Special Issue on IEEE Transactions on Circuits and Systems for Video Technology

Volumetric Video Processing and Compression

Volumetric video represents a significant leap forward in capturing, processing, and experiencing 3D content, which can be classified into various forms such as 3D Gaussian splattings (GS), neural radiance fields (NeRF), point clouds, and meshes. Unlike traditional 2D video formats, volumetric video can capture a scene in three dimensions, allowing for fully immersive and interactive experiences. This technology holds promise across a wide range of applications, including virtual reality (VR), augmented reality (AR), gaming, immersive storytelling, and telepresence. However, volumetric video faces significant challenges in several areas that must be addressed to unlock its full capabilities. 1) Acquisition: generating high-quality 3D representations such as GS and NeRF has drawn much interest in recent years. Meanwhile, the raw data captured by 3D sensors such as point clouds are also noisy and incomplete, which poses challenges to subsequent processing. 2) Compression; large data amount of volumetric video content challenges its development and application. Volumetric video usually has a flexible and non-uniform structure, making it difficult to capture sufficient spatial and temporal redundancies. Efficient and time-saving volume video compression methods are urgently needed. 3) Transmission: delivering volumetric video content presents significant challenges due to its massive data size, complex structure, and the need for real-time display. Additionally, user mobility, particularly with six degrees of freedom in VR and AR environments, further complicates interaction with this medium. This underscores the urgent need to design novel transmission systems and algorithms to ensure the high-quality streaming of volumetric videos. 4) Evaluation: effective quality metrics can guide the generation, compression, and transmission algorithms. However, how to qualify the volumetric video, especially emerging data such as NeRF and 3D GS, is still an open problem. Prospective authors are invited to submit original manuscripts on topics including, but not limited to:

- High-efficiency volumetric video generation
- Traditional or learning-based volumetric video compression
- Immersive volumetric video transmission systems and architectures
- Traditional or learning-based volumetric video transmission
- Perceptual-friendly volumetric video quality assessment metrics and loss functions
- Quality of service & experience and human Factors for immersive volumetric video system

Prospective authors should submit their manuscripts following the IEEE T-CSVT guidelines at https://ieee-cas.org/publication/tcsvt/tcsvt-manuscript-submission-guide.

Authors should submit a PDF version of their complete manuscript to https://ieee.atyponrex.com/submission/dashboard?siteName=TCSVT according to the following schedule:

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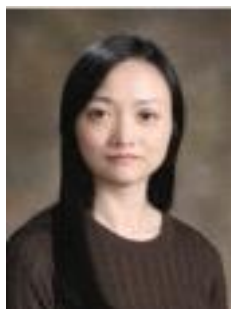
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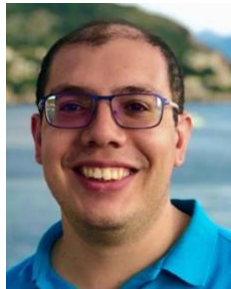
Biography of Guest Editors:

Yiling Xu received the BS, MS, and PhD degrees from the University of Electronic Science and Technology of China, in 1999, 2001, and 2004 respectively. From 2004 to 2013, she was a senior engineer with the Multimedia Communication Research Institute, Samsung Electronics Inc., South Korea. She joined Shanghai Jiao Tong University, where she is currently a professor in the areas of multimedia communication, 3D point cloud compression and assessment, system design, and network optimization. She is the associate editor of the IEEE Transactions on Broadcasting. She is also an active member in standard organizations, including MPEG, 3GPP, and AVS.

Zhu Li received the Ph.D. degree in electrical and computer engineering from Northwestern University in 2004. He is a Professor with the Department of Computer Science and Electrical Engineering, University of Missouri, Kansas City, where he is the Director of the NSF I/UCRC Center for Big Learning. He was AFRL Summer Faculty with the UAV Research Center, U.S. Air Force Academy from 2016 to 2018 and from 2020 to 2023. He was Senior Staff Researcher with Samsung Research America's Multimedia Standards Research Lab, Richardson, TX, USA, from 2012 to 2015, a Senior Staff Researcher with FutureWei Technology's Media Lab, Bridgewater, NJ, USA, from 2010 to 2012, an Assistant Professor with the Department of Computing, The Hong Kong Polytechnic University from 2008 to 2010, and a Principal Staff Research Engineer with the Multimedia Research Lab, Motorola Labs from 2000 to 2008. His research interests include point cloud and light field compression, graph signal processing and deep learning in the next gen visual compression, image processing, and understanding. He has 50+ issued or pending patents, 190+ publications in book chapters, journals, and conferences in these areas. He received the Best Paper Award at IEEE International Conference on Multimedia and Expo, Toronto, in 2006, and IEEE International Conference on Image Processing, San Antonio, in 2007. He is an Associate Editor-inChief for IEEE TRANSACTIONS ON CIRCUITS AND SYSTEM FOR VIDEO TECHNOLOGY. He has been an Associate Editor for IEEE TRANSACTIONS ON IMAGE PROCESSING since 2020. He was an Associate Editor of IEEE TRANSACTIONS ON MULTIMEDIA from 2015 to 2018 and IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY from 2016 to 2019.

