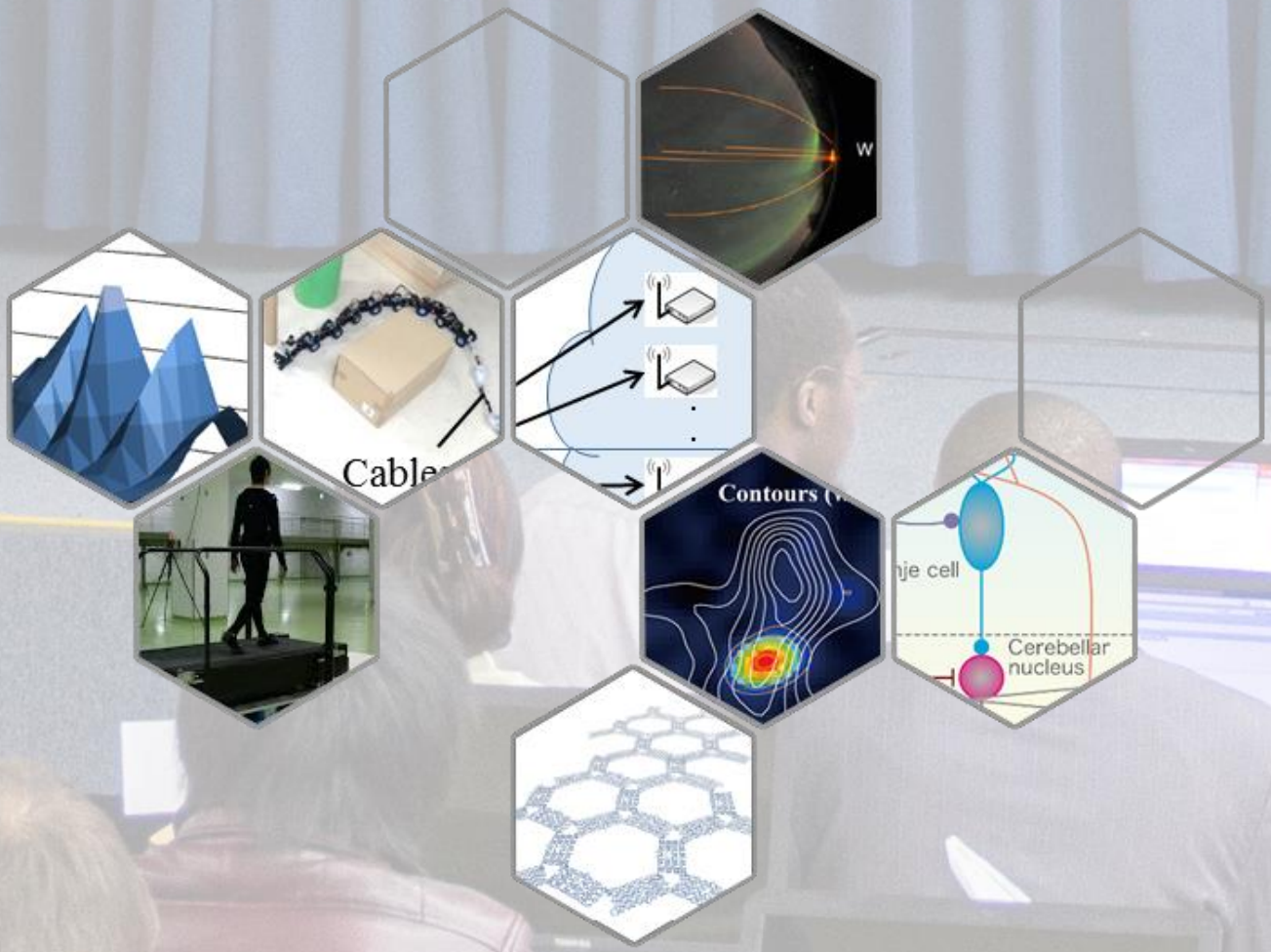
The University of Electro-Communications

UEC e-Bulletin

Updates on research, innovation, and events at UEC:
Unique and Exciting Campus in Tokyo

Vol.8, December 2015



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Research Highlights

Topics

News and Events

Preface to volumes 8 and 9 of the UEC e-Bulletin

Volumes 8 and 9 of the UEC e-Bulletin are special issues dedicated to highlighting the excellence in research of young members of faculty on the UEC Tenure Track Program.

Specifically, in 2007 UEC was selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for its ‘Initiative for the Promotion of Young Scientists' Independent Research’ under MEXT's ‘Special Coordination Funds for Promoting Science and Technology’.

Following the success of the MEXT program, UEC introduced its own‘Program to Disseminate Tenure Tracking System’ throughout the university for hiring all members of faculty as assistant professors. To-date, UEC has employed more than 40 tenure track assistant professors for many hundreds of applicants in this program.

These two issues of UEC e-Bulletin showcase the unique, challenging, and international research being undertaken by sixteen highly talented tenure track assistant professors at UEC, Tokyo.

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Wireless transceivers: Hardware still limits the unlimited

The field of 'software-defined radio' (SDR) technology - a wireless communications system that implemented by means of software on a computer to replicate the work of traditional hardware - has potential in the cognitive radio and its research and development. Advantages of SDRs include the ability to comply with various wireless protocols without hardware modification. It may be possible not only virtualizing the wireless transceiver but also compensating for the instability of the wireless protocol at the receiving end, or launching the wireless transceiver corresponding to the signal automatically.

Work is ongoing to create networks of SDR 'wireless transceivers' - combined transmitters / receivers based in the virtual world. However, enabling these transceivers to work together efficiently on fluctuating parameters is challenging.

Now, Yuusuke Kawakita and Haruhisa Ichikawa at the University of Electro-Communications, Tokyo, Japan, have developed the Appliance Defined Ubiquitous Network, or ADUN; a mechanism that delivers unlimited broadband radio-wave information (or 'radio space information') to clients via a distribution server. To build such networks, virtualized wireless transceivers are implemented using the cloud computing and the broadband Internet.

In trials, the researchers found that ADUN worked effectively as a scale-out solution to deliver radio space information. However, the upper number of clients receiving information at any one time was limited by the number of physical CPUs in the distribution server. In fact, a CPU is needed for each client - adding logical CPUs made little difference to performance.

Their findings hold implications for building global networks of distribution servers that can deliver unlimited radio data to multiple clients simultaneously, because limitations lie within hardware rather than software.

