



国立情報学研究所 研究成果発表一般公開

オープンハウス

2019

未来価値創成 飛情報学

Day1 5/31 Fri.

Day2 6/1 Sat.

Special Lecture 2F Hitotsubashi Hall

English



11:00-12:00

Jeffrey Ullman  
Professor, Stanford University

Running Fire of Research Presentation at NII 2F Hitotsubashi Hall

Japanese

13:00-14:30



Opening Address 2F Hitotsubashi Hall

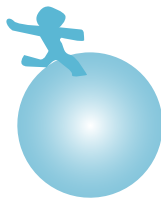
Japanese



13:00-13:30

Masaru Kitsuregawa  
Director general, NII

Keynote 1



13:30-14:00

Kengo Sakurada  
President, Group CEO,  
Chairman & Executive Officer, Sampo Holdings, Inc.

Guidance of SOKENDAI

(The Graduate University for Advanced Studies)

16:00-18:00

2F Small Conference Room

Japanese

Keynote 2



14:30-16:00

Ken Satoh  
Professor, NII

NII Computer Science Park

11:00-17:00

2F Conference Room

Industrial-Government-Academic Exchange Meeting

16:10-16:50

1F Conference Room

Japanese

Demos & Poster

2F Conference Room

Japanese & English

Day1 11:00-18:00

Day2 11:00-17:00

SINETARIUM

1F Entrance Lobby

Day1 11:00-18:00

Day2 11:00-17:00

# Demo&Poster

## A

- A01 Challenges to "soft" hardware  
Reconfigurable devices for globally asynchronous / locally synchronous systems**  
Tomohiro Yoneda We work on projects by academic and industry organizations in Europe and Japan that aim at solving various city problems with Cloud, Internet of Things (IoT), and BigData technologies. Our projects provide the foundation for solving city problems by collecting a variety of information and delivering proper control and information, as well as field trials in cities.
- A02 Intelligently Connect All the Things and People in the City  
BigClouT: Cloud of Things and BigData for Empowering the Citizen Clout in Smart Cities**  
Fuyuki Ishikawa  
Feng Chen, Kenji Tei  
(Waseda University),  
BigClouT Consortium We work on projects by academic and industry organizations in Europe and Japan that aim at solving various city problems with Cloud, Internet of Things (IoT), and BigData technologies. Our projects provide the foundation for solving city problems by collecting a variety of information and delivering proper control and information, as well as field trials in cities.
- A03 Intelligently test and repair software  
Search & Learning based Software Engineering**  
Formal Methods and Intelligence Group in ERATO-MMSD Project  
Fuyuki Ishikawa, Ichiro  
Hasuo, Paolo Arcaini,  
Shaukat Ali, Xiaoyi Zhang The complexity of software systems is constantly increasing, posing novel challenges for software verification and validation. In our work, we are investigating approaches to solve various problems in software engineering by search and learning. We realize effective and efficient techniques for automated test generation and automated repair by intelligently narrowing down the target area and learning the tendency. We specifically focus on the application of (autonomous) driving systems.
- A04 Dealing with complexity of software with abstraction  
Research on abstraction of formal specifications**  
Tsutomu Kobayashi  
Daichi Morita, Shinnosuke  
Saruwatari, Paulius Stankaitis,  
Guillaume Dupont, Yamine Ait  
Ameur, Fuyuki Ishikawa, Ichiro  
Hasuo In order to ensure the dependability of software systems, it is essential to clarify the requirements and verify they are satisfied. Recent complex systems, especially, requires careful consideration of requirements but makes verification more difficult to handle. We tackle this problem based on an approach called "stepwise refinement", namely starting from verifying abstract requirements and gradually making them complex and realistic. This presentation introduces our studies on the abstraction of requirements from various viewpoints including refactoring, reverse engineering, and approximation. We also present applications of such techniques to advanced systems such as hybrid systems.
- A05 Promote world-leading research, education and practice for cutting-edge software engineering  
GRACE Center: Center for Global Research in Advanced Software Science and Engineering**  
GRACE Center GRACE Center is a world-leading software research center in NII engaged in research, education and practical work in alliances with research organizations in Japan and overseas and as part of industry-academia collaboration. GRACE center seeks to put in place the foundations of 21st century software, while developing world-class researchers and engineers who will go on to play central roles in the next generation.
- A06 機械学習をつかったサービスの品質を担保する  
高信頼な機械学習応用システム**  
Y.Yoshioka, F.Ishikawa, M.Suguiyama, T.Sekiyama
- A07 Education Program for Software Engineers**  
TopSE The Top SE Project is a practical education program aiming to cultivate software engineers who have acquired highly advanced development techniques based on the concept, "intellectual manufacturing education based on science."
- A08 Intercloud  
Building a distributed application environment over multiple cloud platforms**  
 Center for Cloud Research and Development  
"GakuNin cloud on-demand configuration service" enables us to build a distributed application environment such as a genome analysis workflow manager by using templates. We use container technologies, overlay network technologies and Jupyter notebook for it. We also aim to establish a way to automatically reconfigure an application environment by adding and removing servers during runtime.
- A09 Cloud  
Operation and monitoring of Academic Baremetal Cloud**  
 Advanced ICT Center / Center for Cloud Research and Development  
NII operates a private bare metal cloud of OpenStack for researchers within our institute. Academic Baremetal Cloud, the third generation as our private cloud deployments, supports SINET's VPN and strict tenant separation within backyard networks. In addition, LC4RI: Literate Computing for Reproducible Infrastructure, which utilizes the Jupyter Notebook for infrastructure operations, has made it possible to provide management services with a small engineering team. In this presentation, we will demonstrate how our private cloud is operated and maintained and also show our interactive infographic tool "map".
- A10 Collaboration and Learning Environment  
CoursewareHub : A classroom tool for conducting lessons based on Notebooks**  
 Center for Cloud Research and Development  
The Jupyter Notebook is a web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. It is popular to utilize notebook in a class room where the JupyterHub can be used to serve notebooks to a class of students. NII's CoursewareHub is its extension, which assist teachers' workflows delivering teaching materials and gathering answers of exercises. It can utilize 学認 authentication. In addition, the CoursewareHub collects student's activities on notebooks. It is possible to analyze learning activities through CoursewareHub's logs. In this presentation, we introduce the CoursewareHub.

