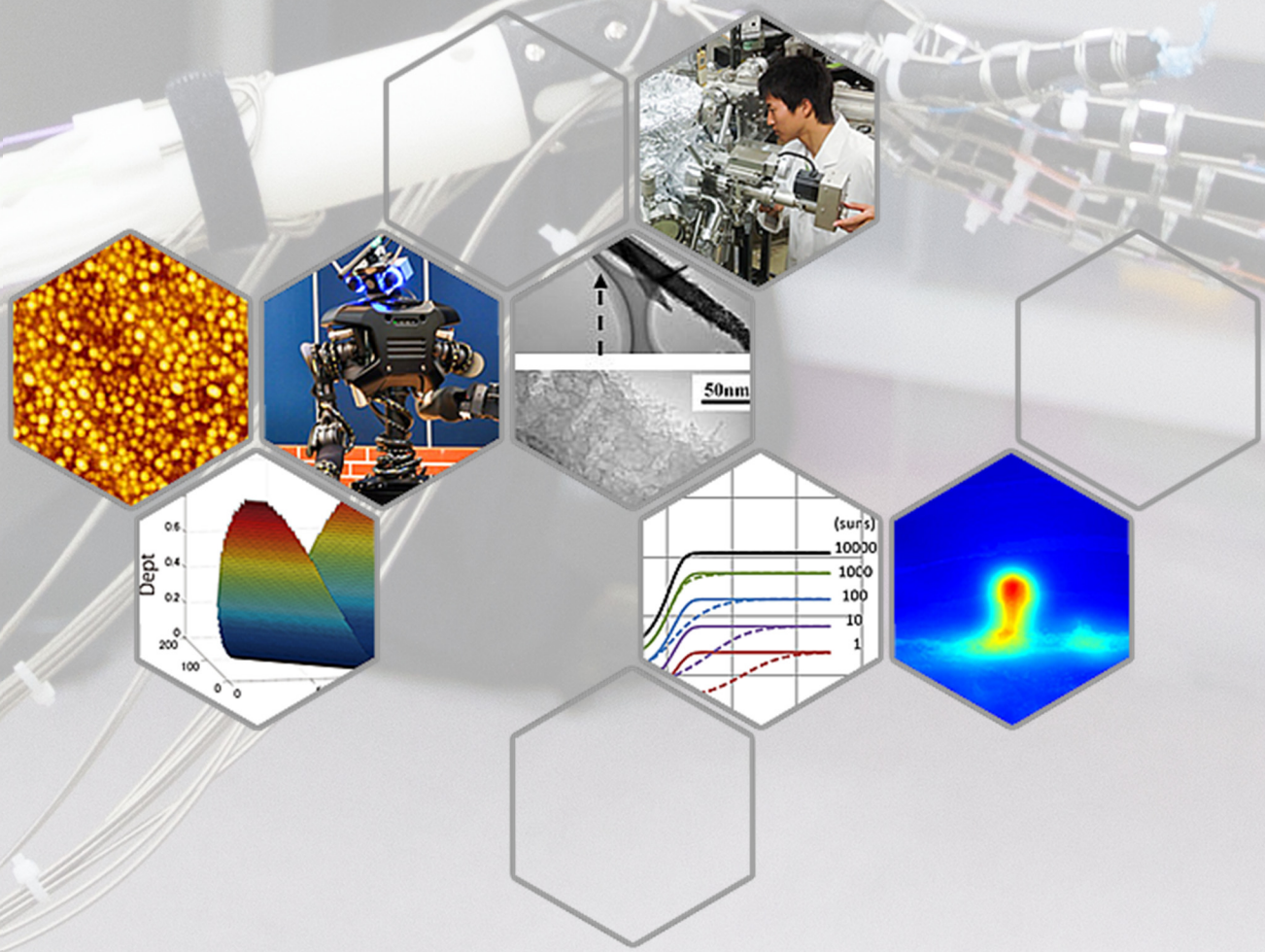
The University of Electro-Communications

UEC e-Bulletin

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

Vol.3, September 2014



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Nanotechnology for real world applications: Self-organized indium arsenide quantum dots for solar cells

Professor Koichi Yamaguchi
Department of Engineering Science
Graduate School of Informatics and Engineering

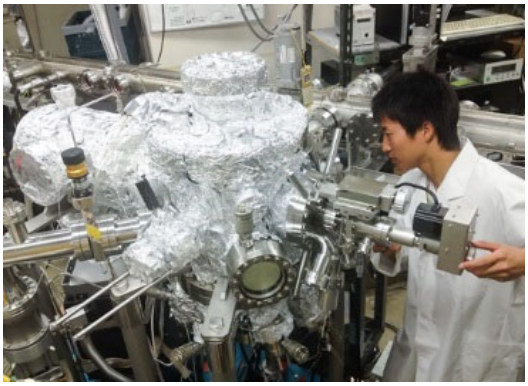
Professor
Koichi Yamaguchi

Kouichi Yamaguchi is internationally recognized for his pioneering research on the fabrication and applications of 'semiconducting quantum dots' (QDs). "We exploit the 'self-organization' of semiconducting nanocrystals by the 'Stranski-Krasnov (SK) mode of crystal growth for producing ordered, highly dense, and highly uniform quantum dots," explains Yamaguchi. "Our 'bottom-up' approach yields much better results than the conventional photolithographic or 'top-down' methods widely used for the fabrication of nano-structures."

