Yair WEISS

Vendredi 17 juin 2005
Conférence Analyse Bayésienne

15h00 – 15h45

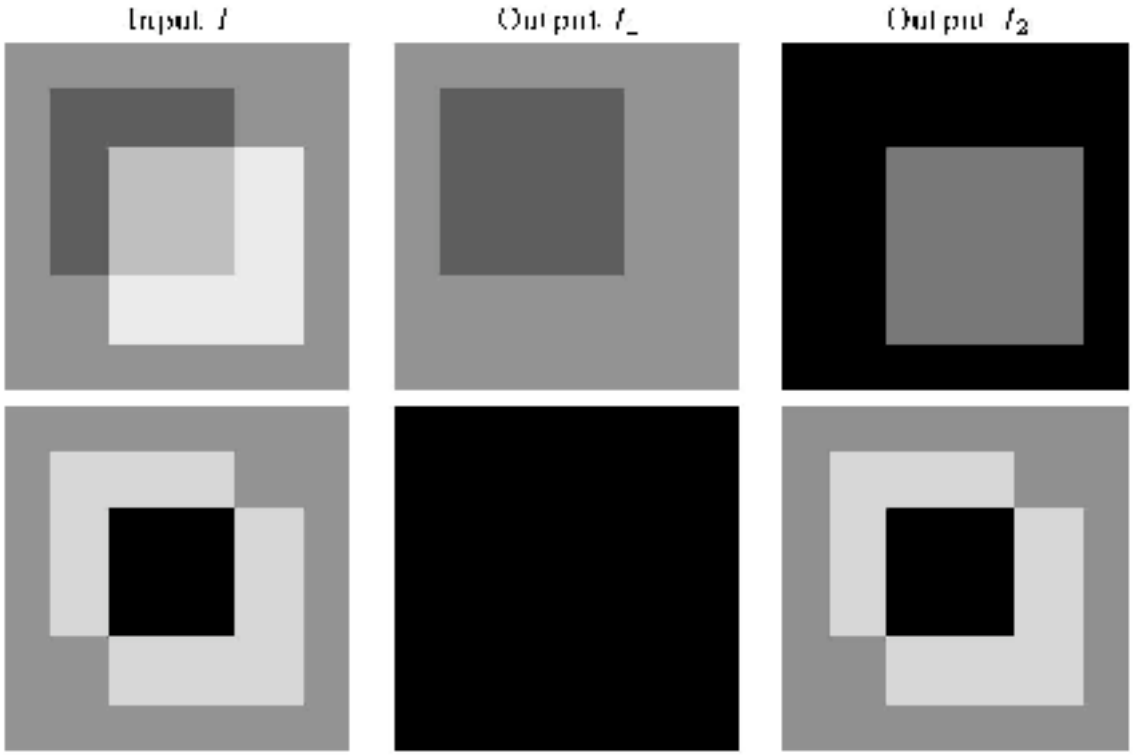
Perception and the statistics of natural scenes

Natural images take up only a tiny fraction of the space of all possible NxN matrices. It thus makes sense that perceptual systems, both biological and artificial, would use image statistics to improve their performance. This idea goes back at least to Mach (1886) and Helmholtz (1925) but operationalizing it has proven to be difficult.

In this talk I will describe the computational challenges raised by such an approach - learning very non Gaussian distributions in high dimensional spaces and performing inference with such distributions. I will then summarize some of our research in this direction. The good news is that very simple statistical models can lead to surprisingly powerful algorithms. The bad news is that even these simple statistical models lead to complicated optimization problems. Specifically, I will discuss our hypothesis that the percept of transparency is a rational result of the statistics of natural images.
You can see some images from the talk at:
http://www.cs.huji.ac.il/~yweiss/NipsAnim/nips02Anim.html

Yair WEISS
School of Computer Science and Engineering
The Hebrew University of Jerusalem
91904 Jerusalem, Israel
email: yweiss@cs.huji.ac.il
phone: +972-2-658-6429
fax: +972-2-6758990

BP Animation



This demo illustrates the dynamics of using belief propagation to analyze transparency using our model. Our model prefers decompositions with less edges and less corners. We represent a decomposition via its gradient field. Thus there are two gradient fields, g1 and g2 (for the two layers) and in BP we calculate the marginal probability at every pixel for g1 and g2. In the discretization we use here, each gradient can take on one of at most four possible values. When a pixel in g1 has a strong belief in a nonzero gradient, it turns red in the animation and when a pixel in g2 has a strong belief in a nonzero gradient, it turns green.

The animation for the top figure is shown here and the animation for the bottom figure is shown here .