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Interval-Censored Survival Analysis with Continuous Covariates

This work addresses the problem of estimating the conditional survival function when event times are subject to interval censoring and continuous covariates are present. Such data structures arise frequently in real-world operational contexts, including maintenance planning, healthcare monitoring, and quality control systems, where events are only observed within time intervals due to periodic inspections. We propose two nonparametric methodologies based on kernel smoothing and iterative Expectation-Maximization (EM) algorithms. These approaches generalize Turnbull's estimator to the conditional setting and enable flexible estimation without relying on strong parametric assumptions. From an operational research perspective, the ability to accurately model survival probabilities as a function of continuous covariates supports more informed decision-making under uncertainty.

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