Reference

1. Kawakita, Y. & Ichikawa, H. A resource analysis of radio space distribution for the wide-area virtualization of wireless transceivers. *IEICE Trans.Commun.* **E97-B** (9) (2014)

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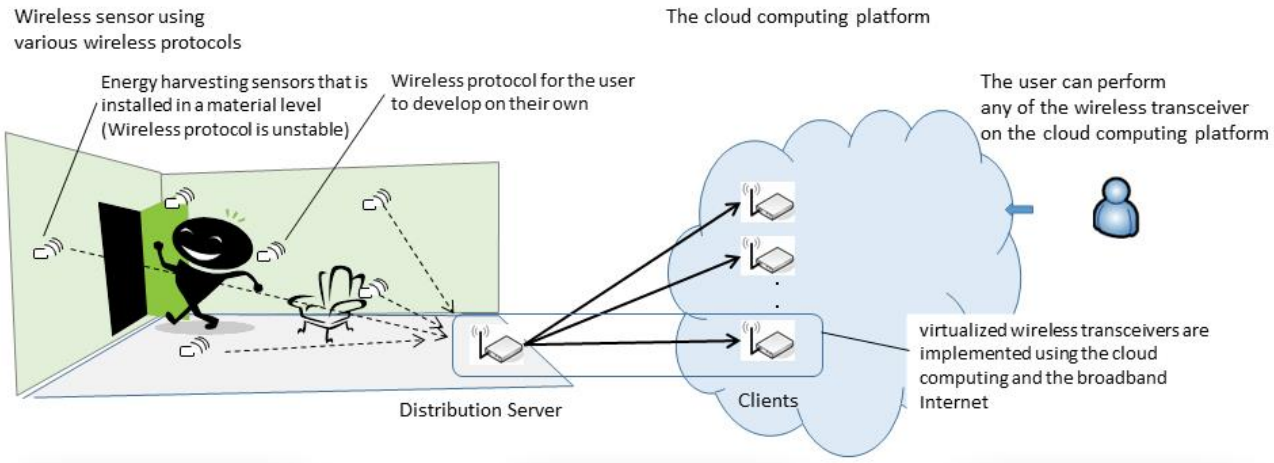
Sensing platform for energy harvesting wireless sensors embedded in the living space, wireless protocol for the user to development



Prototype implementation of the sensing node

Prototype implementation of the distribution server

Prototype implementation of the cloud computing platform

Researchers at the University of Electro-Communications, Tokyo have developed a method for distributing unlimited radio space information to multiple users, for use in 'software-defined radio' scenarios. Importantly, their findings show data distribution to clients is still limited by physical hardware.

Assistant Professor: Kawakita Yuusuke (Ph.D. from Keio University 2008/03)

Current research areas: Communication/ Network engineering

Current research subjects: Sensing Platform for Energy Harvesting Wireless Sensors

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Walking control: Influence of lower limb co-ordination

Walking on two legs is inherently unstable, meaning that the human central nervous system must work hard to maintain balance. Walking motion is maintained by two control approaches - feedforward control, in which the body anticipates possible disturbances to steady walking, and feedback control, when the body reacts to an unseen disturbance to stay upright. The precise mechanisms underlying these control approaches are not yet fully understood.

To uncover variables underpinning feedback control, Tetsuro Funato at the University of Electro-Communications, Tokyo, Japan, together with scientists from Kyoto University, used a technique based on 'uncontrolled manifold analysis' (UCM) - a way of quantifying the behavior of different multi-segmental motion, how their relationships are formed and how they are used in response to disturbances.

Funato and his team gathered data from 11 healthy male participants who were asked to walk steadily on a treadmill. The researchers sped up or slowed down the treadmill abruptly, with consecutive disturbances occurring either frequently (within one walking cycle) or gradually (over a few steps).

The team were interested in the significance of 'intersegmental co-ordination' on walking control - specifically, the interaction of the thigh, shank and foot during motion phases. They compared this with fluctuations in the participants' center of mass, head and limb axis during both steady and disturbed walking.

Their UCM-based results indicated that fluctuations in intersegmental co-ordination were smaller than center of mass, head and limb axis fluctuations. This suggests intersegmental co-ordination may play a significant role in a feedback control of walking by maintaining a continuous cyclic pattern regardless of disturbances.

Reference

1. Funato, T., Aoi, S., Tomita, N., & Tsuchiya, K. Validating the feedback control of intersegmental coordination by fluctuation analysis of disturbed walking. *Exp. Brain Research* **233** 1421-1432 (2015)

Walking subject on a treadmill.
Researchers at the University of Electro-Communications, Tokyo, and Kyoto University, have shown that 'intersegmental co-ordination' may play a key role in feedback control of walking. Smaller fluctuations in the behavior of parts of the lower limbs during disturbances point to a cyclical pattern maintained regardless of disturbance.

Assistant Professor: FUNATO Tetsuro (Ph.D from Tokyo Institute of Technology 2008/03)

Current research subjects: Intelligent mechanics/ Mechanical systems

Current research areas: Evaluation of biological rhythm control for system designing using the environmental dynamics.

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Snake robot range-sensing control system avoids tail-end collisions

Rescue operations at disaster scenes often use robots to avoid further human danger. Modelling robots on snakes can provide better access through narrow paths in rubble, but previous models that control snake robots by the head do not adequately avoid collisions between the body of the robot and surrounding obstacles. Researchers at the University of Electro-Communications and Kyoto University have now demonstrated an improved control system for avoiding collisions along the full length of snake robots.

Motoyasu Tanaka, Kazuyuki Kon and Kazuo Tanaka consider a snake robot comprising a series of sections joined by links that either pitch up and down or yaw through sideways turning angles. An operator controls the velocity of the first link with a joystick. Previous results demonstrated motion control using passive wheels that prevent sideways slipping. These wheels provide the side friction force required for the robot to slither forward, and by lifting the wheels out of contact with the terrain at a particular link, the direction of motion can be adapted to avoid collisions between an obstacle and the body of the robot.

Tanaka, Kon and Tanaka have now demonstrated the ability to navigate not just one but a series of obstacles in unfamiliar environments, by incorporating range sensors and map generation with semi-autonomous control at each link.

"The experimental system, which has range sensors and the function generating environmental map using simultaneous localization and mapping, was developed with decreasing calculation cost," explain the researchers in their report, highlighting the computational optimization of the control algorithm. Experiments with the snake robot verify how effectively their control system performs in unknown environments.

