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UEC e-Bulletin

Updates on research, innovation, and events at UEC:
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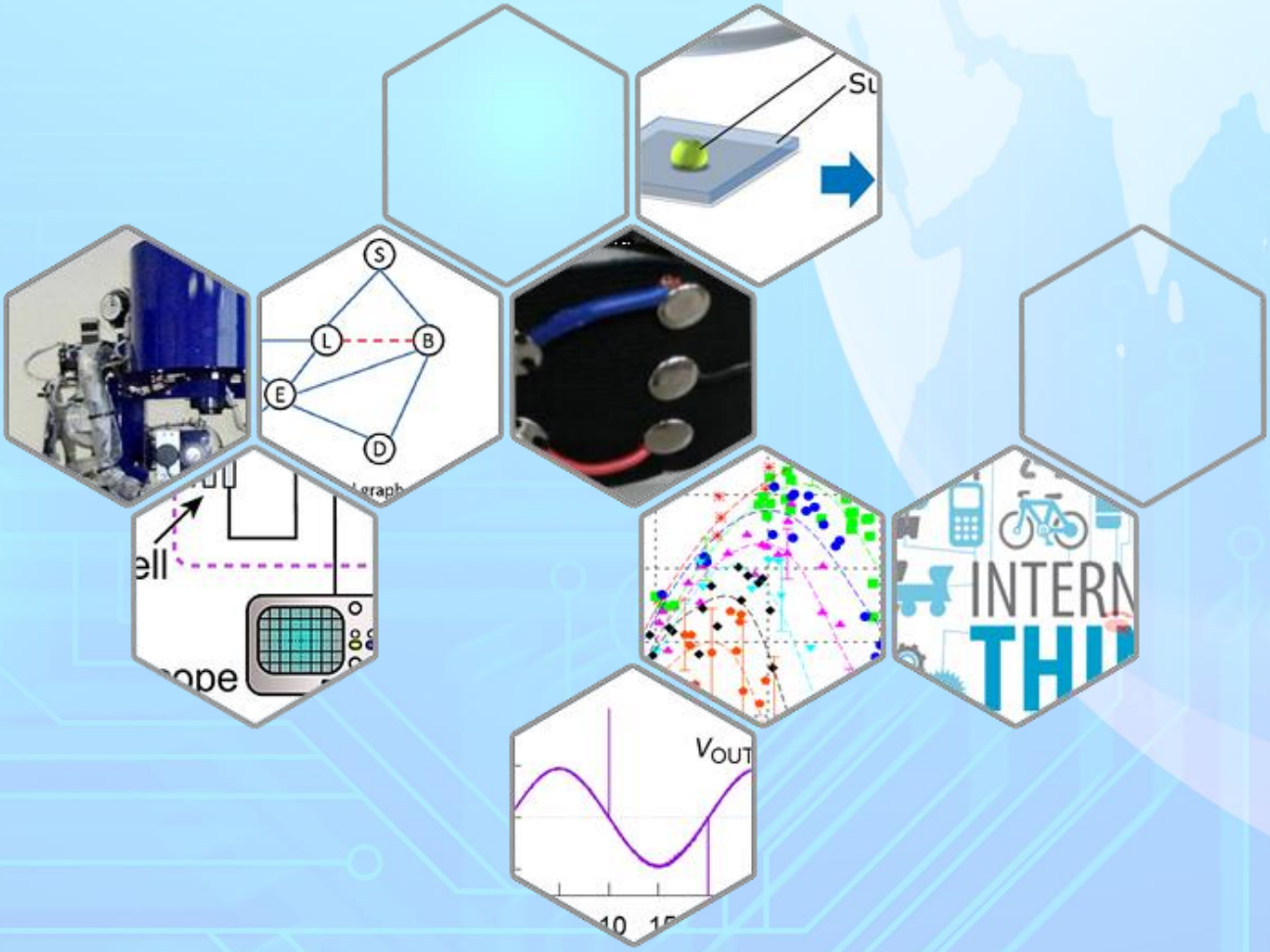
Vol.14, June 2017



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Computer science: Post-quantum cryptography and security for Internet of Things

"I have been really lucky to have studied and worked with many people in many countries," says Bagus Santoso, tenure track assistant professor at the Department of Computer and Network Engineering, University of Electro-Communications, Tokyo. "In Indonesia, my home country, I really enjoyed mathematics at high school. I was interested in applying math concepts, and decided to come to Japan to study computer science." After a year learning Japanese in Tokyo, Bagus was admitted to study at the famous Toyota National College of Technology, Toyota, Aichi, where he got his first opportunity to study computer science, electronic engineering, and artificial intelligence.

After graduating with as an Associate in Computer Engineering in March 2001, he was accepted to study for a bachelor's degree at University of Electro-Communications, Tokyo. "At UEC I studied public-key encryption and cryptanalysis for my graduation project under the supervision of Professor Kazuo Ohta," says Bagus. "My thesis was entitled, 'public-key traitor tracing scheme revisited'. I was really fascinated by this subject and continued to conduct research in the Ohta Lab, starting with my master's degree on 'comprehensive optimal security proof for PFDH under strong existential unforgeability', and then my doctorate on 'analysis and design of cryptographic schemes for lightweight devices' that covered the areas of cryptanalysis, public-key identification scheme, lattice theory, number theory, and security proofs."

