

Learning for Future Video

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Learning has made it possible to unleash the power of data. We have moved away from the detailed modeling of a system or a phenomenon of interest thanks to the abundance of data as well as the huge improvements in processing power. With approaches like dictionary learning we can discover linear relationships between the input and output. On the other hand, recent advancements in deep learning have made it possible to discover non-linear relationships. As one of the examples in this talk we discuss the application of dictionary and deep learning to the video super-resolution problem. We describe a multiple-frame algorithm based on dictionary learning and motion estimation. We further describe the use of a convolutional neural network that is trained on both the spatial and temporal dimensions of videos to enhance their resolution. We demonstrate experimentally the effectiveness of these approaches. We finally discuss future research directions on the topic of learning.



Aggelos Katsaggelos received the Diploma degree in electrical and mechanical engineering from the Aristotelian University of Thessaloniki, Thessaloniki, Greece, in 1979 and the M.S. and Ph.D. degrees both in electrical engineering from the Georgia Institute of Technology, Atlanta, Georgia, in 1981 and 1985, respectively.

In 1985 he joined the Department of Electrical Engineering and Computer Science at Northwestern University, Evanston, IL, where he is currently professor, holder of the Joseph Cummings Chair (previously holder of the AT&T and Ameritech Chairs). He is also Academic Affiliate Staff, Department of Medicine, at NorthShore University HealthCare System, an affiliated faculty at the Department of Linguistics, Northwestern University, and an appointee at the Argonne National Laboratory.

His current research interests include multimedia signal processing and communications, computational photography, and machine learning. He has published extensively in the areas of multimedia signal processing and communications (over 230 journal papers, 500 conference papers and 40 book chapters) and he is the holder of 25 international patents. He is the co-author of *Rate-Distortion Based Video Compression* (Kluwer, 1997), *Super-Resolution for Images and Video* (Claypool, 2007), *Joint Source-Channel Video Transmission* (Claypool, 2007), and

Machine Learning Refined (Cambridge University Press, 2016). He has supervised 54 Ph.D. theses so far.

Prof. Katsaggelos has served the IEEE and other professional Societies in many capacities. Among his many professional activities he was Editor-in-Chief of the *IEEE Signal Processing Magazine* (1997–2002), a BOG Member of the IEEE Signal Processing Society (1999–2001), a member of the Publication Board of the IEEE Proceedings (2003-2007), and he is currently a Member of the Award Board of the IEEE Signal Processing Society. He is a Fellow of the IEEE (1998) and SPIE (2009) and the recipient of the IEEE Third Millennium Medal (2000), the IEEE Signal Processing Society Meritorious Service Award (2001), the IEEE Signal Processing Society Technical Achievement Award (2010), an IEEE Signal Processing Society Best Paper Award (2001), an IEEE ICME Paper Award (2006), an IEEE ICIP Paper Award (2007), an ISPA Paper Award (2009), and a EUSIPCO paper award (2013). He was a Distinguished Lecturer of the IEEE Signal Processing Society (2007–2008).