NICT NEWS
独立行政法人
情報通信研究機構
National Institute of Information and Communications Technology
2014 FEB
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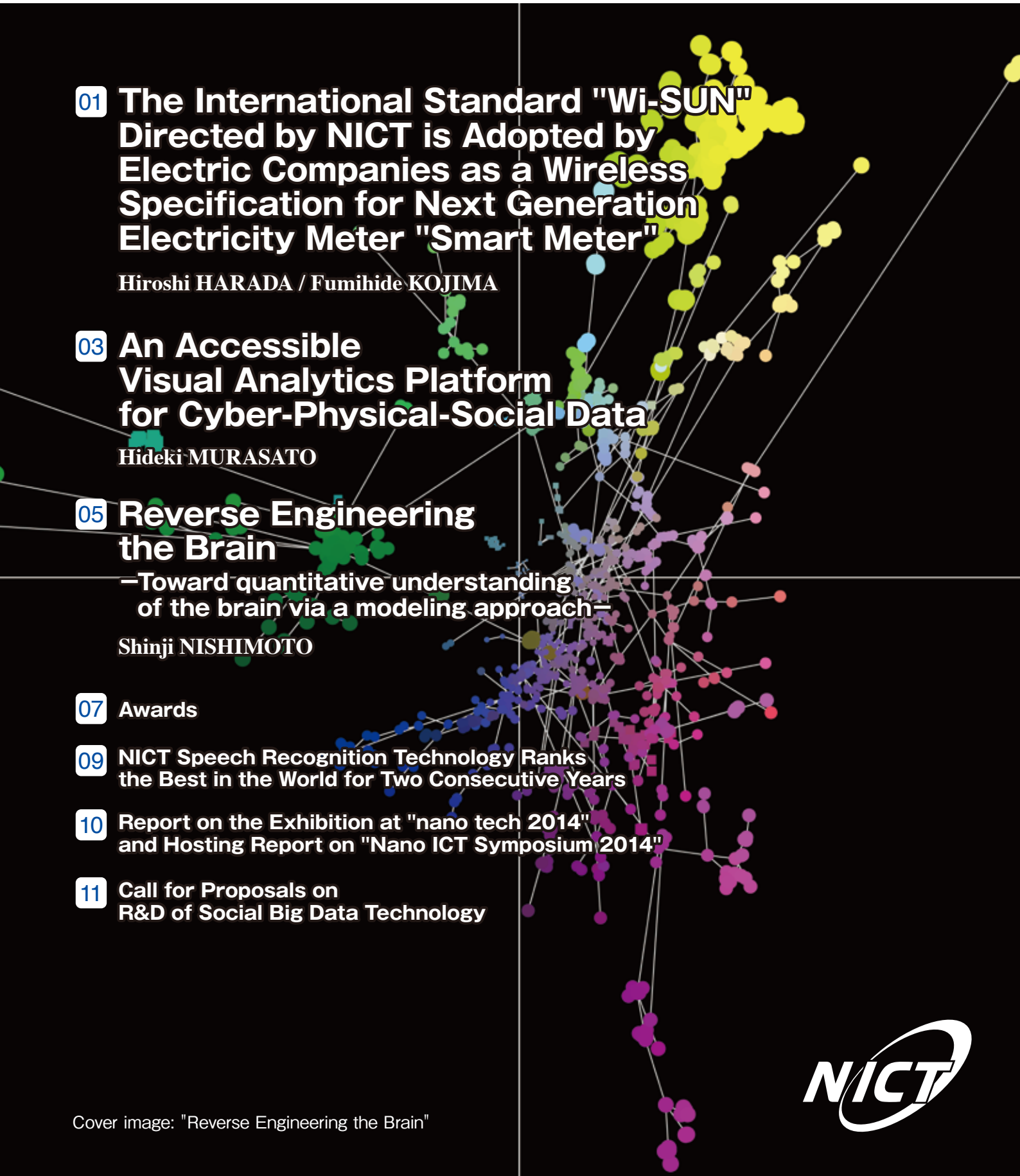
No. 437



Cover image: "Reverse Engineering the Brain"

The International Standard "Wi-SUN" Directed by NICT is Adopted by Electric Companies as a Wireless Specification for Next Generation Electricity Meter "Smart Meter"

Hiroshi HARADA
Director of Smart Wireless Laboratory, Wireless Network Research Institute

After completing a doctoral course in engineering, he joined Communications Research Laboratory, the Ministry of Posts and Telecommunications (currently NICT) in 1995. He is engaged in the research and development of cognitive radio, software-defined radio, smart utility networks, mobile communication systems using millimeter wave, VHF, and UHF bands, as well as their standardization. Ph.D. (Engineering).

Fumihide KOJIMA
Research Manager, Smart Wireless Laboratory, Wireless Network Research Institute

In 1999, he completed a doctoral course in engineering. The same year, he joined Communications Research Laboratory, the Ministry of Posts and Telecommunications (currently NICT). Since then, he has been engaged in research and development on 384 kbps high speed PHS, low-rate video real-time transmission, ROF road-to-vehicle multi-service communication, and VHF band customer-provided mobile communication. Currently, he is engaged in the research and development of PHY/MAC technology in SUN, and in its dissemination activities. Ph.D. (Engineering).

Energy management by next-generation electricity meter "smart meter"

The smart meter, a meter with communication functions installed in various lifelines like electricity, gas, and water, allows two-way efficient controls of lifelines such as automatic metering, remote shut-off and billings is now under research and development and being examined for practical use. It manages energy by communicating with HEMS (Home Energy Management System) and BEMS (Building Energy Management System), energy management systems installed in homes and buildings, or with electric equipment in home (Figure 1). ECHONET Consortium has established the "ECHONET Lite Standard", an international communication standard for energy management applications. While this standard specifies upper layers such as a session layer, presentation layer, and application layer, it wasn't intended for lower layers such as a transport layer, network layer, data link layer and physical layer. As such, NICT has been engaged in research and development of wireless equipment related to lower layers as shown in Table 1 with the aim of standardization and dissemination of research results.