In addition to academic research, Bagus has extensive experience of working on projects in industry and national research institutes, including Research Center for Information Security (RCIS), National Institute of Advanced Industrial Science and Technology (AIST), Japan. "During my time at AIST, I was able to expand my scope to hardware security and digital signature schemes with complex additional properties such as privacy and anonymity," says Bagus.

Bagus was a research scientist at the internationally renowned Institute for Infocomm Research (I2R), Agency for Science, Technology and Research, (A*STAR), in Singapore. "My research at A*Star was on design and analysis of efficient secure cryptographic protocols for mobile cloud computing," says Bagus. "I really enjoyed the international scope of the projects there. I worked with people from all over the world including China, Middle East and some Western countries."

Now, Bagus is focused on cryptography and information security, with specific topics including cryptography for IoT, RFID, IC cards; post-quantum cryptography and cryptographic protocols based on multivariate polynomials; cryptographic protocols based on code theory, cryptanalysis using lattice theory; zero-knowledge protocols; public-key encryption especially in attribute-based encryption; digital signatures; and theoretical framework of provable security.

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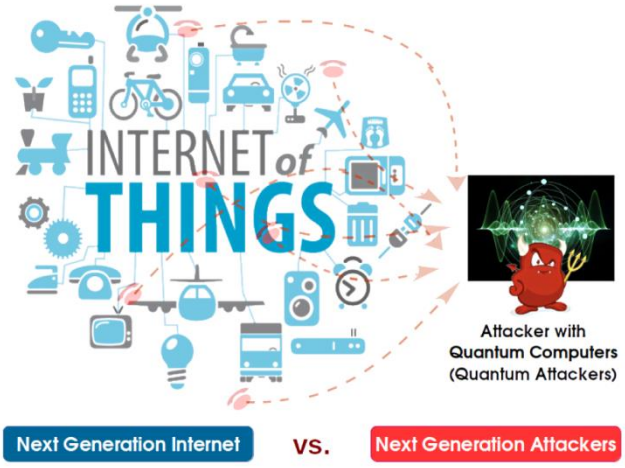
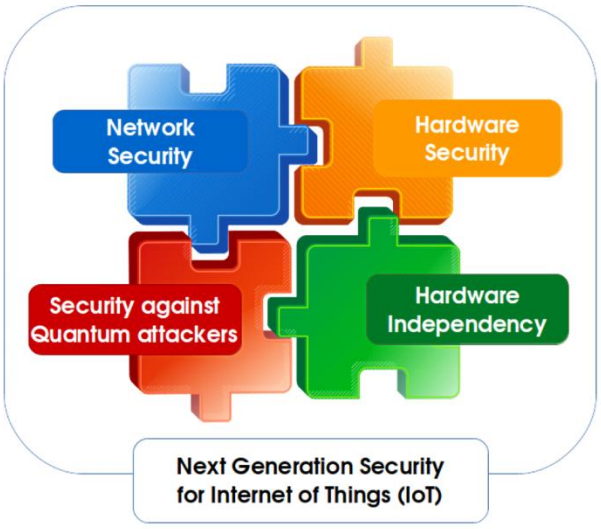
[1] Chunhua Su, Bagus Santoso, Yingjiu Li, Robert H. Deng, and Xinyi Huang. Universally Composable RFID Mutual Authentication. In IEEE Transactions on Dependable and Secure Computations (TDSC), Vol. 14, No. 1, pp.83-94 (12 pages), 2017.
[2] Bagus Santoso, Kazuo Ohta, Kazuo Sakiyama, and Goichiro Hanaoka. An Effcient Authentication for Lightweight Devices by Perfecting Zero-Knowledgeness. In IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E94-A, No.1, pp.92-103, 2011.
[3] Goichiro Hanaoka, Shoichi Hirose, Atsuko Miyaji, Kunihiko Miyazaki, Bagus Santoso, and Peng Yang. Sequential Bitwise Sanitizable Signature Schemes. In IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E94-A, No.1, pp. 392-404, 2011.
[4] Bagus Santoso and Kazuo Ohta. A New 'On the Fly' Identifcation Scheme: An Asymptoticity Trade-Off between ZK and Correctness. In IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E92-A, No.1, pp. 122-136, 2009.
[5] Bagus Santoso, Noboru Kunihiro, Naoki Kanayama and Kazuo Ohta. Factorization of Square-Free Integers with High Bits Known. In IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E91-A, No.1, pp. 306-315, 2008





Assistant Professor: Bagus Santoso (Ph.D. in Information and Communication Engineering from University of Electro-Communications, 2009/03)
Current research areas: Theory of informatics, Computer and information network, and Information security.
Research keywords: Cryptography, Post-Quantum Cryptography, Security for Internet of Things.

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Eco-friendly organic photovoltaics: Saving the planet with flexible electronics

"My research on organic photovoltaic (OPVs) devices reflects my fascination with electronic gadgets and concerns about the environment," says Varun Vohra, tenure-track assistant professor at the Department of Engineering Science, UEC, Tokyo. "So I want to save the planet with flexible electronics!"

In a nutshell, Vohra and his group aim to produce low cost, eco-friendly, and highly efficient solar cells using organic materials.[1,2]

"Eco-friendly organic photovoltaics necessities reducing the quantity of chlorinated solvents used in their fabrication process," says Vohra. "This is slightly counterintuitive to the perception held by non-scientists, where 'organic' is often envisaged as being good for nature."

