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Watching too closely leads to degraded motor learning

−Brain mechanism for error correction of rhythmic movements−

Tsuyoshi Ikegami

Specialist, Brain ICT Laboratory, Advanced ICT Research Institute

After completing a doctoral course and serving as a researcher at Advanced Telecommunications Research Institute International, Ikegami joined NICT in 2010. He is involved in research related to human motor control and learning mechanism.

Background

When we learn new motor skills, what exercises enable us to learn faster and better? So far we know that when you learn a one-shot movement (discreet movement) like throwing a ball, your brain adjusts the next motor command based on the gap (error) between actual movement and intended movement and facilitates learning. Under this idea, error information can be viewed as always favorable to motor learning. On the other hand, the brain mechanism in rhythmical repetitive movement (rhythmic movement) like dribbling a basketball was not well understood. In the case of rhythmic movement, where the brain continuously receives error information, do adjustment commands in the brain work as well as in discreet movement?

This time, we performed an experiment to clarify this issue, discovering in rhythmic movement that excess visual information of the movement inhibits learning, and showed the counterintuitive result that not receiving too much visual information, for example by closing your eyes on occasion, is most effective for learning.

Mathematical modeling of motor learning process

We used a “system identification*” data analysis technique to investigate how the brain processes visual error information (“gap” between actual movement and intended movement) and adjusts / learns movement when learning rhythmic movement. In the experiment to perform system identification, we had the subject operate a robot arm’s handle and periodically move the cursor on the screen in a linear motion between two targets (Figure 1, left).During the experiment, we created an artificial error relative to the actual handle movement where we made the cursor movement tilt to the left or right at random angles around the front target (Figure 1, right).Based on this visual error information,

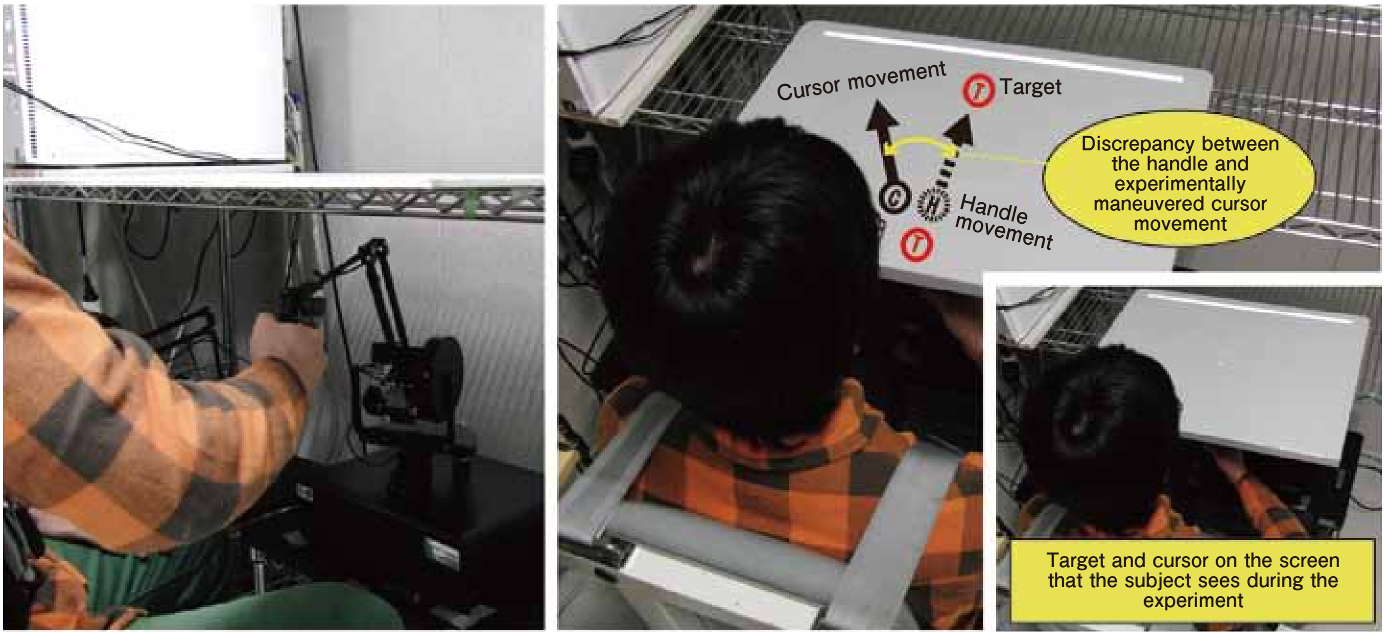


Figure 1●Visual movement transformation task utilizing a robot arm

We had the subject grip and move the robot arm handle with their right hand (left figure) and maneuver the cursor on the screen (right figure). The subject was asked to move the cursor periodically back and forth (1 cycle: 400ms) between two targets (7cm between T and T). During the experiment, the subject could not see their hands (the handle) movement directly due to a screen.

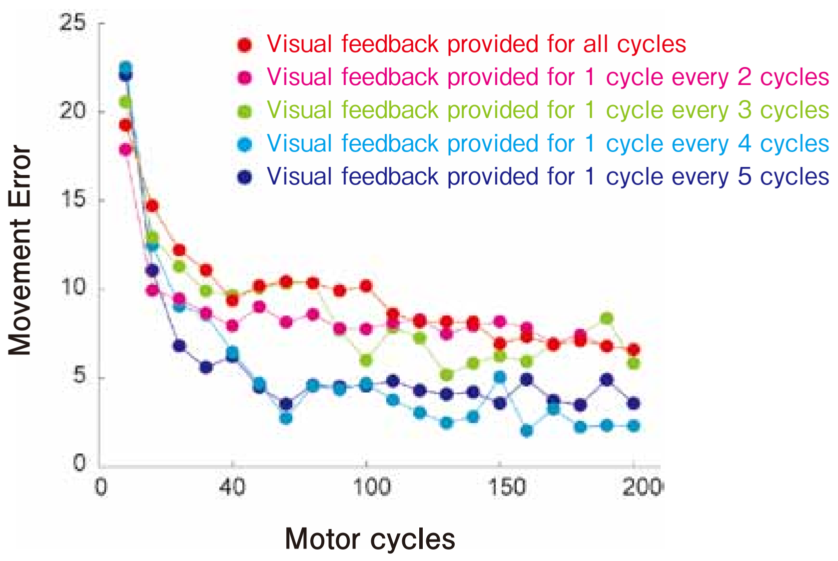


Figure 2●Changes in motor learning achievement in various visual feedback conditions