## B

- B01 Mathematical Logic and Program Logic  
Solution of Brotherston Conjecture**  
Makoto Tatsuta The Brotherston conjecture is a famous conjecture in mathematical logic, and it states the equivalence between an inductive definition system and a cyclic proof system. It was proposed in around 2001 and it had been not solved until Tatsuta in NII and Berardi in Torino University solved it in 2017.
- B02 From Mathematics to Software and Manufacturing  
ERATO HASUO Metamathematics for Systems Design Project**  
Global Research Center for Systems Design and Mathematics  
Ichiro Hasuo, Shin-ya Katsumata  
and other members of the SDM  
Center "Formal methods" refer to a body of mathematical techniques for quality assurance of software and computing hardware. The principal mathematical language that underlies formal methods is that of logic; we use it for formalizing and manipulating proofs. Our project aims at extending the application realm of formal methods to cyber-physical systems (such as cars), exploiting another mathematical language of algebra and especially category theory.

**B03 Monitoring of Cyber-Physical Systems  
From Qualitative to Quantitative Safety Monitoring**

Masaki Waga  
Ichiro Hasuo

**B04 方程式を使って、モノの動きをデザインする  
制御理論って何？**

Masako Kishida

**B05 A solution to the view update problem in RDB  
BIRDS: a framework for bidirectional programming in relational database**

Vandang TRAN  
Zhenjiang Hu, Hiroyuki Kato

The view update problem is a classical problem in database community. The key challenge in this problem is in the ambiguity of translating view updates to base relations. We propose a Datalog-based framework that applies putback-based bidirectional programming to address the key ambiguity problem posed by view updating.

**B06 How do we measure the complexity of data?  
Inlierness, Outlierness, Hubness and Discriminability: an Extreme-Value-Theoretic Foundation**

Michael HOULE

To date, no unifying theory of data mining has been proposed. Many ad-hoc techniques have been designed for individual problems, such as classification or clustering. Solutions involve much invention and reinvention, with few guidelines. A theoretical framework that ties together different fundamental machine learning and data mining tasks (including indexing, clustering, classification, data discriminability, subspace methods, etc.) could help the discipline, and serve as a basis for future investigation.

