Information

Event Report: NTT Communication Science Laboratories Open House 2016

Jun Suzuki, Norimichi Kitagawa, Masaru Tsuchida, Katsuhiko Ishiguro, and Shinobu Kuroki

Abstract

NTT Communication Science Laboratories Open House 2016 was held in Keihanna Science City, Kyoto, on June 2 and 3, 2016. Nearly 1300 visitors enjoyed 6 talks and 29 exhibits, which focused on our latest research activities and efforts in the fields of information and human sciences.

Keywords: information science, human science, artificial intelligence

1. Overview

At NTT Communication Science Laboratories (NTT CS Labs), two kinds of fundamental research are underway. The first is research to create the future. We are leading the world in preparing for a new era by developing technologies that will bear fruit five to ten years in the future and by accumulating knowledge. The second is research that addresses the needs of today. We are utilizing the technologies and knowledge we have cultivated to tackle the societal challenges directly confronting us now.

NTT CS Labs Open House has been held annually with the aim of introducing the results of the labs' basic research and innovative leading-edge research to both NTT Group employees and visitors from various industries, universities, and research institutions who are engaged in research, development, business, and education.

This year, the open house was held at the NTT Keihanna Building in Kyoto on June 2 and 3, and nearly 1300 visitors attended it over the two days. We prepared many hands-on exhibits to allow visitors to intuitively understand our latest research results and to share a vision of the future where new products based on the research results are widely used. We also organized an invited talk on the theme of communication. This article summarizes the event's research talks and exhibits.

2. Keynote speech

The open house started with a speech by the Vice President and head of NTT CS Labs, Dr. Eisaku Maeda, entitled "From information transmission to mutual understandings—Paradigm shift in the age of data," (**Photo 1**).

Dr. Maeda introduced NTT Group's artificial intelligence technology called corevo™, which creates

Photo 1. Dr. Eisaku Maeda, Vice President, Head of NTT CS Labs, giving the keynote speech.

models of intelligence from all kinds of data related to people, for example, written words, speech, images, music, vital signs, muscle activity, and brain activity. Through this process, intelligence is componentized by disassembling it into a variety of forms and then reassembling it. An era will certainly arrive sooner or later in which intelligence is treated as a product in the market economy. In this talk, he also pointed out the fact that the flow of physical time does not change, and the lifespan of human beings as organisms does not drastically change. However, environments that surround people are undergoing radical transformation despite these fixed limitations. He stated that NTT CS Labs is pursuing and exploring deeply and broadly the essence of communication between people and between people and machines in order to draw this future blueprint.

3.   Research talks

Four talks were given, as summarized below, which highlighted recent significant research results and high-profile research themes. Each presentation introduced some of the latest research results and provided some background and an overview of the research. All of the talks were very well received.
(1)   "Avenues toward super-human speech recognizers—Advances in deep learning and signal processing that are making speech recognition leap forward," by Dr. Takuya Yoshioka, Media Information Laboratory

Dr. Yoshioka described how deep learning has been used and how it has changed the way speech recognition is performed and described microphone array processing technologies that make speech recognition available in different situations. He also talked about the future of speech recognition technology and how it will impact our lives (**Photo 2**).
(2)   "How to transmit high-quality sound via networks—Research and deployment of speech codec EVS for VoLTE and lossless audio codec ALS for broadcasting," by Dr. Yutaka Kamamoto, Moriya Research Laboratory

Dr. Kamamoto introduced two recent enhancements in speech and audio codecs. One was EVS (Enhanced Voice Service) standardized by 3GPP (3rd Generation Partnership Project), the new standard for speech codec, which is capable of transmitting even the ambient sound on the speaker's side. The other was MPEG-4 ALS (Audio Lossless Coding) defined by the Moving Picture Experts Group, which enables us to perfectly transmit high-quality audio content

Photo 2.   Research talk by Dr. Takuya Yoshioka.