Each piece of data is the average value of every 10 cycles. As the motor cycles increase, we can see that the error from the goal grows smaller and learning progresses. That attainment level of learning differs based on the frequency of visual feedback shown. From this task, we know that feedback from visual feedback provided approximately one time every four or five cycles improves the attainment level of learning.

we mathematically modeled the process in which the subject adjusted subsequent motor commands, and applied this to actual data. As a result, we learned that information on motor errors that occur in certain cycles adjust the motor command to compensate that error in the next cycle. This result coincided with findings on motor learning of discrete movement where motor error information guides motor learning in a proper direction. However, surprisingly, it became clear that what motor error information had an effect on was not motor command adjustment in the next cycle's but two or more cycles later, and moreover, that the effect does not facilitate learning but rather works to inhibit it.

Facilitating motor learning by not providing too much motor visual information

Normally, to improve and learn rhythmic movement such as dribbling a basketball, we intuitively feel that it is important to always clearly discern the difference between actual movement and intended movement. However, the result obtained by system identification gave us an interesting hypothesis contradictory to that intuition. If motor error information has an inhibitory effect on adjusting the motor command after two cycles, providing visual feedback of the hand (cursor) movement not continuously every cycle but intermittently only one cycle out of numerous ones so that the brain does not accept harmful error information for learning, the attainment level of motor learning should improve. In order to verify this hypothesis, we examined rhythmic movement learning achievement under various visual feedback conditions. As we predicted, the result showed that in providing visual feedback in only one cycle per four or one per five cycles, learning achievement for the motor task improves more than if the information was provided in every cycle (Figure 2).

From our research, we showed for the first time that in rhythmic movement learning, motor error information does not only facilitate learning, but also can inhibit it. The results, which show that feedback from excessive motor information in fact inhibits learning, are a practical inspiration for sports practice and rehabilitation techniques.

Future Prospects

With this research, we revealed how the brain processes visual error information of movement. We believe that the further understanding of the structure of information processing in the brain will lead to further development of effective attainment and re-attainment of motor skills. In addition, this achievement was printed in “The Journal of Neuroscience” Jan 11, 2012 issue.

Glossary

＊ System identification

Engineering method that determines dynamic characteristics of system input-output based on experimental data.

Communicating new light with nanotechnology

—Broadband optical gain device based on semiconductor quantum dot technology—

Naokatsu Yamamoto

Senior Researcher, Lightwave Devices Laboratory Photonic Network Research Institute

After completing a doctoral course and serving as an assistant at Tokyo Denki University, School of Engineering, Yamamoto joined Communications Research Laboratory (currently, NICT) in 2001. He currently engages in research including semiconductor nanostructure, future photoelectron material, optoelectronic devices, semiconductor lasers, and optical transport subsystem technology. In 2008, he became a visiting associate professor at Tokyo Denki University, School of Engineering. Ph.D. (Engineering).

Koichi Akahane

Senior Researcher, Lightwave Devices Laboratory Photonic Network Research Institute

After completing a doctoral course, Akahane joined Communications Research Laboratory (currently, NICT) in 2002. He engages in research related to compound semiconductor crystal growth, optical devices, optical electronics, and carbon nanotubes. Ph.D. (Engineering).

Tetsuya Kawanishi

Director, Lightwave Devices Laboratory Photonic Network Research Institute

After completing a doctoral course and working as a research fellow at Kyoto University Venture Business Laboratory, Kawanishi joined Communications Research Laboratory (currently, NICT) in 1998. He engages in research including optical modulation devices, millimeter-wave/microwave photonics, and high-speed optical transmission technology. In 2004, he became a visiting researcher at University of California, San Diego. Ph.D. (Engineering).

Optical frequency resource depletion, need for further development

In an optical information and communications technology network (optical ICT), C-band-based bandwidth (wavelength range of 1.53~1.56 μm), which has the lowest optical fiber transmission loss, is distributed and generally used as an optical frequency channel (Figure 1). In recent years, various technological innovations aiming for efficiency in optical frequency usage and multilevel-based high capacity processing such as high-speed and new modulation format, wavelength-division, polarization division, and space-division multiplexing, etc. have been underway. However, there are fundamental concerns that only bandwidth of approximately 5THz exists in this C-band and that further expansion of optical ICT usage will exhaust the optical frequency bandwidth in the future.

By taking the optical frequency bandwidth as a resource and focusing, with a pioneering-spirit, on the importance of optical frequency resource development as necessary for future optical ICT enhancement, higher capacity production, and improvement of flexibility, we are trying to develop ICT nanomaterial and ICT devices with new features and to construct the underlying technology that applies to that optical transmission system. We are focusing particularly on new optical frequency bandwidth use of the wavelength spectrum 1.0μm (1.0~1.26) called thousand band (T band) and O band (1.26~1.34μm). We think that new development of extensive optical frequency resources residing in O and T bands that exceed 75THz can contribute to a substantial increase in the number of optical network channels in the future. Like these numerous wavelengths (channels) shown in Figure 2, by switching and routing, we can attain higher flexibility and expect an access system requiring many nodes and a datacenter optical interconnect network with a more efficient structure.

Constructing new nanotechnology-based materials: quantum dot technology

When we thought about development of the extensive, new optical frequency bandwidth residing in T and O bands and what is conducive to its effective utilization, important research will involve new optical gain material focused on wider bandwidth and optical ICT devices. The mostly operative innovative technology for this bandwidth widening is nanotechnology. In this article, we will explain quantum dot technology within nanotechnology whose research is being advanced at NICT.

