



# Signal Processing and Systems (SP&S) Seminar

You are invited to attend a lecture by

הנכם מוזמנים להרצאה של

Oleg Kuybeda

Department of Electrical Engineering  
Technion

בנושא :

## Anomaly Preserving Redundancy Reduction in High-Dimensional Signals

In this research we address the problem of redundancy-reduction of high-dimensional noisy signals, which may contain anomaly vectors that we wish to preserve. Since anomalies contribute weakly to the  $\ell_2$ -norm of the signal as compared to the noise, classical approaches based on the  $\ell_2$  criterion are unsatisfactory for obtaining a good representation of anomaly vectors. The proposed Maximum Orthogonal-Complements Algorithm (MOCA) is designed to estimate the anomaly preserving signal-subspace. It combines  $\ell_2$  and  $\ell_\infty$  norms and considers two aspects: One aspect deals with a suboptimal signal-subspace estimation aiming to minimize the maximum of data-residual  $\ell_2$ -norms, denoted as  $\ell_{2,\infty}$ , for a given rank conjecture. The other aspect assesses the rank conjecture validity for the obtained signal-subspace by applying Extreme Value Theory results on the noise  $\ell_{2,\infty}$ -norm.

Next, we develop an Anomaly Extraction and Discrimination Algorithm (AXDA), which is an adaptation of MOCA for anomaly detection, discrimination and population estimation of anomalies, in hyperspectral images. We also develop an optimal algorithm for the  $\ell_{2,\infty}$ -norm minimization, which we call Maximum Orthogonal complements Optimal Subspace Estimation} (MOOSE). The optimization is performed via a natural conjugate gradient learning over the set of  $n$  dimensional subspaces in  $R^m$ ,  $m > n$ , which is a Grassmann manifold. Finally, we propose a novel approach for designing multispectral filters tuned for anomaly detection algorithms. The proposed approach is based on processing a sample hyperspectral image of a typical scene that is likely to be faced by anomaly detection algorithms. The sample image is not necessarily required to include anomalies.

\* PhD Research under the supervision of Prof. David Malah and Dr. Meir Barzohar

The lecture will take place on Wednesday, 26/11/2008  
at 13:30 in room 1061  
Electrical Eng. Building  
Technion City

ההרצאה תתקיים ביום רביעי, 26/11/2008  
בשעה 13:30 בחדר 1061  
בבניין הפקולטה להנדסת חשמל  
קריית הטכניון

כיבוד קל יוגש לפני תחילת ההרצאה

הזמנה זו מהווה אישור כניסה עם רכב לטכניון