**B07 Quantum Computer and Quantum Technology  
Quantum Error correction + Hybrid Quantum Science Systems**

Global Research Center for Quantum Information Science

We present two different topics from quantum information and computation in this presentation. In the first poster, we introduce quantum error correction, which is an essential element for large-scale quantum computation. We start with a brief explanation of what quantum error correction is and how quantum error correction codes work, and then show some recent results from the Global Research Center for Quantum Information Science. The second poster is to showcase some of exciting results from the research network "Science of Quantum Hybrid Systems", which we are part of.

**C01 How Do Computers Learn?  
Machine Learning for Knowledge Discovery**

Mahito Sugiyama

I will introduce a mechanism of machine learning. In particular, I will explain how to efficiently treat information on computers and how to find valuable knowledge using statistics.

**C02 How can you find phrases you don't know?  
A Writing Assistance System for English Scientific Papers**

Kenichi Iwatsuki  
Akiko Aizawa

It is to make the most of formulaic expressions that is important for efficiently writing English papers. Formulaic expressions that can be used for the same purpose have different syntactic structures, which makes it difficult to search for them with keyword-based searching. In this study, I propose new methodology for searching that is based on document structure.

**C03 Sharing Understandings with Computers through Natural Language  
Developing Dialogue Systems for Common Grounding under Continuous and Partially-Observable Context**

Takuma Udagawa  
Akiko Aizawa

Humans can create and maintain various kinds of mutual understandings through natural language communication. In this study, we develop a new dialogue task to evaluate and analyze dialogue system's capability for such sophisticated communications skills.

**C04 Can computers understand texts?  
What makes reading comprehension questions easier?**

Saku Sugawara  
Akiko Aizawa

Machine reading comprehension (MRC) task is a testbed for testing capabilities of natural language understanding by letting machines answer questions about given texts. To construct an MRC dataset, it is important to create questions that require human-level language understanding. In this presentation, we introduce our attempts to organize harder questions for human-level reading comprehension by using some heuristics to identify easy questions.

**C05 Connecting Society and Academia with Knowledge Graphs  
Building the Knowledge Graph Platform for Open Data and Open Science**

Hideaki Takeda  
Ikki Ohmukai, Sungmin Joo, Phuc Tri  
NGUYEN, Nami Iino, Tadashi Okada

Open data and open science efforts to publicize information from public sector and research institutions in a reusable format are spreading around the world. In order to promote advanced utilization, it is necessary to introduce semantic technologies such as information structuring and vocabulary design. In this booth, we introduce several research that constructs knowledge base in specialized fields using knowledge graphs.

**C06 Resilient AI**  
Katsumi Inoue

Guillaume Lorthioir, Yin Jun Phua, Shota Katsumata, Hikaru Ikeda, Tianyu Chen, Yuutaro Totsuka, Seiya Nakata, Florian Richoux, Taisuke Sato, Tenda Okimoto, Nicolas Schwind, Morgan Magnin, Kotaro Okazaki

In an ever changing environment, AIs that can react well to scenarios originally unanticipated are in high demand. When AIs are required to change their decisions due to external factors, the speed in making the next optimal decision is an important topic. AIs that can take into account the cost of switching decisions to achieve optimal overall results are also being researched. Such an AI is called a resilient AI, and is currently one of the hot topics in AI research.

**C07 Robust knowledge base for solving social problems on Robust Intelligence and Social Technology  
Research on applied technology to use robust intelligence for social problem solution**

Center for Robust Intelligence and Social Technology: CRIS

CRIS works on solving social issues by using robust intelligence and its elemental technologies for various social issues.

**C08 Innovative aids for medicine through IT  
Study on cloud platform and AI image analysis for medical bigdata**

Research Center for Medical Bigdata

Founded in November 2017, Research Center for Medical Bigdata (RCMB) has been working on construction of cloud platform for medical bigdata and studies for medical image analysis using machine learning including artificial intelligence (AI). Here we are going to introduce our last 18 months activities and what the future might hold for the bigdata and AI.