By taking advantage of the self-organizing III-V compound semiconductor crystal[*1] technique, the several nanometer-high island structure like the cross-section structure shown in Figure 3(a) takes the form of a quantum dot[*2]. In this quantum dot, efficient emission is expected from electrons and holes being tightly three-dimensionally enclosed in the inner area, and the bandwidth widening of the wavelength emission area becomes potential new material based on increased size-control at the atomic level. On the other hand, due to the electron being firmly locked into the nanostructure, the electron is strongly influenced by the quality of the structure. In order to make the quantum dot a more efficient luminescent material, increasingly high quality techniques such as size-control, density growth, and aggregation control are essential. At NICT, we are proposing as a new, high quality processing technique the "Sandwiched sub-nano separator growth technique" shown in Figure 3(b). In this technique, GaAs thin-film only 3 molecular layers thick is used as a separator layer between the InGaAs background layer and quantum dot. Multiple massive aggregate structures that are large impediments to current drive have been confirmed with conventional technology, but by using this new technique, aggregate structure generation was suppressed, and with the world's strongest multi-grade high-density shown in Figure 3(c), quantum dot formation was achieved.

New beneficial use of light realized by nanotechnology

Due to the sandwiched sub-nano separator growth technique being an efficient technique to obtain high-quality quantum dots, its broadband operation has become a breakthrough for the realization of potential quantum dot optical gain material/ICT devices. Figure 4(c) is a quantum dot optical gain device fabricated at NICT. In fabricating advanced transistor nanomaterial and optical device systems, we utilized devices in the Photonic Device Lab, NICT (Koganei). By use of this quantum dot optical gain chip, the world-leading broadband wavelength tunable, high-precision quantum dot light source as shown in Figure 4(b) was developed through an industry-academia-government collaboration framework. For the wavelength tunable system, we are using a highly robust external resonator with an optical filter. Figure 4(c), one example of wavelength tunability, had a broadband operation of wavelength 1.26~1.32μm (>10 THz) confirmed through low power consumption. Also confirmed was the ability via quantum dots to efficiently fabricate optical gain devices with a wavelength range of (approximately 1.0~1.3 μm), once difficult to develop through conventional technology. In addition, the constructed illuminant functions as a narrow linewidth laser at

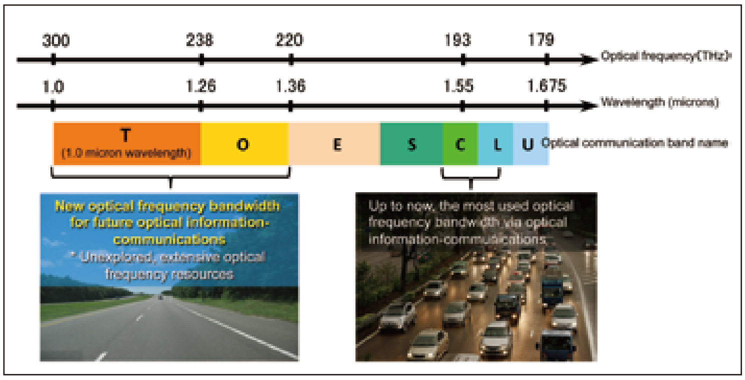


Figure 1●Relationship between band names allocated by optical information-communications and optical frequency (wavelength) bands

The band frequency centered on the C band at a wavelength of 1.55 micron is most widely used as an optical information-communications band frequency. Very extensive optical frequency resources latent in the T band at wavelengths between 1.0～1.3 micron and O band are expected to be beneficially utilized in future optical information-communications.

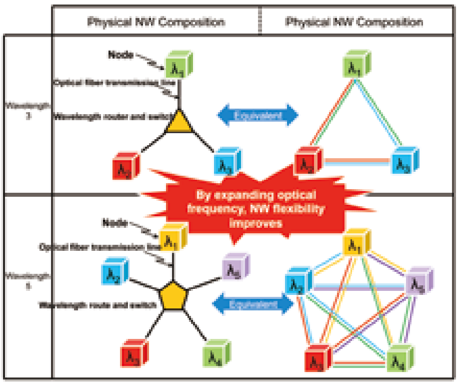


Figure 2●Improvement in network flexibility with increase in available optical frequency bands

By combining wavelength routing and switching over wider than ever optical frequency bands, it is expected that more nodes can be setup with more design flexibility in access and data center optical networks.

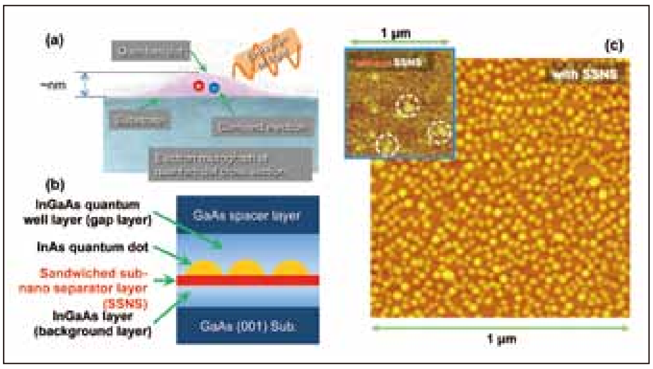


Figure 3●High-density, high-quality semiconductor quantum dot technology

(a) Cross-sectional electron micrograph of quantum dot structure fabricated on a semiconductor substrate surface, (b) NICT' s quantum dot high-quality technology: sandwiched sub-nano separator growth technique, (c) topographic image of world' s highest density, highest-quality quantum dot implemented by the sandwiched sub-nano separator growth technique (top left is the quantum dot structure using a conventional technique).

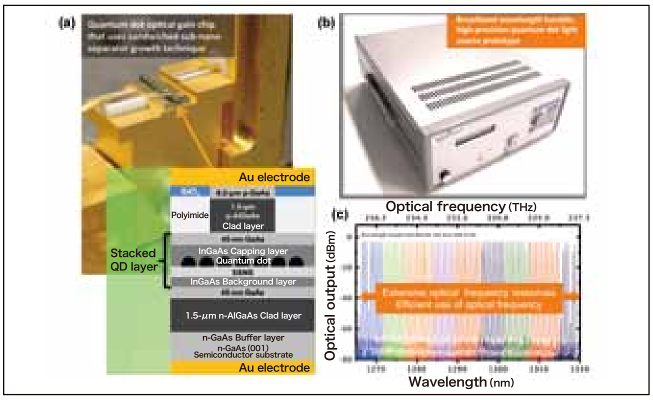


Figure 4●Development of broadband wavelength tunable, high-precision quantum dot light source

(a) Cross-sectional schematic view of quantum dot optical gain device and exterior of actual chip, (b) through an industry-academia-government collaboration, the world' s first successfully developed bench top broadband wavelength tunable, high-precision quantum dot light source prototype. (c) One example of quantum dot light source' s wavelength tunability characteristic.

approximately 100kHz. By using quantum dot technology, new light sources with narrow linewidth characteristics leading to higher-precision in optical frequency and higher application efficiency, and wide wavelength tunability specific to quantum dots have been realized.