Notably, electrons in quantum dot structures are confined inside nanometer sized three dimension boxes. Novel applications of 'quantum dots'—including lasers, biological markers, qubits for quantum computing, and photovoltaic devices—arise from the unique opto-electronic properties of the QDs when irradiated with light or under external electromagnetic fields.

"Our main interest in QDs is for the fabrication of high efficiency solar cells," says Yamaguchi. "Step by step we have pushed the limits of 'self-organization' based growth of QDs and succeeded in producing highly ordered, ultra-high densities of QDs."

The realization of an unprecedented QDs density of 5 x 10^{11} cm^{-2} in 2011 was one of the major milestones in the development of 'self-organization' based semiconducting QDs for solar cells by Yamaguchi and his colleagues at the University of Electro-Communications (UEC). "This density was one of the critical advances for achieving high efficiency quantum dot based photo-voltaic devices," says Yamaguchi.

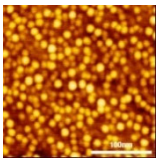


Molecular beam epitaxy (MBE) used to grow InAs QDs solar cells

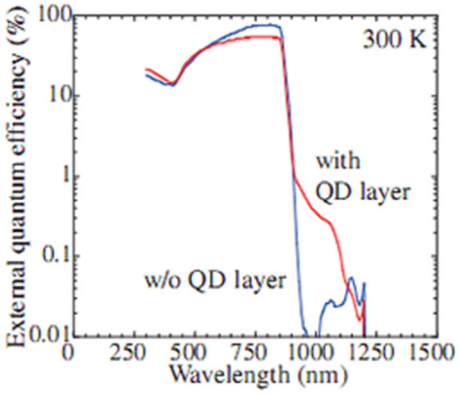
Specifically, Yamaguchi and his group used molecular beam epitaxy (MBE) to grow a layer of InAs QDs with a density of 5 x 10^{11} cm^{-2} on GaAsSb/GaAs (100) substrates. Importantly, the breakthrough that yielded this high density of highly ordered QDs was the discovery that InAs growth at a relatively low substrate temperature of 470 degrees Celsius on Sb-irradiated GaAs layers suppressed coalescence or 'ripening' of InAs QDs that was observed at higher temperatures. Thus the combination of the Sb surfactant effect and lower growth temperature yielded InAs QDs with an average height of 2.0-2.5 nm.

The potential for photovoltaic device applications was examined by sandwiching a single layer of InAs QDs in a pin-GaAs cell structure. The resulting external quantum efficiency of these solar cell structures in the 900 to 1150 nm wavelength range was higher than devices with the QD layer.

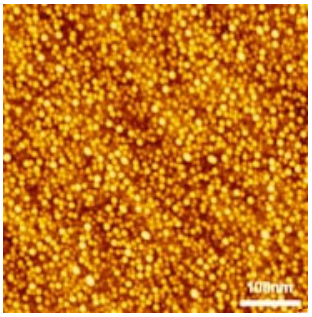
"Theoretical studies suggest QDs solar cells could yield conversion efficiencies over 50%," explains Yamaguchi. "This is a very challenging target but we hope that our innovative approach will be an effective means of producing such QD based high performance solar cells. We have recently achieved InAs QDs with a density of 1 x 10^{12} cm^{-2}."



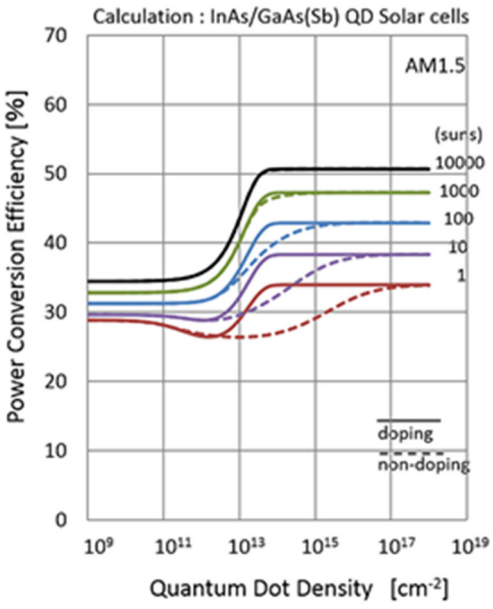
InAs QD density: 5.0×10^{11} cm^{-2}



External quantum efficiency of solar cell with only one InAs-QD layer.



InAs QD density: 1.0×10^{12} cm^{-2}



Variation of power conversion efficiency with quantum dot density (calculated results).

References
Edes Saputra, Jun Ohta, Naoki Kakuda, and Koichi Yamaguchi, “Self-Formation of In-Plane Ultrahigh-Density InAs Quantum Dots on GaAsSb/GaAs(001)”, *Appl. Phys. Express* **5**, 125502, (2012).
DOI: http://dx.doi.org/10.1143/APEX.5.125502

Katsuyoshi Sakamoto, Yasunori Kondo, Keisuke Uchida and Koichi Yamaguchi, “Quantum-dot density dependence of power conversion efficiency of intermediate-band solar cells”, *J. Appl. Phys.* **112**, 124515 (2012).