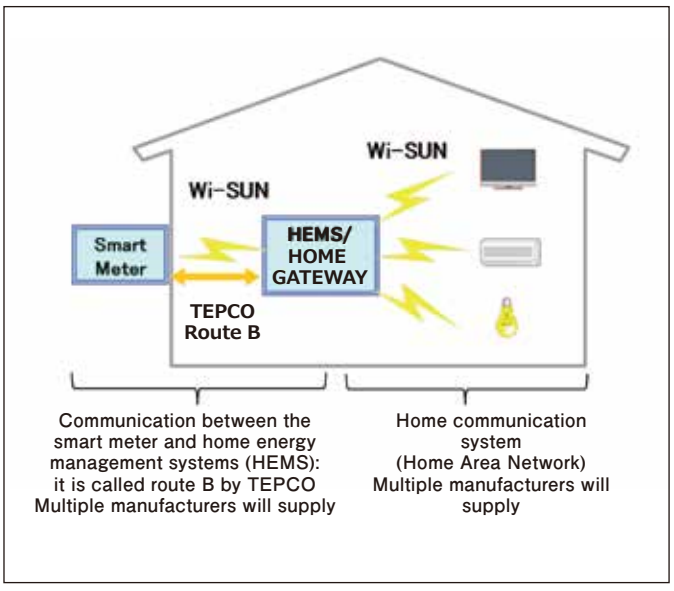


Figure 1 Energy management by the smart meter (e.g. in a house)

Developed radio device

Figure 2 shows the Wi-SUN radio device, which has been currently developed for ECHONET Lite. Within the device, a radio module is mounted as shown in Figure 2. Also, the interface board for connecting to various external devices, and the interface to an antenna, are mounted. Figure 3 shows the basic functions of the radio module. Table 2 shows the specification of the physical layer. Wi-SUN Alliance, a global industry association, developed the specification of the physical layer, MAC layer, and

Table 1 NICT activity results so far

until 2008	Promoted basic research of smart meters for power-saving wireless communication systems (communication specifications, propagation characteristics of radio wave, etc.).
from 2009	Proposed standardization of research results to the Institute of Electrical and Electronics Engineers, USA IEEE802.15.4g/4e to enact a smart meter for physical layer/MAC layer standard. Part of proposal adopted for standardization. Led the standardization as vice-chairman of IEEE802.15.4g.
January 2012	Established a "Wi-SUN Alliance" (as of January 2014, joined by 43 companies from Japan and overseas). NICT is a founding member and a Chair of Board of Promoters, Wi-SUN Alliance. Established test items based on IEEE802.15.4g specification with interoperability between manufacturers.
March 2012	Conducted research and development related to the lower layers of the "wireless utility" and succeeded in the development of a compact, power-saving wireless utility.
May 2012	In cooperation with four U.S. companies, standardized communication specifications for wireless utilities as the smart meter wireless international standard, the IEEE802.15.4g.
November 2012	Set lower layers of IPv6 support and established the committee of standards for security features for the transmission of "ECHONET Lite standard" applications in the "Wi-SUN Alliance". Led specifications as chairman.
February 2013	Wi-SUN specification was adopted as the home network communication interface standard (JJ300.10) for ECHONET Lite, which the Telecommunication Technology Committee (TTC) developed.
May 2013	Succeeded in developing a "wireless utility" that has ECHONET Lite and Wi-SUN standard (and JJ300.10).
September 2013	ECHONET Lite for Wi-SUN standard is adopted as the route B for wireless communication systems of Tokyo Electric Power Company, Incorporated.
January 2014	Wi-SUN wireless utility NICT developed as one of the Wi-SUN certified products for the first time.

Figure 2 Wi-SUN radio device that supports ECHONET Lite developed in NICT (Left: wireless utility, Right: radio module installed in the radio device)

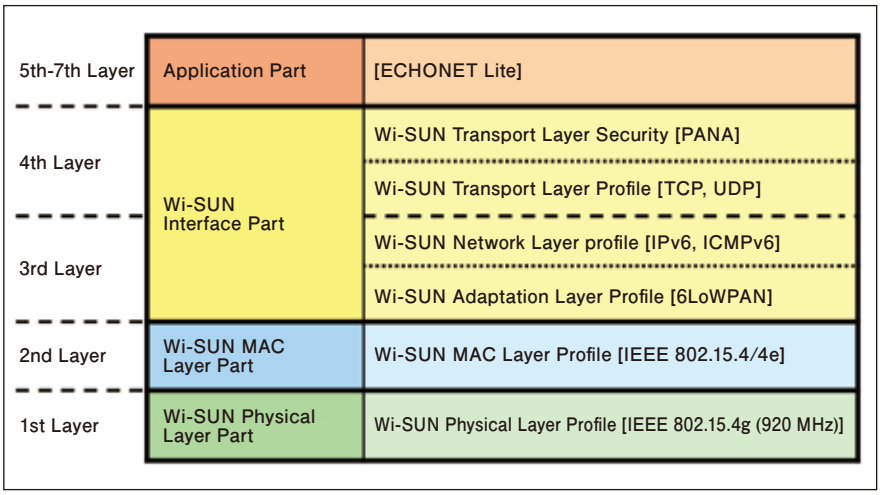


Figure 3 Wi-SUN functions on the radio module developed in NICT

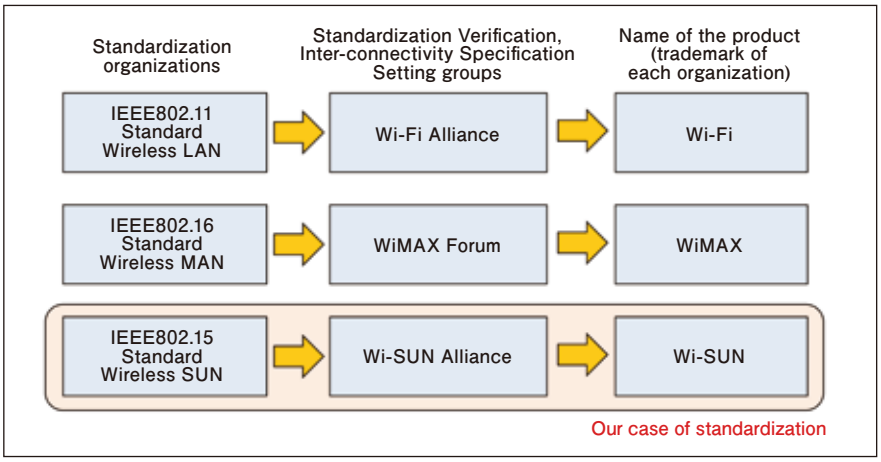


Figure 4 Relationship between standards body, standard conformance and interoperability certification body and product names

interface layer for ECHONET Lite. Using this specification, we also specified test items for an interconnection and conformance test of equipment from various manufacturers. Generally speaking, once the standardization is completed by a standardization organization, it often contains too many optional functions. Therefore standard certification groups and interconnectivity specification setting groups certify the standard and set inter-connective specifications. The final product is named after the group when being commercialized. Figure 4 shows the position of Wi-SUN Alliance.

"Wi-SUN" was adopted as the wireless standard for a new generation electricity meter "smart meter"

On September 30, 2013, there was an announcement from Tokyo Electric Power Company, Incorporated that the Wi-SUN standard for ECHONET Lite would be adopted as the wireless communication system (so-called Route B) between smart meters, which is to be maintained by the company and the in-home energy management systems that is in homes or companies (Figure 3). Japan Smart Community Alliance (JSCA), an important advisory body to set standards of smart meters and promotes national and international smart community infrastructure, held a HEMS-TF, JSCA Smart House/Building Standardization and Business Promotion Study Group.

In it, three items are under discussion for future prospect:

(1) To set smart meters that support route B in advance.
(2) To adopt communication systems that are known and standard.
(3) To ensure interconnectivity.

