

Frontiers in Energy-Efficient Computing and Applications

Hosted by PKU CECA, in Cooperation with PKU-UCLA JRI and PROFIT
18 August 2017, Elites Banquet Hall (B1 Floor), Building No.1, Global Village PKU
No. 126 Zhongguancun North Street, Haidian District, Beijing | Tel: +86 (0) 10-6275-2288

AGENDA

08:35 – 09:00 **Opening Remarks** *Jason Cong, Director of PKU CECA*

Session 1: Keynote Speeches (Chair: Jason Cong)

09:00 – 09:45 **Keynote: Entering the Information Age**
John Hopcroft, IBM Professor, Cornell University/Peking University

09:45 – 10:30 **Keynote: City Brain and its Visual System**
Wen Gao, Boya Chair Professor, Peking University

10:30 – 10:35 **Group Photo**

10:35 – 10:55 **Break**

Session 2: Architectures and Heterogeneous Computing for AI (Chair: Chenren Xu)

10:55 – 11:15 **Memory-Centric Computing for Neural Network Applications**
Yuan Xie, Professor, UCSB, Adjunct Professor, PKU CECA

11:15 – 11:35 **Design Exploration of FPGA-based Accelerators for Deep Neural Networks**
Guangyu Sun, Associate Professor, PKU CECA

11:35 – 11:55 **Towards Autotuning FPGA Synthesis for AI**
Guojie Luo, Associate Professor, PKU CECA

11:55 – 12:15 **Efficient Heterogeneous Computing for AI**
Yun Liang, Assistant Professor, PKU CECA

Poster Session (Chair: Jun Huang)

12:15 – 13:15 **Lunch** *Time Western Restaurant (2nd Floor)*

12:30 – 14:00 **Poster Session** *Elites Banquet Hall (B1 Floor)*

Session 3: IEEE Council on EDA (CEDA) Distinguished Lecture (Chair: Guojie Luo)

14:00 – 14:50 **Machine Learning on FPGAs**
Jason Cong, Chancellor's Professor, UCLA, National Distinguished Visiting Professor, PKU CECA

Session 4: Intelligent Wireless Networks and IoT Systems (Chair: Yun Liang)

14:50 – 15:10 **Automated Intelligence for 5G networked systems**
Songwu Lu, Professor, UCLA, Adjunct Professor, PKU CECA

15:10 – 15:30 **Towards A Systematic Understanding of WiFi Chip Defects: Measurements and Applications**
Jun Huang, Assistant Professor, PKU CECA

15:30 – 15:50 **The Rise of Edge Intelligence: A Backscatter Communication Perspective**
Chenren Xu, Assistant Professor, PKU CECA

15:50 – 16:10 **Romer - An Affective Intelligent Robot with Extrasensory Perception**
Tao Wang, Associate Professor, PKU CECA

16:10 – 16:30 **Break**

16:30 – 18:00 **Panel Discussion: Accelerators for Deep Learning and Beyond (Moderator: Guangyu Sun)**



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Keynote: Entering the Information Age

John Hopcroft, IBM Professor, Cornell University/Peking University

Abstract: The world is entering the Information Age which is changing the education needed to prepare for good jobs and successful future careers. We are now concerned with extracting information from the enormous data sets that are available. Information, such as medical records, previously stored on paper will be digitized raising issues about how to preserve privacy. New ideas, such as zero knowledge proofs, are being developed. This talk will discuss the Information Age and give examples of the mathematics needed to undergird the education necessary for the jobs of the future.

Biography: John E. Hopcroft is the IBM Professor of Engineering and Applied Mathematics in Computer Science at Cornell University. His research centers on theoretical aspects of computer science. He was dean of Cornell's College of Engineering from 1994 to 2001.

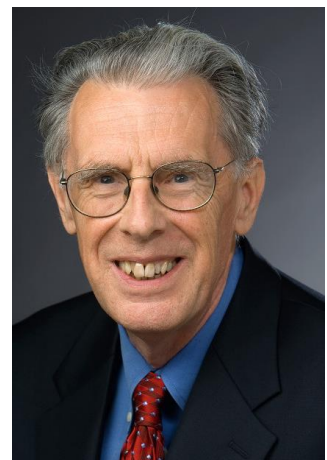
In 1992 he was appointed by President George H.W. Bush to the National Science Board, which oversees the National Science Foundation, and served through May 1998. He serves on Microsoft's Technical Advisory Board for Research Asia, and the advisory boards of IIT Delhi and Seattle University's College of Engineering.