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The 1st Global Alliance Lab between King Mongkut's Institute of Technology Ladkrabang, Thailand and the University of Electro-Communications

The 1st Global Alliance Lab (GAL) between King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand, and the University of Electro-Communications was set up at both universities on August 2014 with the help of Office for Promotion of Advanced IT and Global Creative Engineering Education.

Signing ceremony at UEC by Prof. B. Taworn and Prof. K. Abe

The main aims of GAL include establishing international collaboration academic activities including bi-directional student exchange programs, internships, special lectures by faculty members from both universities, and research collaboration.

One of the unique features of GAL is that both universities can set up space on each other's campus for faculty members, researchers and students to use during their visit.

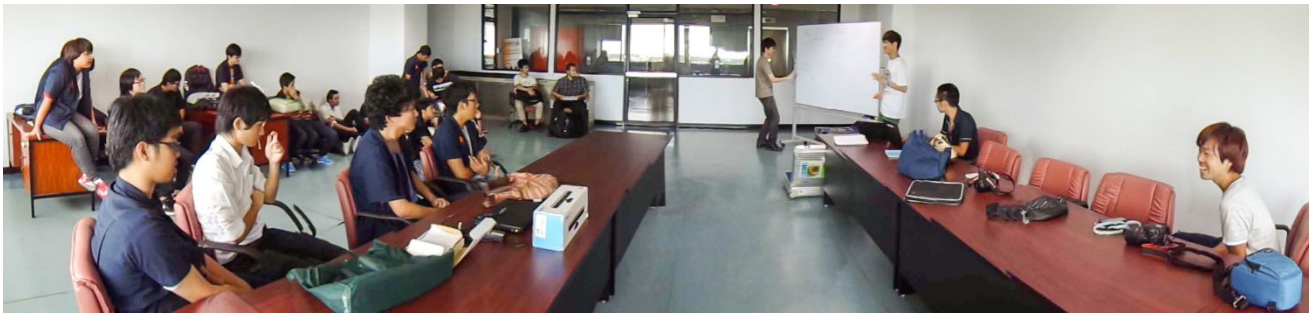
Welcome address to UEC Short Exchange Students at GAL by Dr. Anatawat Kunakorm, KMITL Vice-President.

The GAL will facilitate continuous international collaboration activities between the two universities. Furthermore, members of other GALs can also use the network. In 2014, four UEC students stayed at the KMITL GAL at for a short summer exchange student program.

On September 1st, Professor Ikeda and Professor Hamano, of the UEC International Exchange Center visited to the KMITL GAL to discuss the UEC JUSST program.
Another international project underway is on the development and competition of internet based remote controlled robotic systems. Both students and faculty collaborate on the design, fabrication and remote control between KMITL and UEC via the GALs.

Prof. Ikeda and Prof. T. Hamano, UEC Int'l Exchange Center visited to KMITL GAL on 1st of Sept. 2014

Other GALs are being prepared to strengthen international relations on research and education in Russia, China, Taiwan, France, and USA.



International collaboration projects on internet based cross over remote control robot systems are also carried out in both GALs.

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Silicon nanophotonics: controlling photoluminescence for better devices

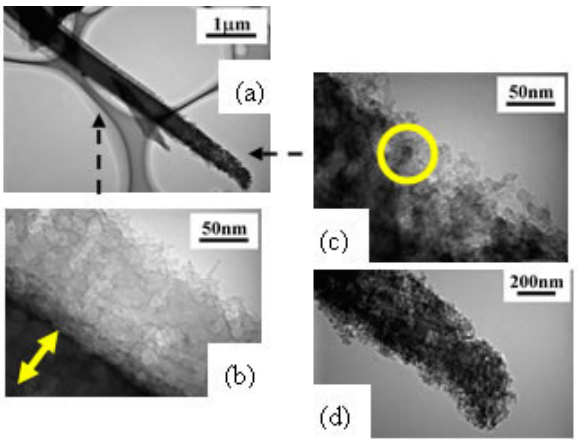
Silicon nanowires have a great deal of potential in future high-performance electronic, sensing and energy devices. Red photoluminescence has been reported in silicon nanowires, but for many applications this hampers device performance. As Tsuyoshi Okuno from the University of Electro-Communications and his colleagues point out in a recent report, “Although the photoluminescence mechanism is often discussed, the condition of the appearance and the absence of the red photoluminescence is rarely reported.”

Okuno and his colleagues fabricated silicon nanowire arrays by metal-assisted chemical etching, an approach that is simple and cost-effective. They deposited metal nanoparticles on a silicon wafer and etched nanowires using aqueous H2O2. Although the researchers did not have precise control over the nanowire morphology, they did observe that higher concentrations of H2O2 led to thicker nanowires. Photoluminescence studies did not reveal a link between photoluminescence and nanowire diameter or length alone, but low aspect ratio nanowires exhibited red photoluminescence.

Further observations of the morphology identified silicon nanocrystals at the nanowire ends, which was corroborated by Raman studies of single nanowires. These nanocrystals disappear on annealing, as does the red photoluminescence.

