Title:
Instrumental Variables and Mendelian Randomization with Invalid Instruments

Speaker:
Hyunseung Kang
PhD Candidate
Wharton School of Business
University of Pennsylvania

Time & Place:
Monday, February 2, 2015, 4:00-5:00pm
Room 133 SMI
(Cookies & Coffee @ 3:30 in Rm 1210 MSC)

Abstract:
Instrumental variables have been widely used for estimating the causal effect of an exposure on an outcome. Conventional estimation methods require complete knowledge about all the instruments' validity; a valid instrument must not have a direct effect on the outcome and not be related to unmeasured confounders. Often, this is impractical as highlighted by Mendelian randomization studies where genetic markers are used as instruments and complete knowledge about instruments' validity is equivalent to complete knowledge about the involved genes' functions.

In this talk, we propose a method for estimation of causal effects when this complete knowledge is absent. First, we show that the causal effects are identified and can be estimated as long as less than 50% of the instruments are invalid, without knowing which of the instruments are invalid. We also present necessary and sufficient conditions for identification when the 50% threshold is violated. Second, we introduce a fast penalized L1 estimation method, called sisVIVE, to estimate the causal effect without knowing which instruments are valid, with theoretical guarantees on its performance. Third, we propose a simple and robust method to estimate confidence intervals in this context by utilizing a unique feature of the Anderson-Rubin confidence interval (Anderson and Rubin, 1949). Finally, we demonstrate the proposed methods are demonstrated on simulated data and a real Mendelian randomization study. An R package sisVIVE is available online.