**C09 コンピュータが法律推論？**  
Ken Satoh

**D01 Advanced visual media fall in love with light field representation rather than conventional image processing  
Light field restoration with 3D consistency for advanced visual media**Kazuya KODAMA  
Shunsuke ISHIHARA

Nowadays we enjoy visual media based on technologies for image acquisition, compression, processing, transmission and displays. Recent researches deal with not only images but also light fields for advanced visual media. We introduce ray space representation of light fields and its various applications. For example, multi-view images acquired by real or virtual camera arrays allow us to observe scenes from arbitrary viewpoints for ambient communications. Moreover, only with a single system of lenses, scene refocusing with arbitrary bokeh is achieved.

**D02 AI can edit images using texts!  
Semantic Image Synthesis**Akihiro Sugimoto  
Minh Duc VO

Semantic image synthesis is to render foreground (object) given as a text description into a given source image. This has a wide range of applications such as intelligent image manipulation, and is helpful to those who are not good at painting. We propose a generative adversarial network having a pair of discriminators with different architectures, called Paired-D GAN, for semantic image synthesis where the two discriminators make different judgments: one for foreground synthesis and the other for background synthesis.

**D03 View the old map in 3D  
History gallery system with 3D map display function**

Takeshi Abekawa

This system arranges old photographs and old drawings accumulated by time on the old map created at the time and displays them as a gallery. The system maps the correspondence between the old map and the current map, and displays the old map in 3D by mapping the current elevation information to the old map. By looking at the old map like a bird's eye view, you will be able to understand the background of the photographic subject affected by the topography.

**D04 Creating the sharing culture of research data sets  
Shared Use of Informatics Data Resources**

Center for Dataset Sharing and Collaborative Research

Keizo OYAMA, Noriko KANDO,  
Shin'ichi SATOH, Junichi  
YAMAGISHI, Tomoko OHSUGA

Researchers of informatics need large scale data such as text, speech and video generated from sensors, social media, etc. We promote the shared use of such data by means of mediating between industrial bodies and researchers, so that the research can be activated and the range of informatics expanded. We also organize evaluation workshops using common data and questions, aiming at deepening of technologies and formation of communities. The posters will present the Center's overview, summaries of the data sets provided through the "Informatics Research Data Repository (IDR)", and some examples of the research using the data sets.

**D05 Deep learning based text-to-speech synthesis  
A new method that directly converts text to speech without using knowledge of word pronunciation**Yusuke Yasuda  
Xin Wang, Junich Yamagishi

Text-to-speech synthesis is a technology to convert text to human speech. A traditional text-to-speech synthesis requires a dictionary contains pronunciation, accent and morphological information of words. Here we describe a new approach called end-to-end text-to-speech synthesis that directly converts text to speech without a dictionary.

**D06 人を楽しませる音声の合成に向けて  
伝統話芸 落語音声の合成**Shuhei Kato  
Junichi Yamagishi, Yusuke Yasuda, Xin Wang**D07 Media Forensics  
Detection of computer-generated fake audio**Xin Wang  
Junich Yamagishi

In the speaker verification technology, "impersonating another person" is a problem due to speech synthesis technology that synthesizes the voice of a desired person from text and voice conversion technology that converts the voice of another person to the voice of the desired person. Although machine learning is expected to be effective in identifying such subtle differences between the voice of a human being and a machine, there is no corpus that can learn models and quantitatively evaluate the risk of each attack. We used recent speech synthesis and voice conversion technology to build a large-scale spoof speech corpus and launched the ASVspoof Challenge 2019. The In this presentation, we introduce ASVspoof Challenge 2019, current biometric technology, and remaining issues.

**D08 Speech science  
Can we express appropriate emotional speech in noise?**Zhao Yi  
Junich Yamagishi, NTT

Speakers usually adjust their way of talking in noisy environments involuntarily for effective communication. This adaptation is known as the Lombard effect. Although speech accompanying the Lombard effect can improve the intelligibility of speaker's voice, the changes in acoustic features such as fundamental frequency (F0), speech intensity, and spectral tilt caused by the Lombard effect may also affect the listener's judgment on emotional content. To the best of our knowledge, there are almost no published studies on the influence of the Lombard effect in emotional speech. Therefore, we recorded parallel emotional speech waveforms uttered by twelve speakers under both quiet and adverse conditions in a professional recording studio in order to explore how the Lombard effect interacts with emotional speech. By analyzing confusion matrices and acoustic features, we aim to answer the following questions:

- (1) Can speakers express their emotions correctly even under adverse conditions?
- (2) Can listeners recognize the emotion contained in speech signals even under noise?
- (3) How does emotional speech uttered in noise differ from emotional speech uttered in quiet conditions in terms of acoustic characteristic?