Wi-SUN supports international standard IEEE802.15.4g/4e and IPv6, and has high interconnectivity between wireless devices. Also, its encryption and authentication methods were considered sufficiently. In the future, wireless utilities that have Wi-SUN standard will be gradually installed in the smart meters in homes and businesses.

Table 2 Basic function of the radio module developed in NICT

Frequency (Japan)	920MHz band
Transmission power	20mW
Primary modulation scheme	2GFSK
Transmission speed	50kbps、100kbps、200kbps
Maximum data length	2047octets
Communication distance	About 500m

Future prospects

The results this time have been achieved by NICT having not only performed research and development and international standardization, but also from having worked actively, consistently on standard certification, interconnectivity specification settings, promotion, and practical use. We believe this is a very significant result. Along with the adoption of "Wi-SUN" standard, we are developing instruments for conformance and interconnectivity tests with private instrument vendors for the future. In addition, we will proactively host and join tests to check interconnectivity and compatibility. Also, by promoting activities that stabilize "Wi-SUN" as a standard, we will contribute to realize efficient energy management in homes and businesses. Furthermore, We believe that IEEE802.15.4g is not only for smart meters, but can be used for various applications such as structural monitoring, agriculture, the medical field, and so on. We believe that by expanding into these different fields, we can contribute to the realization of social ICT, a goal NICT aims for.

An Accessible Visual Analytics Platform for Cyber-Physical-Social Data

Hideki MURASATO

Technical Expert,
Information Services Platform Laboratory, Universal Communication Research Institute

After completing his master's degree and working as an Advanced Telecommunications Research Institute International (ATR) Research Engineer, he has assumed his present post since 2009. He has been engaged in development of information visualization systems and a search interface.

Background

In recent, the amount of the sensor data that reflect the real-world natural phenomena and social phenomena has been growing rapidly. Furthermore, these sensor data are continuously increasing and being widened their usability and values through the development of sensing technologies and the participation of open data activities.

NICT is developing a participatory sensing platform to help users to collect, search, share the sensor data, and even discover a new information about real-world occurrences. The platform consists of 4 components for: data collection, storage, retrieval, and visualization. This article introduces STICKER, a tool for visual analytics through interactive visual interfaces.

Visual analytics of interdisciplinary sensor data

Visual analytics is a sensemaking and reasoning process to make data more understandable, accessible, and actionable. Figure 1 illustrates the visual analytics process combining automated data analysis with parameter refinement and visual data exploration through human interaction to gain knowledge from data.

The STICKER (Spatio-Temporal Information Clustering and Knowledge ExtRaction) platform we are developing enables users to find correlated datasets from heterogeneous sensor data, and to achieve correlation analysis with human interactions in specified factors (parameters such as time, space, threshold, and keyword). It helps to access data that have a certain spatio-temporal pattern and discover a new correlation in different fields where building scientific models is arduous.

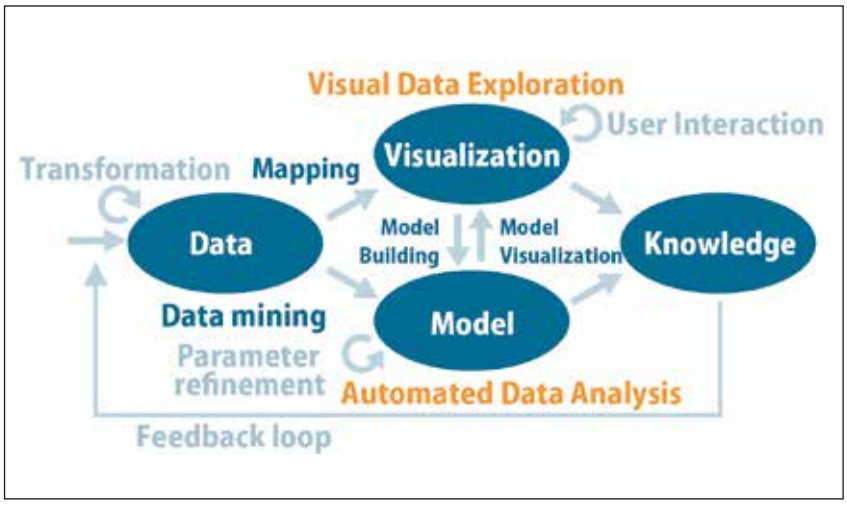


Figure 1 Process of Visual analytics
The process features data aggregation, visualization, modeling, and user interactions to find insight.

Main features of STICKER

STICKER represents data as three-dimensional (3D) geometries in a space-time cube, comprised of the geography base (x and y-axis) and the height axis to represent time (z-axis). This visualization is a typical way for the display of changes of spatial information over time like animation. In the STICKER, we support more accessible, interactive and data-driven features to discover and explore hidden correlations between diffuse data.

Firstly, we transform various types of data into STT (Space, Time, Theme) schema as shown in Figure 2 to improve data accessibility with a unified manner. By controlling the attributes in STT schema, the user can easily select and filter dataset. The second is a visual aggregation by the interaction to divide a space-time cube into small STT cells with equal intervals along each axis. In particular, the STT-cell model enables the scalable data processing and visual operations by controlling the granularity of data. Finally, it generates visual 3D geometries based on selected STT cells that satisfy the given conditions and parameters. Comparing to pre-defined shapes in traditional methods, we dynamically create a continuous shape in a spatiotemporal space using result sets. These features allow refining of parameters that emphasize distinctive patterns and their combinations.

Case study: PM2.5 correlation

Here we demonstrate two use cases on the STICKER. Figure 3 presents an analysis result on "the strong correlation among phenomenon—concentration of PM2.5, precipitation, and social behaviors in Japan". It shows the distribution of air quality (PM2.5), observed data of precipitation, and tweets that contain any keywords related to traffic jams in August 2013 in Japan. Red indicates the area with 35 μg/m³ or more of PM2.5. While early in August the area spread across the country, in mid-August it ceased. Light blue shows the regions of 2 mm/h or more of precipitation and you can observe how these regions change to compensate red area. Also, gray shows the places where people had traffic-jam-related tweets. You can view the distribution of them from East to West in mid-August, and it overlaps with the return rush peak before and after "Bon" holidays. With such observations, for example, you can hypothesize that the concentration of traffic in summer holidays may increase the value of PM2.5 to 35 μg/m³. From one piece of information, you can expand the searching and analyzing processes to find clues or counter-examples before establishing a sophisticated and scientific model in the feedback loop of the visual analytics process. In addition, the user can obtain the result datasets to achieve his/her goals.

Figure 4 shows a result of an exploration on "a combination of natural and social phenomena that has a strong correlation for a time period in Japan". This indicates distributions of the precipitation observations and tweets containing rain-related keywords in August 2013 in Japan. There exist overlapping areas between the spatiotemporal domains of two datasets. By using their spatiotemporal relationships, users might find interchangeable sensor data or sometimes discover similar patterns. In addition, by comparing differences between two areas, heavy area and not-so-heavy rain area, the user can observe the different reactions of people over tweets about rain (for example, you can examine when the number of messages about "Guerrilla Rainstorm" (unexpected strong rain) increases with data, or where and how many mm/h of rainfall occurs).

