we provide a service with a mechanism to automatically block attacks. Providing such network services makes the network more stable for users.

A treasure trove of challenge and diversity

—This work is very attractive, being full of intellectual challenge and social impact. Finally, what do you think is the appeal of working at NII?

KOMIYAMA: NII RDC has been selected for the Ministry of Education, Culture, Sports, Science and Technology's "Developing a Research Data Ecosystem for the Promotion of Data-Driven Science." We are working with RIKEN, the University of Tokyo, Nagoya University, and Osaka University on platform expansion and development. I find it very rewarding to be involved in a national project, working to maintain and expand the infra-structure that society needs.

TAKEFUSA: As I mentioned, NII has two jobs: services and research. Being able to combine these two roles is one advantage of being a researcher on the service side of NII. When conducting research, you often wonder, "Will my research benefit society?" But at NII, you can open-source your research results or develop them as services, so you really get a sense of how your work is contributing to society.

On the services side, we often work in teams. I feel this is an environment where young people can naturally grow and develop, with advice from colleagues, senior researchers and management.

It's not uncommon for male researchers to take childcare leave. I think this is a feature of working in a team.

KURIMOTO: I think the diversity of backgrounds is another feature of NII. Coming from a corporate background myself, the world of academic research is very exciting. NII is an environment of diverse people and an incredible wealth of knowledge.

I hope to further develop our services, working with researchers who will lead the next generation.

Fostering Future Experts in Information Science

Professor, Principles of Informatics Research Division, NII
Director of Global Research Center for Big Data Mathematics

KAWARABAYASHI, Ken-ichi

The Experts in Information Science Program sets teenagers with a talent and passion for information science on the path towards becoming world-class researchers and engineers. We asked Professor KAWARABAYASHI, Ken-ichi, who is responsible for planning and running the program, how far it has come, and what the future holds.

University is too late to develop talent

Around the world today, most of the researchers leading the way in information science and the engineers providing new services to society are young people aged 25 to 35 years. Looking at their career paths, it is not uncommon to see stories like: "I was keen on programming since I was in elementary school, and got into a prestigious university based on my skills and achievements." But Professor KAWARABAYASHI says that in the past, Japan's education system has unfortunately not been geared towards nurturing such talent. "In the 2010s, as global information science human resources became younger, we found that Japan was falling behind in cultivating the younger generation. At the International Olympiad in Informatics, every member of the Japanese team won gold medals two years in a row, so we know there are many talented high school students in Japan. But this did not follow though to producing world-class researchers, due to weak links with universities and graduate schools."

To address this issue, the Experts in Information Science program was planned to provide junior high school and high school students all over Japan with the opportunity to learn cutting-edge information science and conduct their own research.

Around forty teenagers with a grounding and passion for the subject learn university-level information science over the course of six months to a year. Selected students then work on their own research under the guidance of a mentor (young researcher). As the finishing touch at the end of the program, they give a presentation at the Information Processing Society of Japan (IPSJ) national conference in March. Students work on diverse research topics from mathematical research and algorithms to applications, hardware, and gaming strategies. The program is aimed at junior high school, high school, and technical college students with the programming ability and algorithm knowledge level of a third-year university student, so after systematically studying information science, they should have no problem conducting research.

Turning the effects of COVID-19 to an advantage

Going back to March 2020, just when the first cohort of students were looking forward to starting the program, the COVID-19 pandemic struck. The program had to be delivered entirely online from April.

Professor KAWARABAYASHI recalls: "It was hard in the sense that the students missed out on the opportunity to actually come to campus, interact with researchers, and experience the research environment."

But there were positives, too. Stu-

dents are often busy with after-school activities, so it is difficult to coordinate times to meet with their university supervisors. Several students living outside Japan take part in the program each year, too. Video lectures allow students to learn from anywhere at their own pace. The program was originally intended to be delivered in person, but even now that the pandemic is over, it is staying online. There are opportunities to meet in person three times a year—two campus visits plus the IPSJ conference at the end of the program.

"During the campus visits, they get the chance to see inside the computer center, which even university students hardly ever get to see. Standing next to the supercomputer in action, when they are shown old CPUs and computers, the students have incredulous looks on their faces. It must be exciting for these children who have grown up in a world where computers are taken for granted."

Links with universities and companies all over Japan are one of NII's strengths. Collaboration with a variety of institutions is vital to provide comprehensive learning and opportunities to experience cutting-edge research. This program is run in cooperation with the Japanese Committee for International Olympiad in Informatics as well as the IPSJ.

