



Fall 2011 Colloquium
Temple University
Computer and Information Sciences

Believing is seeing - how prior beliefs influence perception

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Abstract:

Our percept of the world is shaped by our beliefs and expectations about what there is to be perceived. This has been well-known. Yet only recently we began to better understand what these beliefs represent and the computational mechanisms by which they affect the perceptual process, leading to the hypothesis that our percepts are the results of optimal statistical inference.

However, the validation of this hypothesis is not trivial because it typically requires strong assumptions about the prior beliefs of an observer when modeling particular behavioral tasks. Consequently, Bayesian models have faced some criticism for being under-constrained. Here, I will present a model that avoids the need for such assumptions because it allows us to 'reverse-engineer' the exact form of individual subjects' prior beliefs and their internal noise characteristics from psychophysical data. Applied to the specific case of visual motion perception, I will show that the extracted perceptual noise characteristics match known tuning and noise characteristics of motion sensitive neurons in visual cortex, and that subjects' prior assumptions are in line with predictions based on the spatial and temporal frequency spectra of natural scenes.

Finally, I will present recent results that demonstrate that the extracted prior beliefs and noise characteristics generalize and can predict subjects' perception in an entirely different psychophysical experiment.

Bio:

Alan A. Stocker received the MS degree in Material Sciences and Biomedical Engineering and the PhD degree in Physics from the Swiss Federal Institute of Technology in Zürich, Switzerland, in 1995 and 2001, respectively. From 2003 to 2008, he was a postdoctoral fellow at the Center for Neural Sciences of New York University. In 2009 he joined the faculty of the Psychology Department at the University of Pennsylvania, where he also holds a secondary appointment in the Department of Electrical and Systems Engineering. His research interests are in computational neuroscience with a focus on models of visual perception. Furthermore he is interested in the application of these models in robotics. He published in major neuroscience and engineering journals, and wrote a book about neuromorphic VLSI circuits for visual motion processing published by Wiley and Sons.