Recent Nonparametric Advances in Jump Process Estimation for Insurance

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Abstract

This work presents recent advances in nonparametric inference for finite-state jump processes in both Markov and non-Markov settings, with a focus on insurance applications. We develop flexible methods to estimate state occupation probabilities and transition mechanisms under minimal assumptions. We condition on internal information (such as current state, duration, and landmark history) together with external covariates, to obtain sharper individualized and subgroup-specific predictions relevant for life insurance modeling and valuation. To handle complex or high-dimensional data, we introduce adaptive tree- and forest-based learning strategies for transition prediction. Finally, we discuss procedures for transition-rate estimation and their asymptotic properties. The talk is based on the following papers: [1, 2, 3], and associated software packages.

Keywords: jump processes; multistate models; nonparametric inference; insurance mathematics; transition prediction.

References

[1] Bladt, M., and Furrer, C. (2025), "Conditional Aalen–Johansen Estimation." *Scandinavian Journal of Statistics*, **52**(2), 873–902.

[2] Bladt, M., and Lemvig, R. F. (2026), "Random Jump Forests." Preprint.

[3] Bladt, M., and Lemvig, R. F. (2026), "Local Asymptotic Theory for Adaptive Estimation of Transition Rates of Jump Processes." Preprint.