COMPUTER EXERCISE 9
EXPLORATORY TOOLS FOR POINT PROCESSES
SPATIAL STATISTICS AND IMAGE ANALYSIS TMS016

1 Introduction

The purpose of this computer exercise is to give an introduction to exploratory tools for point processes. When in doubt about how to use a specific function in R, use the help() function or the ? operator to get more information.

2 Exploratory analysis of point processes

Install the ***spatstat*** library in R and load the library with **library(spatstat)**

The *swedishpines* dataset within *spatstat* gives the locations of pine saplings in a Swedish forest.

- Plot the swedishpines data with plot(swedishpines).
- Use the Window() function to get the dimensions of the study region.
- Use the intensity() function to obtain an estimate of the average intensity of trees (number of trees per unit area).

  Does this point pattern seem random to you? Let's compare it with realisations from a homogeneous Poisson processes. with intensity p.

- The command **rpoispp(100)** generates realisations of the Poisson point process with intensity p= 100 in the unit square. Repeat the command **plot(rpoispp(100))** several times to build your intuition about the appearance of a completely random pattern of points.
- Now plot a Poisson point process with intensities 10, 20 and 200. How many points are plotted each time and how is that related to the intensity function?

  As can be seen, the points (unsurprisingly) are much more random that want one might think. “Randomly” drawing points on a piece of paper one would usually draw a point pattern that is more regular (i.e. the points are repulsive).

3 Summary functions and simulation envelopes

Summary functions are used to study the dependence between the points

- Calculate the estimate of the K-function for the swedishpines using ***Kest.*** Plot the estimate for the K function against r. Create and plot pointwise envelopes from 39 simulation of CSR using the ***envelope*** function.

- Calculate the estimate of the L-function and plot it against r using ***Lest***. Create pointwise envelopes from 39 simulations of CSR. What are your conclusions from these plots about the interpoint interaction in the data?

- Repeat the previous two tasks for a Poisson point process with intensity p=100. What are your conclusions?

- Now let's simulate and plot the points from a Neyman-Scott point process namely the Thomas point process, using rThomas(kappa= 10, scale= 0.05, mu= 8)). Repeat that a few times, and interpret the results. Experiment with the arguments of rThomas to obtain point patterns that

  1) Consist of a few, well-separated, very tight clusters of points
  2) Look similar to realisations of a Poisson point process

- Plot the K function with simulation envelopes for a Thomas point process. What are your conclusions?