Bias correction and bootstrap methods for a spatial sampling scheme

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Motivated by sampling problems in forestry and related fields, we suggest a spatial sampling scheme for estimating the intensity of a point process. The technique is related to the ‘wandering quarter’ method. In applications where the cost of identifying random points is high relative to the cost of taking measurements, for example when identification involves travelling within a large region, our approach has significant advantages over more traditional approaches such as T-square sampling. When the point process is Poisson we suggest a simple bias correction for a ‘naive’ estimator of intensity, and also discuss a more complex estimator based on maximum likelihood. A technique for pivoting, founded on a fourth-root transformation, is proposed and shown to yield second-order accuracy when applied to construct bootstrap confidence intervals for intensity. Bootstrap methods for correcting edge effects and for addressing non-Poisson point-process models are also suggested.

Keywords: boundary effect; confidence interval; edge effect; forestry; intensity estimation; pivotal statistic; Poisson process; T-square sampling; wandering quarter sampling