So how do you reduce chlorinated solvents during the manufacture of OPVs? Vohra and his colleagues are working on two promising approaches. The first is so-called 'push-coating' where polydimethylsiloxane (PDMS) films are used to capture the solvent from a small amount of polymer solution to fabricate homogeneous thin active layer for polymer devices formed on a transparent electrode substrate without generating any active material waste (Fig.1). This process necessitates robust 2 to 4 mm thick PDMS films that are easy to handle and have favorable solvent retention properties. The UEC group has fabricated organic photovoltaic and light emitting diodes using PDMS where the device layer thicknesses were optimized by varying the solution concentration and thickness of PDMS. Importantly, the push-coating process requires only 5 microliters of polymer solution compared with 100 microliters for spin coating methods. However, the UEC researchers emphasize that the push-coating approach is limited to solvents that diffuse inside PDMS layers.

"We have fabricated densely packed crystallites at low temperature by push-coating," says Vohra. "The typical power conversion efficiency (PCE) of devices was around 3.1% with a fill factor of 64%. These results are promising for low cost, high volume manufacture of devices by roll-to-roll production."[3]

The other approach being pursued is the synthesis of 'donor-acceptor' nanoparticles from water based micro emulsions in which the active material (donor) also acts as the emulsifying agent (Fig.2). "To-date the main problem with similar procedures has been that the surfactant (insulator) is not entirely removed after the synthesis and finds its way into the active layers," explains Vohra. "However, the block-copolymer we have designed is an electrically active surfactant and we have obtained PCEs of 2.5% with this method. So it has real potential."[4]

Plans for research on water based emulsions include the fabrication of inverted architecture OPV devices and other devices including organic LEDs and field-effect transistors.

Other projects at the Vohra lab include self-assembled nanoporous films for PDMS-based hybrid nanostructured electrodes for light-emitting pressure sensor fabrication;[5] biomimetic ordered polymer assemblies for PDMS based deformation and solvent vapor sensors, where the color of the films changes when it is deformed or senses solvents.

References

[1] Varun Vohra, Kazuaki Kawashima, Takeshi Kakara, Tomoyuki Koganezawa, Itaru Osaka, Kazuo Takimiya, Hideyuki Murata. Efficient inverted polymer solar cells employing favourable molecular orientation. *Nature photonics* 9, 403-408 (2015)

[2] Varun Vohra, Takuya Anzai, Shusei Inaba, William Porzio, Luisa Barba. Transfer-printing of active layers to achieve high quality interfaces in sequentially deposited multilayer inverted polymer solar cells fabricated in air. *Science and Technology of Advanced Materials* 17, 530-540 (2016)

[3] Varun Vohra, Wojciech Mroz, Shusei Inaba,[a] William Porzio, Umberto Giovanella, Francesco Galeotti. Low-cost and green fabrication of polymer electronic devices by push-coating the polymer active layers. *Submitted to ACS Applied Materials & Interfaces*

[4] Stefania Zappia, Guido Scavia, Anna Maria Ferretti, Umberto Giovanella, Varun Vohra, Silvia Destri. Eco-friendly approach for efficient organic solar cell fabrication with water-processable amphiphilic low band gap block copolymer:fullerene nanoparticles. *Submitted to Advanced Sustainable Systems*

[5] Rie Shimotsu, Takahiro Takumi, Varun Vohra. All solution-processed micro-structured flexible electrodes for low-cost light-emitting pressure sensors fabrication. *Submitted to Scientific Reports*

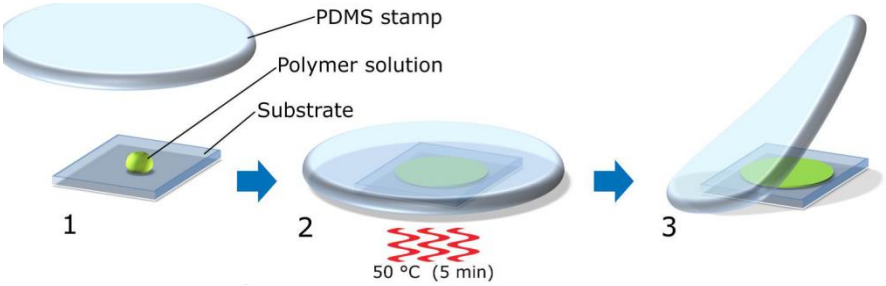

Fig. 1 Push coating devices onto substrates with polydimethylsiloxane (PDMS) films. 1. Deposit approximately 5 microliters of solution on a substrate; 2. Press the PDMS stamp against it. 3. Wait for the solvent to diffuse inside PDMS and remove PDMS.

