

Center for Imaging Science and Department of Mathematical Sciences
The Johns Hopkins University

JOINT SEMINAR

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110 Clark Hall
Refreshments: 3:30 p.m.
Seminar: 4:00 p.m.

MODELING IMAGES AND OBJECTS

ABSTRACT

Understanding an image is an instance of a class of problems for which available data are decomposed into a multitude of elementary features which are strongly correlated, and distributed according to an unknown, highly structured, model. Although a complete understanding of this model is hard and probably out of reach, image-processing solutions are nonetheless far more efficient when this stochastic organization is taken into account, at least with a coarse approximation.

Modeling visual cues is a fundamental challenge. Discrete spatial models such as Markov random fields (and synchronous random fields, which will also be described) analyze the data as provided from digital devices. They have potentially a wide range of applications, but also are computationally highly demanding, inducing an unavoidable trade-off between accuracy and feasibility. They are, in particular, notoriously hard to train from data; but efficient learning procedures, which will be presented in this talk, can be derived. Recent experiments on maximum entropy extensions of microimage models and tentative models of artificial perceptive systems will be presented.

Whereas very efficient for performing low level image processing, and potentially serving to model clutter, or “non-objects,” Markov random fields fail to provide the necessary high-level cues required to handle object or pattern recognition. I shall describe two lines of current work in order to address this problem. The first is designed to detect, by cooperatively training a sufficiently large set of classifiers, the relevant features for high-level analyses of scenes. The second focuses on shapes, with the point of view, emerging from Grenander’s pattern theory, to understand objects, not from their intrinsic properties, but from the way they respond to the action of deformations. Deformation analysis of shapes and images, connected to the theory of infinite dimensional groups of diffeomorphisms, is a stimulating topic which has already provided encouraging results in medical image processing.