Quantum dot technology is extremely useful in constructing broadband optical gain material. On the other hand, when we thought about optical transmission systems, besides an optical gain device that contributes to laser and optical amplifiers, the optical transmission line also becomes an important component. The photonic crystal fiber*3, composed by controlling and configuring a number of nanometer-sized minute holes, functions as a single-mode optical transmission line with an extremely wide wavelength range. In short, this means that by utilizing nanotechnology such as quantum dots and photonic crystals, ultra-broadband optical transmission systems can be constructed that take advantage of optical information-communications in the wide range of T, O bands, along with the conventional C band. First, we applied a (1) broadband wavelength tunable, high-precision quantum dot light source and (2) ultra-broadband photonic crystal fiber and constructed the optical transmission subsystem in Figure 5. High-speed transmission at 10Gb/s was confirmed with a distance beyond 10km that is expected to be used in future access optical networks and optical communications in data centers. The high-speed optical transmission subsystem construction, this time utilizing quantum dot and photonic crystal technology and world-leading demonstration of function, is both the beginning of the use of extensive, new optical frequency spectrums latent in T, O bands and also an important result that showed how the use of nanotechnology can contribute to the development of optical information-communications broadband.

Future Prospects

For the future, we would like to continue contributing to the research and practical application of leading-edge optical ICT devices that utilize more advanced nanotechnologies by promoting research aimed at the increasing advanced use of new optical frequency T, O bands and by actively pursuing industry-academia-government collaborations.

Glossary

***1 III-V compound semiconductor crystal**

A semiconductor crystal composed of a combination of two or more types of elements in the periodic table III and V groups. Widely used in optical devices and high-speed electronic devices.

***2 Quantum dot**

Nano-meter sized minute particle composed of semiconductor crystals. It is drawing attention as a highly efficient luminescent material because electrons can be bound within the minute particle.

***3 Photonic crystal fiber**

A next-generation optical fiber for efficiently trapping light from a wide band of wavelength. With multiple holes that are nanometer precise, a periodically positioned clad layer is used.

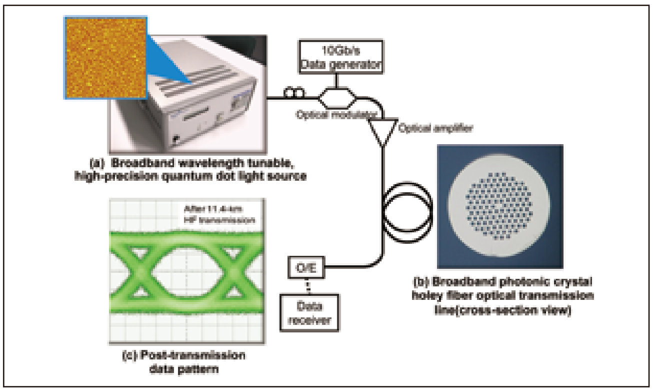


Figure 5●Two broadband optical ICT devices created by using nanotechnology

(a) Wavelength tunable quantum dot light source and (b) photonic crystal fiber optical transmission line. By combining these, the demonstration of world-leading structure/high-speed data transmission function that formed (c) this optical transmission subsystem.

Development of the aurora forecast system

–Aurora Alert website open–

Kaori Sakaguchi

Researcher, Space Weather and Environment Informatics Laboratory, Applied Electromagnetic Research Institute

After completing a doctoral course and working at the Solar-Terrestrial Environment Laboratory, Nagoya University (Japan Society for the Promotion of Science Research Fellowship for Young Scientists), Sakaguchi joined NICT in 2010. She is engaged in space weather forecast research. Ph.D. (Science).

What is an aurora?

Surely everyone has thought they wanted to see an aurora brilliantly painting the polar night sky once in their lives. An aurora is a luminous phenomenon of a tenuous atmosphere that occurs higher than clouds between space and Earth at an altitude of approximately 80-500km in the upper atmosphere. The luminescence is made up of principle components in the upper atmosphere such as oxygen, nitrogen atoms / molecules and their ions. When charged particles from space (plasma) blow into Earth, atoms, molecules, and ions in the upper atmosphere become excited by collisions with plasma. The emission lines unleashed the moment excited particles transit to ground state—this light is the source of an aurora. Aurora is thought of as a phenomenon that can be seen in polar regions, but the closer you get to the pole does not mean the better you can see aurora for there is a latitude where it best appears and going to a higher latitude causes the aurora to become harder to see. The area toroidally encompassing both poles where auroras frequently appear is called the aurora zone. The aurora zone is an area where plasma from space easily penetrates along magnetic field lines.

Space weather

In our laboratory, we are conducting research on plasma flying about in circumterrestrial space. When you hear about space, you may picture a vacuum with nothing there, but it actually is like an atmosphere, brimming with a variety of plasma particles. Circumterrestrial plasma is supplied mainly by the sun. Thus, circumterrestrial plasma energy and quantity fluctuates greatly in response to solar activity and, in some cases, plasma may damage artificial satellites flying around Earth. Research to forestall damage to artificial satellites, etc. due to this space environment is called space weather research. A portion of plasma particles accumulated in space around Earth blows into the aurora zone along magnetic field lines and light up the aurora in the upper atmosphere. The amount of plasma that shines down depends on the space weather condition. Therefore, when you go to an aurora zone, auroras that dance vibrantly actually cannot be seen anytime and anywhere. Brightness, color, movement, and shape change based on the energy and amount of plasma shining down.