Photo 3.   Research talk by Dr. Yutaka Kamamoto.

such as that produced in a studio to our home (**Photo 3**).
(3)   "Hacking human vision, controlling material appearance—Liquid material impression and Hen-GenTou," by Dr. Takahiro Kawabe, Human Information Laboratory

Dr. Kawabe described an unsolved but important question, "How do human observers perceive non-rigid materials such as liquid, smoke, and jelly?" He explained the finding that the human visual system utilizes the dynamic pattern of image deformation to see these materials, and introduced Hen-Gen-Tou, a light projection technique based on this finding (**Photo 4**).
(4)   "Creating a computer that can perform casual conversation—Advances and challenges in open domain natural language processing," by Dr. Ryuichiro Higashinaka, Innovative Communication Laboratory / Media Intelligence

Photo 4.   Research talk by Dr. Takahiro Kawabe.

Photo 5.   Research talk by Dr. Ryuichiro Higashinaka.

Laboratories

Dr. Higashinaka explained current topics related to open domain natural language processing for building casual conversation systems. He also introduced NTT's casual conversation system that is now able to perform casual conversation with users to some extent (**Photo 5**).

4.   Research exhibits

The open house featured 29 exhibits displaying NTT CS Labs' latest research results.

We categorized them into four areas: Science of Machine Learning, Science of Computation and Language, Science of Media Information, and Science of Human and Communication. Each exhibit was housed in a booth and employed techniques such as slides on a large-screen monitor or hands-on demonstrations, with researchers explaining the latest results directly to visitors (**Photos 6** and **7**). The following list gives the titles of the research exhibits in each category. More details including the names of researchers associated with each exhibit can be found on the website [1, 2].

4.1   Science of Machine Learning
(1)   Learning from a large number of feature combinations—CFM: low-rank regression with global optimality guarantees
(2)   Find a good number of salient patterns in a matrix—Infinite Plaid Models for Infinite Biclustering
(3)   Relational data analysis by infinite trees—R-tree structure grows through stochastic process

Photo 6.   Lively discussions were held at the exhibition booths.

Photo 7.   Visitors enjoyed hands-on demonstrations.

(4) Navigate people with comfortable traveling route—Dynamic migration scheduling for greater visitor satisfaction

(5) How did you get here? Where will you go?—Trajectory analysis and prediction using deep learning

(6) Where are hotspots of "2020" traffic?—Predict the traffic of future events based on the individual behavior

(7) Fast and accurate deep learning—Efficient learning utilizing directions of past gradients

4.2 Science of Computation and Language

(1) Error correction, lossy compression ... as you like it—Multipotential coding method achieving the Shannon limit

(2) Quantum search over huge network for hidden structures—High-speed search over hyper-graphs via quantum walk

(3) Assuring next generation web security—Formal verification of the QUIC and TLS protocols

(4) Generating true randomness for secure ICT—Gbps streaming of physical random numbers

(5) Pitarie: Find a picture book just right for a child—Picture-book search with interdisciplinary approach

(6) Analyze and translate Japanese in various domains—Written and spoken language analysis and machine translation

(7) Find words from age and proportion of acquisition—Creating child language development database by checklist method

(8) We want to talk with you!—Encouraging speech dialogue using multiple robots

4.3 Science of Media Information

(1) Reading designed words appearing in scenes—Optical word recognition with CNN features and WFST decoding

(2) Intonation morphing from one speaker to another—Prosody conversion with generative voice F0 contour model

(3) Additional finding beyond the real thing—Adding information to art using high-definition multiband image

(4) Recognizing your voice even in noisy environments—Advances in distant speech recognition technologies

(5) Speech/audio coding for telephone and broadcasting—Low-bit-rate speech coding EVS and lossless audio coding ALS

(6) Hen-Gen-Tou 2.0 (Animation Lamps)—Auto-matic projection of motion impression using image search

(7) How to change a dry scene into a scene after the rain—Material editing that makes object surfaces look wet

4.4 Science of Human and Communication

(1) English is OK!—Assistive technology for non-native speakers

(2) Different word acquisition of Japanese and English—Cross-linguistic study of parental input and word acquisition

(3) Making eye-contact with people in teleconference—Social telepresence with eye-contact using kinetic avatars

