THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

PhD Dissertation Proposal Presentation

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"Scalable gradient-based variational inference for flexible point process modeling of spatiotemporal data"

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Abstract

We propose a series of related point process modeling approaches tailored to three different real-world applications on (spatio)temporal data. The first application centers on customer transaction data for which we build a temporal renewal process model to predict future customer transactions and infer interpretable behavioral latent variables. We develop a strategy for parameter estimation based on amortized variational inference and gradient-based stochastic optimization which is highly scalable and enables the flexible incorporation of covariates. Next, we build a spatiotemporal point process model. The model is inspired by international relations data that contain a series of dyadic events over time based on news articles. The data can be understood as taking the form of a tensor, whose cells each record a different point process. The model we propose then assumes the rate functions across cells share structure, drawing upon themes from tensor factorization. We develop a gradient-based variational inference algorithm based on the Neyman-Scott process to infer the latent structures. Lastly, we extend this model to apply on monkey brain activity data tensor over different neurons, time and experiments.

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