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IMPRECISE SURVIVAL SIGNATURE COMPUTATION THROUGH INTERVAL PREDICTOR MODELS

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In recent years, the survival signature [1] has seen promising applications for the reliability analysis of critical infrastructures. It outperforms traditional techniques by allowing for complex modelling of dependencies, common causes of failures and imprecision. However, as an inherently combinatorial method, the survival signature suffers greatly from the curse of dimensionality. Computation for very large systems, as needed for critical infrastructures, is mostly infeasible.

New advancements have applied Monte Carlo simulation to approximate the signature instead of performing a full evaluation [2]. This allows for significantly larger systems to be considered. Unfortunately, these approaches will also quickly reach their limits with growing network size and complexity.

In this work, instead of approximating the full survival signature, we will strategically select key values of the signature to accurately approximate. These entries are then used to build an Interval Predictor Model (IPM) [3] for the prediction of the remaining unknown values. In contrast to standard models, IPMs return an interval bounding the survival signature entry. The resulting imprecise survival signature is then fed into the reliability analysis, yielding upper and lower bounds on the reliability of the system.

Keywords: Survival signature, reliability analysis, interval predictor models, imprecision, Monte Carlo simulation

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