

ACMS Statistics Seminar



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154 Hurley Hall
3:30 PM – 4:30 PM

Optimal Cox Regression Under Federated Differential Privacy: Coefficients and Cumulative Hazards

We study two foundational problems in distributed survival analysis: estimating Cox regression coefficients and cumulative hazard functions, under federated differential privacy constraints, allowing for heterogeneous per-server sample sizes and privacy budgets. To quantify the fundamental cost of privacy, we derive minimax lower bounds along with matching (up to poly-logarithmic factors) upper bounds. In particular, to estimate the cumulative hazard function, we design a private tree-based algorithm for nonparametric integral estimation. Our results reveal server-level phase transitions between the private and non-private rates, as well as the reduced estimation accuracy from imposing privacy constraints on distributed subsets of data. To address scenarios with partially public information, we also consider a relaxed differential privacy framework and provide a corresponding minimax analysis. To our knowledge, this is the first treatment of partially public data in survival analysis, and it establishes a no-gain in accuracy phenomenon. Finally, we conduct extensive numerical experiments, with an accompanying R package `FDPCox`, validating our theoretical findings. These experiments also include a fully-interactive algorithm with tighter privacy composition, which demonstrates improved estimation accuracy.

The Department of Applied and Computational
Mathematics and Statistics
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