Statistics Seminar

Friday, March 8, 12:00 – 1:00 pm CT Derr 325 and Zoom

Z-Residual Diagnostic Tool for Assessing Covariate Functional Form in Proportional Hazards Models with Shared Frailty

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Abstract: Survival analysis often involves modelling hazard functions while considering frailty to account for unobserved cluster-level factors in clustered survival data. Shared frailty models have gained popularity for this purpose, but assessing covariate functional form in these models presents unique challenges. Martingale and deviance residuals are commonly used for visually assessing covariate functional form against continuous covariates. Nevertheless, their subjective nature and lack of a reference distribution make it challenging to derive numerical statistical tests from these residuals. To address these limitations, we propose "Z-residuals", a novel diagnostic tool designed for shared frailty models, leveraging the concept of randomized survival probability, and introducing both graphical and numerical tests. To implement this approach, we develop an R package to compute Z-residuals for shared frailty models. Through extensive simulation studies, we demonstrate the high power of our derived numerical test for assessing the functional form of covariates. To validate the effectiveness of our method, we apply it to a real data application concerning the modelling of survival time for acute myeloid leukemia patients. Our Z-residual diagnosis results reveal the inadequacy of log-transformation of the covariate, highlighting the limitations of other diagnostic methods for effectively assessing covariate functional form in shared frailty models.

Bio: Dr. Longhai Li is a professor at the University of Saskatchewan, located in Saskatoon, SK, Canada. He received his Ph.D. degree in statistics from the University of Toronto, where his supervisor was Prof. Radford Neal. Before that, Dr. Li received B.Sc honours in statistics from the University of Science and Technology of China. He is currently a member of the NSERC Individual Discovery Grant Evaluation Group 1508 (Mathematics and Statistics) committee (term: 2022-2025). His research activities focus on developing and applying statistical machine-learning methods for high-throughput data and complex-structured data. His research has been funded by NSERC, CFI, CFREF, and MITACS. His research papers have appeared in high-impact journals, such as Journal of American Statistical Association, Bayesian Analysis, Statistics in Medicine, Statistics and Computing, Scientific Reports, and BMC Bioinformatics. A predictive model comparison method called integrated importance sampling introduced in this paper was included in a textbook by Peter Congdon: Bayesian Hierarchical Models: With Applications Using R.

