

CNN as Guided Multi-layer RECOS Transform

by

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Abstract

There is a resurging interest in developing a neural-network-based solution to supervised machine learning in the last 5 years. In this talk, I will provide a theoretical foundation to the working principle of the convolutional neural network (CNN) from a signal processing viewpoint. To begin with, the RECOS transform is introduced as a basic building block for CNNs. The term "RECOs" is an acronym for "REctified-CORrelations on a Sphere". It consists of two main concepts: data clustering on a sphere and rectification. Then, a CNN is interpreted as a network that implements the guided multi-layer RECOs transform. Along this line, we first compare the traditional single-layer and modern multi-layer signal analysis approaches. Then, we discuss how guidance is provided by data labels through backpropagation in the training with an attempt to offer a smooth transition from weakly to heavily supervised learning. Several future research directions are pointed out at the end.

Biography of the Speaker

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 Dean's Professor in Electrical Engineering-Systems. His research interests are in the areas of digital media processing, compression, communication and networking technologies. 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, and the 2017 IEEE Leon K. Kirchmayer Graduate Teaching Award. Dr. Kuo is a Fellow of AAAS, IEEE and SPIE. He has guided 140 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, 14 books and 30 patents.