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Nonlinear Unmixing of Hyperspectral Images

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A hyperspectral image has pixels that are measures of light in hundreds of spectral bands. These spectral pixels can be used to identify materials in a scene. However, the spectra of the materials in the scene are usually mixed together via the imaging optics, a linear process, or by physical processes, generally nonlinear processes. To perform accurate material identification, the pixels need to be unmixed. Researchers have focusing intensely on the spectral unmixing problem over the past 10-15 years. A majority of this focus has been on unmixing the Linear Mixing Model (LMM). In spite of receiving less attention, nonlinear unmixing algorithms have been investigated steadily throughout the period. The success in unmixing the LMM and documentation of the non-negligible effects of nonlinearities are sufficient to warrant an increased focus on nonlinear unmixing algorithms.

This talk presents two different approaches to nonlinear unmixing that are related to the Sparsity Promoting Iterated Constrained Endmember (SPICE) unmixing. The first algorithm, PCOMMEND, models the image as a collection of linear models. The second, BISPICE, models the image as a combination of linear and bilinear models. Algorithms will be derived and analyzed. Results will be provided on a number of hyperspectral images.

Biography

Paul Gader received his Ph.D. in Mathematics from the University of Florida in 1986 for research in parallel image processing. Since then he has worked on a wide variety of theoretical and application problems involving automated analysis of sensor measurements including parallel processing, mathematical morphology, fuzzy sets, machine learning, handwriting recognition, medical image processing, automatic target recognition, and landmine detection. He is a Fellow of the IEEE and has several hundred technical publications.

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