He is a member of the National Academy of Engineering (1989) and National Academy of Sciences (2009), and a fellow of the American Academy of Arts and Sciences, American Association for the Advancement of Science, Institute of Electrical and Electronics Engineers (IEEE), Association of Computing Machinery (ACM), and Society of Industrial and Applied Mathematics.

He has received the A.M. Turing Award (1986), IEEE Harry Goode Memorial Award (2005), Computing Research Association's Distinguished Service Award (2007), ACM Karl V. Karlstrom Outstanding Educator Award (2009), IEEE John von Neumann Medal (2010), and China's Friendship Medal (2016), China's highest recognition for a foreigner. In addition, the Chinese Academy of Sciences has designated him an Einstein professor.

He has honorary degrees from Seattle University, the National College of Ireland, the University of Sydney, St. Petersburg State University in Russia, Beijing University of Technology, and Hong Kong University of Science and Technology, and is an honorary professor of the Beijing Institute of Technology, Shanghai Jiao Tong University, Chongqing University, Yunnan University, and Peking University.

He received his BS (1961) from Seattle University and his MS (1962) and PhD (1964) in electrical engineering from Stanford University.





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Keynote: City Brain and Its Visual System

Wen Gao, Boya Chair Professor, Peking University

Abstract: A city brain is the central decision system in the smart/intelligent city. In this talk, I will present several grand challenges for smart city brain and then highlight the necessity of the development of a new-generation evolutionary city eye, called the visual system of city brain. Like human eyes, the visual system can not only own the function of video coding for storage and offline viewing, but also can perform feature coding for pattern recognition and scene understanding. Towards this end, I share our recent developments, including background-modeling-based surveillance video coding, visual feature compression for visual search, joint R-D and R-A optimization, as well as IEEE 1857.4/AVS2 and MPEG CDVS/CDVA standards for digital retina. I believe the the city eyes with its visual system should be a key step of evolution towards the massive artificial visual system.

Biography: Wen Gao received the B.S. degree in computer science from Harbin University of Science and Technology in 1982, the M.S. degree in computer science from Harbin Institute of Technology in 1985, the Ph.D. degree in computer science from Harbin Institute of Technology in 1988, Harbin, China, and the Ph.D. degree in electronics engineering from the University of Tokyo in 1991, Tokyo, Japan.

Wen Gao now is a Boya Chair Professor and the Director of Faculty of Information and Engineering Sciences at Peking University. He is the founding director of NELVT (National Engineering Lab. for Video Technology) at Peking University. He is the vice president of National Natural Science Foundation of China since 2013, and the president of China Computer Federation (CCF) since 2016.



Prof. Gao works in the areas of multimedia and computer vision, topics including video coding, video analysis, multimedia retrieval, face recognition, multimodal interfaces, and virtual reality. His most cited contributions are model-based video coding and face recognition. He published seven books, over 220 papers in refereed journals, and over 600 papers in selected international conferences. His publications have been cited for over 28,000 times, and his H-index is 75, according to Google Scholar.

Prof. Gao is active in national and international academic activities. He has been featured by IEEE Spectrum in June 2005 as one of the "Ten To Watch" among China's leading technologists. He served as the chairman of steering committee for intelligent computing system in 863 Hi-Tech Program from 1996 to 2001. He served or serves as the vice chairman of Chinese Association of Image and Graphics, the vice chairman of Chinese Association of Software Industry. He was the Head of Chinese Delegation to the Moving Picture Expert Group (MPEG) of International Standard Organization (ISO) from 1997 to 2011. He is the chair of Audio Video coding Standard (AVS) working group in China, and the chair of IEEE 1857 standard working group, which is a new standard working force in IEEE standard society for internet multimedia coding.

He is a fellow of IEEE, a fellow of ACM, and a member of the Chinese Academy of Engineering.



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IEEE Council on EDA (CEDA) Distinguished Lecture: Machine Learning on FPGAs

Jason Cong, Chancellor's Professor, UCLA, National Distinguished Visiting Professor, PKU CECA

Abstract: This talk presents our research on design automation for neural networks on FPGAs, including a general simulation framework on FPGAs for biological neural networks of different degrees of complexity, an automated compilation system that can map any convolutional neural networks (CNN) in Caffe to FPGAs for efficient implementation. We have applied such tools for simulating a variety of neural microcircuits that perform oscillatory path integration, and mapping various CNN networks to FPGAs.

