University of California, Irvine
Statistics Seminar

Learning from Changing Times: Analyzing Non-Stationary High-Dimensional Time Series

Ali Shojaie
Professor and Associate Chair, Department of Biostatistics
Professor, Department of Statistics
Norm Breslow Endowed Professor
University of Washington

4-5 p.m.
Thursday, March 6, 2025
6011 Donald Bren Hall

High-dimensional time series from changing environments are collected in many applications and are prevalent in biology and medicine. Ignoring these changes, or assuming stationarity, results in erroneous conclusions. As we demonstrate in neuroscience applications, non-stationary time series can also reveal changes in brain connectivity in disease conditions or in response to external stimuli. Motivated by these applications, 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 brain connectivity resulting from optogenetics stimulation. 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.