The researchers attribute the red photoluminescence to defect states between nanocrystals and surrounding oxide, and excitonic transitions. As the researchers conclude in their report, “These results of Si nanowire arrays are believed to be useful for future optoelectronic and photovoltaic applications.”

Oda, K., Nanai, Y., Sato, T., Kimura, S. & Okuno, T. Correlation between photoluminescence and structure in silicon nanowires fabricated by metal-assisted etching. Physica Status Solidi A 211(4), 848-855 (2014) doi: 10.1002/pssa.201330163



Studies by Okuno and colleagues suggest that nanocrystals are responsible for the red photoluminescence in silicon nanowires. Transmission electron microscopy images show a silicon nanowire (a), a zoom in on the interface between silicon crystalline core (arrow) and surrounding silicon oxide in the middle part of the nanowire in (b) and a zoom in on the top end (c) and (d). The circle in (c) shows an example of silicon nanocrystals.

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Micromanipulators: Taking the future in hand

Micromanipulators are used for precision procedures such as medical surgery and cell manipulation, where a higher level of dexterity is required than is achievable with the human hand. The micromanipulator is often part of a robot or microscope, but these pieces of equipment are expensive and can be difficult to operate. Newer technology is being developed which allows handheld versions of the devices to be made, which may prove cheaper and easier to use.

Handheld devices must take into account the vibrations and involuntary movements made by the human hand in order to manipulate with precision. Now, Sungwan Boksuwan and co-workers at the University of Electro-Communications in Tokyo, together with scientists in Thailand, have created a new robust two-dimensional handheld micromanipulator for use in cell manipulation.

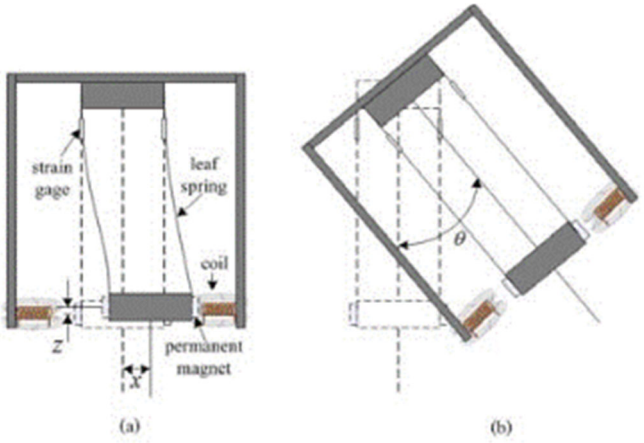
Boksuwan and his team built their device using two flexible links constructed from parallel springs, powered by a simple motor comprising permanent magnets and electric coils. The design means that the two links do not interfere with each other as the device is moved (see image), enhancing overall performance.

The main aim of the project was to simplify the design as far as possible in order to create robust, finely-tuned control. The micromanipulator was carefully calibrated in order to compensate for tiny vibrations of the hand. The researchers successfully optimized the tracking performance of the device through a combination of computer modelling and a conventional 'proportional-integral-derivative' controller.

Further research is required into other factors affecting performance, such as more substantial jerking of the hand.

Reference

1. Boksuwan, S., Benjanarasuth, T., Kanamori, C., & Aoyama, H. Robust hybrid control for two-dimensional handheld micromanipulator. Journal of Robotics and Mechatronics (2014)



Control model of electromagnet driven micromanipulator.
A new handheld micromanipulator developed by researchers at the University of Electro-Communications, Tokyo, could prove very useful for cell manipulation in labs. The design demonstrates high quality tracking by taking into account the tiny vibrations from a human hand.

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Depth perception - understanding ambiguities

Binocular vision allows us to gauge depth. For example a dot directly ahead of the left eye will be at an angle to the right that decreases with distance. So how, ask Eiichi Mitsukura and Shunji Satoh at the University of Electro-Communications in Tokyo, can we estimate the depth of black or white paper? With no pattern or texture on the paper there should be no way of determining its contours. They turned to the computational tools used for filling in blind spots for an answer.