Reference

Motoyasu Tanaka[1*], Kazuyuki Kon[2*], and Kazuo Tanaka[1*] Range-sensor-based semiautonomous whole-body collision avoidance of a snake robot, *IEEE Transactions on Control Systems Technology*, **23**, 1927-1934 (2015).

1. Department of Mechanical Engineering and Intelligent Systems, University of Electro-Communications, Tokyo 182-8585, Japan
2. Graduate School of Engineering, Kyoto University, Kyoto 606-8501, Japan

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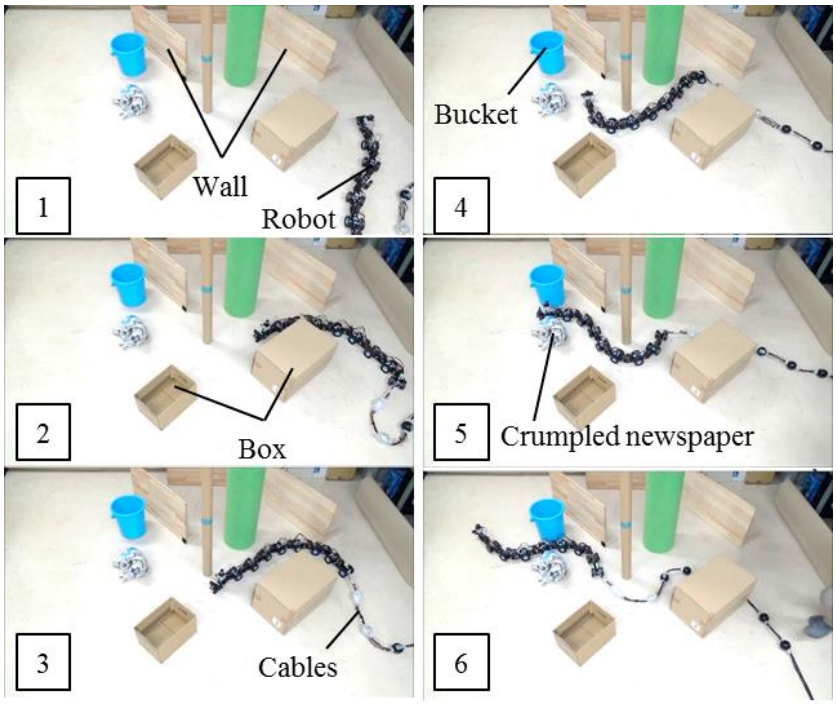

Motion of the robot using both range sensors and map in field C.

Assistant Professor: TANAKA Motoyasu (Ph.D. from The University of Electro-Communications 2009/03 2009/03)

Current research areas: Dynamics/Control, Intelligent mechanics/ Mechanical systems

Current research subjects: Modeling and control of snake robots, Development and control of flying robots, Control of robots based on brain-wave, and Control of nonlinear systems.

Website: https://sites.google.com/site/motoyasutanakalab/english-1

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Random additions efficiently anonymize large data sets

Balancing transparency and freedom of information with the right to privacy lays high demands on data handling methods. So far methods for anonymizing shared data sets have assumed that there is a distinction between details that can be used to identify an individual (quasi-identifiers) and details that are deemed 'sensitive' and private, but this is not always the case. Now Yuichi Sei and Akihiko Ohsuga from the University of Electro- Communications, alongside Takao Takenouchi from NEC Corporation in Japan, have devised an algorithm that efficiently anonymizes data sets without assuming this distinction.

The researchers use hospital lists as an example. A data set may include the name (direct identifier), address and age (quasi-identifier) and sensitive information (a medical condition). Even without giving the name for each entry, someone using the data set could identify entries from the age and address. In addition, anonymization should be resistant to attempts to identify particulars by comparing two anonymized sets for the same data.

One approach to anonymizing data is to add noise to a data set, where the frequency of each possible value for each attribute is presented in a histogram. However as Sei, Ohsuga and Takenouchi point out this can greatly increase the quantity of the data. "Because almost all of the categories have only a few people in the histogram, the noise added to each category of the histogram has a heavy impact."

The UEC-NEC Corporation researchers instead randomised the data set for each attribute and added random values to each entry. "Through simulations of real data sets, we prove that our proposed method can anonymize and reconstruct databases while keeping a high quality of data within a realistic period." The approach may be useful for anonymizing public records such as the census and electronic electoral votes.

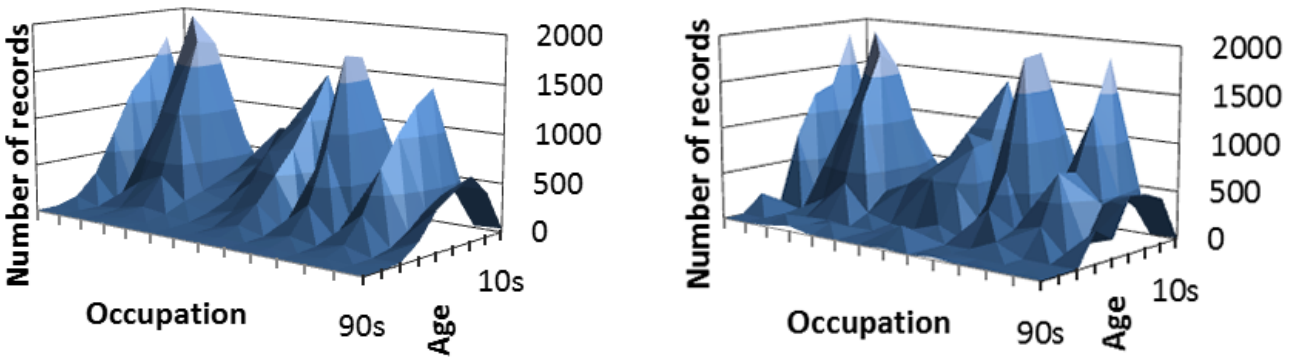
Reference
Yuichi Sei[1*], Takao Takenouchi[2*], Akihiko Ohsuga[1*] (l1, ..., lq)-diversity for anonymizing sensitive quasi-identifiers *2015 IEEE Trustcom/BigDataSE/ISPA* 596-603 doi: 10.1109/Trustcom-BigDataSe-ISPA.2015.424

1. Graduate School of Information Systems, The University of Electro-Communications, Tokyo, Japan
2. Cloud System Research Laboratories, NEC Corporation, Kanagawa, Japan

*corresponding authors e-mail: sei@is.uec.ac.jp, takenouchi@bu.jp.nec.com, ohsuga@uec.ac.jp

Name	Age	Address	Job	Job
Alex	41	13021	Artist	Fever
Becky	41	17025	Artist	Cancer
Carl	50	13021	Writer	Fever
Diana	51	14053	Nurse	HIV

Table of patient data including direct identifiers (name) sensitive quasi identifiers (age, address, job and disease)



original (left) and reconstructed anonymized data (right) for age and occupation using the proposed algorithm.

