

# Space and circular time log Gaussian Cox processes with application to crime event data

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We view the locations and times of a collection of crime events as a space-time point pattern. So, with either a nonhomogeneous Poisson process or with a more general Cox process, we need to specify a space-time intensity. For the latter, we need a *random* intensity which we model as a realization of a spatio-temporal log Gaussian process. In fact, we view time as circular, necessitating valid separable and nonseparable covariance functions over a bounded spatial region crossed with circular time. In addition, crimes are classified by crime type. Furthermore, each crime event is marked by day of the year which we convert to day of the week.

We present models to accommodate such data. Then, we extend the modeling to include the marks. Our specifications naturally take the form of hierarchical models which we fit within a Bayesian framework. In this regard, we consider model comparison between the nonhomogeneous Poisson process and the log Gaussian Cox process. We also compare separable vs. nonseparable covariance specifications.

Our motivating dataset is a collection of crime events for the city of San Francisco during the year 2012. Again, we have location, hour, day of the year, and crime type for each event. We investigate a rich range of models to enhance our understanding of the set of incidences.