Kurume University

Biostatistics Seminar

In-person & Online

Modelling for time-to-event data with random effects

ランダム効果を用いたイベント時間データのモデリング

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When: Tuesday, February 27, 2024 18:00-19:30

Where: Computer room, Biostatistics Center, Kurume University

久留米大学 バイオ統計センター コンピュータ室（医学部B棟7階）

Abstract

Survival models with random effects (e.g. frailty models) for various types of time-to-event data including clustered or correlated survival data have been widely studied in areas of biomedicine (e.g. multi-center clinical trial or genetic study of twin/family), engineering (e.g. reliability) or econometrics (e.g. insurance), etc. Correlation and/or heterogeneity caused by clusters can be modelled by introducing unobserved frailty components (random effects) into the hazard function; the correlation can also be modelled via a copula function (Emura & Chen, 2018). For the purpose, semi-parametric frailty models, generalizations of Cox's (1972) PH models, have now been widely used. However, current likelihood-based inferences may encounter difficulties caused by (i) intractable integration required to obtain marginal likelihood (ii) incompleteness of data due to censoring and/or truncation and (iii) nuisance parameter problems due to non-parametric baseline hazard.

In this talk, we introduce both the basic concepts of random-effect models and how to model the survival data via random effects (Ha et al., 2017, 2021), and present likelihood-based inference methods (e.g. marginal likelihood and h-likelihood by Lee & Nelder 1996) which overcome the challenging problems above. We also introduce how the likelihood frameworks are extended to the advanced survival analyses; for example, (i) interval estimation of individual random effects, (ii) model selection, (iii) penalized variable selection, (iv) competing risks or multi-state (e.g. semi-competing risks) modelling, and (v) joint models for different outcomes such as longitudinal and time-to-event data. The proposed methods are demonstrated with simulation study and practical example data. Further extensions to deep learning survival models through the random effect are finally presented.

Key words: Competing risks, frailty models, H-likelihood, marginal likelihood, Random effects, Joint models

References

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