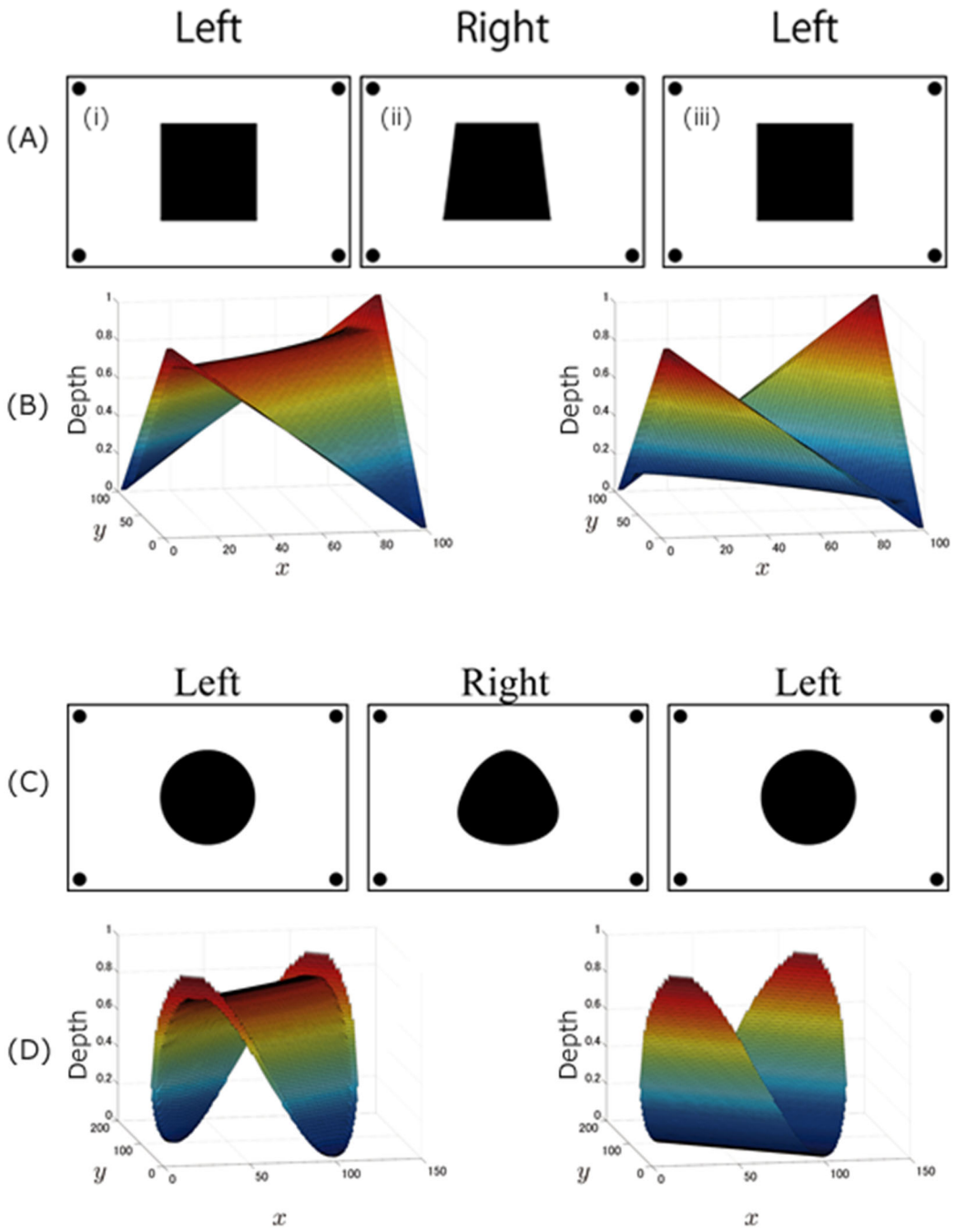
The visual system fills in blind spots much like art restorers touch up paintings. Extrapolating surrounding areas can be used to fill in missing areas and algorithms have been devised from this intuitive principle for filling in missing parts of digital images.

In previous work Satoh expanded on the intuitive descriptions for filling in gaps in images using mathematical descriptions for images based on contours and flow lines [1]. Their curvature, bias and divergence can be used to develop an algorithm for filling in blind spots that is in fact similar to those that describe physiological processes in the visual system as developed based on observed neural properties and mechanisms.

In a recent paper Mitsukura and Satoh apply similar mathematical descriptions used for blind spot image in-filling, to fill in depth details [2]. Similar to the human visual system, the model successfully distinguishes folds from curves.

1. Satoh S Computational identity between digital image inpainting and filling-in process at the blind spot. Neural Computing and Applications 21, 613–621 (2012) doi: 10.1007/s00521-011-0646-y
2. Mitsukura E & Satoh S Computational study of depth perception for an ambiguous image region: How can we estimate the depth of black or white paper? M. Lee et al. (Eds.): ICONIP 2013, Part III, LNCS 8228, pp. 225–232, 2013. (Springer-Verlag, Berlin Heidelberg, 2013)

The researchers have developed a model that can fill in depth details for ambiguous areas such as a sheet of paper. These are results from the proposed model using different initial conditions.



A) : An example of uniformly coloured stereograms: a black object on a white background. Figures A (i) and A (ii) are for the parallel view method and figures A(ii) and A(iii) are for the cross-eyed view. No unique depth solution is theoretically determined in the black object, while a convex or a concave “flat” surface is perceived by human subjects, as presented in (B). (B): Depth map obtained from the researchers’ model for depth perception. (C) and (D): another example of stereograms and the resultant depth-maps.

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Internet protocol networks: Optimizing link reinforcements

Internet protocols are a set of communication 'rules' which are followed in order to deliver data packets between computers. Nowadays, the amount of data that the internet carries is so vast that significant network congestion can occur.

At any given moment in time, a network can be represented by a series of nodes and links. Each link is given a 'weight' – a measure of the link's quality of service. The aim of an internet engineer is to keep the links as uncongested as possible, allowing as much data as possible to flow freely at any one time.