**D09 Spectrum beyond Three Primary Colors  
The Real World Understanding based on Reflection Analysis**Imari Sato  
Mihoko Shimano, Yuta  
Asano, Shin Ishihara

The spectrum of the light observed in our world includes much information of various behavior when the light hit the substances such as "absorption", "transmission", "scattering" and "fluorescence emission". We show that visibility enhancement of fluorescent substance in consideration of an object shape, using a characteristic that the fluorescent components are not affected by different ambient illumination. We derive an analytical spectral appearance model of wet surfaces that expresses the characteristic darkening spectral sharpening due to multiple scattering and absorption in the surface. The model also enables the recovery of the original surface color and the degree of wetness from a single observation.

**D10 Media Forensics  
Fake video detection and gait anonymization**Isao Echizen  
Nguyen Hong Huy, Tieu Thi  
Ngoc Dung, Fuming Fang,  
Junichi Yamagishi

Advanced machine learning technologies have brought us a lot of benefits and it also introduced many problems. One example is the cloning of biometric information such as face, voice and gait, which can be used to impersonate someone. This demonstration show a fake video detection method using advanced deep learning techniques. We also introduce a gait anonymization method for privacy protection.



D11

ロボットに社会経験を積ませるには？  
クラウド型 VR による知能ロボットのための学習システム

DEMO



Tetsunari Inamura

D12

**Development of Data-Driven Humanities and Humanities Big Data  
ROIS-DS Center for Open Data in the Humanities**

DEMO



Center for Open Data in the Humanities

Asanobu Kitamoto,  
Chikahiko Suzuki, Mika  
Ichino, Train Clanuwat

ROIS-DS Center for Open Data in the Humanities (CODH) is working on research and development for enhancing access to humanities data using informatics and statistics to open up new possibilities of research framework in digital humanities. We will introduce various research projects conducted by CODH such as Historical Big Data, AI Kuzushiji Recognition, Collection of Facial Expressions and Bukan Complete Collection.

E

E01

**Finding network anomalies in Internet traffic  
Detecting IPv6 network scans**

Kensuke Fukuda

We demonstrate a method to detect network-wide IPv6 network scans.

E02

**Discover root causes of network troubles  
Causal analysis of SINET log data for network troubleshooting**

Satoru Kobayashi  
Kensuke Fukuda

For fast and efficient network troubleshooting, it is necessary to analyze network operational data automatically. In this research, we discover causal relations among network events in SINET log data. This technology enables system operators to find system behaviors and overlooked troubles.

E03

**暗号を使って、情報を守りながらモノを動かす  
制御システムをまるごと暗号化**

Masako Kishida

F

F01

**Software Engineering for Trustworthy Society  
Quality Assurance of Machine Learning Software**

Shin NAKAJIMA

We present quality assurance evaluation levels for machine learning software, which is supposed to be used in a third-party evaluation framework, and discuss how the metamorphic testing plays a key role in the quality assurance.

F02

**Uncovering global relationships by informatics  
Defense strategy for nations or firms against global issue: network analysis of big data on global investment**

Mitsuhiro Odaka  
Takayuki Mizuno

Global relationships among nations have changed accompanied with accelerating global investment. Here we aim to make a contribution to advocacy on defence strategies against dominance risk (e.g. foreign regulations) based on quantitative analysis of investment big data.

F03

**サイバー空間とフィジカル空間の繋がり  
The Flow of Bitcoin in Real World**

Jun Joomi  
Takayuki Mizuno

Human activities create a specific pattern in 24 hours. The pattern is influenced by the time zone where people live. In this study, we construct a time zone classifier that estimates bitcoin user's area using human daytime activity pattern. Then, we classify the area(time zone) where the user who transfers bitcoin in the specific event lives. And we visualize the flow of bitcoin in the real world.