Assistant Professor: SEI Yuichi (Ph.D. from The University of Tokyo 2009/03)

Current research areas: Software and Information security.

Current research subjects: Software Development Process Improvement based on Incident Data Analysis, Process Improvement, Text mining, Privacy-Preserving, Data Mining Security, Privacy, Sensor networks.

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Geophysics: Insights into the origins of sodium and other metallic layers in the Earth's upper atmosphere

Takuo Tsuda, Assistant Professor,
Graduate School of Informatics and Engineering,
University of Electro-Communications, Tokyo.

The Earth's atmosphere is critical for the existence of mankind. A close inspection of reveals that the atmosphere consists of several regions: troposphere is where humans live (ca. 0-15 km); stratosphere and thin layer of ozone (ca. 15-50 km) that absorbs ultra-violet radiation; and the mesosphere/ionosphere (ca. 50-100 km) and thermosphere (where aurora occur) (ca. 100-600 km). For reference, the International Space Station orbits at approximately 400 km above the Earth.

Intriguingly, in the late 1920s scientists first reported that the glow of light in the Earth's atmosphere contained light from sodium at a wavelength of 589 nm. In the 1960s a layer of sodium at approximately 90 km above the Earth was discovered. Later, layers of potassium, iron and calcium were reported to exist near the sodium layer.

These observations raise many questions such as the origins of these well-defined narrow regions of metal layers, and could they be useful for monitoring climate change.

At UEC, Takuo Tsuda, is literally shed light on the sodium layer surrounding the Earth. "My interest in the sodium layer is inspired by the desire to expand our knowledge of the outer atmosphere for future space utility and for insights into climate change," says Tsuda. "So far I have used facilities in northern Europe, Japan's Showa Base in Antarctica, and monitoring stations in Japan to measure levels of sodium and other metals at 80-100 km."

Tsuda uses the so-called resonance fluorescence lidar technique where a pulsed laser beam is pointed at the upper atmosphere and scattered light from sodium and other metals is detected by a telescope on the ground for determining the concentration and location of the metals in the upper atmosphere.

Recent research findings include the first ever observation of 'thermospheric Na layers' above 110 km [1]. "These experiments were conducted at the Syowa Station in Antarctica," explains Tsuda. "Other metal layers have been observed above 110 km but our report was the first such observation of a sodium layer at this high altitude.

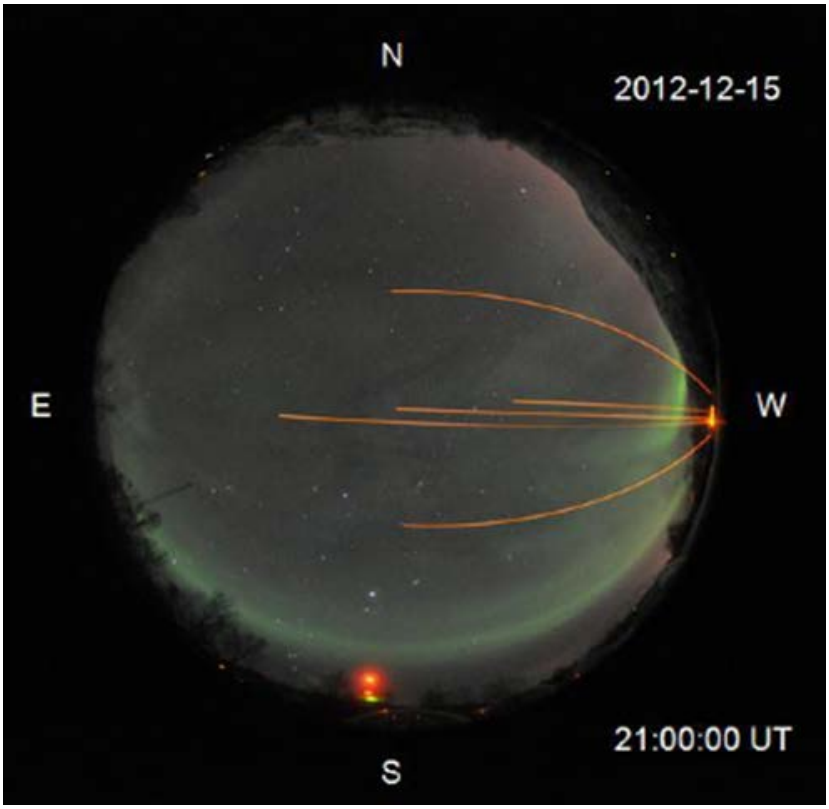
In research on the stability of metal layers in the upper atmosphere, Tsuda and co-workers reported on the observation of a so-called 'sporadic sodium layer event' from a site in Norway [2]. This event was proposed to be "advected by the background wind".

These metals layers are most likely due to dust left by comets orbiting the Sun and from asteroids from other parts of the Solar System. "In addition to enhancing our knowledge of the Earth and near space, this research is expected to yield insights into the atmospheres of other planets in our galaxy," says Tsuda.

