Tapered composite likelihood for spatial max-stable models

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Spatial extreme value analysis is useful to environmental studies, in which extreme value phenomena are of interest and meaningful spatial patterns can be discerned. Max-stable process models are able to describe such phenomena. This class of models is asymptotically justified to characterize the spatial dependence among extremes. However, likelihood inference is challenging for such models because their corresponding joint likelihood is unavailable and only bivariate or trivariate distributions are known. In this talk, we propose a tapered composite likelihood approach by utilizing lower dimensional marginal likelihoods for inference on parameters of various max-stable process models. We consider a weighting strategy based on a taper range to exclude distant pairs or triples. The optimal taper range is selected to maximize various measures of the Godambe information associated with the tapered composite likelihood function. This method substantially reduces the computational cost and improves the efficiency over equally weighted composite likelihood estimators. We illustrate its utility with simulation experiments and an analysis of rainfall data in Switzerland.

Keywords: Composite likelihood; Generalized extreme-value distribution; Max-stable process; Statistics of extremes