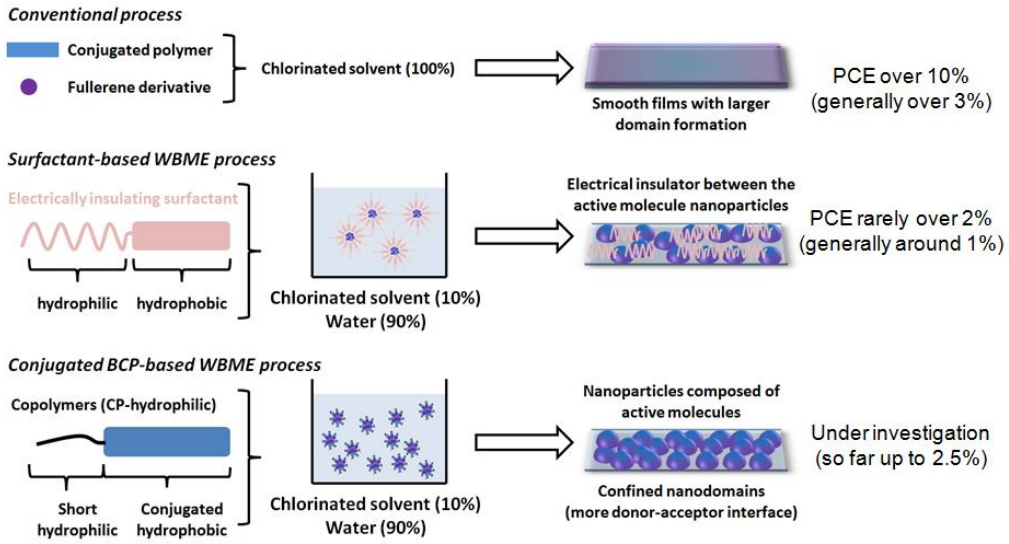

Fig. 2: Schematic comparison of thin film morphology and device performances of active layers prepared using conventional spin-coating from chlorinated solvents, recently introduced water-based micro-emulsion processes and water-based micro-emulsion process developed at UEC.

Associate Professor: Varun Vohla (PhD in Material Science at the University of Milano-Bicocca, 2009/12)

Current research areas: Device related chemistry, Composite materials/Surface and interface engineering, Structural/Functional materials, and Material processing/Microstructural control engineering.

Current research subjects: Electro-spinning, Polymer-Polymer self-assembly, Organic light emitting devices, and Organic solar cells.

Personal website: http://www.i-m.mx/vohralabo/VOHRALAB/home.html and https://www.researchgate.net/profile/Varun_Vohra3

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Prosthetic limbs made user-friendly with polymer based elastic sensors.

Prostheses are used to replace body parts damaged through trauma or congenital deficiencies. A wide range of prosthetic limbs exist including myoelectric prostheses that operate by so-called surface electromyography (sEMG), where pulses of electrical voltage from muscles are relayed to sensors when users want to initiate a movement. However, a major problem limit the application of such prosthetic devices is the instability of the electrical signals measured.

Now, Yinlai Jiang and colleagues at the University of Electro-Communications, Tokyo, and collaborators in China, have developed sensors made of polypyrrole (PPy), a conductive polymer that is sewn onto elastic bands. The flexibility of these bands makes them much easier for patients to wear with one hand, and highly ergonomic.

The functionality of the sensors was tested by comparing the signals measured with the proposed sensor and those with traditional wet Ag/Agcl electrodes. Four subjects were recruited to wear sensors on their arms using both type of electrodes. Subsequently, signals measured by each kind of electrode when contracting the same set of muscles was measured. The quality of the signals measured in both cases had high correlation, indicating the functioning of PPy electrodes to be equivalent to traditional ones. Furthermore, prosthetic hands usually provide five basic motions and the recognition of each motion by the PPy sensor was also confirmed to be similar to traditional electrodes.

The PPy sensors are in direct contact with skin, in contrast to the wet electrodes that are covered by an electrolyte gel. This electrode-skin contact often exacerbates the source impedance or resistance in the circuit, masking the quality of signal. Balancing the source impedance however, restores the signal to noise ratio. The researchers conclude, "Source impedances, rather than the shape and the size of the electrodes, are important for sEMG measurement." This renders flexibility in the design of the PPy electrodes.

The research team plans to expand this study with trials for a longer duration, and more patients. Given this study's promising results, the rigorous training, which patients must undergo to stabilize signals for myoelectric control, could be made much simpler in the future.

Reference

Yinlai Jiang, Masami Togane, Baoliang Lu and Hiroshi Yokoi. "sEMG sensor using polypyrrole-coated nonwoven fabric sheet for practical control of prosthetic hand." *Frontiers In Neuroscience*, Published online (6 February 2017); doi: 10.3389/fnins.2017.00033
https://doi.org/10.3389/fnins.2017.00033

Sensor band

Design of the PPy band.

Ag/Agcl electrodes vs. PPy electrodes worn on similar regions of the arm.

Associate Professor: Yinlai Jiang (Ph.D from Kochi University of Technology 2008/03).
Current research areas: Soft computing, Intelligent robotics, and Rehabilitation science/ Welfare engineering.
Current research subjects: Biomedical engineering, Rehabilitation and assistive robotics, and Human robot interface.
Personal website: http://www.hi.mce.uec.ac.jp/yklab/

Professor: Hiroshi, YOKOI (Doctor of Engineering from Hokkaido University 1993/03).
Current research areas: Rehabilitation science/ Welfare engineering and Intelligent mechanics/ Mechanical systems.
Current research subjects: Computational intelligence in robotics, Artificial life, and Medical engineering.
Personal website: http://www.hi.mce.uec.ac.jp/yklab/

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Digital to analog convertors generate bipolar voltages when coupled to a polarity switchable double flux amplifier

Digital to analog convertors (DACs) are devices that convert digital, typically binary signals to outputs in the form of voltage. The voltage generated can then be used to produce light, as in video and television or sound, as in MP3 players. Single-flux-quantum (SFQ)-based DACs fabricated using superconducting Josephson junctions generate voltages of quantum accuracy, which would be applied for metrological applications, i.e., realization of AC voltage standards.