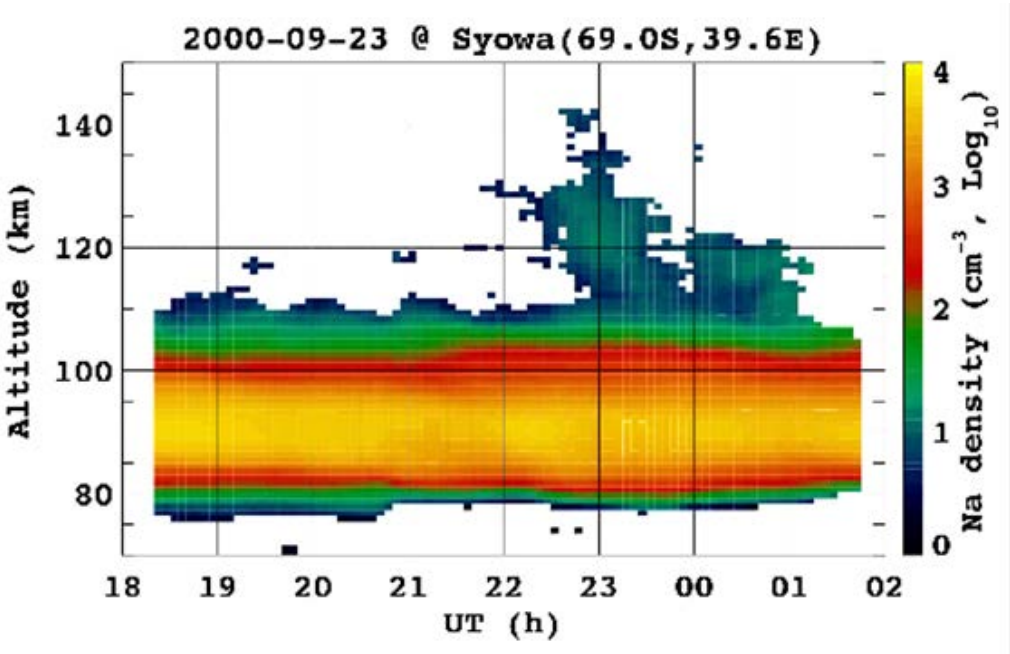
Further information

References

1. T. T. Tsuda, X. Chu, T. Nakamura, M. K. Ejiri, T. D. Kawahara, A. S. Yukimatu, and K. Hosokawa, A thermospheric Na layer event observed up to 140 km over Syowa Station (69.0ºS, 39.6ºE) in Antarctica, Geophys. Res. Lett., 42, 3647-3653, (2015).
2. T. T. Tsuda, S. Nozawa, T. D. Kawahara, T. Kawabata, N. Saito, S. Wada, C. M. Hall, M. Tsutsumi, Y. Ogawa, S. Oyama, T. Takahashi, M. K. Ejiri, T. Nishiyama, T. Nakamura, and A. Brekke, A sporadic sodium layer event detected with five-directional lidar and simultaneous wind, electron density, and electric field observation at Tromsø, Norway, Geophys. Res. Lett., 42, 9190-9196, (2015).



An all-sky image above Tromsø at 21:00 UT on 15 December 2012, captured by a color digital camera with 15 s exposure. The five laser beams in the lidar observation can be seen as orange lines, which were directed to vertical, south, north, west, and east directions. The zenith angle in the oblique beams was 30°.



Time-altitude variations of Na number density from 18:00 UT on 23 September to 02:00 UT on 24 September 2000. The integration time and height are 30 min and 5 km, and the time and height intervals are 5 min and 1 km, respectively. Only data with errors (defined as one standard deviation) of less than 50% are displayed. It should be noted that the local time (LT) at Syowa Station is three hours ahead of UT, i.e., LT = UT + 3 h and that there is no difference between the magnetic local time (MLT) at Syowa Station and UT, i.e., MLT = UT + 0 h.

Assistant Professor: Takuo TSUDA (Doctor of Science from Nagoya University 2009/03)

Current research areas: Space and upper atmospheric physics

Current research subjects: Upper atmospheric science, Lidar system, and Optical system

Website: Takuo Tsuda laboratory: http://ttt01.cei.uec.ac.jp/

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Neuroscience: Creating realistic computational models of the cerebellum

Tadashi Yamazaki, Assistant Professor,
Graduate School of Informatics and Engineering
University of Electro-Communications, Tokyo

In spite of gigantic advances in medical science over the last century there are still huge gaps in our knowledge of the inner workings of the human brain. For example, how do people in their eighties still remember sights, sounds, and fragrances from their childhood; what are dreams; and why certain people can master many different languages and others have their hands full with just one? Underscoring the deep interest in uncovering the functions of the brain, multi-billion dollar projects have been launched in the USA, EU, and Japan to address these and much deeper aspects of the brain.

Importantly, in the quest for answers to such questions one of the fundamental issues for neuroscientists is developing effective scientific approaches to elucidate the mysteries of the human brain--an organ known for its innate inaccessibility.

At UEC, Tokyo, Tadashi Yamazaki is focusing his efforts on the cerebellum or 'little brain' in Latin. Notably, in terms of relative size, the cerebellum is approximately 10% of the brain but it contains 80% of the neurons. So computational models based on the cerebellum could potentially be effective in describing the functions of the whole brain.

"The functions of the cerebellum are much better understood than the much larger cerebrum," says Yamazaki. "For example we know that the cerebellum plays a major part in coordinating and integrating information from our senses with activation of joints and muscles to produce movement. So in my research I use the wealth of scientific data and information already available about the cerebellum to create realistic computational models of the structure and functions of the cerebellum. Our models provide many insights into how the cerebellum and even the other parts of the brain work for building a complete whole-brain model on a computer."

Recent findings by Yamazaki and colleagues include the use of a graphics processing unit (GPU) to create a 'real time cerebellum' comprising of over 100,000 neurons that trained a robot to hit a ball bowled in real-time [1]. These results are important for robotics research where teaching robots to move precisely is critical for many applications.

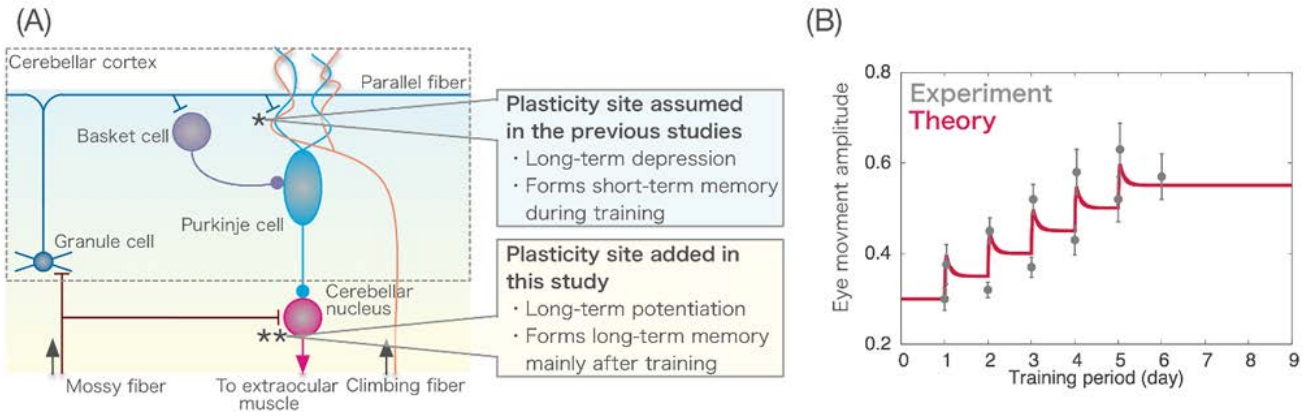
Furthermore, in research related to memory, Yamazaki and colleagues created a theoretical model of memory consolidation in the cerebellum. These results offer insights into why 'practice makes perfect' in motor learning, offering an innovative approach to developing new learning methods and intelligent robots [2].

