

Statistics and Data Science Seminar

Flexible spatio-temporal Hawkes process models for earthquake occurrences

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Abstract: Hawkes process is one of the most commonly used models for investigating the self-exciting nature of earthquake occurrences. However, seismicity patterns have complicated characteristics due to heterogeneous geology and stresses, for which existing methods with Hawkes process cannot fully capture. This study introduces novel nonparametric Hawkes process models that are flexible in three distinct ways. First, we incorporate the spatial inhomogeneity of the self-excitation earthquake productivity. Second, we consider the anisotropy in aftershock occurrences. Third, we reflect the space-time interactions between aftershocks with a non-separable spatio-temporal triggering structure. For model estimation, we extend the model-independent stochastic declustering (MISD) algorithm and suggest substituting its histogram-based estimators with kernel methods. We demonstrate the utility of the proposed methods by applying them to the seismicity data in regions with active seismic activities.

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