

Dynamical Survival Analysis for Epidemic Modeling under Partial Observability: A Case Study of COVID-19 in Kenya.

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Abstract:

We apply the Dynamical Survival Analysis (DSA) framework to derive an individual-level epidemic model suitable for analyzing partially observed data in both longitudinal and cross-sectional formats. Within this framework, survival and hazard functions are constructed from available random samples of infection and recovery times, enabling principled, likelihood-based inference. To demonstrate the utility of this approach, we analyze the COVID-19 outbreak in Kenya from 2020 to 2022, focusing on three of the five observed pandemic waves—the first, second, and the most severe, fifth wave. The model is estimated using the Hamiltonian Monte Carlo method implemented in Stan. Results indicate a good fit to the observed epidemic curves and reveal substantial variation in response times for patient identification and isolation across different waves. These findings underscore the flexibility of DSA as a novel inference tool for epidemic modeling under partial observability.