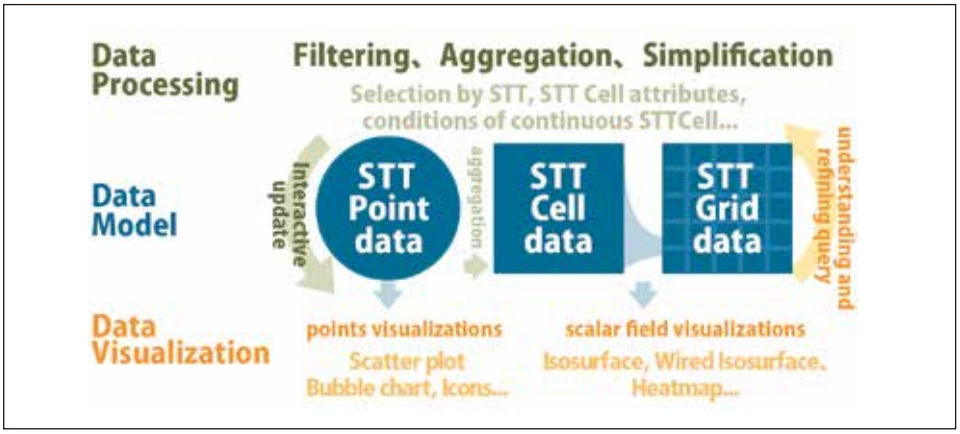


Figure 2 Data handling for visual analytics by STICKER based on STT format

STT format enables data operation and visualization over heterogeneous sensor data with a unified manner. By the interactive update between the operations and the visualizations, users refine a query efficiently.

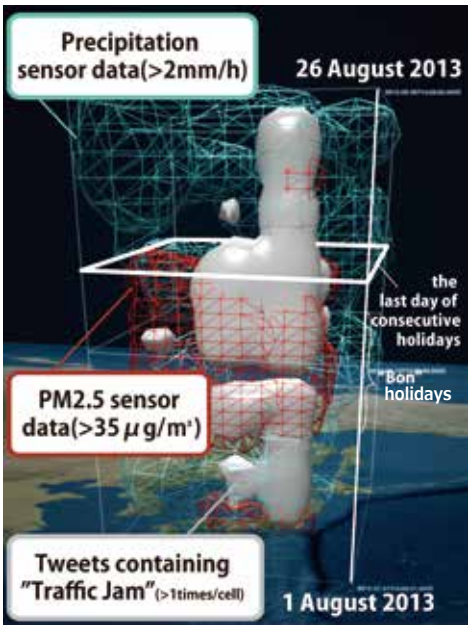


Figure 3 Data of Phenomena in August 2013 in Japan

Red line: 35 μg/m³ or more of PM2.5
Light blue line: 2 mm/h or more of precipitation
Gray region: one or more tweets with traffic-jam-related keywords per one STT cell

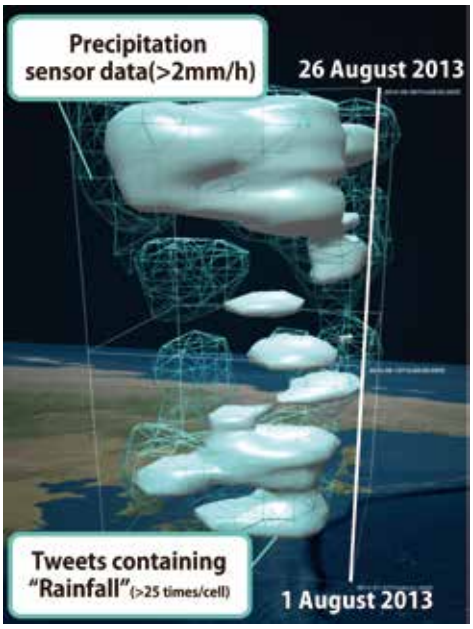


Figure 4 Data of Phenomena in August 2013 in Japan

Light blue line: 2 mm/h of precipitation
Light blue region: 25 or more tweets with rain-related keywords per one STT cell

Future prospects

The Participatory Sensing Platform aims to collect and analyze various sensor data with social collaboration on Knowledge and Language Grid (K-L Grid) of NICT. It consists of 4 parts: User Defined Sensor, which provides users a tool to collect data from a targeting data source by themselves, Event Warehouse that stores and manages the data based on STT format, sensor data searching technologies, and STICKER. For future plans, we will produce real-world awareness information services based on this platform. We expect users can easily access the services to share their data and analyze environmental issues (e.g., air pollution or climate change) and the influence on society cooperatively. As a result, the platform will be a global platform of collective intelligence to interconnect data, people, and services.

Also, we are planning to support big data visual analysis with strong correlation by time, space, and theme (correlation search function). We are also developing a focusing function that only indicates occurrences of a certain event from massive sensor data (i.e., abnormal event detection function). In addition, we will improve the performance and the usability: when users find missing or lacking data during the visual analysis processes, they can create User Defined Sensor instantly or share the result of analysis among many users via the STICKER.

[Acknowledgements]

I would like to show my greatest appreciation to Koji ZETTSU, Kyoung-Sook KIM, and Teruhiro SHOZEN.

Reverse Engineering the Brain

—Toward quantitative understanding of the brain via a modeling approach—

Shinji NISHIMOTO

Senior Researcher, Brain Networks and Communication Laboratory, Center for Information and Neural Networks

After completing a doctoral program and serving as a post-doctoral researcher at the University of California, Berkeley, he joined NICT in 2013. His current research topics include modeling and decoding of brain activity under naturalistic perceptual and cognitive conditions. Ph.D. (Neurophysiology).

Introduction

The ultimate target of communication is the brain. If the intended contents of a brain are transmitted to another brain, we call it a successful communication. If they are not conveyed correctly, the communication fails. And it is so often that our communications fail in everyday life. You would find that you can communicate with your spouse or close friends with more than 90% of accuracy, while you might feel that when communicating with a new face, he or she does not understand half of what you say.

One of the reasons for the difficulty in communication between brains is that we do not understand well enough how the brain sends and accepts information. If we can quantitatively unravel this—what protocol do brains interpret, what internal expression do they employ, and how do they process information—we will be able to realize more efficient communication. Moreover, the accumulation of such insight will lead to a foundation for brain machine interfaces.

In a series of studies from around 2011, including ones at my former position, I have been conducting research in an attempt to understand human brain activity quantitatively, using a technique called modeling approach. This approach aims to understand the brain activity in natural conditions through making an artificial brain (model) that can predict its behavior (Figure 1). Through a series of studies using a modeling approach, we succeeded in quantitatively identifying the semantic space in the brain and decoding visual experience from brain activity incorporated by "Big Data". In this article, I will introduce some of these results, their implications, and the outlook for the future.

