

# Opportunities and Challenges of Global Network Cameras

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Since the introduction of consumer digital cameras, user-created multimedia content has become increasingly popular. Digital cameras, together with inexpensive editing tools, and free hosting sites have made multimedia an integral part of everyday life. Today, hundreds of hours video are uploaded to hosting sites every minute. Video-on-demand through wireless networks and smartphones have profoundly changed how people consume multimedia content. Meanwhile, the widely deployed network cameras can provide live views of many parts of the world. These cameras can provide rich sources creating multimedia content. This panel will explore the opportunities and discuss the challenges using global network cameras for creating multimedia contents and understanding the world.

Every year, millions of network cameras are deployed. The data from some of these network cameras are publicly available, continuously streaming live views of national parks, city halls, streets, highways, and shopping malls. A person may see multiple tourist attractions through these cameras, without leaving home. Researchers may observe the weather in different cities. Using the data from the cameras, it is possible to observe natural disasters, such as volcano eruption or tsunami, at a safe distance. News reporters may obtain instant views of an unfolding riot without risking their lives. A spectator may watch a celebration parade from multiple locations using the street cameras. Despite the many promising applications, the opportunities of using global network cameras for creating multimedia content have not been fully exploited.

The opportunities also bring forth many challenges. Managing the large amount of data would require fundamentally new thinking. The data from network cameras are unstructured and have few (if any at all) metadata describing the content. Searching the relevant content would be a challenge. Moreover, many network cameras are stationary watching the same scenes continuously (even though some have pan-tilt-zoom). The data from outdoor cameras have repetitive content due to the periodic daylight (with gradual

seasonal changes or sudden changes due to storms); storing the data efficiently may require new compression techniques. Because network cameras continuously produce data, processing must be able to handle the streaming data. This imposes stringent requirements of the performance. The panelists will present their views about how network cameras could be utilized and what new technologies are needed to realize the potential from the cameras.

**Joanna Batstone** is the Vice President and Lab Director, IBM Research-Australia and Chief Technology Officer, IBM Australia and New Zealand. Previously she was Vice President, Architecture & Technical Solution Design, IBM Global Technology Services, Ireland, and Director for Distributed Computing in IBM Research - Watson, with worldwide strategy responsibility for Distributed Computing. Her IBM career has included a variety of technical and business leadership roles across different IBM Lines of Business, including Healthcare & Life Sciences, Sensors & Actuators, Physical Sciences and Application and Integration Middleware. She received a B.Sc., in Chemical Physics and a Ph.D., in Physics from The University of Bristol, UK, followed by postdoctoral work at AT&T Bell Laboratories, NJ, and a Lectureship in the Department of Materials Science and Engineering at the University of Liverpool, UK, before joining IBM Research. She received the '95 Burton Medal from the Microscopy Society of America, the '91 Robert Lansing Hardy Gold Medal from The Minerals, Metals and Materials Society and the '89 Cosslett Award from the Microbeam Analysis Society.

**Touradj Ebrahimi** is a Professor at EPFL heading its Multimedia Signal Processing Group. He was also adjunct Professor with the Center of Quantifiable Quality of Service at Norwegian University of Science and Technology (NTNU) between 2008 and 2012. In 1993, he was a research engineer at the Corporate Research Laboratories of Sony Corporation in Tokyo, where he conducted research on advanced video compression techniques for storage applications. In 1994, he served as a research consultant at AT&T Bell Laboratories working on very low bitrate video coding. He has been the recipient of various distinctions and awards, such as the IEEE and Swiss national ASE award, the SNF-PROFILE grant for advanced researchers, Four ISO-Certificates for key contributions to MPEG-4 and JPEG 2000, and the best paper award of IEEE Transactions on Consumer Electronics. He became a Fellow of the international society for optical engineering (SPIE) in 2003. He has initiated more than two dozen National, European and International coopera-

