

# PROFESSOR URBASHI MITRA



## SPARSE SAMPLING FOR ACTIVE LEARNING OF MULTI-SOURCE AND MULTI-MODAL ENVIRONMENTS

### ABSTRACT

Consider a field of interest from which you can only collect a few observations. From these observations, we wish to find a target's location. Such a problem arises in military surveillance, environmental monitoring, cyber-security, medical diagnosis, and epidemic detection. In this talk, we consider a novel approach to target detection (or environmental sensing) from sparse samples. In particular, we model the target of interest as one emitting a signature that has spatial extent across the field (versus being a single pixel); furthermore, this signature is "low rank" and decays as a function of the distance of the observation point from the target (unimodal). The target detection and localization algorithm employs highly incomplete and noisy samples. By exploiting modern signal processing techniques such as matrix completion and active search methods, we develop a high performance, moderate complexity algorithm for target detection. This method is extended to the case of multiple targets via novel matrix factorization and isotonic projection methods. We further extend the approach to handle multimodal sensor data by exploiting tensor completion methods. Theoretical performance bounds are derived. The methods are tested against the state of the art on both synthetic and real data sets.

### 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. She began her academic career at The Ohio State University. Dr. Mitra is currently the Gordon S. Marshall Professor in Engineering at the University of Southern California with appointments in Electrical Engineering and Computer Science. She is the inaugural Editor-in-Chief for the IEEE Transactions on Molecular, Biological and Multi-scale Communications. She was a member of the IEEE Information Theory Society's Board of Governors (2002-2007, 2012-2017), the IEEE Signal Processing Society's Technical Committee on Signal Processing for Communications and Networks (2012-2016), the IEEE Signal Processing Society's Awards Board (2017), and the Vice Chair of the IEEE Communications Society, Communication Theory Working Group (2017). Dr. Mitra is a Fellow of the IEEE. She is the recipient of: a 2015 UK Royal Academy of Engineering Distinguished Visiting Professorship, a 2015 US Fulbright Scholar Award, IEEE Communications Society Distinguished Lecturer, 2012 Globecom Signal Processing for Communications Symposium Best Paper Award, 2012 US National Academy of Engineering Lillian Gilbreth Lectureship, the 2009 DCOSS Applications & Systems Best Paper Award, Texas Instruments Visiting Professor (Fall 2002, Rice University), 2001 Okawa Foundation Award, 2000 OSU College of Engineering Lumley Award for Research, 1997 OSU College of Engineering MacQuigg Award for Teaching, and a 1996 National Science Foundation CAREER Award. She has had numerous editorial positions and visiting scholar positions. Her research interests are in: wireless communications, communication and sensor networks, biological communication systems, detection and estimation and the interface of communication, sensing and control.

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**WCH 205/206**  
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