F04

**Financial Market Switching-Points and Economic Anomalies**

Research Center for Financial Smart Data

Takayuki Mizuno, Yuan Yuan

Recently, anomaly detection is used in a lot of fields, such as medical problems, document error detection, suspicious behavior detection, machine failure detection, and so on. However very few studies use anomaly detection to financial market. At the same time, with increasing financial data and macroeconomic data, how to deal with the high dimension data is a new challenge. In this paper, our aim is to clarify the statistical relationship between the switching points of financial market and anomalies of various economic indicators by using machine learning. Our study contributes to both anomaly detection of financial market and applying high dimension data to financial market. As a practical example, we detect anomaly of Nikkei 225 by using high dimension data with 83 economic indicators which is commonly used by Japanese fund managers. First, we define the switching point of Nikkei 225 following Preis et al. (2011). Second, we pick up the relative important variables from the high dimension data which have effect on switching point. Here, we use the least absolute shrinkage and selection operator (LASSO) which is commonly applied to select important variables when using high dimension data in existing literature. In order to considering the different switching point caused by different factors, we divide our samples into different periods. Interestingly, LASSO-selected variables are related with different factors and common factors of different periods. Third, using the defined switching points and the LASSO-selected variables we make out-of-sample forecast of the anomaly. We find our forecast results are reliable.

F05

**Food and cooking computing  
Cooking Recipes without Border Ecosystem**

DEMO



Frederic Andres  
Roxane JOUSEAU, Ly Quoc  
Thang

The Cooking Recipes Without Border project demonstrates, Flavorlens, a social media platform for sharing food photos and tasting experience. The first challenge is related to community detection/clustering. The cooking recipe knowledge base is a collection of generalized cooking recipe semantic graphs. The second challenge is related to cooking recipe execution plans.



**001 The 75th anniversary of ISM on June 5th, 2019**  
**The celebration of the 75th anniversary and open house of The Institute of Statistical Mathematics**

The Institute of Statistical Mathematics

Established in 1944, The Institute of Statistical Mathematics will celebrate its 75th anniversary on June 5th, 2019. In commemoration of this, the memorial ceremony will be held at the Hitotsubashi Hall, and the memorial lecture, the panel discussion, and the open house will also be held on the same day.

**002 Bit kun!**  
 Publicity Team, NII

We introduce the activities of NII's publicity team.

**003 Introduction of Department of Informatics, SOKENDAI**  
**Outline of Department and exam guideline for the admission**

SOKENDAI (The Graduate University for Advanced Studies), Department of Informatics

NII establishes Department of Informatics, School of Multidisciplinary Science at SOKENDAI (Graduate University for Advanced Studies) and offers both 5 year and 3 year doctoral programs. These 2 courses make the best use of the specialty of NII that is pioneering and international research institutions of informatics, and aims at the promotion of the excellent talent who leads "Knowledge society" of the 21st century. The department is located in the center of Tokyo, and this good location makes busy students easier to come to learn and research. It has about 90 students, about 60% of them are international students, and 20% of them are working students. We will guide the outline of Department of Informatics and entrance exam for the admission October 2019 and April 2020.

**004 NII Shonan Meeting**  
 The office of Shonan Meetings

NII Shonan Meeting is a series of informatics seminars, managed by NII, following the style of the well-known Dagstuhl Seminars. It aims to resolve various challenges in the field of informatics by providing another world's premier venue for world-class scientists.

**005 Demonstration of VCP (Virtual Cloud Provider) using SINET wide area data collection infrastructure**  
**Real-time image analysis using mobile network: Collaboration demonstration between SINET wide area data collection infrastructure and cloud data processing environment**



Academic Infrastructure Division Cyber Science Infrastructure Development Department  
 Research and Development Center for Academic Networks, Center for Cloud Research and Development

Transfer the sensors' video data to clouds via SINET WADCI (Wide Area Data Collection Infrastructure) and display the result of image analysis in real time. Research will be promoted by linking SINET WADCI and real-time data analysis using clouds.

## Demos & Poster Layout