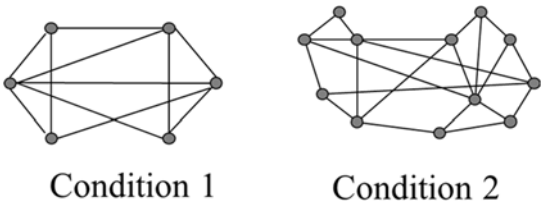
In order to transfer data packets in the fastest and cheapest way, 'start-time optimization' procedures are used to find the best set of link weights to minimize congestion. Stephane Kaptchouang and co-workers at the University of Electro-Communications in Tokyo have successfully built a new 'preventative start-time link-weight optimization' scheme (PSO) capable of predicting the 'weaker links' in any given chain – singling out the ones which need reinforcing in order to create a less congested network.

Applying reinforcements to every link in a network is a costly process in terms of resources, and so predicting which links need to be reinforced is very useful. Previous start-time optimizations considered all possible failure scenarios at any given time on a network, disregarding reinforcements already in place. Kaptchouang's team built their PSO to allow for existing reinforcements, therefore reducing the number of failures the network operators need to address, and speeding up the process considerably.

The realization of an unprecedented QDs density of 5×10^{11} cm^{-2} in 2011 was one of the major milestones in the development of 'self-organization' based semiconducting QDs for solar cells by Yamaguchi and his colleagues at the University of Electro-Communications (UEC). "This density was one of the critical advances for achieving high efficiency quantum dot based photo-voltaic devices," says Yamaguchi.

Reference

1. Kaptchouang, S., Ouedraogo, I.A., & Oki, E. Preventative start-time optimization of link weights with link reinforcement. IEEE Communications Letters, 18 (7) (2014) doi: 10.1109/LCOMM.2014.2325814



Researchers at the University of Electro-Communications, Tokyo, have developed a new optimization scheme capable of predicting the weak links in a network in order to pinpoint where reinforcements are required. Their work could help lessen network congestion on the internet.

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Intelligent robots as models for studying human communication

Prof. T. Nagai (left) and Prof. T. Nishino (right)

Takayuki Nagai and Tetsuro Nishino share a dream of creating robots with human-like intelligence and, importantly, with "hearts and minds".

"The key to the success of our research is creating robots that can both adapt to their environment and communicate naturally with humans," says Nagai, a professor at the Department of Mechanical Engineering and Intelligent Systems. "This entails enabling robots to learn natural languages and the use of tools by trial and error."

Specific projects include teaching robots to comprehend words by communication and experience, just like a child learns to speak, and object/pattern recognition studies. Recent results include the development of a system to enable a robot to recognize a pair of scissors and identify them as a toll for cutting objects such as paper.

"My role in this research is focused on developing programs for artificial intelligence and natural languages," says Nishino, a professor at the Department of Informatics. "Enabling robots to recognize natural languages is very challenging but essential for our goals."

Intriguing aspects of this area of research are the international competitions that have been launched to assess advances in the development of human-like robots. Specifically, 'RoboCup' is an international competition launched in 1997 to assess advances in research on robotics and artificial intelligence. The ultimate aim of the RoboCup is to develop autonomous robots to play and win a game of soccer against a human team by 2050 according to FIFA rules. Other competitions include 'RoboCupRescue', 'RoboCup@Home', and 'RoboCupJunior'.

"We participate in the "RoboCup@Home" competitions," says Nagai. "In 2008 our robots were awarded first place in both the Japan and international competitions. We were first in the Japan competition this year."

To say that the "RoboCup@Home" is challenging would be an understatement. Tasks include following someone into and out of an elevator and moving to a specified room, finding and fetching 'green tea'.

This multidisciplinary research is focused on developing human-like robots, but Nagai and Nishino have found that they are also looking into the mysteries of human nature, where the robot is the tool.

Related publications:

1. Muhammad Attamimi, Takaya Araki, Tomoaki Nakamura, Takayuki Nagai, "Visual Recognition System for the Cleaning Task by Humanoid Robots," International Journal of Advanced Robotic Systems: Humanoid, 10:384. doi:10.5772/56629, Nov.2013
2. Muhammad Attamimi, Takaya Araki, Tomoaki Nakamura, Takayuki Nagai, "Visual Recognition System for the Cleaning Task by Humanoid Robots," International Journal of Advanced Robotic Systems: Humanoid, 10:384. doi:10.5772/56629, Nov.2013
3. Muhammad Attamimi, Takaya Araki, Tomoaki Nakamura, Takayuki Nagai, "Visual Recognition System for the Cleaning Task by Humanoid Robots," International Journal of Advanced Robotic Systems: Humanoid, 10:384. doi:10.5772/56629, Nov.2013

Further information

Takayuki Nagai Lab : http://apple.ee.uec.ac.jp/isyslab/index_e.html

Nishino Tetsuro Laboratory : http://www.nishino-lab.jp/eng/index.html

The RoboCup@Home league : http://www.robocupathome.org/

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UEC Kendo Club: A unique form of international collaboration

Kazuyuki Mito
Associate Professor
Department of Informatics
Graduate School of Informatics and Engineering

Chief Advisor of UEC Kendo Club, Dr. Kazuyuki

The UEC Kendo Club is one of the oldest clubs within the University of Electro-Communications. “Records show that the club was formed in 1943,” explains Kazuyuki Mito, an associate professor at the Department of Informatics and advisor to the club. “We currently have 20 regular members, including two students from Brazil, and meet four times a week to practice.”