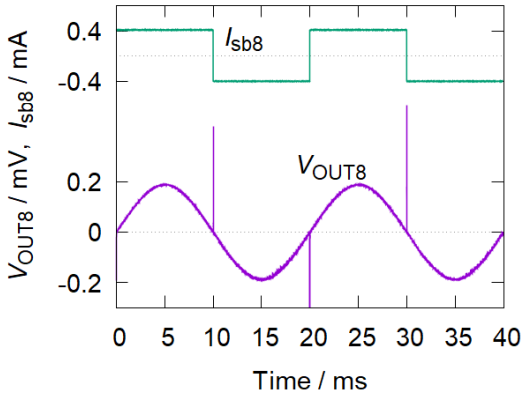
A group led by Yoshinao Mizugaki at the University of Electro-Communications in Tokyo has developed SFQ-based DACs producing only unipolar voltages, with positive polarity. This makes them less advanced than other available DACs for metrology. Their previous attempts to resolve the issue of unipolarity were quite exhaustive. The team has now attempted to develop their device by adding a simple fixture to the circuit.

A DAC was designed using a so-called polarity-switchable double flux amplifier (PS-DSQA). The PS-DSQA consisted of three-junction loops, or stacks of cells, that produced output voltages with polarities corresponding to the polarity of deliberately applied (bias) currents. Thus switching the polarity of the bias current resulted in switching of the generated voltage. When an 8-bit digital input code was applied, in the form of a variable pulse number multiplier, the voltage generated was measured using an oscilloscope. The bias current was forwarded to a PS-DSQA capable of ±500 and ±8 fold magnification of voltage.

Notably, the PS-DSQA produced positive and negative currents, albeit not of equal magnitude at ±500 fold. However, at ±8 fold, bias current conditions were more feasible for equivalent bipolar voltages. Sinusoidal waves were observed, indicating proper functioning and generation of bipolar voltages. Mizugaki and co-workers successfully built on their previous work, creating DACs with performances equivalent to devices currently available.

Reference

Yoshinao Mizugaki, Tomoki Watanabe, and Hiroshi Shimada. "Single-Flux-Quantum Bipolar Digital-to-Analog Converter Comprising Polarity-Switchable Double-Flux-Quantum Amplifier." *IEEE transaction on superconductivity*, Published online (7 November, 2016); doi: 10.1109/TASC.2016.2625739 https://doi.org/10.1109/TASC.2016.2625739



Sinusoidal waves indicative of bipolar outgoing voltages generated using the 8-bit variable pulse number multiplier.

Professor: Yoshinao, MIZUGAKI (Ph.D. from Tohoku University 1995/01)
Current research areas: Electronics, Applied Physics
Current research subjects: Superconductive single-flux-quantum circuits, Single-electron tunneling devices, and Electric application of lipid bilayer
Personal website: http://mogami.ee.uec.ac.jp/index-e.html

Associate Professor: Hiroshi, SHIMADA (Ph.D. from The University of Tokyo 1989/07)
Current research areas: Low-Temperature Physics, Applied Physics
Current research subjects: Small Josephson junctions, Ferromagnetic single-electron devices, and Quantum electromagnetic circuits
Personal website: http://inaho.pc.uec.ac.jp/?lang=english

Former Graduate Student: Tomoki, WATANABE (Master of Engineering from the University of Electro-Communications 2016/03)
Former research subjects at the Graduate school of the UEC: Development of superconductive digital and analog circuits designed for precise DAC applications

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Inference of Bayesian networks made fast and easy using an extended depth-first search algorithm

A Bayesian network is a directed acyclic graph (DAG) or a probabilistic graphical model used by statisticians. Vertices of this model represent different variables. Any connections between variables indicate a conditional dependency and a lack of connections implies a lack of it.

Traditionally, Bayesian networks are used for modelling and inference of large amounts of information using algorithms. One such common algorithm is the junction tree algorithm that uses the method of triangulation: The DAG is simplified into triangles, based on the connections (regardless of direction) and subsequently cliques making up each triangle act as junctions or "nodes" of a hierarchical tree. Ottosen and Vomlel first proposed the depth-first search (DFS) algorithm based on this principle. The DFS algorithm was based on two components: depth-first search and dynamic clique maintenance to scan and eliminate nodes and identify new cliques, respectively. However this method is time-consuming and leads to problems such as finding the same clique twice.

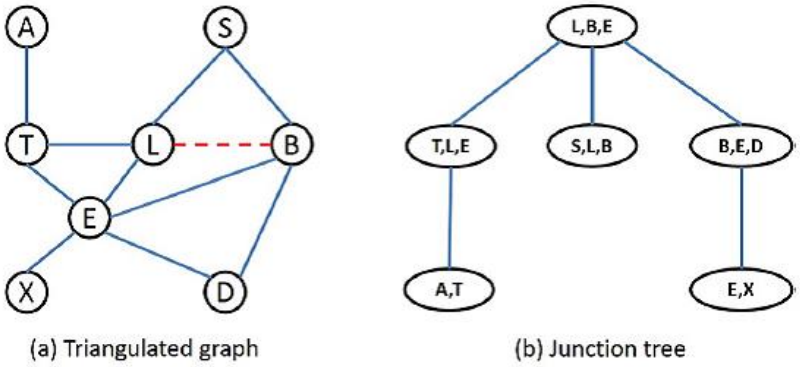
Here, Chao Li and Maomi Ueno at the University of Electro-Communications in Tokyo have further refined this algorithm and created a new extended depth first algorithm (EDFS). Based on their algorithm, only cliques with new edges introduced are selected, thus making clique selection very specific. Their second improvement to the algorithm is "pivot clique pruning". This is a sophisticated method of eliminating orders or variables from the network, which greatly reduces the size of the search tree.