Aurora forecast

When a lot of plasma accumulates in space around the Earth, or in other words when there is bad space weather, the aurora is a natural phenomenon between space and Earth that appears brighter and more beautiful. In fact, when plasma blows into the aurora zone, the ground magnetic field fluctuates greatly, inductive current flows in power lines, and there is a risk of damage to power plant electrical power transmission systems. Space weather research is essentially this type of research for minimizing dangers from space, but in this research, we developed a system that predicts the appearance of aurora in addition to helping people enjoy aurora that occur. By using the Auroral Electrojet (AE) index[*1] as an index of predicted aurora activity, we developed a method to calculate activity level of global aurora. Previous research reveals that when a flow of plasma that includes southward magnetic fields reaches the Earth from the sun, aurora activity intensifies after a few hour delay. In our research, by utilizing this tendency and conducting time-series analysis based on the multivariate autoregressive model as an explanatory variable for solar wind electric field $Es=V\times Bs$[*2], we succeeded in deriving a linear-predictive model that replicates AE index fluctuations (Figure 1). The figure 1 graph shows the result after comparing the AE index predicted values calculated based on the model we developed (red line) and values actually observed (black line). On this day, an extremely bright aurora with an AE index over 800nT is appearing (photo). Looking at the graph in figure 1, you can see that the model we actually developed predicts the AE index surpassing 800nT approximately an hour before.

※An aurora does not always cause damage when it occurs.

●An aurora shot by a live camera in Alaska on January 22, 2012 at 2:56AM (11:56 world standard time)

Aurora Alert

In a winter polar night whose average temperature drops below freezing, unless you can endure the exceptional cold, waiting for an aurora to appear in the freezing outdoors is tough. The lowest temperature I felt was minus 42ºC where whenever I blinked, my eyelashes would freeze together. If you knew how many more hours before an aurora would appear, you could wait warmly indoors without feeling cold until then. In order to provide easily understandable forecast information that we developed in this research of aurora activity a few hours in advance, we created a website called Aurora Alert (Figure 2). In Aurora Alert, latest forecast values are delivered every 10 minutes and every hour via an easy-to-understand 5-level icon. Here, you can view future aurora activity forecasts up to 3 hours ahead. However, this website can still only provide forecasts that show an aurora becoming active “somewhere” in the aurora zone. In the future, we hope to modify it further and develop an algorithm that predicts “where” a bright aurora will occur.

We also quickly setup a smartphone version of the site where you can check the aurora forecast. When checking Aurora Alert on a sleepy, cold night, it may prevent missing a bright, intense aurora a few hours later. If you ever manage to see a level 5 aurora brilliantly covering the whole sky, it will certainly be a scene you will never forget.

Glossary

∗1 AE index

AE index is index that shows the size of magnetic field fluctuation in polar regions with aurora activity. The unit used is nanotesla (nT) that indicates geomagnetic size.

∗2 Es=V×Bs

V is solar-wind velocity, Bs is the southward component of interplanetary magnetic fields.

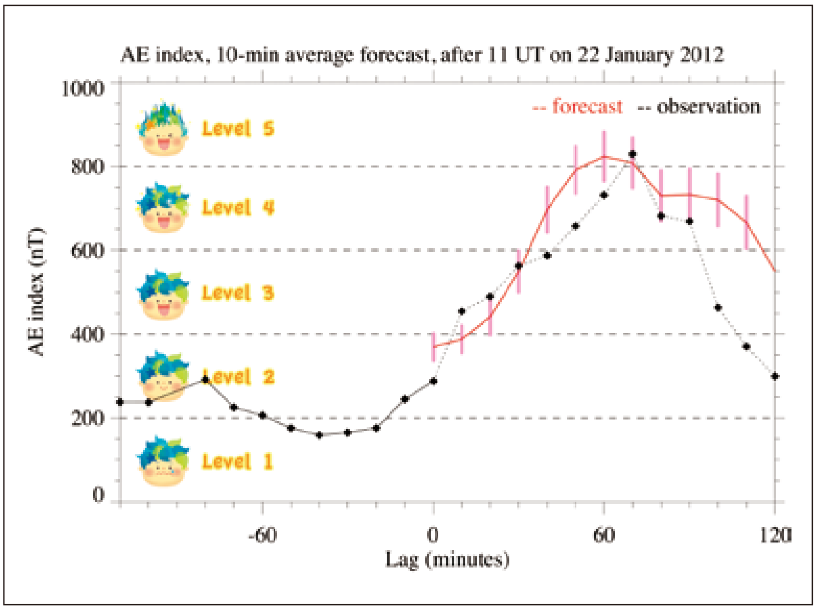


Figure 1●Graph of AE index predicted values (red line) compared to actual observed values (black line)

You can see the forecast of an AE index reaching its peak (the aurora becoming most active) approximately one hour later.The current Aurora Alert provides forecasts by dividing the AE index into 5 levels per 200nT.【Level 1: hard to watch, Level 2: weak, Level 3: can see a bright aurora, Level 4: aurora moving across sky, Level 5: aurora spread throughout the sky】