Preparing for competition

Mito stresses the importance of the practicing and implementing the so-called ‘three Ks’—kimochi (mental concentration and spirit), ken (katana) (sword), and karada (body). “In competitions a victory by ‘ippon’ is only awarded when the judges see the player fuse of these three powers into one,” says Mito.

Kendo is widely practiced in Japan with young children having many opportunities to learn at their primary and junior high schools and local ‘dojo’. In an intriguing case of international collaboration’ the UEC Kendo Club played a central role in establishing the Cambridge University Kendo Club. “In 2008 we had a visitor from Cambridge University who participated in one of our sessions,” explains Mito. “He was so impressed by the experience that he decided to set up a kendo club at Cambridge University.”

Kendo competitions in action

The two clubs now visit each other to hold competitions every year. “About 10 members from UEC visit Cambridge and the same numbers of people visit us here in Chofu,” says Mito. "In the future I may take the group from Cambridge to Jindaiji Temple, which is close to the UEC campus. The Temple has a natural 'onsen' or hot spa and would give our visitors an opportunity to experience another facet of Japanese culture.” The UEC kendo Club has approximately 300 graduates who support the current members with the running of the club, including financial support for visits to Cambridge.

Kendo in Cambridge: University of Electro-Communications, Cambridge University (剣橋大学), and South Wales

“Kendo is forever,” says Mito. “You can practice until your late 70s. Also our experience with Cambridge University shows that this martial art is also a means of making friends in other countries. It may even lead to international scientific collaboration.”

UEC Kendo Club : http://www.megrokai.or.jp/kendo/

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Visions of reality: Insights into information processing by the brain

"I am intrigued by the mechanisms underlying motor control and visual perception by our brain," says Shunji Satoh, an associate professor at the Department of Human Media Systems at the University of Electro-Communications. "We develop computational models to analyze experimental observations."

In motor control, Satoh and his group are developing computational theories based on control theory, robotics, and learning theory to investigate puzzles such as how humans are able to move and pick up a drink, a process that the brain is able to compute and execute in less than 200 ms.

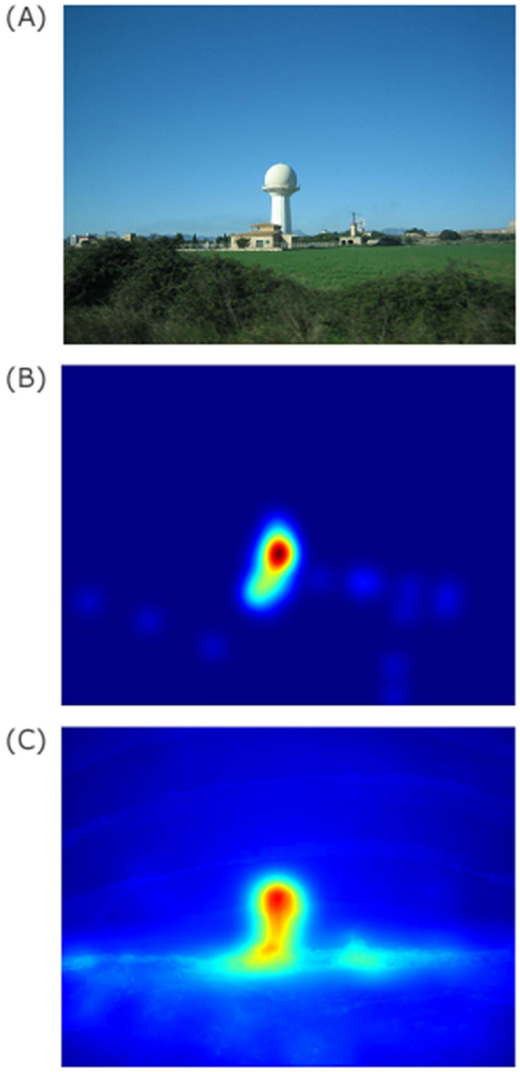
"We are also working on visual perception," says Satoh. "For example, we are developing computer algorithms and neural models to clarify well known experimental findings such as the brain filling in the effects of the blind spot in visual fields."

Recently, one of the projects being conducted by Satoh and colleagues was acknowledged as the world's number one in the 'MIT Saliency Benchmark' (8 August 2014).

"I am confident that our research will find applications in assisting people with poor vision," says Satoh. "Other applications include driver assistance and robotics."

Relevant publications

1. Xuehua HAN, Shunji SATOH, Daiki NAKAMURA. Kazuki URABE, "Unifying computational models for visual attention yields better scores than state-of-the-art models," Advances in Neuroinformatics, 2014 (accepted)
2. Shunji SATOH, "Computational identity between digital image inpainting and filling-in process at the blind spot," Neural Computing and Applications, 21(4), pp. 613-621 (2012)



(a) an example of natural images observed by human subjects, and being input to vision models. (b) Heat map of eye fixation. Spatial positions of eye fixation are monitored by an eye-tracking system [Judd et al., MIT Tech. Rep. (2011)]. Human tend to fix their eye position around the red area corresponding to the tower of (a). (c) The saliency map generated by our visual model for eye-fixation prediction.