Yamazaki is also pursuing projects with national research institutes and local hospitals in Japan on the development of brain-style artificial intelligence; neuron circuit simulations based on the shapes of cells; and rehabilitation based on the simulation of brain and body movement.

Further information

Publications

1. Yamazaki T and Igarashi J. Real time cerebellum: A large-scale spiking network model of the cerebellum that runs in real time using a graphics processing unit. *Neural Networks* 47 (11): 103-111 (2013).
2. Yamazaki T, Nagao S, Lennon W and Tanaka S. Modeling memory consolidation during post training periods in cerebellovestibular learning.
   Proceedings of the National Academy of Sciences of the United States of America 112 (11): 3541-3546 (2015).



(A) Schematic diagram of the cerebellar circuit in OKR adaptation, an eye movement reflex. We built a theoretical model that incorporates dual plasticity at parallel fiber-Purkinje cell synapses and mossy fiber-cerebellar nuclear cell synapses. (B) Comparison of mouse experiments (gray dots with error bars) and a computer simulation result (red line). Animals are given daily 1-hour training followed by dark rearing for 23-hours. The eye movement amplitude increases by 1-hour daily training and decays naturally after training, indicating the formation of short-term memory. The amplitude also gradually increases day by day, indicating the formation of long-term memory. The horizontal axis represents the training day, and the vertical axis the amplitude of the eye movement. Reproduced from a press release of Ref 2.
(http://www.uec.ac.jp/eng/news/announcement/2014/20150226-2.html)

Assistant Professor: YAMAZAKI Tadashi (Ph. D. from Tokyo Institute of Technology 2002/03)

Current research areas: Computational Science, Neuroscience, Robotics

Current research subjects: Computational Neuroscience, High-Performance Neurocomputing, Brain-Style Artificial Intelligence, Neuro-Robotics, Computational Rehabilitation

Website: http://numericalbrain.org/en/

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Astrophysics: Birth of high mass stars and the origin of life

Takeshi Sakai, Assistant Professor
Graduate School of Informatics and Engineering
University of Electro-Communications, Tokyo

"I am using the Atacama Large Millimeter/Submillimeter Array (ALMA) facilities in Chile to study the formation of stars," says Sakai. "In particular I am looking at 'high-mass' stars formed in clusters that are approximately 10,000 light years from the Earth. High mass stars play an important role in the evolution of galaxies and ultimately hold the secrets of the origins of life on Earth."

Interest in the formation of stars in clusters stems from research that indicates that 70-90% of stars in our galaxy are born in clusters. In contrast to high mass stars, there is much more knowledge about low mass stars because at 400 light years away, they are located much closer to Earth and more readily accessible with telescopes.

The radio telescopes at ALMA are located at approximately 5000 m above sea level in Atacama, Chile, where the air is dry with minimal absorption of weak infra-red signature signals of the chemical composition of the clusters where high mass stars are born.

"Our telescopes enable us to map the evolution of the chemical compositions of molecular clouds," explains Sakai. "So we are able to detect the very early stages of star formation by looking for changes in the chemical species of molecular clouds." For example, the core of a diffuse cloud may be composed of only ionized carbon but chemical spectra of a dense cloud will show signals from carbon monoxide/ammonia, and complex organic molecules when a star is formed.

In their experiments, Sakai uses the strategy of narrowing down possible targets using single dish telescopes such as those at the Nobeyama Radio Observatory (NRO) in Nagano Prefecture, Japan, and then use the 66 telescopes at ALMA for detailed analysis of these promising targets.

Needless to say astrophysics is a time consuming area of research, where it can take two to three years for data collection. "I collaborate with groups in other countries to write proposals for machine time on all the telescopes we want to use," says Sakai. "In the case of ALMA we usually get a few hours each year."

In research recent Sakai and an international team recently discovered a very young star of about 1000 years old [1,3] and observations of methanol masers in a molecular clump indicating the existence of a star-forming region [2].

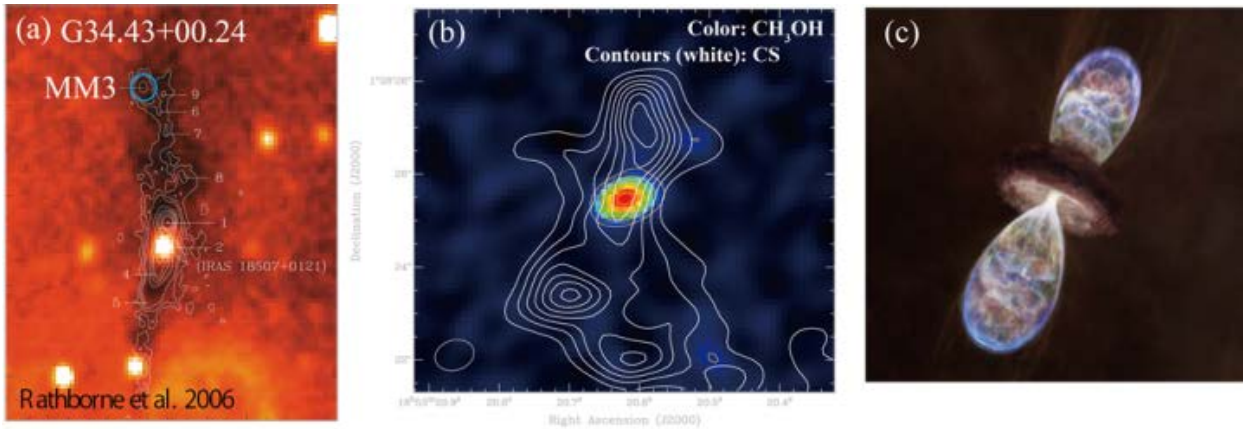
"We hope this research will increase our knowledge of the formation of galaxies and ultimately shed light on the origin of life of Earth."