Biography: Jason Cong received his B.S. degree in computer science from Peking University in 1985, his M.S. and Ph. D. degrees in computer science from the University of Illinois at Urbana-Champaign in 1987 and 1990, respectively. Currently, he is a Chancellor's Professor at the Computer Science Department of University of California, Los Angeles, the Director of Center for Domain-Specific Computing (funded by NSF Expeditions in Computing Award), and the director of VLSI Architecture, Synthesis, and Technology (VAST) Laboratory. He served as the chair of the UCLA Computer Science Department from 2005 to 2008, and is currently serving as an Associate Vice Provost for Internationalization and the co-director of PKU/UCLA Joint Research Institute in Science and Engineering since 2009. He is also a distinguished visiting professor at Peking University and the director of PKU Center for Energy-efficient Computing and Applications (CECA).



Dr. Cong's research interests include electronic design automation, energy-efficient computing, customized computing for big-data applications, and highly scalable algorithms. He has published over 400 research papers in these areas, including 10 Best Paper Awards. He also received two 10-Year Retrospective Most Influential Paper Awards. He was elected to an IEEE Fellow in 2000 and ACM Fellow in 2008. He received the 2011 ACM/IEEE A. Richard Newton Technical Impact Award in Electric Design Automation "for pioneering work on technology mapping for FPGA that has made significant impact to the FPGA research community and industry". He received the 2010 IEEE Circuits and System Society Technical Achievement Award and the 2016 IEEE Computer Society Technical Achievement Award. He is the only one who received a Technical Achievement Award from both the IEEE Circuits and Systems Society and the Computer Society. Dr. Cong was elected to the National Academy of Engineering in 2017.

Dr. Cong has graduated 36 PhD students. Nine of them are now faculty members in major research universities, including Cornell, Fudan University, Georgia Tech., Peking University, Purdue, SUNY Binghamton, UCLA, UIUC, and UT Austin. One of them is now an IEEE Fellow, six of them got the highly competitive NSF Career Award, and one of them received the ACM SIGDA Outstanding Dissertation Award. Dr. Cong has successfully co-founded three companies with his students, including Aplus Design Technologies for FPGA physical synthesis and architecture evaluation (acquired by Magma in 2003, now part of Synopsys), AutoESL Design Technologies for high-level synthesis (acquired by Xilinx in 2011), and Neptune Design Automation for ultra-fast FPGA physical design (acquired by Xilinx in 2013). Currently, he is a co-founder and the chief scientific advisor of Falcon Computing Solutions, a startup dedicated to enabling FPGA-based customized computing in data centers. He also serves on the board of directors of Semiconductor Manufacturing International Corporation (SMIC).



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List of Posters

Accelerating Mobile Applications at the Network Edge with Software-programmable FPGAs	
<i>Student: Shuang Jiang</i>	<i>Advisor: Chenren Xu</i>
Faster Convolutional Neural Network Accelerators	
<i>Students: Qingcheng Xiao, Liqiang Lu, Xuechao Wei</i>	<i>Advisor: Yun Liang</i>
FP-DNN: An Automated Framework for Mapping Deep Neural Networks onto FPGAs	
<i>Students: Yijin Guan, Zhihang Yuan</i>	<i>Advisors: Guangyu Sun, Jason Cong</i>
GRT: An 802.11ac and MIMO-capable SDR Platform for Wireless LAN Physical & Data-link Layers	
<i>Students: Haoyang Wu, Zhiwei Li, Boyan Ding</i>	<i>Advisors: Tao Wang, Songwu Lu, Jun Liu</i>
Heterogeneous Architecture for Real Time Video Processing and Medical Imaging	
<i>Students: Wentai Zhang, Zhuolun He</i>	<i>Advisors: Guojie Luo, Ming Jiang</i>
Performance Modeling and Optimization for Irregular Application on GPUs	
<i>Students: Xiaolong Xie, Xiuhong Li</i>	<i>Advisor: Yun Liang</i>
Programming Model and Application Mapping for FPGAs	
<i>Student: Shuo Wang</i>	<i>Advisor: Yun Liang</i>
Reducing Overfitting in Deep Convolutional Neural Network Using Redundancy Regularizer	
<i>Student: Bingzhe Wu</i>	<i>Advisor: Guangyu Sun</i>
RRAM-based Logic-in-memory Computation	
<i>Students: Feng Wang, Jiayi Zhang</i>	<i>Advisors: Guojie Luo, Guangyu Sun</i>
Scalable and Responsive: MultiFPGA Architecture and Partition	
<i>Students: Jiayi Zhang, Wentai Zhang</i>	<i>Advisor: Guojie Luo</i>