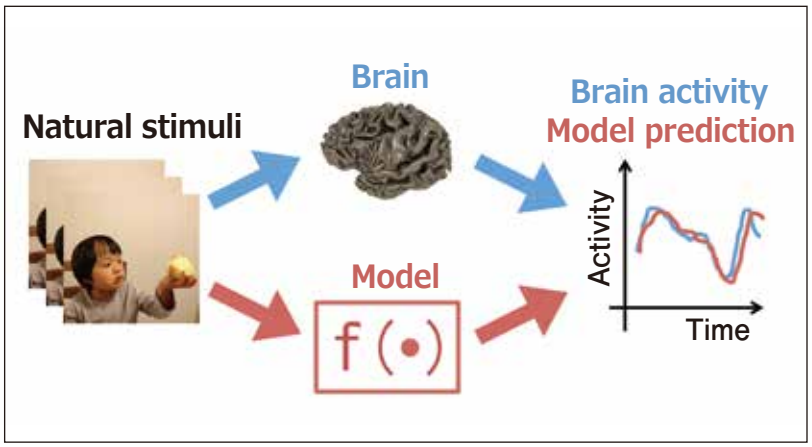


Figure 1 Conceptual diagram of modeling approach

It aims to conduct quantitative analysis on brain functions by constructing a prediction model of brain activity under arbitrary naturalistic perceptual and cognitive conditions.

Quantitative understanding of information representation in the brain

Modeling approach allows us to quantitatively elucidate internal representation in the brain via brain activity recorded under natural circumstances. To take an example, Figure 2 shows a semantic space showing the relationship between the object and action category in the brain, revealed by analyzing the brain activity evoked by natural movies. In this space, categories represented as being similar in the brain are placed near each other and those that do not are placed far away. Thus, for example, categories related to humans are represented as a cluster in the semantic space, which is placed some distance from another cluster related to animals. However, what exists in between these clusters is the cluster showing body parts. Thus, these clusters as a group form a semantic gradient (Figure 2A). Also, the revealed semantic space shows that text (character) is represented as a completely separate thing from the rest of the categories (Figure 2B).

In the past such category representations had been the subject of research primarily as something discrete. By defining the semantic space representing a continuous relationship between each as shown in Figure 2, it allows us to quantitatively and continuously understand how the receipt of information is different according to experiences, individuals or pathology, and cognitive status.

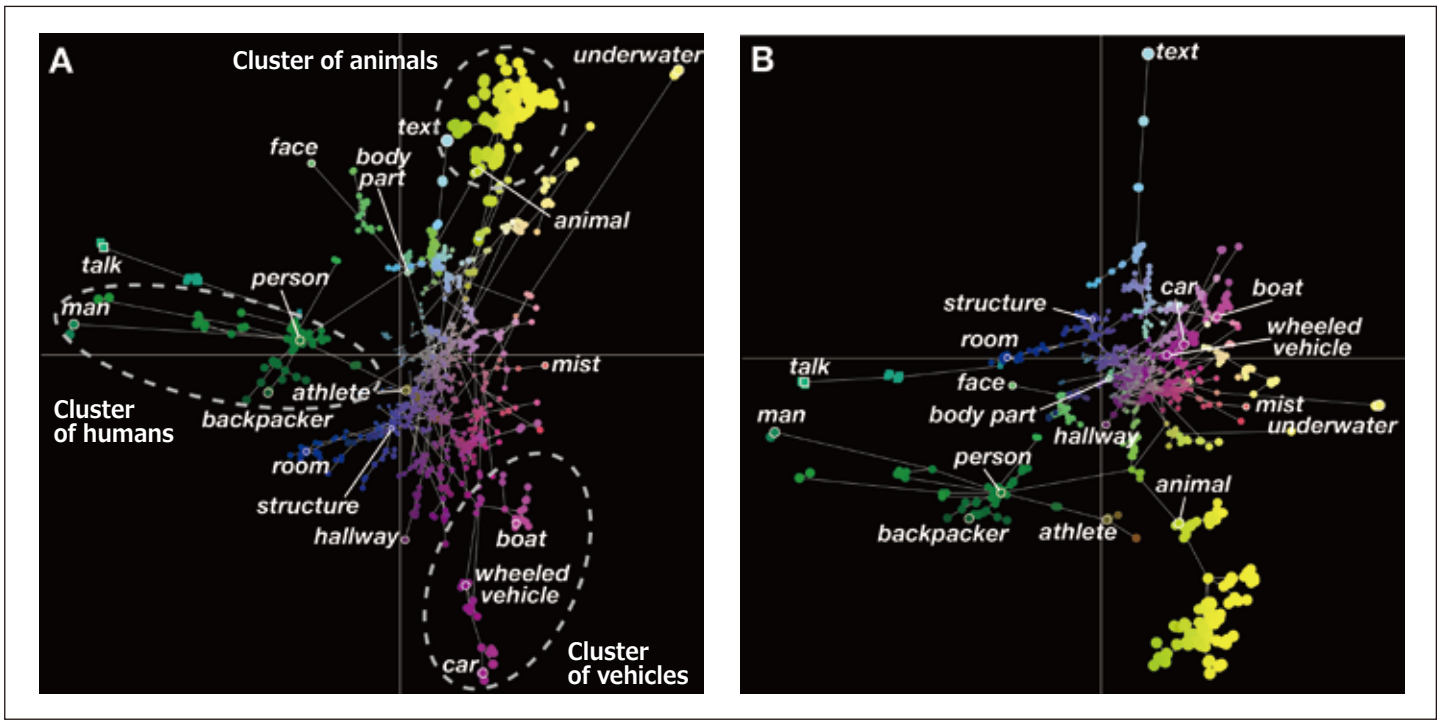


Figure 2　Example of semantic space visualizations within the brain

Each dot represents one object/action category such as face, talk, and man. The distance between dots shows the distance between information representations in a brain. A and B each takes different perspective of three dimensional semantic space. Ellipses in A show typical clusters. (Huth, Nishimoto, Vu, Gallant, Neuron 76:1210–1224 (C) 2012 Elsevier. Image used with permission, partially modified.)

Brain decoding and "Big Data"

By combining the modeling approach with Bayesian inference*, we can effectively read (decode) brain information. For instance, Figure 3 shows an example which visualizes the visual experiences of human brain activity when watching natural movies. The decoded image is still quite rough at the moment, yet such technology would become a foundation for a brain-machine interface in the future via visualization of visual imaginations.

When performing brain activity decoding as shown in Figure 3, we used about 18 million seconds of YouTube video in order to build a prior distribution about natural movies. Although our study was a relatively light example, utilization of such "Big Data" is growing in neuroscience in recent years. In addition, the Human Connectome Project, which is currently conducted in the U.S., estimates that the amount of data that a mouse brain produces is about 60 petabytes per animal, and that a human brain produces about 200 exabytes (200,000 petabytes) per person. Neuroscience itself is becoming a source of large amounts of data. Neuroscience and information/computer science will be involved closely in the course of effective, high speed data processing and interpretation in the future.