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tion projects with leading companies and research institutes around the world. He is also the head of the Swiss delegation to MPEG, JPEG and SC29, and acts as the Chairman of Advisory Group on Management in SC29. He is a co-founder of Genista SA, a high-tech start-up company in the field of multimedia quality metrics. In 2002, he founded Emitall SA, start-up active in the area of media security and surveillance. In 2005, he founded EMITALL Surveillance SA, a start-up active in the field of privacy and protection. He is or has been associate Editor with various IEEE, SPIE, and EURASIP journals, such as IEEE Signal Processing Magazine, IEEE Transactions on Image Processing, IEEE Transactions on Multimedia, EURASIP Image Communication Journal, EURASIP Journal of Applied Signal Processing, SPIE Optical Engineering Magazine. Prof. Ebrahimi is a member of Scientific Advisory Board of various start-up and established companies in the general field of Information Technology. He has served as Scientific Expert and Evaluator for Research Funding Agencies such as those of European Commission, The Greek Ministry of Development, The Austrian National Foundation for Scientific Research, The Portuguese Science Foundation, as well as a number of Venture Capital Companies active in the field of Information Technologies and Communication Systems. His research interests include still, moving, and 3D image processing and coding, visual information security (rights protection, watermarking, authentication, data integrity, steganography), new media, and human computer interfaces (smart vision, brain computer interface).

**Tiejun Huang** is a professor and the director of the Institute for Digital Media Technology, the School of Electronic Engineering and Computer Science, Peking University. He is also the vice director of the National Engineering Lab for Video technology of China from 2009. He was awarded as the New Century Excellent Talents by the Ministry of Education of China in 2011. He is a member of the Advisory Board of IEEE Computing Now, the Board of Director Digital Media Project, and the Editorial Board of Springer 3D Research Journal. In China, he is a council member of Chinese Institute of Electronics, the head of the China delegation of MPEG, a senior member of China Computer Federation. He is also the member of China National Standardization Theory and Methodology Standardization Technical Committee and the Multimedia subgroup of the China National Informational Technology Standardization Technical Committee. His research areas are video coding, image understanding, digital right management (DRM) and digital library. In the last ten years, as the principal investigator, he led ten research projects funded by the Ministry of Science and Technology, Natural Science Foundation, Ministry of Education of China. He involved in three cooperation projects between China and USA, Europe and Korea.

**Yung-Hsiang Lu** is an associate professor in the School of Electrical and Computer Engineering and (by courtesy) the Department of Computer Science of Purdue University. He is an ACM distinguished scientist and ACM distinguished speaker. His research areas include computer systems, mobile and cloud computing, image processing, and robotics. He is an organizing member of the IEEE Rebooting Computing Working Group. He is the chair of the Multimedia Communication Systems Interest Group in IEEE Multimedia Communications Technical Committee; he was a vice-chair of the ACM SIGDA Low Power Technical Committee. He obtained the Ph.D. from the Department of Electrical Engineering at Stanford University.

**Yonggang Wen** is an assistant professor with school of computer engineering at Nanyang Technological University, Singapore. He received his PhD degree in Electrical Engineering and Computer Science from Massachusetts Institute of Technology, Cambridge, USA. Previously he has worked in Cisco to lead product development in content delivery network, which had a revenue impact of 3 Billion US dollars globally. His work in Multi-Screen Cloud Social TV has been featured by global media (more than 1600 news articles from over 29 countries) and received ASEAN ICT Award 2013 (Gold Medal). His work on Cloud3DView for Data Centre Life-Cycle Management, as the only academia entry, has made into the Top 4 finalist on Data Centre Dynamics Awards 2014-APAC. He has also received Best Paper Awards at IEEE WCSP 2014, IEEE Globecom 2013 and IEEE EUC 2012. He serves on editorial boards for IEEE Transactions on Multimedia, IEEE Transactions on Signal and Information Processing over Networks, IEEE Access Journal and Elsevier Ad Hoc Networks, and was elected as the Chair for IEEE ComSoc Multimedia Communication Technical Committee (2014-2016). His research interests include cloud computing, green data center, big data analytics, multimedia network and mobile computing.