Continuing efforts to promote diversity

From the start, there has been an awareness of diversity. "If they were all the same kind of people, it would not vitalize the program, so we try to get students from diverse backgrounds. There are students who have achieved excellent results in the Olympiad in Informatics, Business plan contests, Robot contests, and so on, plus students who are committed to other social activities."

Initially, around 5% of students on the program were female; now, that figure has increased to almost 25%. There are still not enough opportunities for high school or junior high school girls to become interested in information science, but the situation is improving.

One thing which is still a serious issue is the disparity between metropolitan and rural areas. "Information like this program does not seem to be reaching junior high school and high school students in rural areas. There might be an attitude of 'but you're still in high school' in these areas. All we can do is try to steadily increase understanding."

That's why NII is promoting a ten-year plan. "In ten years' time, the students who have completed this program will be finishing graduate school and embarking on their careers as professional researchers and engineers with PhDs. If they return as mentors, the program will naturally come full circle. If that happens, it will help to widen understanding of the meaning for the students and society," hopes Professor KAWARABAYASHI.

If these young "Experts in Information Science" play an active part in fostering the next generation and forming an ecosystem to contribute to Japan in diverse ways, perhaps it will help to reduce the information disparity between metropolitan and rural areas.

First steps towards a fair, grass-roots approach

On the other hand, this program could be criticized by the general public as "elite education."

One of the things the organizers are always aware of is giving back to society. "There may be some criticism that elite education only benefits those who are already winners in life. But producing outstanding human resources to make our country stronger and redressing disparities should not be in conflict with each other. I hope this program will help to develop people who can move society in the right direction, rather than monopolizing rights."

There are also questions about the significance of the program being run by a national institution. "This program does not offer any incentives, like accelerated entry to top universities, which is common in other countries. Also, for now at least, we don't get any funding from private companies. This is a grassroots activity, and we are not really focusing on speed or scale. But I think it is important that it continues to stimulate Japan in a fair way. I believe this is the significance of the program being implemented by a national institution."

Where will the students who have completed this program be in ten years' time? Whether they continue on the path of information science or choose a different path, they are sure to use what they have learned from the Experts in Information Science Program to give back to society in some way. The future will bring more challenges.

Nurturing Global Collaborations through International Exchange at NII

NII International Internship Program

PLANAS, Emmanuel

**Professor/ GLO Deputy Director,
National Institute of Informatics**

Every year, the National Institute of Informatics (NII) welcomes students from MOU partner institutions to take part in joint research. Dr. Emmanuel PLANAS, who leads the International Internship Program, talks about purposes, benefits, and status of accepting interns.

Could you briefly talk about NII's Memorandums of Understanding?

Certainly, we sign Memorandums of Understanding (MOUs) with partner institutions worldwide to enhance research collaboration, and currently have research MOUs with over one hundred partner institutions spanning 35 countries. We enter into MOUs when our researchers are working or are intending to work with prospective partners' researchers on a given research topic. The MOU elevates the collaboration to institutional-level research. It is a strategic way to enhance cooperation, building on a solid foundation of research between the parties involved.

What happens when an MOU is established?

An MOU with a new partner institution drives two significant actions within NII. Firstly, it fosters more collaboration by connecting the researchers through a specialized initiative known as MOU Grants. This program offers financial assistance for our researchers and their counterparts to collaborate on specific projects. Secondly, our renowned International Internship Program opens to students from our partner institutions the possibility of applying for internships here at NII.

Who is eligible for the International Internship Program?

Students eligible to apply for our internship program include second-year master's and PhD students from our partner institutions. The application process involves specific guidelines that are communicated directly to the students through an intermediary professor or manager, with two annual calls for applicants, one in Spring and another in Autumn. We accept approx. 70 students per call.

What are some of the research areas at NII?

Here at NII, we cover a wide range of ICT-related topics, proposed by NII researchers belonging to our four divisions: Principles of Informatics, Information Systems Architecture Science, Digital Contents, and Media Sciences and Information and Society.

What kind of feedback have you heard from past interns about their experience?

We have numerous instances where students apply for internships and find the experience so enriching that they reapply. We are affiliated with SOKENDAI University (the Graduate University for Advanced Studies), and it is not uncommon for our interns to later join PhD programs there. Additionally, many of our former interns continue their academic journey, engaging in further research and even becoming professors. Remarkably, some alumni, even a decade after their initial internship, continue collaborating with us, often

sending their own students. It is a testament to the enduring impact and positive impression our program leaves on individuals, leading to long-lasting academic relationships.