Further information

Lab for Human Informatics, UEC : http://www.hi.is.uec.ac.jp/www/index-e.html

MIT Saliency Benchmark : http://saliency.mit.edu/

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Letter From Alumni

Ibrahim Farouck, Associate Professor of e-Learning and Applied Linguistics, Otaru University of Commerce, Hokkaido Japan.

Dr. Ibrahim Farouck, Associate Professor of e-Learning and Applied Linguistics, Otaru University of Commerce (OUC), Hokkaido Japan.

I received my masters and doctoral degrees from the University of Electro-Communications (UEC) where I studied between 2005 and 2010. My supervisor was Professor Watanabe Shigeyoshi whose research spans over the fields of Software Engineering, Multi-Agent Systems and e-Learning.

I came to Japan on a Japanese Mobukagakusho scholarship in 2005. At that time, e-Learning was not common in Ghana because of low Internet penetration. What was familiar to Ghanaians was "Distance Education." In the Ghanaian context, it was the delivery of education through radio, television, audio/video cassette and CD. The knowledge of Multi-Agent systems was also not common, as in many parts of the world. Therefore, my intention was to study software engineering. This was because, after receiving my bachelor's degree in computer science in Ghana in 2000, I had worked for about five years in the field of ICT, mainly on distributed systems. My first job was IT consultant with an Oracle partner company that was executing a national project which aimed at implementing the then newly created Ghana national salary scheme on Oracle payroll system. The project was sponsored by the International Monetary Fund and the Department for International Development. I had also worked in a state organization that was responsible for paying pension benefits and student loans to all Ghanaian pensioners and university students respectively. In my capacity as a senior system analyst and programmer, I was involved in developing the in-house systems that were used through Intranets by almost all the branch offices in Ghana.

However, at my first meeting with Professor Watanabe Shigeyoshi he suggested that I participate in all the seminars that were organized by the three research groups in his laboratory before I make a final decision regarding my research path. His suggestion was a great opportunity for me because it motivated me to study more about all the three research fields. But, what actually affected my decision was my continuous thought about how my choice could positively impact the development of my country, since that was the main goal of the scholarship. Additionally, I was impressed by the Japanese technological and economic advancement that has been propelled by education. This impression reminded me that, if education becomes available to as many Africans as possible, Africa would be liberated from the challenges that it faces in this century. Indeed, it is only e-Learning that could facilitate the delivery of education to the remotest parts of Africa.

Therefore, I narrowed my choice to e-Learning and, after I made my decision known to my professor, he motivated me by supplying me with many books and articles related to e-Learning research. It was a great honor for me to conduct my research in his laboratory. I recollect his kind smiles and critical supervision. My research has focused on CSCL, ITS, Online Community Learning, Blended Learning, Mechanization of Bloom's Taxonomy, Learner Modeling, and Online Grouping and Learning Incentive Mechanisms.

The 2014 annual meeting of the Hokkaido branch of UEC alumni, Megurokai, was opened on Saturday 26th July, with a keynote speech by Associate Professor Ibrahim Farouck.

After receiving my doctoral degree, I was employed at Otaru University of Commerce, in Hokkaido, at the Center for Language Studies to implement and manage an e-Learning project that was funded by the Japanese Government. I saw this job as a great opportunity since it would enable me to improve my knowledge of e-Learning, especially in the area of large scale application and management. I successfully implemented Moodle learning management system for the school, which has been serving the entire first and second year students of the university since 2011. I am currently engaged in two other projects also sponsored by the Japanese Government. These projects include the design of Active Learning classrooms and also implementation of Learning Management Systems for Blended Learning for language education. My current position has enabled me to extend my research fields to include Applied Linguistics, specializing in Computer Assisted Language Learning. In addition to the management of the e-Learning systems, I conduct research and teach at the undergraduate and graduate schools of the university. I have also been a reviewer of some books and International journals related to educational technology. Additionally, I have engaged in teaching and supporting high school teachers on how to use technology for language teaching. I have also had the opportunity to collaborate with some researchers from around the world, including those from Ghana and other parts of Africa on e-Learning issues. This is how the knowledge that I have acquired from UEC is helping me to contribute my quota to the world.

I am really indebted to many professors and to the staff of UEC who have supported me during my research. I came to Japan without any Japanese skills. But, with the kindness, cooperativeness, professionalism and ever-readiness to support international students of the professors and staff of UEC I succeeded in my studies. Space limitations do not allow me to mention all the names of people from UEC who have affected my life positively. However, apart from my supervisor, two other professors have remained significant to my work, Professor Toshio Okamoto and Professor Akihiro Kashihara. Both of them have been critical members of my dissertation committee. Moreover, professor Kashihara has been receiving me in his laboratory to study his work and that of his students since I came to Japan.

Finally, I am very happy and proud to be part of "Megurokai" Hokkaido. This is the alumni association of UEC in Hokkaido. It has given me the opportunity to meet many influential people. And, I encourage every foreigner to participate in the Megurokai activities, especially if you live in Japan. To all potential students who wish to study in Japan in the field of Information and Communication Technology, I am very proud to recommend UEC. There is also a very large international community there, which can help you improve your intercultural skills and social network with potential life-long friends from across the globe. Finally, I wish to say to the current international students, be ambitious, and make hay while the sun still shines.

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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