

The 8th Hosei University IIST International Colloquium

Trends in Advanced Integrated Science and Technology

This colloquium is the series of events hosted by IIST, Hosei University to introduce the current research development in the field of integrated science and technology. In the 8th IIST colloquium, distinguished guest speakers are invited from Egypt and China. Dr. Mohammed S. Sayed from E-JUST (Egypt-Japan University of Science and Technology, Egypt) will be presenting the advanced method of hardware acceleration of video coding for the video conference/ surveillance video monitoring system. Dr. Gang He from SWUST (South West University of Science and Technology, China) introduces his wide range of research projects in biomedical engineering. Another distinguished guest speaker Dr. Okamoto, the leading researcher of cryptography, will be introducing the hot topic of cryptocurrency. In addition to those guest speakers, IIST faculties Drs. Katsura, Iyatomi and Zhou will be introducing their research topics and big funded projects.

Date: 13:30-16:50 Feb. 28th, 2018

10:00-11:40 Mar. 1st, 2018

Venue: Multimedia Hall, B1F Building West, Hosei University Koganei Campus
3-7-2 Kajino cho, Koganei City, Tokyo 184-8584 JAPAN

<http://www.hosei.ac.jp/access/koganei.html>

Hosted by Hosei University IIST: Institute of Integrated Science and Technology
and

Global Education Center, Hosei University



Bitcoin and Cryptocurrencies

Dr. Tatsuaki Okamoto

Fellow, Nippon Telegraph and Telephone Corporation (NTT), Japan

ABSTRACT: The idea of Bitcoin was proposed in 2008 and its operation was started in 2009 by the inventor, Satoshi Nakamoto. Bitcoin is a truly innovative currency since there is no authority to issue its coins. It is constructed on cryptographic primitives such as digital signatures and cryptographic hash functions. We often call Bitcoin a cryptocurrency. The novel concept of Bitcoin has inspired a lot of people to create various kinds of cryptocurrencies, and we now have more than 1000 cryptocurrencies. In my talk, I will first introduce the basic cryptographic techniques, digital signatures and hash functions, necessary for understanding Bitcoin and other cryptocurrencies. I will then explain how Bitcoin works without an authority. The key techniques are transactions, proof of works (PoW) and blockchains. I will show several defects of Bitcoin and some trials to overcome these defects. Cryptocurrencies are not just a replacement of real cash, but innovate novel applications of currencies that are impossible by real cash. I will show some such cryptocurrencies.



BIOSKETCH: Tatsuaki Okamoto has been working for NTT in the research and development of cryptography, information security, natural language processing and network architectures. He has assumed the leading roles for several projects on electronic money, electronic voting, public-key infrastructures (PKI), cryptographic algorithms, machine translation of natural languages, and standardization. He is a (co-)author of more than 150 academic papers and a (co-)inventor of a number of patents. Okamoto served as President of the Japan Society for Industrial and Applied Mathematics (JSIAM) in 2007-2008, Director of International Association of Cryptology Research (IACR) in 1999-2001, Director of the Institute of Electronics, Information and Communication Engineers, Japan (IEICE) in 2001-2003, and program chair of many international conferences. He has been a member of several advisory committees for the Japanese government, and a guest professor of the Graduate School of Informatics, Kyoto University, Japan. Okamoto received the best achievement award (Kobayashi memorial award) from the IEICE in 1993, the distinguished research award from the Science and Technology Agency, Japan in 1997, the Certicom ECC Technology Award in 2007, the 2009 distinguished lecturer award from the IACR, Medal with Purple Ribbon in 2012, and RSA conference award (mathematics) in 2017. He received his undergraduate, master's, and doctor degrees in engineering of applied mathematics from the University of Tokyo, Japan.

Introduction to Coding Theory: Mathematical Foundation

Dr. Toshiyuki Katsura (IIST, Hosei University)

ABSTRACT: Coding theory is the area to study the properties of codes. It has various aspects, and among them we treat error-correcting codes. This is the theory for the correction of errors in transmitted data, and in the theory we use mathematics in a big way. For error correction we add extra data bits to make the transmission of data more robust to interference on the transmission channel. I will explain what is the essential point for the theory. Then, starting from the definition of linear code, I will summarize fundamental notions and facts in the theory. I will also explain some examples of codes, in particular, the Reed-Solomon code, which is used for correcting errors by scratches and dust of music CD, and QR code, etc. Finally, I will give a very rough survey of the theory of algebraic geometric code that is a generalization of Reed-Solomon code.