Are there any trends in applicants or acceptance rates over time?

Looking back, we have had a total of 1829 internship research stays since 2005, with students coming from our 116 MOU partner institutions in 35 countries. On the whole, we have had upwards of nearly 80 nationalities represented by our interns, reflecting the welcoming environment for international applicants here at NII. Around two-thirds of our applicants come from Europe. We also receive and welcome applications from Southeast Asian countries, notably China, Vietnam, Thailand and Singapore.

What are the fundamental benefits of this international exchange activity?

Internship students at NII bring a surge of youthful energy and fresh perspectives to our research initiatives. Their international background brings original views to our publications; in fact, over half of our international publications are co-authored by these students in addition to their NII host professor's team members. Moreover, their involvement often establishes communication channels with their

With interns at a farewell party for Professor Angelino (Center), March 2019

home universities, leading to further collaborative efforts. This interaction not only enriches our research projects, but also nurtures valuable connections between institutions.

Is the international experience a crucial part of the overall internship experience?

Absolutely! The international experience and the diverse atmosphere are highly valued aspects of our program, which has gained significant recognition over the last 15 years. Not only does interacting with a global community enrich students scientifically, but it also offers a distinctive human experience. The uniquely friendly international setting is an integral part of the program's value, promoting both scientific and cultural growth.

Could you share any personal reflections on your experience with NII's International Internship Program?

Reflecting on the International Internship Program here at NII, I find it to be an exceptionally visionary initiative established by my predecessor, Prof. Henri Angelino, aimed at attracting the best talents to our research institute. It is uniquely efficient and easy to implement, primarily because we focus on accepting selected students from our more than one hundred partner institutions. Also, our contact professors at these institutions play a crucial role in choosing the best candidates based on their performance and proposed research topics. This rigorous selection process ensures a rich pool of high-quality candidates for the internship, enabling fruitful collaborations.

What are your aspirations for the future of the program?

I envision expanding our collaborations to include trilateral programs, moving beyond bilateral exchanges. With common funding initiatives between countries like Germany, France, and Japan, exploring beyond bilateral research activities at the research level is an exciting prospect for the program's future.

International Exchange based on MOU
www.nii.ac.jp/en/about/international/mouresearch/

Interview/Written by FORTE Science Communications   Photo SUGISAKI, Kyoichi

NII NEWS TOPICS

Period: August 1 (Tue.) to → → November 30 (Thu.), 2023

More details about news items are available online.
www.nii.ac.jp/news/2023

Facebook
www.facebook.com/jouhouken/

X (Twitter)
twitter.com/jouhouken

YouTube (audio will play)
www.youtube.com/user/jyouhougaku

Bit (NII Character)
X (Twitter)
twitter.com/NII_Bit

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NEWS RELEASE

2023

Nov. 27 Foujita used three different whites that glow red, green, and blue under ultraviolet light! Fluorescence spectroscopy reveals the secrets of skin textures in the artworks of Léonard Tsuguharu Foujita

Oct. 30 Successful field testing of transmission over a world record-breaking distance of 336 km at 1.2 Tbps per optical wavelength, and data transfer at over 1 Tbps

Oct. 23 LINE stickers and LINE emojis featuring NII character Bit now available

Oct. 20 Development of the large language model LLM-jp-13B with 13 billion parameters: NII-led LLM Working Group (LLM-jp) initial results published to contribute to academic and industrial research and development

Oct. 18 Historical place names "Administrative Division Changes" converted to large-scale open data: Collaboration with Heibonsha Map Publishing to make Nihon rekishi chimei taikei, Japan's historical place names, available as machine-readable data

AWARD

2023

Nov. 28 Research team led by Prof. INOUE, Katsumi (Principles of Informatics Research Division) won 1st and 3rd places in the ROAD-R challenge for NeurIPS2023

Nov. 7 LLM-jp awarded an Excellence Award at the Rakuten Technology Excellence Awards 2023

Sep. 27 A paper by Dr. NGUYEN HONG HUY, (project assistant professor at Information and Society Research Division), FANG Fumin (former project researcher at Information and Society Research Division), Prof. YAMAGISHI, Junichi (Digital Content and Media Sciences Research Division) and Prof. ECHIZEN, Isao (Information and Society Research Division) was awarded the BTAS/IJCB 5-Year Highest Impact Award

