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Keynote Talk:

Target detection and recognition in hyperspectral imagery

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Overview : Detecting signals of interest, particularly with wide signal variability, in noisy environments has long been a challenging issue in various fields of signal processing. Recently hyperspectral sensors have been developed to detect and identify camouflaged and subpixel targets in several applications. In many military situations, hyperspectral sensors are utilized to extract target signatures when the target is obscured or covered by camouflage netting. The difficulties encountered in these situations include low SNR, small numbers of pixels on target, nonlinear atmospheric attenuation and mixed spectral signatures. In this presentation, use of hyperspectral imagery for military applications is reviewed and some of the well known algorithms for detection and recognition of CC&D (camouflage, concealment, and deception) targets are presented. Techniques that are covered include the well-known RX anomaly detector, subspace-based detectors, spectral matched filters, subspace matched filters and their variations. Ability of these algorithms to detect and identify targets in different scenarios is reviewed. Performance of these algorithms are compared and experimental results are presented for several simulated and real hyperspectral imagery. Almost all the well known algorithms are based on the assumption that the signals are Gaussian and do not exploit the higher order correlations. Therefore, several nonlinear detection and recognition techniques are presented that are based on the ideas from kernel-based learning theory. Nonlinear kernel versions of RX anomaly detector and spectral matched (subspace) detectors are also discussed and their performance is compared with the linear versions. Experimental results based on simulated toy-examples and real hyperspectral imagery shows that the kernel nonlinear detectors outperform the conventional linear detectors.

Short Biography : Nasser M. Nasrabadi received the B.Sc. (Eng.) and Ph.D. degrees in Electrical Engineering from Imperial College of Science and Technology (University of London), London, England, in 1980 and 1984, respectively. From October 1984 to December 1984 he worked for IBM (UK) as a senior programmer. During 1985 to 1986 he worked with Philips research laboratory in NY as a member of technical staff. From 1986 to 1991 he was an assistant professor in the Department of Electrical Engineering at Worcester Polytechnic Institute, Worcester, MA. From 1991 to 1996 he was an associate professor with the Department of Electrical and Computer Engineering at State University of New York at Buffalo, Buffalo, NY. Since September 1996 he has been a Senior Research Scientist (ST) with the US Army Research Laboratory (ARL) working on image processing and automatic target recognition.



He has served as an associate editor for the IEEE Transactions on Image Processing, the IEEE Transactions on Circuits, Systems and Video Technology, and the IEEE Transactions on Neural Networks. He is also a Fellow of ARL (1998), SPIE (1997) and IEEE (2001). His current research interests are in Hyperspectral imaging, automatic target recognition, statistical machine learning theory, robotics, and neural networks applications to image processing