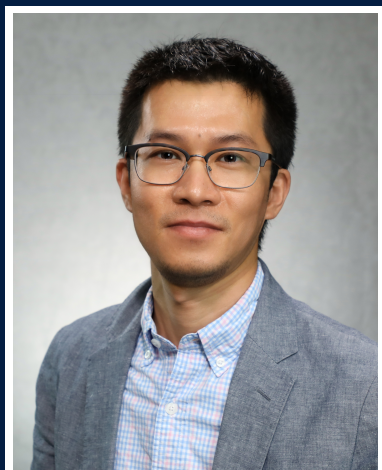


Mathematical Sciences Colloquium Series

Fall 2022



Dr. Dungang Liu
University of Cincinnati

📍 In person at Bell Hall 130 and online via Zoom

Click on this announcement to access the Zoom link

📅 Friday, November 11 ⌚ 3pm

Assessing partial association between ordinal variables: quantification, visualization, and hypothesis testing

Abstract

Partial association refers to the relationship between variables Y_1, Y_2, \dots, Y_K while adjusting for a set of covariates $X = \{X_1, \dots, X_p\}$. To assess such an association when Y_K 's are recorded on ordinal scales, a classical approach is to use partial correlation between the latent continuous variables. This so-called polychoric correlation is inadequate, as it requires multivariate normality and it only reflects a linear association. We propose a new framework for studying ordinal-ordinal partial association by using surrogate residuals (Liu and Zhang, JASA, 2018). We justify that conditional on X, Y_K and Y_1 are independent if and only if their corresponding surrogate residual variables are independent. Based on this result, we develop a general measure ϕ to quantify association strength. As opposed to polychoric correlation, ϕ does not rely on normality or models with the probit link, but instead it broadly applies to models with any link functions. It can capture a non-linear or even non-monotonic association. Moreover, the measure ϕ gives rise to a general procedure for testing the hypothesis of partial independence. Our framework also permits visualization tools, such as partial regression plots and 3-D P-P plots, to examine the association structure, which is otherwise unfeasible for ordinal data. We stress that the whole set of tools (measures, p-values, and graphics) is developed within a single unified framework, which allows a coherent inference. The analyses of the National Election Study ($K = 5$) and Big Five Personality Traits ($K = 50$) demonstrate that our framework leads to a much fuller assessment of partial association and yields deeper insights for domain researchers.

This talk is based on a published article (JASA, 2021, 116, 955-968) and a paper submitted to the Annals of Applied Statistics.

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