Sep. 13 Project assistant professor HONIDEN, Shinichi (Director of Center for Global Research in Advanced Software Science and Engineering) awarded Japan Society for Software Science and Technology 2022 Fundamental Research Award

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市民講座

FY2023 Public Lectures: "The Front Line of Informatics"

See the website for application and details
www.nii.ac.jp/event/shimin/2023/

Lecture 1. Who are you over the network? SAKANE, Eisaku

Lecture 2. How to use robots that learn from experience KOBAYASHI, Taisuke

Lecture 3. From conception to distribution of academic papers NISHIOKA, Chifumi

Lecture 4. How can we protect ourselves from fakes? ECHIZEN, Isao
March 4, 2024 (Mon) In-person and live streamed
To be available in the archive

Lecture 5. Interpreting Japanese culture with AI and big data KITAMOTO, Asanobu
Suitable for high school students Available from January 2024 (online only)

Lecture 6. A message to the investors of the future MIZUNO, Takayuki
Suitable for high school students Available from February 2024 (online only)

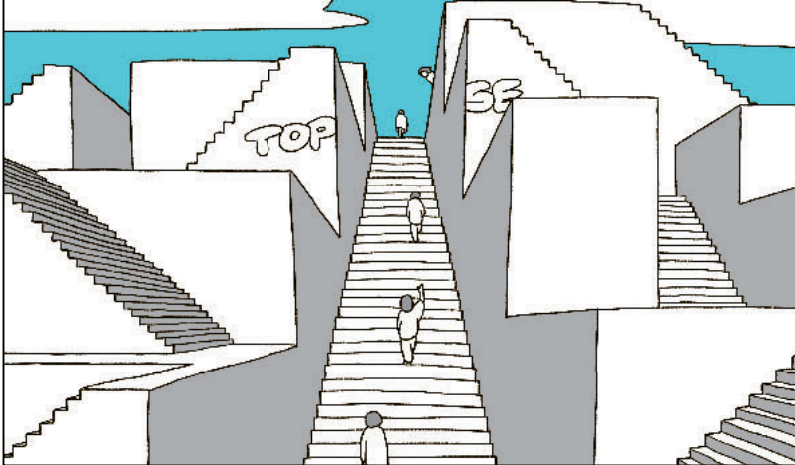**Lectures 1 to 3 will be available soon in the archive**

National Institute of Informatics
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Top SE is an education program for working engineers aiming at developing "super architects" skilled in software engineering techniques, theories, and tools. During the one-year course, participants learn through cutting-edge lectures centering on practical exercises and apply this learning to real-world problems. As well as practical techniques, by applying academic theories and tools, the course trains professionals to support an advanced information-based society.

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Quantum Academy of Science and Technology

A new way to learn about quantum technology

The Quantum Academy of Science and Technology was established in 2020 with the aim of establishing higher education standards for quantum technology and developing human resources with a high level of expertise, capable of a wide range of career paths in quantum technology. As well as joint development and shared use of online courses, the academy provides a database of educational materials. (www.qacademy.jp)

The online courses developed and provided by the Quantum Academy of Science and Technology can be widely used for preparing lectures at universities, summer schools, and so on. Individual students can be managed using the QOLS learning management system, developed based on the NII's GakuNin LMS, making it ideal for university lectures and seminars.
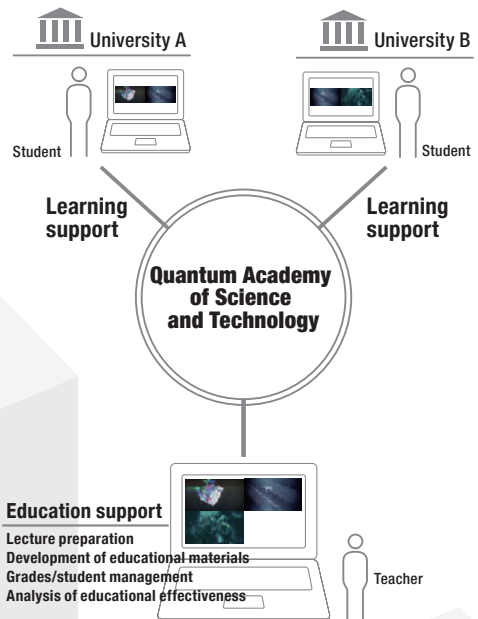
A database of educational materials is available on the academy's website. Diagrams, tables, slides, and problem sets frequently used in quantum science and technology are provided under Creative Commons License CC-BY-SA. These materials can be used without copyright concerns, allowing you to concentrate on teaching and research. The materials are compiled into a searchable database with easy keyword search functions.