Giuseppe Valenzise received the Ph.D. degree in information technology with the Politecnico di Milano, Torino, Italy, in 2011. He is currently a CNRS Researcher with Laboratoire des Signaux et Systèmes (L2S), Université Paris-Saclay, CentraleSupélec, Gir-sur-Yvette, France, where he is the Head of the Multimedia and Networking Team. In 2012, he joined the French Centre National de la Recherche Scientifique (CNRS) as a permanent Researcher, first with the Laboratoire Traitement et Communication de l'Information (LTCI) Telecom Paristech, and in 2016 with L2S. He is the coauthor of more than 100 research publications and of several award-winning papers. His research interests include different fields of image and video processing, traditional and learning-based image and video compression, immersive video (light fields, point clouds), image/video quality assessment, high dynamic range imaging, and applications of machine learning to image and video analysis. He was the recipient of the EURASIP Early Career Award in 2018 for "significant contributions to video coding and analysis". He was/is an Associate Editor for IEEE TRANSACTIONS ON CIRCUITS AND

SYSTEMS FOR VIDEO TECHNOLOGY, IEEE TRANSACTIONS ON IMAGE PROCESSING, Elsevier Signal Processing: Image communication. He is the Chair of the MMSP Technical Committee of the IEEE Signal Processing Society for the term 2024–2025, and he was a member of the Technical Area Committee on Visual Information Processing of EURASIP from 2018 to 2023.

Moncef Gabbouj is a well-established world expert in the field of image processing, and held the prestigious post of Academy of Finland Professor during 2011-2015. He has been leading the Multimedia Research Group for nearly 25 years and managed successfully a large number of projects in excess of 18M Euro. He has supervised 45 PhD theses and over 50 MSc theses. He is the author of several books and over 700 papers. His research interests include Big Data analytics, multimedia content-based analysis, indexing and retrieval, artificial intelligence, machine learning, pattern recognition, nonlinear signal and image processing and analysis, voice conversion, and video processing and coding. Dr. Gabbouj is a Fellow of the IEEE and member of the Academia Europaea and the Finnish Academy of Science and Letters. He is the past Chairman of the IEEE CAS TC on DSP and committee member of the IEEE Fourier Award for Signal Processing. He served as associate editor and guest editor of many IEEE, and international journals.

Ronggang Wang is a professor and PhD advisor at Peking University, Deputy Dean of the School of Information Engineering, and a member of the Guangdong Provincial Committee of the Chinese People's Political Consultative Conference. He was selected for the National Leading Talents Program in Science and Technology Innovation. His research focuses on intelligent processing of Ultra High Definition (UHD) immersive video, with a particular emphasis on intelligent generation, efficient coding, and interactive rendering technologies for UHD immersive video. He has undertaken several national scientific research projects, including key research programs of the Ministry of Science and Technology, the 863 Program, and the National Natural Science Foundation of China. Professor Wang has published over 200 papers in prestigious international journals and conferences and holds more than 100 authorized invention patents. He is one of the main technical contributors to China's national standard for UHD video coding and has led the development of the IEEE immersive video coding standard and the ISO/IEC MPEG internet video coding standard. His leadership in developing real-time UHD video codec cores made significant technological contributions to the launch of China's first UHD channel. Additionally, he led the development of the first interactive free-viewpoint sports watching system, which was used in the production of public signals for the 2022 Beijing Winter

Paralympics and has been included in the list of Olympic Winter Games' technological legacies. Professor Wang currently serves as the chair of the IEEE 1857.9 Immersive Visual Content Coding standard working group, the chair of the VR working group of the China Audio and Video Coding Standardization (AVS) Working Group, and a member of the Visual Signal Processing and Communication Technical Committee of the IEEE Circuits and Systems Society (CASS). His numerous awards include the National Technology Invention First Prize, the China Institute of Electronics' Special Prize for Technical Invention, the Shenzhen Technical Invention First Prize, the IEEE Standards Association's Outstanding Contribution Award, and the AVS Standard Contribution Award.