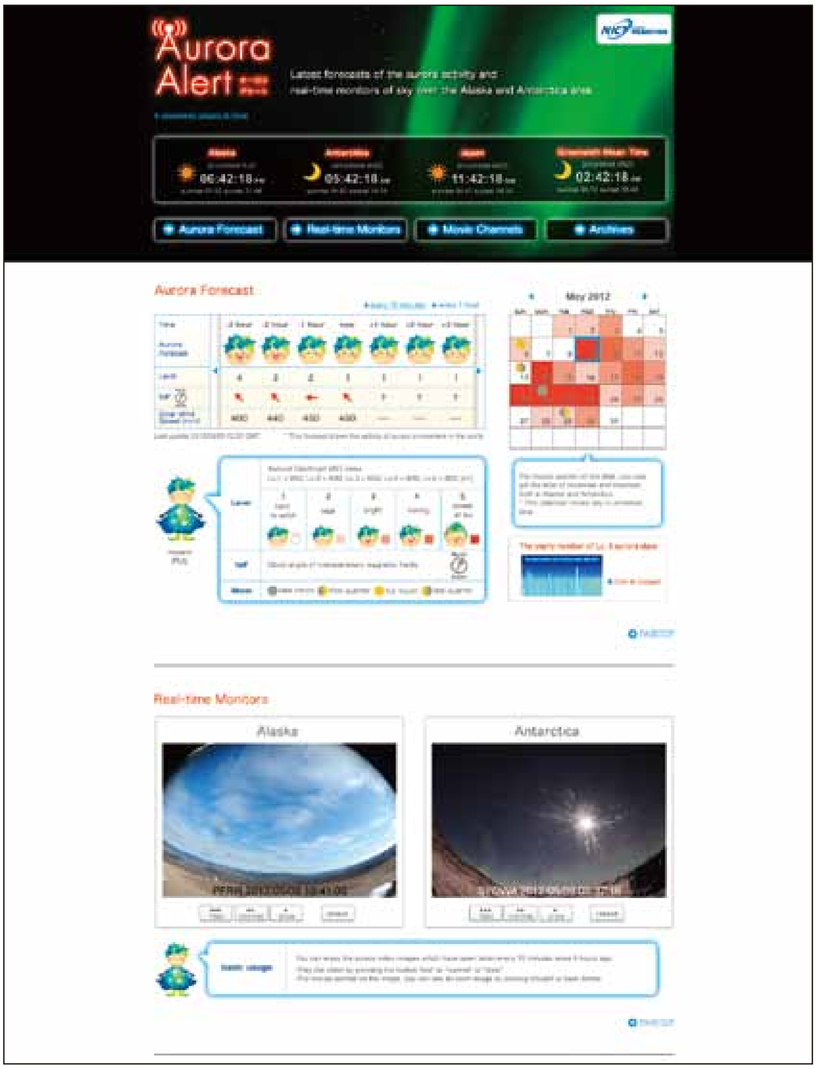


Figure 2●Aurora Alert website http://aurora-alert.nict.go.jp/

Delivering new aurora appearance forecasts and images of aurora in the north and south poles in real-time.

Prize Winners

Prize Winner ● **Zhang Xin** / Smart Wireless Laboratory, Wireless Network Research Institute

◎Date: 2011/7/21

◎Name of Prize:
IEEE Standards Association Award (as Contributor)

◎Details of Prize:
In recognition of his contribution to the development of IEEE Standard 802.22TM-2011

◎Name of Awarding Organization:
IEEE Standards Association

◎Comments by the Winner:

I feel so flattered to receive such an award. The two years that I have been working in NICT is the time I grow the fastest. During this period, I have gained an insight on the development of a worldwide standard and immeasurable improvement on technical ability. IEEE 802.22-2011 is the thus far first published IEEE standard that operates in TV Whitespace. It is my honour to participate in developing such standard. I would like to thank my fellow members for forming such a wonderful team in .22!

Prize Winner ● **Kentaro Ishizu** / Researcher, Smart Wireless Laboratory, Wireless Network Research Institute

◎Date: 2011/9/16

◎Name of Prize:
IEEE Standards Association Award

◎Details of Prize:
Due to substantial contributions to develop IEEE 1900.4a-2011

◎Name of Awarding Organization:
IEEE Standards Association

◎Comments by the Winner:

Upon developing IEEE1900.4a-2011 that defines the architecture and interface of cognitive radio system operated by multiple frequency-sharing radios, as I was submitting contributions and continuing discussions, the leading of WG operations was recognized as 1900.4 secretary. Frequency sharing technology will form the basis for white space technology now being studied to put it into practical use around the world. I hope to continue research and development not only on its standardization but also to put it into practical use.

Prize Winner ● **Morio Toyoshima** / Director, Space Communication Systems Laboratory, Wireless Network Research Institute
Yoshihisa Takayama / Senior Researcher, Space Communication Systems Laboratory, Wireless Network Research Institute

Co-Prize Winners:
Yoshiaki Suzuki, Yoichi Koishi, Yohei Hasegawa,
Yoichi Hashimoto, Shigeru Murata,
Toshiaki Yamashita and Koichi Shiratama
NEC Corporation, Fuchu, Tokyo, 183-8501, Japan

◎Date: 2011/12/1

◎Name of Prize:
The Excellent Paper

◎Details of Prize:
In recognition of the excellent paper titled, "Optical Free Space Communication System for 40Gbps Data Downlink from Satellite/Airplane"

◎Name of Awarding Organization:
AIAA Japan Forum on Satellite Communications

◎Comments by the Winner:

In our research and development of optical space communications, we conducted joint research on laser beam propagation characteristics in atmospheric turbulence and a study on operable optical communication devices and transmission protocols in fading environment, which were contributed to the research and development of airborne laser communication terminals. We would like to sincerely thank all those involved in this paper being awarded The Excellent Paper by AIAA Japan Forum on Satellite Communications. We would like to continue working on research activities that lead to further advancements in the future.

From left, Morio Toyoshima, Yoshihisa Takayama

Prize Winner ● **Akira Akaishi** / Limited Term Technical Expert, Space Communication Systems Laboratory, Wireless Research Network Institute
Takashi Takahashi / Research Manager, Space Communication Systems Laboratory, Wireless Research Network Institute
Yoshiyuki Fujino / Senior Researcher, Space Communication Systems Laboratory, Wireless Research Network Institute
Mitsugu Ookawa / Senior Researcher, Space Communication Systems Laboratory, Wireless Research Network Institute
Toshio Asai / Limited Term Technical Expert, Space Communication Systems Laboratory, Wireless Research Network Institute
Ryutaro Suzuki / Managing Director, Applied Electromagnetic Research Institute

Joint Prize Winners:
Hirofumi Matsuzawa, Mitsubishi Electric Corporation

◎Date: 2011/12/12

◎Name of Prize:
JC-SAT Award

◎Details of Prize:
The paper titled "Development of Optically Controlled Beam-Forming Network"—on an optically controlled beam-forming network developed at NICT—introduced a test model and presented experimental results from a practical application standpoint. It was awarded for the innovativeness of its test model.