You must be a member of GakuNin to access online courses. Please contact the office for details.
qacademy.jp/contact/

University A   University B
Student   Student

Learning support   Learning support

Quantum Academy of Science and Technology

Education support
Lecture preparation
Development of educational materials
Grades/student management
Analysis of educational effectiveness

Teacher

The Quantum Academy of Science and Technology is supported by the Ministry of Education, Culture, Sports, Science and Technology Q-LEAP Program

essay

Communication Brings Research to Life

UNO, Takeaki

Professor, Principles of Informatics Research Division, NII

We always talk about the importance of communication in the workplace, but it often ends up being a low priority. In research, big ideas often come from discussions with other people, yet researchers have a tendency to stay holed up in their offices. That's true of NII, but even here, people are getting a lot out of grass-roots efforts to encourage communication.

Donut Fridays

It's hard to believe it's ten years since Professor TOHKURA, former Deputy Director General of NII, passed away. A few young colleagues helped at his funeral and had a drink together afterwards, and that's how "Donut Fridays" came about. Once a month, we serve sweets so that everyone can get together for about an hour in the afternoon. The idea is to provide an opportunity for people to chat and interact. Professor TOHKURA was very helpful and caring, and people have said that his words helped or guided them. Perhaps this is a way of continuing his legacy of making this a better place to work.

People don't usually make an effort to come out and talk to people they don't know—but when there are donuts on offer, it makes all the difference. We sometimes get around eighty people. Participants have said that a conversation here has made their work easier, or they found out something they didn't know.

Over time, the number of international interns and exchange students at NII has increased. Being in a foreign country, they must be hungry for opportunities to meet other people. We even recruited a researcher for my lab at a Donut Friday event. These things can happen.

Fewer people are taking part in Donut Fridays recently, but that's not a bad thing. It's a sign that other opportunities for interaction have emerged: group chats, gatherings and Slack channels. Donut Fridays were the forerunner of all these. The role of Donut Fridays will probably change in future to a safety net for communication, or in-depth discussions with a purpose.

NII Research Radio

In 2020, the COVID-19 pandemic forced most of us at NII to change to primarily working from home, which meant there were a lot fewer opportunities to form relationships and interact with colleagues. As a result, some people found it difficult to talk about their problems; some people couldn't keep up the pace of their work; some people had no sense of belonging; some people found work more difficult; and some people were not making the progress they wanted. I realized we had to do something.

We could only communicate online, but simply talking became boring. I thought about how people form connections and wondered if relationships come from getting to know someone's personality by talking. That's why we planned "NII Research Radio" as a way to directly convey people's personality, as well as create a sense of camaraderie, motivation, and pace.

Each time, we invite one guest to talk about their work. But rather than the details of their work or research, we ask about their inner thoughts and feelings—what they find interesting, difficult, or meaningful. Then we ask about the history of where those feelings came from, and if possible, about their hopes for the future. We have a meeting to roughly decide the content in advance so that the guests don't feel too nervous.

When we first tried it, we found it to be very popular. A research seminar usually has about ten participants, but over sixty people listen to each radio show, including administrative staff, service department staff, secretaries, and students. Although it is called Research Radio, we also have guests from the service departments, administrative staff, and URAs (university research administrators). Everyone has an inner side that attracts people.

I think people are interested in other people's inner feelings. That makes us want to meet, help each other, and do our best. I believe what we lost during the pandemic was not interaction, but this feeling.

Secretaries Day

Secretaries Day is an annual event when we invite secretaries and administrative staff for a light meal of sandwiches, etc. Professors and students can take part, too. The event originated in Europe and the US as a day to express gratitude to administrative professionals on the fourth Wednesday of April, and we have adopted the idea at NII.

It's a similar idea to Donut Fridays, but it attracts a lot of secretaries, who don't usually take part. They say "I thought it would be OK for me to come because it's Secretaries Day," and they leave having completely overcome the day-to-day lack of conversation. Little things like this can make a big difference in making it easier to take part in events.

PCs have all sorts of apps, and you can adjust various settings like the volume and brightness. All kinds of chairs and computer accessories are available. Our work environments and tools can be adapted and adjusted, so why isn't the same true for workplace communication? Social events tend to be top-down, always following the same old format. If you want to improve things, it all depends on the expertise of the people on the ground. If you think of a good method that anyone can do well, that is new research. Perhaps this is something that researchers should actively explore.