Figure 3　Example image of visual experience from the brain activity

The upper column represents the image shown to a human subject. The lower column shows the visualization of visual experience estimated by the evoked brain activity.
(Nishimoto et al. Current Biology 21:1641–1646 (C) 2011 Elsevier. Image used with permission, partially modified.)

Future prospects

In this article, we looked at quantitative understanding of brain function by a modeling approach, brain decoding, and their relation to Big Data. In the future, by applying similar approaches to cognitive fields such as emotion, imagination, language, memory, and decision making, it is anticipated that this research can offer more inclusive understanding of brain functions and more general brain decoding based on the understandings.

* Bayesian inference
One of the methods to estimate target variables (e.g. perceptual experiences) from the observed data (e.g. brain activity). In estimation, it employs a combination of a likelihood model (e.g. what kind of brain activity occurs when it experiences arbitrary perceptual experiences?) and prior distribution (e.g. what kind of perceptual input is possible in the natural world?).

Awards

Recipient ● Tomoyuki EGUCHI / Assistant Chief, International Cooperation Office, International Affairs Department

◎Award Date: May 15, 2013

◎Name of Award:
Concept Mapping MPA Scholar Award

◎Details:
In recognition of having made the map with comparisons and summaries of concepts which are significant in understanding budget systems and budget status of various types of governments in the United States

◎Awarding Organization:
Western Michigan University School of Public Affairs and Administration

◎Comment from the Recipient:

I am so honored to receive the Concept Mapping MPA Scholar Award. Thanks to NICT's support, I was able to join the graduate class of "Principles of Public Budgeting" at Western Michigan University. In that class, I developed the map with comparisons and summaries of concepts which are significant in understanding budget systems, financial status, and evaluation systems (Performance Budgeting) of various types of governments in the United States, for instance, the federal government of the United States. This time, this concept map was evaluated and led me to receive the award. I would like to express my gratitude from the bottom of my heart to all the people who supported my study at Western Michigan University.

Recipients ● Takeshi USUI / Research Expert of New Generation Network Laboratory, Network Research Headquarters
Masahiro JIBIKI / Invited Advisor of New Generation Network Laboratory, Network Research Headquarters
Nozomu NISHINAGA / Director of New Generation Network Laboratory, Network Research Headquarters

Co-recipients: Yusuke SAKUMOTO
(Tokyo Metropolitan University)
Chisa TAKANO
(Hiroshima City University)
Masaki AIDA
(Tokyo Metropolitan University)

◎Award Date: June 20, 2013

◎Name of Award:
Internet Architecture Research Award

◎Details:
In recognition of "A Server Configuration with Autonomous Session State Migration to Demand Fluctuation"

◎Awarding Organization:
Technical Committee on Internet Architecture, IEICE

◎Comment from the Recipients:

The amount of server access has a large gap between on and off-peak period. To save electricity in a large network, the issue is how to flexibly increase or decrease the number of servers. In this paper, we proposed a method for optimal consolidation or extension of the server by autonomous decisions only by locally sharing the information of each server. The Technical Committee on Internet Architecture selected this study as the "Committee Recommendation paper". We sincerely appreciate all concerned persons' support for this study.

From the left, Nozomu NISHINAGA, Takeshi USUI, and Masahiro JIBIKI

Recipient ● Shinobu ISHIGAMI / Research Manager, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute

◎Award Date: July 23, 2013

◎Name of Award: IEC 1906 Award

◎Details:
Technical contributions to the development of the basic EMC standard on emission and immunity testing in TEM waveguides (IEC 61000-4-20) and his contributions with respect to the description of electromagnetic environments (IEC/TR 61000-2-5)

◎Awarding Organization:
International Electrotechnical Commission

◎Comment from the Recipient:

The IEC 1906 Award is named after the establishment of IEC in 1906, and is given to individuals who contribute to the international standardization of IEC. This time, we received the award in recognition of our humble contribution to the development of the international standard IEC/TR 61000-2-5 second edition and IEC 61000-4-20 second edition. Particularly, a new calibration method for an electric field probe, which NICT proposed, has been added. We thank all concerned persons for their great support.

Recipient ● Eiichiro SUMITA / Director of Multilingual Translation Laboratory, Universal Communication Research Institute

Co-recipients: Teruji KOBAYASHI
(FEAT Limited President & CEO)
Makoto NATSUME
(NARITA INTERNATIONAL AIRPORT CORPORATION President & CEO)

◎Award Date: August 29, 2013

◎Name of Award:
Minister for Internal Affairs and Communications Award of 11th Annual Merit Awards for Industry-Academia-Government Collaboration (Awards granted in recognition of noteworthy successes in, and significant contributions to the promotion of, industry-academia-government collaboration), 2013

◎Details:
In recognition of the achievement for industry-academia-government collaboration activities over "network speech translation technology in practical use" and the contribution to the development of information communication

◎Awarding Organization:
Cabinet Office, Government of Japan

◎Comment from the Recipient:

We developed a multilingual speech-to-speech translation app for smartphones titled "NariTra" in cooperation with Narita International Airport Corporation and FEAT Limited, based on the speech translation technology of NICT. For the app, we have strengthened the words necessary for a trip or in the airport. And also, we broadly promoted the app. These activities were highly evaluated and led to the award. This award would not be possible without support from NICT. We thank everyone from NICT.

Eiichiro SUMITA on the far right

Recipients ● **Varga ISTVÁN**[*i] **Motoki SANO**[*i] **Kentaro TORISAWA**[*ii]
Chikara HASHIMOTO[*iii] **Kiyonori OTAKE**[*iii] **Jong-Hoon OH**[*iii]

*i Researcher, Information Analysis Laboratory, Universal Communication Research Institute *ii Director of Information Analysis Laboratory, Universal Communication Research Institute
*iii Senior Researcher, Information Analysis Laboratory, Universal Communication Research Institute

Co-recipients: Takao KAWAI
(NEC Corporation)
Stijn De SAEGER
(Nuance)

◎Award Date: September 3, 2013

◎Name of Award:
Encouragement award

◎Details:
Problem and aid matching during a large scale disaster

◎Awarding Organization:
Young Researcher Association for NLP Studies

◎Comment from the Recipients:

In this study, we proposed a method of automatically recognizing various problems and their possible solutions from Twitter during a large-scale disaster. We believe that this award represents the recognition that such a system could play a helping role in assisting victims in case of when such a disaster strikes again. This work is a joined effort of all of our research group members and I would like to express my sincere gratitude to each and every one of them.