BIOSKETCH: Toshiyuki Katsura was Professor of the University of Tokyo from 1992 to 2009, and he acted as Dean of the Graduate School of Mathematical Science in 2006-2009. Since 2009, he has been Professor of Hosei University and Emeritus Professor of the University of Tokyo. His specialty is algebraic geometry, in particular, he studies algebraic varieties in positive characteristic, which are used for coding theory and cryptography. He also served as Director of the Mathematical Society of Japan in 1997-2001, and as Cooperation Member of Science Council of Japan in 2011-2017. He serves now as Advisor to President of the Mathematical Society of Japan. He was awarded Algebra Prize of the Mathematical Society of Japan in 2017 for the study of algebraic geometry in positive characteristic. He received his undergraduate and master's degrees from the University of Tokyo, and his doctor degree in science from Tohoku University.

Hardware Accelerators for HEVC Encoder in Video Conferencing and Surveillance Applications

Assoc. Prof. Mohammed S. Sayed

ECE Department, Egypt-Japan University of Science and Technology



ABSTRACT: The H.265/HEVC video coding standard [2] added huge computational complexity to achieve double the compression ratio (i.e. 50% bit rate reduction) for the same video quality in comparison with the preceding H.264/AVC standard. This high computational cost presents a big challenge for real-time compression of video data. Integer-pixel and fractional pixel motion estimation, DCT and quantization, and intra-prediction modules represent almost 90% of the processing load of the HEVC encoder. Video conferencing and surveillance applications have unique characteristics that can be exploited to reduce the tremendous processing load in the HEVC encoder. Special attention should be given to these applications due to their importance. In such applications, real-time processing and low latency are not privilege but a must. We are trying to tackle this problem by developing and implementing hardware accelerators for the most computational intensive modules in the HEVC standard. These modules are Integer-pixel and fractional pixel motion estimation, DCT and quantization, and intra-prediction. Building such accelerators involve working at both the algorithmic and architecture levels. We target video conferencing and surveillance applications so we exploit their unique characteristic of having a relatively fixed background in a period of time.

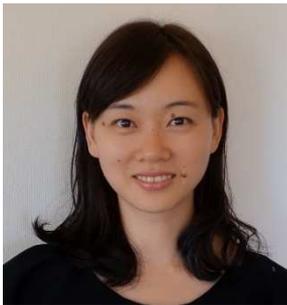
BIOSKETCH: Dr. Mohammed Sharaf Sayed received the B.Sc. degree in Electronics and Communications Engineering from Zagazig University, Zagazig, Egypt, in 1997 and he received the M.Sc. and Ph.D. degrees in Electrical and Computer Engineering from University of Calgary, Calgary, Canada in 2003 and 2008 respectively. Dr. Sayed is currently an Associate Professor and Acting Chairperson of the department of Electronics and Communications Engineering, Egypt-Japan University of Science and Technology, Egypt. His research interests include Video Coding, Digital Systems Design, System-on-Chip, Embedded Vision Systems, and Wireless Body Area Networks. Dr. Sayed received several awards both in Canada and in Egypt. He has one US patent and five contributions to the H.264/MPEG-4 standards, two of them included in the standard's reference hardware model. Dr. Sayed authored and co-authored more than 70 international publications. He managed and participated in several national/international research and development projects. Dr. Sayed acted as a reviewer for the IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Circuits and Systems I, IEEE Transactions on VLSI, IEEE Transactions on Industrial Electronics, Journal of Visual Communication and Image Representation, and IET Image Processing Journal.

Signal Processing Techniques for Multimedia Systems

Assoc. Professor Jinjia Zhou

IIST, Hosei University

ABSTRACT: For the next-generation information society, the Internet of Things (IoT) is expected to connect everyone and everything (video, audio, and texting) in a seamless network. The IoT will lead to unprecedented explosion of multimedia data which is increasingly becoming the “biggest big data.” It covers from everyone’s experiences to everything happening in the world. As a result, the current systems will suffer from huge cost in transfer and store the huge volume of data. Hence, the efficiency of data collection mechanism is going to be challenged. This talk introduces various applications that enhance the world of multimedia. Furthermore, the advanced multimedia compression/coding techniques are described. Finally, future immersive multimedia system is discussed.



