Successive Subspace Learning: Theory, Examples and Performance

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It is common to project signals from a high-dimensional space to a low-dimension space for ease of signal analysis and manipulation. This is known as the subspace method. One example is the principal component analysis (PCA). Being motivated by research on interpretable deep learning, we propose a new data-driven machine learning paradigm based on the subspace concept and call it the successive subspace learning (SSL) methodology. In contrast with the traditional subspace method, the SSL has several novel ingredients. First, each basic unit in the SSL contains subspace dimension expansion and reduction two modules. Second, the SSL system has multiple basic units in cascade. Third, an efficient multi-class classifier based on the subspace concept, called the subspace classifier, is adopted in the SSL system. We will use two examples to demonstrate the SSL methodology; namely, the PixelHop and the PointHop methods. They are developed, respectively, for image object classification and 3D point cloud classification. Experimental results will be provided to demonstrate the advantages of the SSL approach.

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 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 is a Fellow of AAAS, IEEE and SPIE. He has guided 150 students to their Ph.D. degrees and supervised 30 postdoctoral research fellows. Dr. Kuo is a co-author of 280 journal papers, 920 conference papers and 14 books. Dr. Kuo received 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 IEEE Signal Processing Society Education Award, and the 2019 IEEE Computer Society Edward J. McCluskey Technical Achievement Award.