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

◎Comments by the Winner:

This award is for research and development achievements between 2007 and 2010 as part of a subcontract with the Ministry of Internal Affairs and Communications, "Research and Development for Radio Resource Expansion." A heterodyne optically controlled beam-forming network forming beams in the optical region was developed as a miniaturization of large-scale multi-beam antennae feed systems for future satellite communication use and the potential of its practical use was reported. We would like to sincerely thank all those involved in the research up to now.

**From left, Toshio Asai, Akira Akaishi,
Takashi Takahashi, Yoshiyuki Fujino, Mitsugu Ookawa
Composite photo in top-left: Ryutaro Suzuki**

Prize Winner ● **Tetsuya Kawanishi** / Director, Lightwave Devices Laboratory, Photonic Network Research Institute

◎Date:2012/1/1

◎Name of Prize:

In Recognition and Appreciation

◎Details of Prize:

Contribution to IEEE Photonics Technology Letters as Associate Editor

◎Name of Awarding Organization:

IEEE Photonics Society

◎Comments by the Winner:

For four years, I worked as Associate Editor of Photonics Technology Letters. High volumes of contributions posed challenges at times, but I also learned many things. The peer review system's innovativeness was impressive. Despite being a U.S. academic journal, it is run with participation from around the world. The Editor-in-Chief during the latter-half of my term in charge was a Korean professor. The importance of research content goes without saying, but here I felt a high level of professionalism when people from around the world worked together and made efficient use of research results.

Prize Winner ● **Li Huan-Bang** / Senior Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute
Hernandez Marco / Senior Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute
Dotlic Igor / Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute
Yekeh Yazdandoost Kamya / Senior Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute

◎Date:2012/2/29

◎Name of Prize:

IEEE-SA Standards Board acknowledges with appreciation (Plaque)
The IEEE Standards Association acknowledges with appreciation (Certificate)

◎Details of Prize:

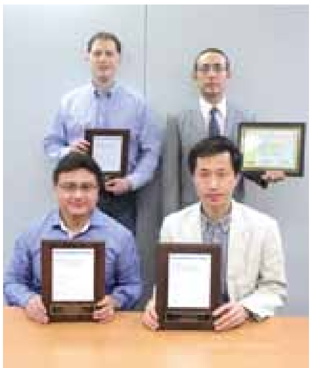
For contribution to the development of IEEE Standard for Local and metropolitan area networks – Part 15.6 Wireless Body Area Networks

◎Name of Awarding Organization:

IEEE Standards Association

◎Comments by the Winner:

The standard IEEE Std 802.15.6 was completed in February 2012 as a result of joint efforts from over 30 corporations, research institutes, and universities from around the world. NICT researchers were awarded the IEEE-SA Standards Board acknowledges with appreciation (Plaque) and The IEEE Standards Association acknowledges with appreciation (Certificate) awards for contributing significantly to specification creation, subcommittee operations, and editing draft in the implementation of this standard. This standardization activity was a main task of the former medical ICT-G and many staffs other than the prize recipients dedicated themselves to the specification discussion and other related works. We would like to express our sincere appreciation to all those involved.



Back row from left:
Dotlic Igor, Yekeh Yazdandoost Kamya
Front row from left:
Hernandez Marco, Li Huan-Bang

Prize Winner ● **Takahiro Kasama** / Researcher, Cybersecurity Laboratory, Network Security Research Institute

◎Date:2012/3/7

◎Name of Prize:

IPSJ Yamashita SIG Research Award

◎Details of Prize:

In recognition of the excellent paper, "Vulnerability of Malware Sandbox Analysis System as an Online Service (Part2)," presented and lectured on at the Information Processing Society of Japan Computer Security Symposium held in October 2010.

◎Name of Awarding Organization:

Information Processing Society of Japan

◎Comments by the Winner:

Recently, there are many services which receive online submissions of possibly malicious files or URLs from an arbitrary user, analyze their behavior, and send analysis reports back to the user. This research, which was highly acclaimed and received an award, pointed out a vulnerability the services against decoy injection attack, in which an attacker detects the sandbox based on its sandbox information which can be obtained by submitting a decoy sample designed for this purpose. I am much honored. I would like to express my gratitude to everyone at the Cybersecurity Laboratory and Yokohama National University for their advices in advancing this research.

Prize Winner ● **Michiaki Katsumoto** / Senior Researcher, Ultra-realistic Video Systems Laboratory, Universal Communication Research Institute

◎Date:2012/3/7

◎Name of Prize:

IPJS Activity Contribution Award

◎Details of Prize:

Contributing to the peer review of an academic journal

◎Name of Awarding Organization:

Information Processing Society of Japan

◎Comments by the Winner:

Since 2010, I have been involved in operations as a peer reviewer of Multimedia Communication and Distributed Processing Symposium in Information Processing Society of Japan, and while making efforts to invigorate the Society in order to promote and spread its research fields, I was active in nominating academic papers to be published in academic journals. This involvement was recognized and I received a contribution award. This award was given to me as an individual, but I am grateful to all the administrators and organizers jointly involved in this activity.

Signing Ceremony for Memorandum of Understanding on Comprehensive Research Cooperation and Workshop with Budapest University of Technology and Economics

In March 2008, NICT and Budapest University of Technology and Economics (BME) signed on a Memorandum of Understanding on comprehensive research cooperation and till now have held the symposium, FuturICT2009, and promoted research exchange in the field of ultrafast photonic networks by receiving three internship research trainees and other means. Recently, the period of this Memorandum of Understanding expired, and we renewed the Memorandum of Understanding until April 2015 and held the signing ceremony on April 16, 2012. The signing ceremony was held at the Japanese ambassador's residence courtesy of Mr. Tetsuo ITO, Ambassador of Japan to Hungary. Mr. Szabolcs TAKACS, Director General, Department of Asia-Pacific, Ministry of Foreign Affairs of Hungary, also attended the ceremony and congratulated both NICT and BME. In Ambassador Ito's congratulatory speech, he also presented words of congratulations from former ambassador Mr. Shinichi NABEKURA (now President of Japan Post Service Co., Ltd.).