To validate the EDFS algorithm, the researchers randomly compared networks from a well-known database with the DFS algorithm. They found that the total running times and time for depth first search and dynamic clique maintenance were less compared to the DFS algorithm.

"The new EDFS algorithm improves the state-of-the-art Ottosen and Vomlel (DFS) algorithm in two orthogonal directions: (1) reduction of the overhead cost, and (2) reduction of the size of the search space," conclude the authors. Time-efficient analysis of Bayesian networks can lead to quick deduction of vast amounts of data.

Reference

Chao Li and Maomi Ueno. "An extended depth-first search algorithm for optimal triangulation of Bayesian networks." *International Journal of Approximate Reasoning*, Published online (30 September 2016); doi: 10.1016/j.ijar.2016.09.012
http://dx.doi.org/10.1016/j.ijar.2016.09.012



(a) Triangulated graph (b) Junction tree

Connected vertices form a triangulated Bayesian network (a) and cliques of each triangle form the nodes of its corresponding junction tree (b).

Researcher: Chao Li (Ph.D. from University of Electro-Communications 2017/03).
Current research areas: Probabilistic Inference, Machine Learning, Decision Making, and Causal inference.
Current research subjects: Decision Making using Bayesian network and Causal inference from observational studies.
Personal website: https://www.researchgate.net/profile/Chao_Li182

Professor: Maomi, UENO (Dr. of Engineering from Tokyo Institute of Technology 1999/04).
Current research areas: Artificial Intelligence, Machine Learning, Bayesian statistics, and Big data analysis.
Current research subjects: Bayesian network, Probabilistic Inference, Causal inference from observational studies, and Intelligent systems.
Personal website: http://www.ai.lab.uec.ac.jp/index-e/

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Robotic vision sensors based on light sensitive bacterial proteins

High performance motion detection technology is critical as the 'eyes' of advanced robotic systems for applications including factory management and autonomous machines in home environments. Traditional robot vision devices such as CCD cameras integrated with microelectronic circuits rely on sophisticated algorithms for high speed imaging and processing for robotic navigation. However, these systems are expensive to implement and require specialists for maintenance when equipment malfunctions.

With a view to producing low cost and simpler systems, scientists are considering bio-inspired approaches in the form of light sensitive bacteria. Specially, bacteriorhodopsin (bR)--a pigment found in the membrane of Halobacteria--that when exposed to light releases protons thereby generating transient electrical currents.

Now, Yoshiko Okada-Shudo at the University of Electro-Communications, Tokyo, and colleagues, have developed a single photocell using bR pigment. The researchers coated an indium tin oxide glass plate with bR solution that was covered in an electrolyte solution to enhance electrical currents and held in place by a spacer plate. The currents generated when this photocell was irradiated with light were measured with an oscilloscope.

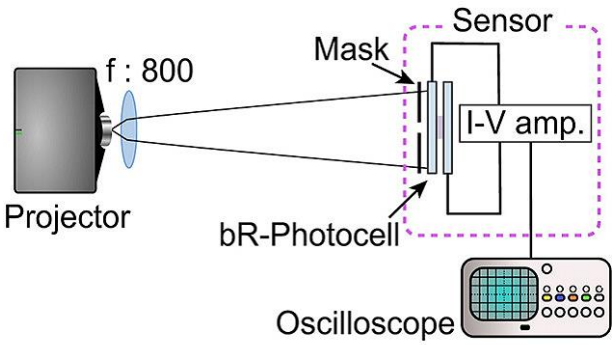
Notably, the direction and speed of light scanned over the photocell could be determined using this simple device. Furthermore, when different kinds of patterned "masks" were introduced between the bR sensor and scanned light, each edge of the pattern caused an asymmetry in the current generated. This asymmetry was indicative of the direction of motion of light. Triangular patterns could be used for bidirectional motion, while a combination of two rectangles showed four directions (up, down, right and left).

In other experiments the researcher investigated whether bR photocells were sensitive to gestural manipulation by controlling the motion of light going through a pinhole mask, using the movement of fingers. Interestingly, the photocell was not only sensitive to the motion of fingers, but also the number of fingers used.

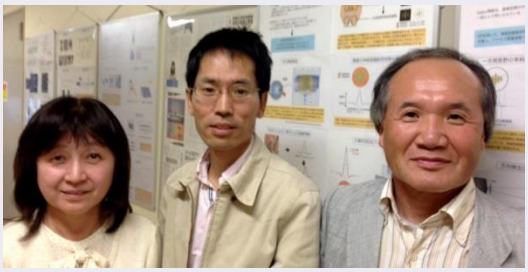
This simple bR device is promising for the development of simple motion sensors without requiring complex algorithms. This research also has potential for gestural manipulation as a means to control such devices, thereby giving an alternative for touch sensors.

Reference

Yoshiko Okada-Shudo, Tokimasa Tanabe, Takayuki Mukai, Katsuyuki Kasai, Yun Zhang and Masayoshi Watanabe. "Directionally selective motion detection with bacteriorhodopsin patterned sensor." *Synthetic Metals*, Published online (3 November 2016); doi:10.1016/j.synthmet.2016.10.020
http://dx.doi.org/10.1016/j.synthmet.2016.10.020



Experimental set-up of the bR photocell using different patterned masks.



(from left to right) Yoshiko, Okada-Shudo, Yun Zhang, and Masayoshi Watanabe.

