



ICWS Seminar Series



HAVING ONE'S CAKE AND EATING IT TOO: THE PROBLEM OF JOINT COMMUNICATION AND SENSING

Professor Urbashi Mitra
Department of Electrical Engineering
University of Southern California

Thursday, November 10, 2011
B-02 Coordinated Science Lab / 4:00 p.m.

Abstract: Traditionally, channel estimation has been undertaken only in service of better data communication. However, a number of problem frameworks (sonar, cognitive radio, digital watermarking) require the reconstruction of a transmitted message as well as estimating properties of the channel over which the message was transmitted. We abstract these scenarios to one wherein a source sends a message to the destination and the destination endeavors to both decode the message and estimate the channel to some fidelity. Three key cases of channel knowledge at the transmitter are considered: the transmitter is oblivious to the channel; the transmitter has strictly causal channel state information and the transmitter has causal channel state information. We establish that the distortion constraint at the destination is equivalent to an additional cost constraint on the input source distribution. We define a new capacity-distortion function which characterizes the fundamental tradeoff between transmission rate and state estimation distortion. We compute the capacity-distortion function for the three cases of channel knowledge at the transmitter. The results provide some interesting insights as to how practical encoding should be designed in order to achieve our goals; in particular, separated training and data signaling is suboptimal. Time permitting, connections to channels with action-dependent states and active classification will be discussed.

Biography: Urbashi Mitra received the B.S. and the M.S. degrees from the University of California at Berkeley and her Ph.D. from Princeton University. After a six year stint at the Ohio State University, she joined the Department of Electrical Engineering at the University of Southern California, Los Angeles, where she is currently a Professor. Dr. Mitra has been an Associate Editor for the following IEEE publications: Transactions on Information Theory (2007-2011), Journal of Oceanic Engineering (2006-2011), and Transactions on Communications (1996-2001). She was a member of the IEEE Information Theory Society's Board of Governors (2002-2007). Dr. Mitra was an invited speaker for the National Academy of Engineering's 2011 China-America Frontiers of Engineering Symposium. She is the recipient of: 2011 USC Zumberge Interdisciplinary Innovation Fund (with M. El-Naggar), USC Center for Excellence in Research Fellowship (2010-2013), the Viterbi School of Engineering Dean's Faculty Service Award (2009), USC Mellon Mentoring Award (2008), IEEE Fellow (2007), Texas Instruments Visiting Professor (Fall 2002, Rice University), 2001 Okawa Foundation Award, 2000 Lumley Award for Research (OSU College of Engineering), 1997 MacQuigg Award for Teaching (OSU College of Engineering), and a 1996 National Science Foundation (NSF) CAREER Award. Dr. Mitra has held visiting appointments at: the Delft University of Technology, Stanford University, Rice University, and the Eurecom Institute. She served as co-Director of the Communication Sciences Institute at the University of Southern California from 2004-2007.