

**STANFORD UNIVERSITY**  
**DEPARTMENT OF STATISTICS**  
**DEPARTMENTAL SEMINAR**

4:15 p.m., Tuesday, January 10, 2006  
Sequoia Hall Room 200  
(Cookies at 3:45 in 1st Floor Lounge)

*Ying Nian Wu*  
UCLA Department of Statistics

**Information Scaling and Cartoonlets**

Cartoons and textures are two ubiquitous classes of patterns in images of natural scenes. Mathematically, cartoons are modeled by piecewise smooth functions with smooth boundaries, whereas textures are modeled by spatial statistics or random fields. We show that the two classes of patterns can be physically unified by what we call information scaling, that is, the change of statistical properties of image data over the scaling or zooming process. In particular, we show that the entropy rate of the image data changes over the scaling process, which transforms cartoons to textures and eventually to white noise. Pursuing the entropy in image data, we come up with a class of image descriptors that we call cartoonlets. Cartoonlets arise from the alignment of phases and orientations of Gabor wavelets in the frequency domain. The concept provides a unified modeling perspective for describing both cartoons and textures, and it is closely connected to three statistical principles in vision, namely, sparse coding, meaningful alignment, and minimum entropy. The talk is based on two papers: Wu, Zhu, and Guo (2005) and Liu, Li, and Wu (2005).