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Interpretable Convolutional Neural Networks (CNNs) via Feedforward Design

by

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Time: 4:30 p.m. – 5:30 p.m.
Venue: Room 1009, 10/F, William MW Mong Engineering Building, CUHK

Abstract

Given a convolutional neural network (CNN) architecture, its network parameters are determined by backpropagation (BP) nowadays. The underlying mechanism remains to be a black-box after a large amount of theoretical investigation. In this talk, I describe a new interpretable and feedforward (FF) design with the LeNet-5 as an example. The FF-trained CNN is a data-centric approach that derives network parameters based on training data statistics layer by layer in one pass. To build the convolutional layers, we develop a new signal transform, called the Saab (Subspace approximation with adjusted bias) transform. The bias in filter weights is chosen to annihilate nonlinearity of the activation function. To build the fully-connected (FC) layers, we adopt a label-guided linear least squared regression (LSR) method. The classification performances of BP- and FF-trained CNNs on the MNIST and the CIFAR-10 datasets are compared. The computational complexity of the FF design is significantly lower than the BP design and, therefore, the FF-trained CNN is ideal for mobile/edge computing. We also comment on the relationship between BP and FF designs by examining the cross-entropy values at nodes of intermediate layers.

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 Distinguished Professor of Electrical Engineering and Computer Science. His research interests are in the areas of media processing, compression and understanding. Dr. Kuo was the Editor-in-Chief for the IEEE Trans. on Information Forensics and Security in 2012-2014. 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 147 students to their Ph.D. degrees and supervised 29 postdoctoral research fellows. Dr. Kuo is a co-author of 275 journal papers, 920 conference papers and 14 books.

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