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School of Arts and Sciences

Department of Statistics

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Back to the Basics: Residuals and Diagnostics for Generalized Linear Models

Wednesday, November 13th, 2024
12:00 PM
110 Frelinghuysen Road, Hill Center, Room 116

Zoom Meeting: Meeting ID: 969 0606 4706
Password: 745339

https://rutgers.zoom.us/j/96906064706?pwd=ZklvbExpRVBJQ3c5dUhhYTFuR2ZrZz09

Light refreshments will be served in Hill 452, 11:20am

Abstract:

Ordinal outcomes are common in scientific research and everyday practice, and we often rely on regression models to make inference. A long-standing problem with such regression analyses is the lack of effective diagnostic tools for validating model assumptions. The difficulty arises from the fact that an ordinal variable has discrete values that are labeled with, but not, numerical values. The values merely represent ordered categories. In this talk, I introduce a framework that began with a surrogate approach to defining residuals for an ordinal outcome Y. The idea is to define a continuous variable S as a ``surrogate'' of Y and then obtain residuals based on S. For the general class of cumulative link regression models, we study the residual's theoretical and graphical properties. I will illustrate that the residual has null properties similar to those of the common residuals for continuous outcomes. Our numerical studies demonstrate that the residual has power to detect misspecification with respect to 1) mean structures; 2) link functions; 3) heteroscedasticity; 4) proportionality; and 5) mixed populations. The proposed residual also enables us to develop numeric measures for goodness-of-fit using classical distance notions. Our results suggest that compared to a previously defined residual, our residual can reveal deeper insights into model diagnostics. I will end with a uniformed framework of constructing a functional residual for generalized linear models.
This is a joint work with Dungang Liu, University of Cincinnati Lindner College of Business, and Zewei Lin at Texas State University.

Bio: Heping Zhang, Ph.D., is Susan Dwight Bliss Professor of Biostatistics at Yale School of Public Health, Professor in the Child Study Center and Professor of Obstetrics, Gynecology, and Reproductive Sciences at Yale School of Medicine (secondary), and Professor of Statistics and Data Science at Yale University (secondary). He has founded and been directing the Collaborative Center for Statistics in Science at Yale. He is a fellow of the American Statistical Association and the Institute of Mathematical Statistics (IMS). He is the founding Editor-in-Chief of Statistics and Its Interface and a former editor of the Journal of the American Statistical Association (JASA) – Applications and Case Studies. He was a recipient of 2008 Myrto Lefkopoulou Distinguished Lecture of Harvard School of Public Health, 2011 IMS Medallion Lecture and Award and 2022 Neyman Lecture and Award, 2023 Distinguished Achievement Award by the International Chinese Statistical Association, and 2023 Highly Cited Researcher by the Web of Science.