Varga ISTVÁN on the left

Recipient ● **Tetsuya KAWANISHI** / Director of Lightwave Devices Laboratory, Photonic Network Research Institute

◎Award Date: September 18, 2013

◎Name of Award:
Electronics Society Award

◎Details:
In recognition of the demonstration by the pioneering research of the vector lightwave modulation technology with a focus on speeding up the process of lightwave modulator, and the use of multi-level modulation, which enables dramatic increase in capacity in optical communication system by the technology. Also, the contribution to opening up new possibilities of modulation technology and to development in the optoelectronics field.

◎Awarding Organization:
Electronics Society, The Institute of Electronics, Information and Communication Engineers (IEICE)

◎Comment from the Recipient:

The subject of the award is about a study of lightwave modulation technology, which is one of the basic elements of optical communication. The field belongs to optical technology, but it is the frontline area where you apply the knowledge, such as signal processing, which is cultivated by wireless technology to high-speed optical communication. I think the research results were brought forth with the accumulation of NICT's continued knowledge from the Radio Research Laboratory. Also, with these powerful techniques we were able to proceed further external cooperation and it was possible to circulate ideas and experience well. We are extremely grateful to everyone who assisted us.

Recipients ● **Masato TANAKA** / Distinguished Researcher
Kazuhiro KIMURA / Director of Planning Office, Universal Communication Research Institute

◎Award Date: October 10, 2013

◎Name of Award:
Space Development and Utilization Award, Minister of Internal Affairs and Communications Award

◎Details:
In recognition of remarkable contribution regarding the proposal and research on quasi-zenith satellite system, in development and utilization of space as seen from an information communication perspective view

◎Awarding Organization:
Cabinet Office, Government of Japan

◎Comment from the Recipients:

The idea of high elevation angle orbit satellite system that uses an inclined synchronous orbit was thought to be unrealistic and difficult to realize. For the idea, we established a station keeping method and verified the validity of the high elevation angle by the experiment using a non-geostationary satellite that had failed to be put into geostationary orbit, and named the high elevation angle orbit satellite system the Quasi-zenith satellite system. This research led to the realization of the navigation satellite "MICHIBIKI" and the award. We thank those concerned for their support.

In the center, Yoshitaka SHINDO, Minister of Internal Affairs and Communications, and on the right Kazuhiro KIMURA, left, Masato TANAKA

Recipients ● **Yuuki TAKANO** / Researcher, Security Architecture Laboratory, Network Security Research Institute
Ruo ANDO / Senior Researcher, Security Architecture Laboratory, Network Security Research Institute
Takeshi TAKAHASHI / Senior Researcher, Security Architecture Laboratory, Network Security Research Institute

Co-recipients: Satoshi UDA
(Japan Advanced Institute of Science and Technology)
Tomoya INOUE
(Japan Advanced Institute of Science and Technology)

◎Award Date: October 25, 2013

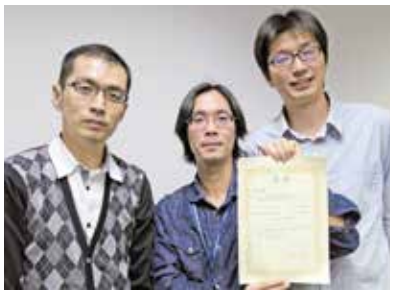
◎Name of Award: Paper Award

◎Details:
Research paper "A Measurement Study of Open Resolvers and DNS Server Version"

◎Awarding Organization:
Internet Conferences 2013

◎Comment from the Recipients:

DNS Amplification Attack is one of the DDoS attack methods that have been actively used recently. In this study, we reported and investigated Open DNS Resolver servers, which are used as a stepping stone to DNS amplification attack, in detail unprecedented worldwide. We are glad that such a study towards real-world data was evaluated externally. In the future, we will continue to perform research that faces reality.



From left, Ruo ANDO, Yuuki TAKANO, Takeshi TAKAHASHI

NICT Speech Recognition Technology Ranks the Best in the World for Two Consecutive Years

—Ranks First Place in English Speech Recognition at IWSLT—

In the 10th International Workshop on Spoken Language Translation (IWSLT) which was held in Heidelberg, Germany, on December 5 and 6, 2013, NICT led the institutes in the automatic speech recognition (ASR) evaluation campaign joined by 10 research institutes (8 research teams) from 7 countries, resulting in the best recognition rates among them for two consecutive years since 2012.

The ASR systems developed by the attending institutes were tested on transcribing the English lecture speech to texts and the performance evaluation was based on comparing the word error rates of the systems. Traditionally, speech recognition on long utterances by various speakers is a difficult task. This year's campaign required two more special challenges; the test data set[*1] for this year (as shown in the following table "test data set C") (1) included many lectures given by non-native English speakers, and (2) had many unknown acoustic events which required a speech activity detection algorithm before doing any recognition (compared with given speech activity segments from last year). The task was more difficult, and more advanced techniques were required than that of the previous year.

Concerned with the novelty by comparing with other research institutes, NICT has developed speaker adaptive training on deep neural network (DNN)[*2]. This technique significantly improved the recognition performance, particularly on solving the non-native speaker speech problems as mentioned above. In addition, the system developed by NICT achieved the best performance on the ASR tasks in years 2011 and 2012.

Evaluation results of English speech recognition

Participating research institutions	The test data set　Number shows word error rate (%)		
	The test data set A tst2011 (8 lectures)	The test data set B tst2012 (11 lectures)	The test data set C tst2013 (28 lectures)
NICT	**7.9**	**8.6**	**13.5**
KIT	9.3	9.6	14.4
MIT-LL/AFRL	10.6	11.3	15.9
RWTH	10.2	11.3	16.0
NAIST	9.1	10.0	16.2
UEDIN	10.2	11.6	22.1
FBK	13.6	16.2	23.2
PRKE/IOIT	14.6	16.2	27.1

KIT: Karlsruhe Institute of Technology (Germany)
MIT-LL/AFRL: Massachusetts Institute of Technology Lincoln Laboratories/ Air Force Research Laboratory (USA)
RWTH: RWTH Aachen University (Germany)
NAIST: Nara Institute of Science and Technology (Japan)
UEDIN: University of Edinburgh (United Kingdom)
FBK: Institute of Fondazione Bruno Kessler (Italy)
PPKE/IOIT: Pázmány Péter Catholic University (Hungary)/ Institute of Information Technology, Vietnamese Academy of Science and Technology (Vietnam)

*1 Each test data set consists of TED (Technology Entertainment Design) lecture speech data. TED (http://www.ted.com/)

*2 Deep Neural Networks (DNN): machine learning method using multilayer neural network. This method outperforms conventional methods in speech recognition, and has received a lot of attention in recent years.

Report on the Exhibition at "nano tech 2014" and Hosting Report on "Nano ICT Symposium 2014"

NICT exhibited at nano tech 2014, The 13th International Nanotechnology Exhibition & Conference which took place in Tokyo Big Sight from January 29 to 31, 2014. We introduced latest achievement of R&D; high-performance devices and systems with advanced functions related to nano technology and bio-ICT such as "Superconducting nanowire Single-Photon Detector (SSPD)", a highly efficient, high-speed response technology that leads to realize quantum communication and single photon imaging, as well as "cell and molecule sensing system" which takes advantage of the advanced features of biological system.