Further information

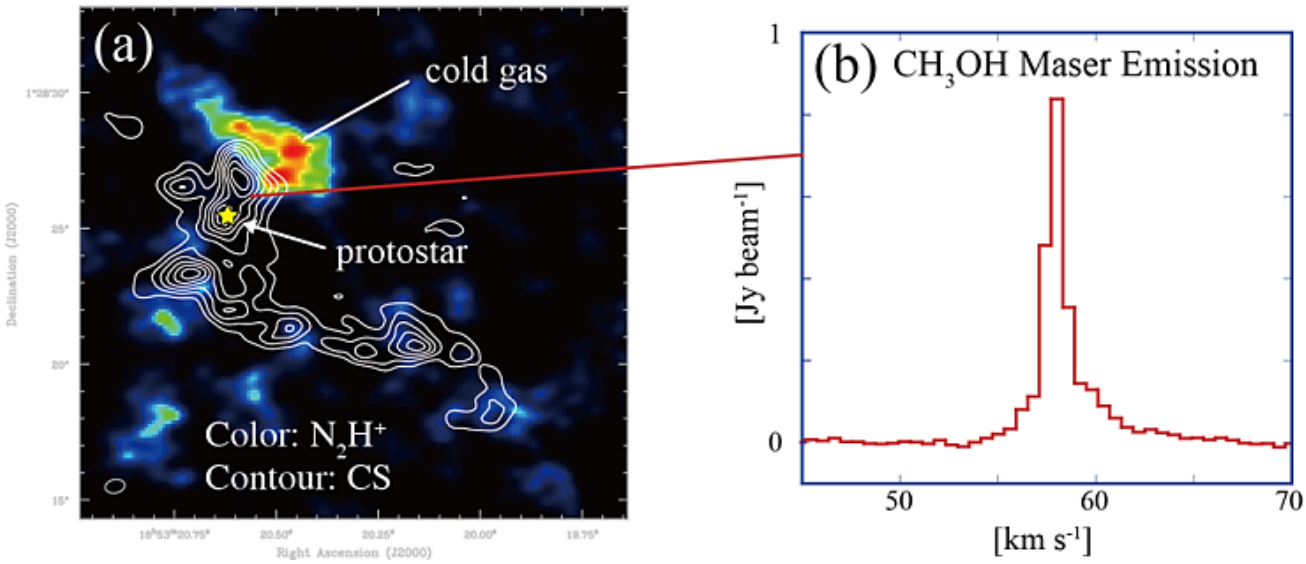
References

[1] Takeshi Sakai et.al, ALMA OBSERVATIONS OF THE IRDC CLUMP G34.43+00.24 MM3: DNC/HNC RATIO, Astrophysical Journal, 803:70 (9pp), (2015)
[2] Takahiro Yanagida et.al, ALMA OBSERVATIONS OF THE IRDC CLUMP G34.43+00.24 MM3: 278 GHz CLASS I METHANOL MASERS, Astrophysical Journal Letters, 794:L10 (6pp), (2014).
[3] Takeshi Sakai et.al, ALMA OBSERVATIONS OF THE IRDC CLUMP G34.43+00.24 MM3: HOT CORE AND MOLECULAR OUTFLOWS, Astrophysical Journal Letters, 775:L31 (6pp), (2013)

Atacama Large Millimeter/Submillimeter Array (ALMA) facilities in Chile



(a) 8 micron color image overlaid with 1.2 mm continuum (Rathborne et al. 2006). The blue circle indicates the observed object (G34.43+00.24 MM3). (b) CH3OH color image overlaid with CS contour image taken with ALMA. The CH3OH emission traces hot (>100 K) regions around the embedded protostar, while the CS emission traces the outflow driven by the protostar. (c) Artist's image.



(a) N2H+ color image overlaid with CS contour image toward G34.43+00.24 MM3. The N2H+ emission traces cold gas, while the CS emission traces the outflow. The anti-correlation between N2H+ and CS suggests that the outflow is interacting with the cold dense gas. (b) Spectrum of methanol maser. We detected the methanol maser emission toward the interacting regions between the outflow and cold dense gas.

Assistant Professor: SAKAI Takeshi (Doctor of Science from The University of Tokyo 2004/03)

Current research areas: Astronomy

Current research subjects: Investigating the diversity of the formation processes of high-mass stars, radio astronomy, star formation, high-mass stars, molecular clouds, interstellar molecules

Website: Takeshi Sakai laboratory: http://www.t-sakai.cei.uec.ac.jp/

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Cotranscriptional folding: Computational modelling of self-assembly of RNA origami for universal computation

Shinnosuke Seki, Assistant Professor
Graduate School of Informatics and Engineering
University of Electro-Communications, Tokyo

Imagine a world where the basic building blocks of massive structures interacted autonomously to self-assemble into majestic landmarks such as the Eiffel Tower in Paris and the Golden Gate Bridge in San Francisco.

Needless to say the self-assembly of such huge structures is still the realm of science fiction but self-assembly is ubiquitous on the atomic scale where atoms and molecule act autonomously to form much larger structures such as liquid crystals, lipids, and layer by layer synthesis of single crystal semiconductor thin films.

Effectively exploiting self-assembly of atoms and molecules for the mass production of nano-circuits or molecular robots requires a deep understanding of the highly complex processes governing the formation of structures exemplified by self-assembled DNA-origami, as reported recently. So research on self-assembly is highly interdisciplinary with experiment-based biologists, chemists and physicists collaborating with mathematicians and computer scientists.

At UEC, Shinnosuke Seki is collaborating with the groups in Denmark and USA who developed so-called 'RNA origami' [1-4]. "My role is to model the self-assembly of RNA origami," says Seki. "Our research focused on a new phenomenon that we refer to as 'cotranscriptional folding'.

Here transcription refers to a process where RNA polymerase binds to a DNA sequence and produces its RNA copy sequence nucleotide by nucleotide while scanning the DNA template from one end towards the other."

Notably, unlike famous double-helical structure of DNA, RNA exists naturally as a single-strand that folds onto itself as soon as a few of its nucleotides are transcribed. This property of RNA the methodology enables the use of easy to handle single strands of RNA to construct complicated shapes.

