

# Spring 2014 Seminar Series

Presented by the CS Division

## THE CANONS OF DISEASE ETIOLOGY

THURSDAY APRIL 17, 2014

5:00 PM – HEC 101

The dream of a powerful integrated computational framework, only hinted at in Ibn Sina's Canon, can now be fulfilled at a global scale as a result of many recent advances: foundational advances in statistical inference; hypothesis-driven experiment design and analysis and the dissemination of peer-reviewed publications among communities of scientists; distributed large-scale databases of scientific and auxiliary experimental data; algorithmic approaches to model building and model checking; machine learning approaches to generate large number of hypotheses, and multiple hypotheses testing to tame computational complexity and false-discovery rates, etc. More specifically, in the area of biomedical sciences, there has been an explosion of new technological advances: genomics, transcriptomics and proteomics; web interfaces allowing patients to keep personal logs; genome-wide association studies; detailed analyses of hereditary, genetic and ancestral history of patients' genomes; construction of phenomenological models of disease initiation and progression; type-level and token-level analysis of the causal bases of human diseases; translational systems biology for biochemical explanations of diseases; and the accessible integration of these capabilities into a multi-faceted system with specific attention to the ethical use of medical data, patient privacy, powerful hardware and software infrastructure and cognitive consonance with biomedical scientists, physicians and care-givers. We will focus on an application centered on cancer – "the emperor of all maldies."

We will also discuss the relevance of this research to Data Science, Big Data, DARPA's Big Mechanism effort and the X prize for Mobile Diagnostics.

### **BUD MISHRA** New York University

Bud Mishra is a professor of computer science and mathematics at NYU's Courant Institute of Mathematical Sciences, professor of human genetics at Mt. Sinai School of Medicine, and a professor of cell biology at NYU School of Medicine. He currently leads several groups working in biotechnology, bioinformatics, biomedicine, cyber security, data privacy, and data sciences. Prof. Mishra has a degree in Science from Utkal University, in Electronics and Communication Engineering from IIT, Kharagpur, and MS and PhD degrees in Computer Science from Carnegie-Mellon University. He has industrial experience in Computer Science (ATTAP, SeQster, and Tartan Laboratories, etc.), Finance (Instadat, PRF, LLC, and Tudor Investment, etc.), Robotics and Bio- and Nanotechnologies (Abraxis, Bioarrays, MRTechnology, OpGen, etc.). He is an author of a textbook on algorithmic algebra and more than two hundred archived publications. He has advised and mentored more than 40 graduate students and post-docs in the areas of computer science, robotics and control engineering, applied mathematics, finance, biology and medicine. He is an inventor of Optical Mapping and Sequencing (SMASH, Gentig/Haptig, Sutta-Assembler & TotalReCaller), Array Mapping, Copy-Number Variation Mapping, Cancer Therapy Design, Model Checker for circuit verification, Robot Grasping and Fixturing, Reactive Robotics, Nanotechnology for DNA profiling, Causality Analysis and Personal Private Data Markets. He is a fellow of IEEE, ACM and AAAS, a Distinguished Alumnus of IIT-Kgp, and a NYSTAR Distinguished Professor. He also holds adjunct professorship at Tata Institute of Fundamental Research in Mumbai, India. From 2001-04, he was a professor at the Watson School of Biological Sciences, Cold Spring Harbor Lab; currently he is a QB visiting scholar at Cold Spring Harbor Lab.

*Hosted by: Dr. Sumit Jha*

