

Speaker: Ali Shojaie (University of Washington)

Date: 20/04/2026 at 13:15 in 4 West 1.7 (Wolfson Lecture Theatre)

Title: Learning from the changing brain: Statistical machine learning for dynamic functional connectivity networks

Abstract:

Dynamic, non-stationary time series arise naturally in many neuroscience applications, from experiments involving multiple stimuli in one session, to measurements of brain activity in patients suffering from neurodegenerative diseases. While it is well known that ignoring this non-stationarity can lead to incorrect conclusions and false discoveries, in this talk we argue that ignoring non-stationarity can also lead to missed discoveries. More specifically, we will show that changes in brain functional connectivity networks can provide novel insights into mechanisms of information processing in brain and provide effective biomarkers for early detection of neurodegenerative diseases. We present two approaches for inferring changes in brain connectivity networks from non-stationary high-dimensional time series. The first approach directly infers the changes in brain connectivity networks in the spectral domain. We develop efficient estimation and inference procedures for the change in the brain network connectivity and illustrate its utility in detecting changes in functional connectivity. The second approach considers a high-dimensional Markov switching vector autoregressive (VAR) model, a VAR model whose transition matrices depend on the states of an (unobserved) discrete Markov process. We propose an approximate Expectation-Maximization (EM) algorithm to estimate the model parameters and establish the consistency of the resulting estimates.