"Using this phenomenon of cotranscriptional folding, Geary, Rothemund, and Andersen1 developed the experimental technique called RNA origami for the autonomous production of nanoscale structures," explains Seki. "As my contribution to this research, I have proposed a mathematical model of computation by cotranscriptional folding called oritatami system."

Specifically, the Oritatami system is a mathematical model of computation by cotranscriptional folding where starting from an initial 'seed' conformation, a primary building block (such as a chain of molecules) is folded cotranscriptionally over a predefined grid. "One of the important features of the Oritatami system is that it does not fold its primary structure at once," says Seki. "Instead we transcribe the fragment of the next 'delay' molecules and work dynamically from there."

This research has many applications including the realization of 'universal computation' and may enable the formation of RNA structures inside living cells.

Further information

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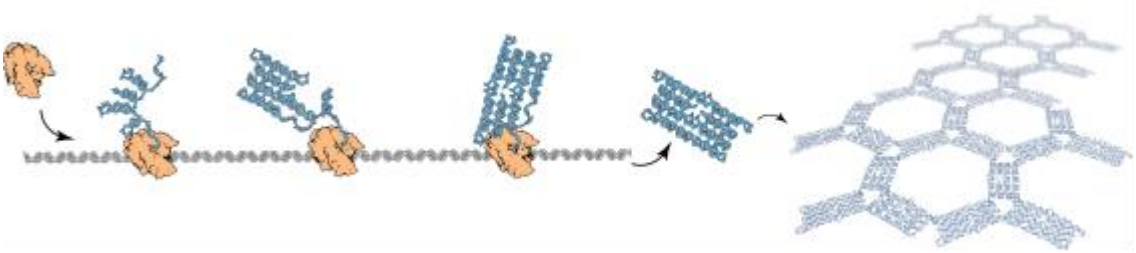


Illustration of RNA origami

Assistant Professor: Shinnosuke SEKI (Ph.D. in Computer Science from University of Western Ontario, 2010/10)

Current research areas: Theory of informatics, Nano/Microsystems, and Computational science.

Current research subjects: Optimization of DNA pattern self-assembly systems.

The University of Electro-Communications
UEC e-Bulletin Vol.8, December 2015

Over 160 participants attend the Irago Conference 2015 at Cape Irago, Aichi Prefecture

Organized jointly by the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology and the University of Electro-Communications, Tokyo, the Irago Conference 2015 was held 22-23 October 2015 at Irago Aichi.

The goal of the Irago Conference (Interdisciplinary Research And Global Outlook) is to enhance mutual understanding between scientists, engineers and policy makers. Now in its fifth year, the conference attracted 160 participants (of whom approximately half were graduate students) who shared their research findings in areas ranging from earthquake prediction and generation ultrashort laser pulses, to monitoring public health and the prevention of contagious diseases in mega-cities.

The 360-degree outlook of the conference impressed invited speakers and guests. "This conference has been extremely informative for both veterans and grad students," noted Makoto Ishida from Toyohashi Tech. "A unique conference with experts from a wide range of backgrounds," noted Justin Llandro from the University of Cambridge.

Graduate students discussing their research at the poster session.

Oral presentation session.

In addition to the invited speakers and poster sessions, the special lunch session provided a platform for graduate students to describe their latest findings as short five minute oral presentations to all the participants at the conference. The members of the audience were asked to vote for the most impressive student speaker who received the 'Best Presentation Award'. This year's recipient was a graduate student from UEC.

The highlight of the conference banquet was the 'Tezutsu Hanabi' (hand-held fireworks) display held on the beach of the conference hotel.

In order to share and disseminate the information from the wide ranging presentations, refereed paper from the conference are published as the Irago Conference proceedings in the AIP Conference Series.

Make a note, Irago Conference 2016 will be held at UEC Tokyo in October/November 2016.

The Irago Conference 2015: http://www.iragoconference.jp/

Group photograph of the participants at Irago Conference 2015.

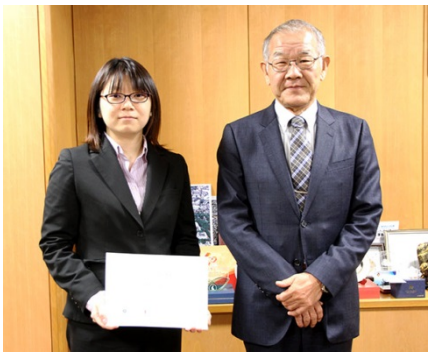
Irago fireworks: 'Tezutsu hanabi' (hand held firework) held during the banquet.

About the Irago Conference series

The Irago Conference was launched in 2011 and is a unique conference combining thought provoking insights into global issues including disaster mitigation, neuroscience, public health monitoring, and nanotechnology by internationally renowned invited speakers with selected talks, posters, and demonstrations from academics, industrialists, and think tanks. The conference is truly a '360 degree outlook on critical scientific and technological challenges' facing mankind.

Recent changes in global economics and industrial priorities, environmental and energy policies, food production and population movements have produced formidable challenges that must be addressed for sustaining life on earth.

The Irago Conference highlights the major issues by bringing together experts from across the world who will give their views on key areas such as energy and natural resources, medicine and public health, disaster prevention and management, as well as other advances in science, technology and life sciences.



Ms. Kanami Ikeda, the recipient of the `Best Presentation Award', with Dr. Takashi Fukuda, President of UEC.

Certificate of `Best Presentation Award' in IRAGO2015

The University of Electro-Communications (UEC) in Tokyo

is a small, luminous university at the forefront of applied sciences, engineering, and technology research. Its roots go back to the Technical Institute for Wireless Commutations, which was established in 1918 by the Wireless Association to train so-called wireless engineers in maritime communications in response to the Titanic disaster in 1912. In 1949, the UEC was established as a national university by the Japanese Ministry of Education, and moved in 1957 from Meguro to its current Chofu campus Tokyo.

With approximately 4,000 students and 350 faculty, UEC is regarded as a small university, but with particular expertise in wireless communications, laser science, robotics, informatics, and material science, to name just a few areas of research.

The UEC was selected for the Ministry of Education, Culture, Sports, Science and Technology (MEXT) Program for Promoting the Enhancement of Research Universities as a result of its strengths in three main areas: optics and photonics research, where we are number one for the number of joint publications with foreign researchers; wireless communications, which reflects our roots; and materials-based research, particularly on fuel cells.

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