Before the signing ceremony, a workshop was held at BME campus aimed at further promoting future research cooperation. After introductions in the beginning on recent research at the respective institutes by Mr. Tamás HENK, Head of Department at Department of Telecommunications and Media Informatics, and Dr. Hiroshi KUMAGAI, Vice President, NICT, achievement presentations and exchanges of opinions by various researchers took place on the topics of photonic networks and multilingual translation. The workshop concluded with agreement on expanding present areas of research cooperation in the future such as not only a physics layer in the field of photonic networks, but adding network control and design-related themes and cooperating in the field of multilingual translation.

●Post-signing commemorative photo (From left: Mr. Takacs, Director General, Department of Asia-Pacific, Ministry of Foreign Affairs of Hungary, Mr. Dvorszki, International and Scientific Director, BME, Dr. Kumagai, Vice President, NICT, Mr. Ito, Ambassador of Japan to Hungary)

●Workshop at BME

NAB Show 2012 Exhibition Report

NICT was invited to and held an exhibition at NAB Show 2012 (April 16~19, 2012), the world's largest broadcast equipment exhibition held every year in April by NAB (The National Association of Broadcasters), an association that supervises U.S. regional radio and all private television broadcasters. The NICT booth was setup in a corner of International Research Park which holds exhibits related to future technology. There, NICT held demonstrations on technology related to leading-edge research development centered on 200-inch autostereoscopic display technology.

This year's NAB show received approximately 100,000 visitors, 7,000 of whom stopped by the NICT booth. Mr. Julius Genachowski, Chairman of the Federal Communications Commission, Mr. Gordon Smith, Chairman of NAB, Mr. Peter Owen, Chairman of IBC (International Broadcasting Convention),, Mr. Douglas Trumbull, a film director, and other VIP guests also visited, attracted favorable comment from visitors.

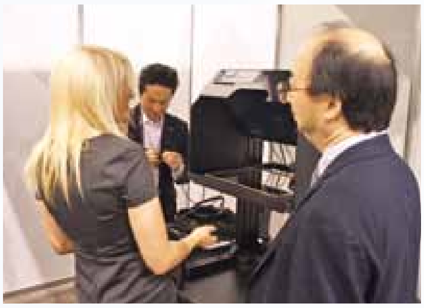
NICT set up following 4 exhibits this time.

200-inch Autostereoscopic Display Technology
(Universal Communication Research Institute)

The full spec system of this technology, featuring a visual area (visible stereoscopic range) expanded to 4 meters roughly equivalent to the display width, was released to the public for the first time. In addition, newly developed automatic adjustment technology was also introduced for the first time, and by enabling high-precision pixel control across the entire screen, the screen resolution improved and 3D with the best image quality ever was able to be showcased. All visitors gasped in surprise at numerousness of viewpoints and the fact that they could go around and view the inside of a car frame used as content.

Multi-Sensory Interaction System
(Universal Communication Research Institute)

Using balloons as the content, visitors experienced an exhibit of 4 senses: 3D senses of visual, audio, force, and aroma. A demonstration was held where breaking balloons would produce two different types aromas via the newly developed aroma-producing device and sounds heard from behind via stereoscopic sound presentation using head-related transfer function technology. Many visitors were moved by the curious experience.

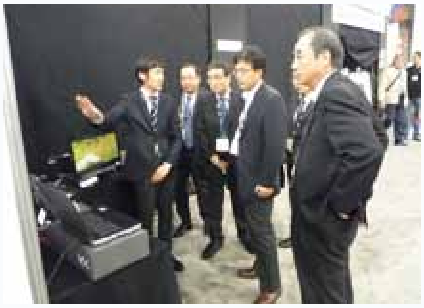


nicter / NIRVANA
(Network Security Research Institute)

A demonstration was held that showed the scene of a cyber attack in real time. Although it was not broadcast technology itself, it was so meaningful that the importance of network security has been reaffirmed recently by increase of internet broadcasts and material transmission.

60GHz Millimeter-Wave Wireless LAN System
(Wireless Network Research Institute)

This IEEE802.11ad-compliant system, attracting attention as the future wireless LAN standard, received favorable comments from many visitors due to its ability to wirelessly transmit large amounts of data such as full high vision 3D video and music files in seconds via millimeter-waves even in over-the-horizon environment that has been regarded difficult for millimeter-waves. Staffs received technical questions—from persons wishing to create a cable-less broadcasting studio—on implementation not only in home video delivery but also television cameras.



Institute Open House 2012

free admission

Advanced ICT Research Institute – Experience the future of information communications!! –

Place: Advanced ICT Research Institute
588-2, Iwaoka, Nishi-ku, Kobe, Hyogo 651-2492, Japan
http://www2.nict.go.jp/advanced_ict/plan/ippankoukai/2012/index.html

Date: Saturday, July 28, 2012 10:00~16:00 (reception open until 15:30)

Institute Open House held in 2011 (Advanced ICT Research Institute)

●Experiment for extraction and observation of Broccoli DNA

●Cell image observation with a Leeuwenhoek microscope

●Experiment to feel polarization and birefringence with a fabricated "Rainbow Box" using a polarizing plate

●Commentary on the marvelous structure of the brain

Permanent Staff Recruitment 2013 Information

The National Institute of Information and Communications Technology is an incorporated administrative agency that contributes to the realization of a prosperous, safe and secure society and to Japan's advancement as a world-leading intellectual power through the promotion of research and development of information communications technology from basic to applied research with an integrated perspective.

In order to promote information and communications technology development and research here at NICT, we are recruiting both distinguished, motivated research staff (research posts) and administrative staff who can support the research staff (administrative posts).

Start of employment ●April 1, 2013 (fixed)
Number of persons to be recruited ●Permanent research staff (several openings)
Permanent administrative staff (3 openings)

For detailed information on the application period, etc., please see recruitment information on the NICT homepage.
http://www.nict.go.jp/employment/index-top.html

Please Contact
●National Institute of Information and Communications Technology
Personnel Affairs Group, Personnel Affairs Office, General Affairs Department
4-2-1 Nukui-Kitamachi, Koganei, Tokyo 184-8795, Japan
Tel: +81-42-327-7304 e-mail: jinjig@ml.nict.go.jp

NICT National Institute of Information and Communications Technology

Information for Readers

The next issue will feature Smart Meter radio currently in application phase, nanosized antenna technology that receives light, safety enhancement of network switches utilizing quantum key distribution, and much more.

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