(4) Ear's delicate coding mechanism—Conversion from amplitude modulation to frequency modulation in the inner ear

(5) Mobile gadget for tugging at your hand—Evolution and application of "Buru-Navi"

(6) Shaping the athletic brain!—Sports performance improvement system based on brain science

(7) Ticket-to-talk: improving intra-family communication—How tracking technologies support caregiving at home

5. Invited talk

This year's event also featured an invited talk by playwright and director Mr. Oriza Hirata. The title of his talk was "Standing together on no common ground," and it explored the idea of what the essence of communication ability is, which is also an important research topic at NTT CS Labs. He pointed out that understanding the context is essentially the most important part of communication, and understanding the context enables us to design communication. To prove this, he showed evidence that was induced from his activities such as directing a play in which both human actors and robots took part and holding workshops using theatrical methods, and from cross-cultural understanding and communication in the bio-medical area.

6. Information transmission using web

The members of NTT CS Labs have made a continuous effort to inform a lot of people both domestically and internationally about their research activities and results. As part of the ongoing effort, they simultaneously released both Japanese and English

websites [1, 2] for NTT CS Labs Open House 2016, which included a booklet, exhibition posters, and reference information. They plan to upload photos of the presentation and exhibition halls and videos of the director's keynote speech and the three research talks.

The members of NTT CS Labs consider it important to disseminate high-quality and valuable information on a timely basis. They also have a clear awareness that it is important to convey information on the professional research activities that are underway at the laboratories to a wide range of people in ways that are easy to understand. NTT CS Labs is therefore continuously trying to improve the ways of disseminating their research activities and results.

7. Concluding remarks

Just as they did last year, many visitors came to NTT CS Labs Open House 2016 and engaged in lively discussions on the research talks and exhibits and provided many valuable opinions on the presented results. In closing, we would like to offer our sincere thanks to all of the visitors and participants who attended this event.

References

[1]   Website of NTT Communication Science Laboratories Open House 2016 (in Japanese),
      http://www.kecl.ntt.co.jp/openhouse/2016/index.html
[2]   Website of NTT Communication Science Laboratories Open House (in English),
      http://www.kecl.ntt.co.jp/openhouse/2016/index_en.html

Jun Suzuki
Senior Research Scientist, Linguistic Intelligence Research Group, Innovative Communication Laboratory, NTT Communication Science Laboratories.
He received a Ph.D. in engineering from the Graduate School of Information Science, Nara Institute of Science and Technology in 2005. He joined NTT Communication Science Laboratories in 2001. He is currently researching machine learning, natural language processing, and artificial intelligence areas.

Katsuhiko Ishiguro
Research engineer, Learning and Intelligent Systems Research Group, Innovative Communication Laboratory, NTT Communication Science Laboratories*.
He received a Ph.D. in engineering from University of Tsukuba in 2010. He is conducting research on machine learning, especially modeling of structured data.
*He is currently with Mirai Translate, Inc.
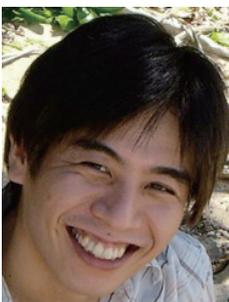
Norimichi Kitagawa
Senior Research Scientist, Sensory Resonance Research Group, Human Information Science Laboratory, NTT Communication Science Laboratories.
He received a Ph.D. in psychology from Tokyo Metropolitan University in 2003. His research interests include multisensory perception and perception-emotion interactions.

Shinobu Kuroki
Research Scientist, Sensory Representation Research Group, Human Information Science Laboratory, NTT Communication Science Laboratories.
She received a Ph.D. in information science and technology from the University of Tokyo in 2011. Her research is focused on human tactile processing, in particular, frequency perception, time perception, and motion perception.

Masaru Tsuchida
Research Scientist, Recognition Research Group, Media Information Laboratory, NTT Communication Science Laboratories.
He received a Ph.D. from Tokyo Institute of Technology in 2002. His research interests include multispectral imaging, three-dimensional image processing, and computer vision.