High Dimensional Bayesian Mediation Analysis for Understanding Biological Mechanisms

Bhramar Mukherjee
University of Michigan

Abstract

Mediation analysis serves two primary purposes in scientific studies: interventional causal inference and the characterization of biological mechanisms. The former quantifies the natural indirect effect (NIE) of an intervention (A) on an outcome (Y) through an intermediate variable (M), aiding in understanding the effect of changes in M on Y. The latter, increasingly common, focuses on elucidating the pathways through which an exposure affects an outcome, often utilizing high-dimensional molecular measurements such as epigenetic and lipid markers as mediators. In this talk, I will discuss several approaches for applying "shrinkage" to the NIEs—often represented by products of two sets of regression coefficients—when dealing with a large number of mediators (M). Additionally, I will demonstrate how leveraging external information on the total effect of A on Y, which is often well-established, can enhance the estimation properties of mediation models. These methods will be illustrated through examples from two ongoing birth cohort studies on environmental exposure and maternal and child health, in which I have been involved for over a decade: LIFECODE and PROTECT.