

Rethinking Convolutional Neural Networks (CNNs)

C.-C. Jay Kuo

University of Southern California

The superior performance of Convolutional Neural Networks (CNNs) has been demonstrated in many applications such as image classification, detection and processing. Yet, the CNN solution has its own weaknesses such as robustness against perturbation, scalability against the class number and portability among different datasets. Furthermore, CNN's working principle remains a mystery. In this talk, I will first explain the reasons behind the superior performance of CNNs. Then, I will present an alternative solution, which is motivated by CNNs yet allows rigorous and transparent mathematical treatment, based on a data-driven Saak (Subspace approximation with augmented kernels) transform. The kernels of the Saak transform are derived from the second-order statistics of inputs in a one-pass feedforward way. Neither data labels nor backpropagation is needed in kernel determination. The pros and cons of CNNs and multi-stage Saak transforms are compared.

Speaker's Biography



Dr. C.-C. Jay Kuo received his Ph.D. degree from the Massachusetts Institute of Technology in 1987. He is now with the University of Southern California (USC) as Director of the Media Communications Laboratory and USC Distinguished Professor. His research interests are in the areas of digital media computing and compression technologies and deep learning. Dr. Kuo is a Fellow of AAAS, IEEE and SPIE. He has guided 144 students to their Ph.D. degrees and supervised 25 postdoctoral research fellows. Dr. Kuo is a co-author of about 250 journal papers, 900 conference papers and 14 books.

Dr. Kuo was the Editor-in-Chief for the IEEE Trans. on Information Forensics and Security in 2012-2014. He was the Editor-in-Chief for the Journal of Visual Communication and Image Representation in 1997-2011, and served as Editor for 10 other international journals.

Dr. Kuo received the 1992 National Science Foundation Young Investigator (NYI) Award, the 1993 National Science Foundation Presidential Faculty Fellow (PFF) Award, the 2010 Electronic Imaging Scientist of the Year Award, the 2010-11 Fulbright-Nokia Distinguished Chair in Information and Communications Technologies, the 2011 Pan Wen-Yuan Outstanding Research Award, the 2014 USC Northrop Grumman Excellence in Teaching Award, the 2016 USC Associates Award for Excellence in Teaching, the 2016 IEEE Computer Society Taylor L. Booth Education Award, the 2016 IEEE Circuits and Systems Society John Choma Education Award, the 2016 IS&T Raymond C. Bowman Award, the 2017 IEEE Leon K. Kirchmayer Graduate Teaching Award, the 2017 Signal Processing Society Education Award and the 2018 USC Provost's Mentoring Award.