Associate Professor: Yoshiko, OKADA-SHUDO (Ph.D. from Yokohama National University 1990)
Current research areas: Biophotonics, Bioelectronics
Current research subjects: Protein based artificial retina, Protein based receptive fields for image processing.
Personal website: http://www.okada-lab.es.uec.ac.jp/e-index.html

Associate Professor: Yun Zhang (Doctor of Science from Shanxi University 2000/07)
Current research areas: Quantum optics, Laser technology, Biooptics
Current research subjects: Quantum optics with both continuous variable and discrete variable Modelling.

Professor: Masayoshi, WATANABE (Ph.D. in Engineering from Tokyo University 1990)
Current research areas: Laser engineering, Quantum electronics
Current research subjects: VUV generation / Frequency stabilization / Control of coherent light.

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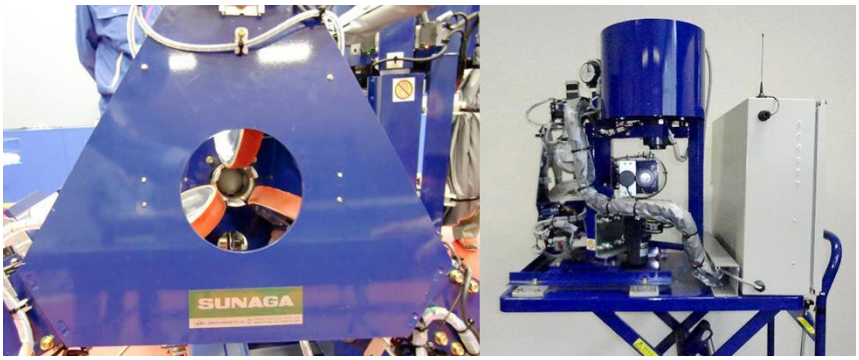
Fluid mechanics of table tennis balls: Discovery of 'spin-crisis'

Research conducted by Takeshi Miyazaki and colleagues at the Complex Fluids Lab at UEC, Tokyo, covers environmental fluid mechanics in massive systems such as flight of projectiles and motion of vortices in the Earth's atmosphere and oceans, as well as so-called granular flows where studies focus on determining how the behavior of individual particles affect macroscopic fluid flow.

Intriguingly, the other major area of research addresses fluid mechanics in sport including aerodynamics of flying arrows and spinning balls used in baseball, and recently table tennis balls.

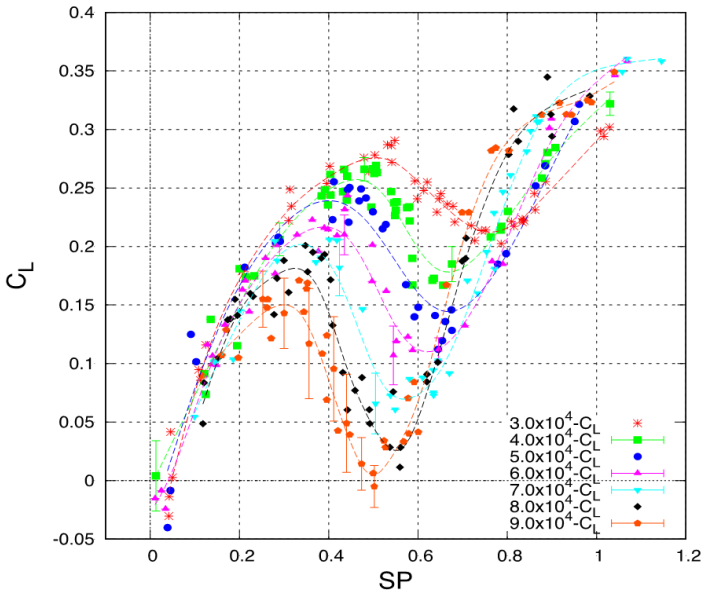
"It is surprising that the aerodynamic properties of table tennis balls are not clear," says Miyazaki. "This may be because engineers have little interest in spinning spheres with Reynolds numbers less than 105, as is the case for the lightweight table tennis balls. But such is research is important for sports science."

In fluidics the Reynolds number is a guide to the transition from stable, laminar flow to rougher and turbulent motion of objects. Miyazaki and colleagues used high speed video cameras to track and monitor the trajectories of table tennis balls launched by a specially designed 'three rotator machine'.



Three rotor launching machine "Chiquita".

"We unexpectedly found a dip in the lift coefficient for table tennis balls traveling at a spin rate of less than 0.5," explains Miyazaki. "We refer to these results as 'spin-crisis' because they imply that more spin does not mean more lift. In fact, too much spin on the ball causes it to go down."



Lift coefficient as a function of the spin parameter SP.

This research highlights the many unresolved phenomena in fluid dynamics.

References

T Miyazaki et al, Lift crisis of a spinning table tennis ball, *Eur. J. Phys.* 38 (2017) 024001 (16pp) doi:10.1088/1361-6404/aa51ea

Professor: Takeshi, MIYAZAKI (Ph.D. from University of Tokyo, 1984/09)
Current research areas: Fluid Mechanics, Vortex Dynamics, Heat and Mass Transfer in Fluids, and Micro-fluidics
Current research subjects: Statistical Mechanics of Geophysical Vortices, Motion and Instability of Coherent Structures in Geophysical Flow, Scalar Dispersion in Geophysical Flow, Sports Fluid Dynamics, Motion Capturing TSP/PSP Measurements, Chaotic Mixing induced by Capillary Oscillations of a Sessile Drop.
Personal website: http://www.miyazaki.mce.uec.ac.jp/en/

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Innovative insights into artificial intelligence

Satoshi Kurihara is conducting research in the areas of intelligent traffic light controls; verification of the validity of multi-agent type information diffusion models (AIDM); and realization of artificial intelligence based active learning environments.