BIOSKETCH: Jinjia Zhou received B.E. degree from Shanghai Jiao Tong University, China, in 2007. She received M.E. and Ph.D. degrees from Waseda University, Japan, in 2010 and 2013, respectively. From 2013 to 2016, she was a junior researcher with Waseda University, Fukuoka, Japan. Currently she is an Associate Professor with Hosei University. During 2017-2018, She is also a senior visiting scholarship in State Key Laboratory of ASIC & System, Fudan University, China. Her interests are in algorithms and VLSI architectures for multimedia signal processing, especially in low-power high-performance VLSI design for video codecs including H.265/HEVC (High Efficiency Video Coding) and H.264/AVC.

Dr. Zhou was selected as a research fellow by the Japan Society for the Promotion of Science during 2010-2013. She is a recipient of the Chinese Government Award for Outstanding Students Abroad of 2012. Dr. Zhou received the Hibikino Best Thesis Award in 2011. She was a co-recipient of ISSCC 2016 Takuo Sugano Award for Outstanding Far-East Paper, the best student paper award of VLSI Circuits Symposium 2010 and the design contest award of ACM ISLPED 2010. She participated the design of the world first 8K UHD TV video decoder chip, which was granted the 2012 Semiconductor of the Year Award of Japan.

***From Cell Culture to Exoskeleton:
A Sketchy Introduction to the Engineering Part of BME.***

Assoc. Prof. Gang He

Medical Imaging Technology, Southwest University of Science & Technology



ABSTRACT: Biomedical engineering (BME) is the application of engineering principles and design concepts to medicine and biology for healthcare purposes, which seeks to close the gap between engineering and medicine, combining the design and problem-solving skills of engineering with medical biological sciences to advance health care treatment. For a demonstration of the typical engineering skills used in BME, this talk presents some actual systems such as automatic cell culture system (which is used in tissue engineering), glycosylated hemoglobin analyzer, exoskeleton system and other medical devices that designed by the speaker.

BIOSKETCH:

Dr. Gang He received the B.S. degree in *Engineering Mechanics* from Sichuan University, Chengdu, China, in 2006. He studied *Biomedical Engineering* for seven years during when he received the M.S. degree in 2009 and received the Ph.D. degree in Professor GuangFu Yin's Laboratory of Sichuan University in 2013. He worked as *Post doctorate* at the Sichuan University for two years in the field of First principle calculations on Titanium materials. He worked as a *Assoc.Prof.* at Southwest University of Science and Technology, Mianyang, Sichuan Province, China since 2015.

The World of AI and Machine Learning (Tentative)

Dr. Hitoshi Iyatomi (IIST, Hosei University)

ABSTRACT: Coming soon.



BIOSKETCH: Coming soon.

PROGRAM

Day 1 Feb. 28, 2018

13:30 -13:40 Dr. Kazuo Yana, (Director, IIST)
Opening Remarks

SESSION 1

13:40 -14:25 Dr. Tatsuaki Okamoto (Okamoto Res. Lab, NTT)
Invited Lecture
Bitcoin and Cryptocurrencies

14:25-15:10 Dr. Toshiyuki Katsura (IIST, Hosei University)
Introduction to Coding Theory: Mathematical Foundation

15:10-15:20 INTERMISSION

SESSION 2

15:20-16:05 Dr. Mohammed S. Sayed (E-JUST, Egypt)
Invited Lecture
Hardware Accelerators for HEVC Encoder in Video Conferencing and Surveillance Applications

16:05-16:50 Dr. Jinjia Zhou (IIST, Hosei University)
Signal Processing Techniques for Multimedia Systems

Day 2 Mar 1st, 2018

SESSION 3

10:00-10:45 Dr. Gang He (SWUST, China)
Invited Lecture
From Cell Culture to Exoskeleton: A sketchy introduction to the engineering part of BME

10:45-11:30 Dr. Hitoshi Iyatomi (IIST, Hosei University)
The World of AI and Machine Learning (Tentative)

11:30-11:40 Dr. Jinjia Zhou (IIST, Hosei University)
Closing Remarks