Lab 6: Correlation

This session is concerned with summary statistics for interpoint correlation (i.e. dependence between points). The lecturer's R script is available here (right click and save).

Exercise 1

The `swedishpines` dataset was recorded in a study plot in a large forest. We shall assume the pattern is stationary.

1. Calculate the estimate of the K-function using `Kest`.
2. Plot the estimate of $K(r)$ against r
3. Plot the estimate of $K(r) - \pi r^2$ against r.
4. Calculate the estimate of the L-function and plot it against r.
5. Plot the estimate of $L(r) - r$ against r.
6. Calculate and plot an estimate of the pair correlation function using `pcf`.
7. Draw tentative conclusions from these plots about interpoint interaction in the data.

Exercise 2

1. Generate Fry Plots for the Swedish Pines data using the two commands

```r
fryplot(swedishpines)
fryplot(swedishpines, width=50)
```

2. What can you interpret from these plots?

Exercise 3

The `japanesepines` dataset is believed to exhibit spatial inhomogeneity. The question is whether, after allowing for inhomogeneity, there is still evidence of interpoint interaction. We will use the inhomogeneous K-function.

1. Compute the inhomogeneous K function using the default estimate of intensity (a leave-one-out kernel smoother) with heavy smoothing:

```r
KiS <- Kinhom(japanesepines, sigma=0.1)
plot(KiS)
```

2. Fit a parametric trend to the data, and use this to compute the inhomogeneous K function:

```r
fit <- ppm(japanesepines ~ polynom(x,y,2))
lambda <- predict(fit, type="trend")
KiP <- Kinhom(japanesepines, lambda)
plot(KiP)
```

3. Plot corresponding estimates of the inhomogeneous L function, using either `Linhom` or

   ```
   plot(KiS, sqrt(./pi) ~ r)
   ```

   and similarly for `KiP`.

4. Draw tentative conclusions about interpoint interaction.

Exercise 4

To understand the difficulties with the K-function when the point pattern is not spatially homogeneous, try the following experiment.

1. Generate a simulated realisation of an inhomogeneous Poisson process, e.g.

   ```
   X <- rpoispp(function(x,y){ 200 * exp(-3 * x) })
   ```

2. Plot the K-function or L-function. It will most likely appear to show evidence of clustering.

Exercise 5

The cell process (`rcell`) has the same theoretical K-function as the uniform Poisson process.

1. Read the help file
2. Generate a simulated realisation of the cell process with a 10x10 grid of cells and plot it.
3. Plot the K or L-function for this pattern, and determine whether it is distinguishable from a Poisson process.