"In Japan, it is estimated that traffic congestions leads to the loss of 40 hours/year per person, economic losses of 15 trillion JPY/year, and environmental pollution," says Kurihara. "We are using so called real time 'multi-agent coordination' to control traffic signals and thereby mitigate traffic jams. The critical feature of our approach is that traffic lights are autonomous, communicating and coordinating with each other in real time to respond to traffic movements." Detailed information about this research is described in Reference 1.

The aim of the second area of research is to prevent the diffusion of fake rumors in social networking services (SNS). "Twitter and other such SNS were widely used to share information during the Great East Japan Earthquake in March 2011," says Kurihara. "But false rumors spread by SNS were a source of concern. We want to prevent the diffusion of such rumors, especially during natural disasters." The details of this group's research using the Agent-based Information Diffusion Model are given in Reference 2.

The third research topic is 'ambient computing' where technology works for people rather like secretaries and home helpers. "Japan is facing a rapidly aging society so many people will not be able to use conventional technology based on remote controllers to switch appliance on and off," says Kurihara. "We are developing ambient technology that will watch people and anticipate their moves and needs, to support their daily lives." Kurihara has created a so-called 'autonomous environment' in the UEC library to actively support students with their studies. "The UEC Ambient Intelligence Agora is an example of artificial intelligence supporting learning at universities." Further information at the URL in Reference 3.

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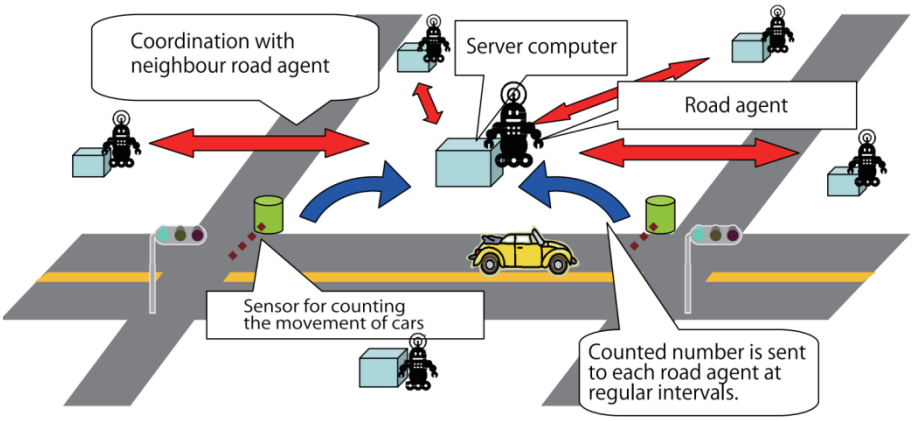
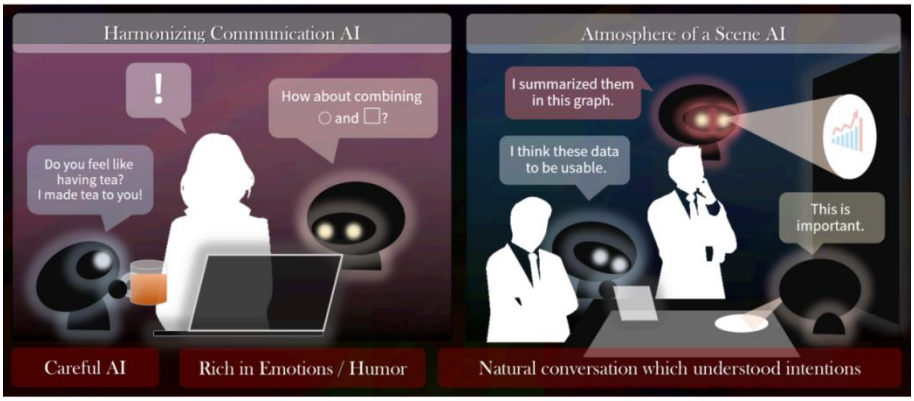


'multi-agent coordination' to control traffic signals



ambient computing

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The University of Electro-Communications
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UEC Event: An open day for industry

The University of Electro-Communications (UEC) held an open day for industry on June 14th. The events were planned to strengthen collaboration between industry-academia-government and consisted of parallel talks that were outlined during an opening address by Kazushi Nakano, Member of Board of Directors, UEC, Tokyo.

The sessions included talks on artificial intelligence (AI), big data, internet of things (IoT), and health, medicine and measurement control.

The presentations were well received with lively discussions, especially on the industrial applications of research on AI, IoT, and healthcare.

The day's events also included laboratory tours, where the participants were divided into eight groups and each visited four departments.

During the "contest for making things", graduate students gave presentations about ideas and research aimed at starting their own businesses. Ryuhei Makino, a first year of doctoral student at the Department of Informatics, received an "excellence" award from the organizers.

Later, approximately 40 people from 20 companies joined a networking meeting after the day's events.

Entrance to the building where the talks of the "Industry-Academia-Government Collaboration Day" were held.

Reception desk with participants registering for the meeting.

Opening address by Kazushi Nakano, Member of Board of Directors, UEC, Tokyo.

Discussion about "spatiotemporal information system".

Dr. Yuki describes acoustic emission for destruction inspection.

Dr. Kurihara talks about his research on artificial intelligence.

The University of Electro-Communications (UEC) in Tokyo

is a small, luminous university at the forefront of pure and 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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