In three days of exhibition, many visitors came to NICT booth, vigorously exchanging ideas with the researchers.

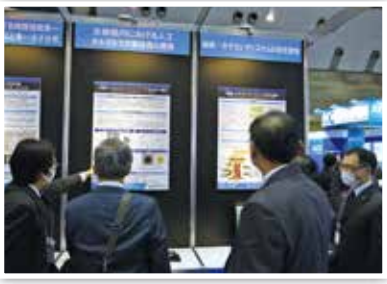
Snapshot of the venue

Compact, lightweight vacuum ion pump

Superconducting nanowire Single-Photon Detector (SSPD)

EO polymer 2 × 2 switch

Bipolar differential response light sensor using biomolecules



Bio-ICT research

On January 29, Nano ICT symposium 2014 was held at the Conference Tower, Tokyo Big Sight, as a side conference/seminar of nano tech 2014, themed in "Social implementation and deployment of ICT to the practical application of basic technology research results that combines nanotechnology and new materials". The conference began with a keynote speech by Dr. Hideo HOSONO, Professor of Tokyo Institute of Technology, who talked about the prospect of transparent oxide electronics, indicating the importance of developing the new materials as a driving force for innovation. Then six talks followed, introducing examples of NICT's R&D on gallium oxide, organic electric-optic polymer, and quantum dots optical device, and their work towards practical implementations. Many participants came to listen to the lecture, actively joining the conversation in question and answer sessions.

We hope to further strengthen the cooperation between the industry and the academia through exhibitions and symposiums, and seek to inform the public about NICT's research achievement on nano technology and bio-ICT.

Snapshot of the venue

Keynote speech by Dr. HOSONO

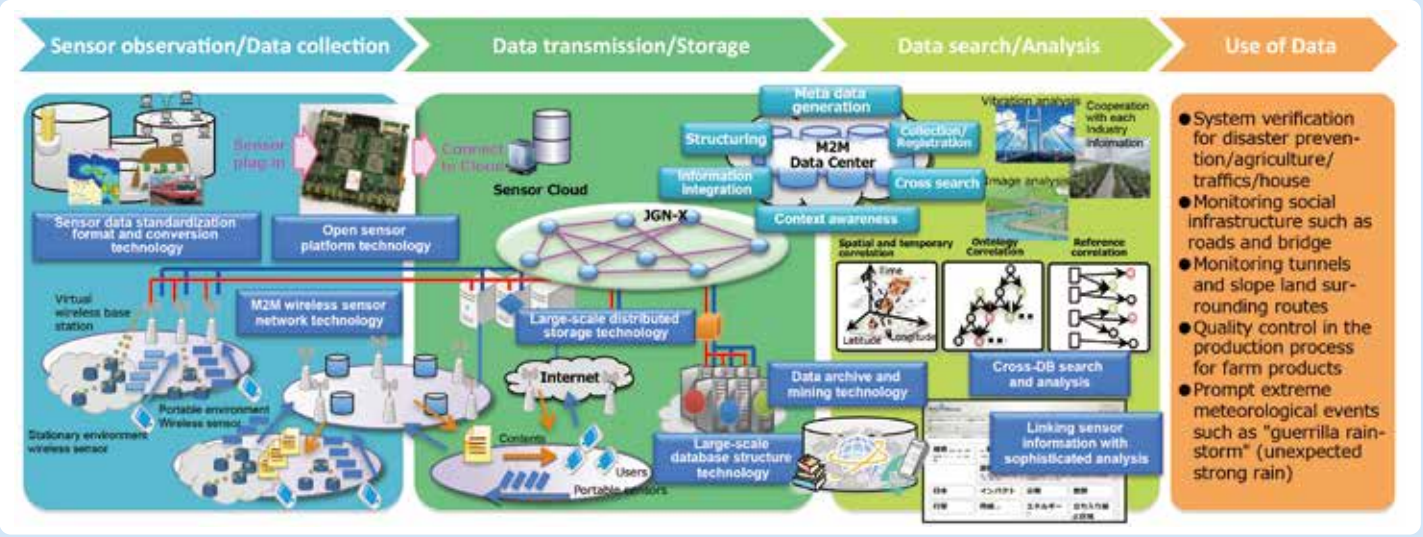
Call for Proposals on R&D of Social Big Data Technology

—Research and Development on Fundamental and Utilization Technologies for Social Big Data—

Application period: from January 29 to March 31, 2014 (no later than noon)

NICT is focusing on research and development on "Social Big Data" which we position as the axis of our key research area making use of Big Data for social contribution to the public.

Our program titled "Research and Development on Fundamental and Utilization Technologies for Social Big Data" is expected to establish key technologies which help to solve various societal challenges and create new service systems, verifying the existing issues of social systems, with the active use of Big Data available in the field of transportation, disaster prevention, agriculture, health, and so on. We look for a variety of research proposals aimed at practical realization.



Overview of Big Data Technologies

1. Research subject: "Research and Development on Fundamental and Utilization Technologies for Social Big Data"

Subject A

Research and Development on Social Applications for utilizing "Social Big Data"

- Research period: from FY2014 to FY2015 (2 years, the period may be extended for another 2 years)
- Number of research proposals to be accepted: about 7
- R&D budget: 188,000,000 JPY (maximum of FY2014) for Subject A in total

Subject B

Research and Development on Fundamental Technologies for utilizing "Social Big Data"

- Research period: from FY2014 to FY2015 (2 years, the period may be extended for another 2 years)
- Number of research proposals to be accepted: about 4
- R&D budget: 327,000,000 JPY (maximum of FY2014) for Subject B in total

Subject C

Research and Development on Implementation Evaluation and Application of Cryptographic Technologies for utilizing "Social Big Data"

- Research period: from FY2014 to FY2016 (3 years)
- Number of research proposals to be accepted: 1
- R&D budget: 30,000,000 JPY (the maximum for FY2014)

2. Application details

Please visit the following URL for more information about details of research subjects and application requirements.
http://www.nict.go.jp/collabo/commission/20140129kobo.html (Japanese version only)

☐ **You can catch the latest information about NICT's application opportunities on Twitter. Please check @NICT_itaku**

☐ **For the overview of the NICT's commissioned research program, please visit the following URL.**
http://itaku-kenkyu.nict.go.jp/ (Japanese version only)

<Inquiry about application>
Commissioned Research Promotion Office, Collaborative Research Department Tel: +81-42-327-6011 E-mail: info-itaku@ml.nict.go.jp

NICT NEWS No.437, FEB 2014
ISSN 2187-4034 (Print)
ISSN 2187-4050 (Online)

Published by
Public Relations Department,
National Institute of Information and Communications Technology
<NICT NEWS URL> http://www.nict.go.jp/en/data/nict-news/

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