



### APSIPA Forum on Intelligent Low-Complexity, Low-Power Visual Signal Processing Systems

**Date:** December 1 (Thursday), 2022

**Time:** 15:30 – 16:30 Taiwan (UTC+8); 08:30 – 09:30 Germany (UTC+1)

**Moderator:** Prof. Kun-Chih Chen (NSYSU, Taiwan)

**Speakers:** Prof. Wen-Hsiao Peng (NYCU, Taiwan); Prof. Heming Sun (Waseda Univ., Japan);  
Dr. Christian Herglotz (FAU, Germany)

**Organizer:** Prof. Wen-Hsiao Peng (NYCU, Taiwan)

This APSIPA forum organized by APSIPA Taiwan Local Chapter aims to raise the awareness of the complexity and practicality issues of visual signal processing systems. The last few years witnessed the explosive grow of artificial intelligence-based visual signal processing systems. Much research effort was invested to demonstrate the full potential of learning-based and/or hand-crafted techniques. As algorithms with high accuracy and high performance are becoming exceedingly more complex, it is time to consider their hidden aspects, particularly from the perspectives of Algorithm/Architecture Co-exploration, in order to facilitate low-complexity and low-power designs. Taking video coding and streaming technologies as examples, this forum invites three honorable speakers to share their views on the practicality issues of learned image/video compression, the real-time FPGA implementation for learned image codecs, and energy-efficient video streaming.

Schedule Detail (15:30 – 16:30, Taiwan)

15:30 – 15:33 Opening Remarks

15:33 – 15:50 Towards Practical Learned Image and Video Compression by Prof. Wen-Hsiao Peng

15:50 – 16:10 Real-time Learned Image Codec on FPGA by Prof. Heming Sun

16:10 – 16:30 Energy Optimizations in Client-Side Video Streaming by Dr. Christian Herglotz

**Join Zoom Meeting:** <https://bit.ly/3OzaioQ>

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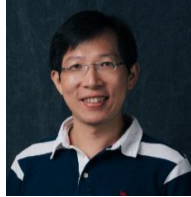
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**Talk #1:** Towards Practical Learned Image and Video Compression

**Speaker:** Prof. Wen-Hsiao Peng, National Yang Ming Chiao Tung University, Taiwan

**Abstract:** Learning-based image/video coding, particularly end-to-end learned image/video coding, is showing great promise for many emerging applications, e.g. perceptual compression for realism, extreme low-rate compression, application-specific image/video compression, and compression for hybrid human and machine vision. This fast growing research area has attracted more than 100+ publications in the literature, with the state-of-the-art methods showing comparable or even better compression results than H.266/Versatile Video Coding (VVC). However, there are many hidden aspects related to learned image/video coding that have not yet been given enough attention as they should. In this talk, I shall provide an overview of recent developments in this area. I shall also touch upon issues and challenges faced by learned codecs, particularly their complexity characteristics in terms of algorithmic-intrinsic metrics. Last but not least, I will mention some notable works that serve as signposts to further research.

**Short-bio:** Dr. Wen-Hsiao Peng received his Ph.D. degree from National Chiao Tung University (NCTU), Taiwan, in 2005. He was with the Intel Microprocessor Research Laboratory, USA, from 2000 to 2001, where he was involved in the development of ISO/IEC MPEG-4 fine granularity scalability. Since 2003, he has actively participated in the ISO/IEC and ITU-T video coding standardization process and contributed to the development of SVC, HEVC, and SCC standards. He was a Visiting Scholar with the IBM Thomas J. Watson Research Center, USA, from 2015 to 2016. He is currently a Professor with the Computer Science Department, National Yang Ming Chiao Tung University, Taiwan. Dr. Peng was Chair of the IEEE Circuits and Systems Society (CASS) Visual Signal Processing (VSPC) Technical Committee from 2020 to 2022. He was Distinguished Lecturer of APSIPA and the IEEE CASS.



**Talk #2:** Real-time Learned Image Codec on FPGA

**Speaker:** Prof. Heming Sun, Waseda University, Japan



**Abstract:** Learned image compression (LIC) has reached a superior coding gain than traditional hand-crafted standards such as JPEG. To accelerate the coding speed, most LIC frameworks are operated on GPU with the floating-point arithmetic. However, the mismatch of floating-point calculation results on various hardware platforms will cause the decoding error if encoding and decoding are performed on different platforms. Therefore, LIC with a fixed-point arithmetic is highly required. This work presents an FPGA design for a LIC with 8-bit fixed-point quantization. Compared with the state-of-the-art FPGA-based LIC implementation, our system can reach 5x faster decoding speed.

**Short-bio:** Dr. Heming Sun received the B.E. degree in electronic engineering from Shanghai Jiao Tong University, Shanghai, China, in 2011, and received the M.E. degree from Waseda University and Shanghai Jiao Tong University, in 2012 and 2014, respectively, through a double-degree program. In 2017 he earned his Ph.D. degree from Waseda University, where he is currently an assistant professor. He was a researcher at NEC Central Research Laboratories from 2017 to 2018. He is selected as JST PRESTO Researcher, during 2019 to 2023. His interests are in algorithms and VLSI architectures for image/video processing and neural networks.



**Talk #3:** Energy Optimizations in Client-Side Video Streaming

**Speaker:** Dr. Christian Herglotz, Friedrich-Alexander University Erlangen-Nürnberg (FAU), Germany

**Abstract:** In recent years, online video services have become an integral part of billions of users worldwide. As a consequence, recent studies found that systems and devices enabling this technology are nowadays contributing substantially to global greenhouse gas emissions. As a consequence, research targeting energy-efficient video streaming solutions is of high interest for the future of our planet. In this talk, we provide an overview on current research targeting the energy efficiency of end-user devices. We will talk about different factors influencing the power consumption and about potential solutions using sophisticated energy and power modeling, quality assessment, and crowdsourcing data.

**Short-bio:** Christian Herglotz received the Dipl.-Ing. in electrical engineering and information technology in 2011 and the Dipl.-Wirt. Ing. in business administration and economics in 2012, both from Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen University, Germany. Since 2012 he has been a Research Scientist with the Chair of Multimedia Communications and Signal Processing, Friedrich-Alexander University Erlangen-Nürnberg (FAU), Germany, where he received his Dr.-Ing. degree in 2017. In 2018 and 2019, he worked as a PostDoc-Fellow at



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École de technologie supérieure in collaboration with Summit Tech Multimedia, Montréal, Canada on energy efficient VR technologies. Since 2019, he is with Friedrich-Alexander University Erlangen-Nürnberg as a senior scientist. His current research interests include energy efficient video communications and video coding. Since 2020, he is with the Visual Signal Processing and Communications Technical Committee of the IEEE Circuits and Systems Society.