MAX PLANCK INSTITUTE
FOR HUMAN COGNITIVE AND BRAIN SCIENCES

Wednesday, September 13, 2023, 16:00 hrs
Hybrid Meeting (C402 and via Zoom)

Guest Lecture

Dr Justin Haldar

Signal and Image Processing Institute and the Ming Hsieh Department of Electrical and Computer Engineering at the University of Southern California/U.S.A.

Constrained Magnetic Resonance Imaging and the Blessings of Dimensionality

Magnetic resonance (MR) imaging technologies provide unique capabilities to probe the mysteries of biological systems, and have enabled novel insights into anatomy, metabolism, and physiology in both health and disease. However, while MRI is decades old, is associated with multiple Nobel prizes (in physics, chemistry, and medicine), and has already revolutionized fields like medicine and neuroscience, current MRI methods are still very far from achieving the full potential of the MRI signal. In particular, traditional methods are based on classical sampling theory, and suffer from fundamental trade-offs between signal-to-noise ratio, spatial resolution, and data acquisition speed. These issues are exacerbated in high-dimensional applications, due to the curse of dimensionality. Our work addresses the limitations of traditional MR imaging using signal processing approaches that are enabled by modern computational capabilities. These approaches are possible because of certain "blessings of dimensionality," e.g., that high-dimensional data often possess unexpectedly simple structure that can be exploited to alleviate classical barriers to fast high-resolution imaging. This seminar will describe approaches we have developed that use novel constrained imaging models to guide the design of new MR data acquisition and image reconstruction methods, and enable substantial acceleration of both low-dimensional and high-dimensional MR imaging experiments.