abstract

One of the main themes of this thesis is the application to spatial data of modern semi- and nonparametric methods. Another, closely related theme is maximum likelihood estimation from spatial data. Maximum likelihood estimation is not common practice in spatial statistics. The method of moments and minimum contrast methods are traditionally more often applied.

The thesis is organized around three problems. 1. Laslett's line segment problem. We observe the intersection of a random set and a collection of scattered linesegments of random length. We find a non-parametric maximum likelihood estimator for the length distribution of the line segments. We prove consistency of our estimator. 2. Estimation of the chord length distribution. This problem is a variation of Laslett's problem. We estimate the distribution of the length of a typical chord of a random set. The chord length distibution is closely related to the more familiar linear contact distribution. 3. Estimation for the Boolean model of discs. Here we observe the union of randomly scattered discs. We present a method to approximate the maximum likelihood estimator (MLE) of the mean number of disc-centers per unit area.
Direct computation of the MLE is impossible because occlusion prevents us from observing the presence of a disc's center when the disc itself is completely covered by other discs. Our way around this problem involves an algorithm to sample from random point processes conditioned to have a given property.

The thesis is selfcontained in that theory and tools are described in an introductory chapter. In addition, this chapter features some new theory on the consistency of the maximum likelihood estimator and a modification of the stochastic version of the EM algorithm.