

HW 4 - Point Pattern Analysis

Due Tuesday, September 24, 2024

Point-pattern Analysis:

Assignment: This assignment involves analyses of both simulated and real point-pattern datasets. As in previous coding assignments, you will be graded on your answers and your ability to produce clean, well commented R code that performs the tasks listed below. If you used AI code generating tools, please indicate this in your submission.

Write R scripts to complete the following tasks and answer each question.

1. Simulate three types of point-patterns: (i) Complete Spatial Randomness (CSR), (ii) clustered, and (iii) segregated. Convert each to a `ppp` object and plot your simulated point-patterns (be sure to add an appropriate title so I know which is which).

For the point-pattern with CSR: what is the value of lambda and what is the definition of this parameter?

2. Analyze each point pattern using G-, K- and F-tests and assess the significance of each test using null models and a Monte Carlo approach. Provide a brief interpretation of each of your simulated patterns as informed by the G-, K- and F-tests.
3. Analyze the forest tree point pattern dataset from Harvard Forest
 - Load `hf253-04-stems-2014.csv`
 - Subset the data to (i) spatial extents of `gx` between `c(600, 700)` and `gy` between `c(400, 500)` and (ii) retain only the four most abundant species in the original dataset.
 - Create a marked multivariate point pattern from the subsetted data, assigning the species code as a qualitative mark. Note that you will need to convert the species code to a factor as follows: `factor(myData$speciesColumn, levels="vector of species")`.
 - Use tools at your disposal, including plotting and statistical tests, to propose an interpretation of the possible role of biotic processes, including intra- and interspecific interactions between the four tree species, in generating the spatial pattern. For this latter task rely on the G-Function for statistical analysis - as well as any others you found useful.

Hints

- See `rThomas` or `rMatClust` for functions to generate a clustered point-pattern.
- There are different ways to produce a segregated point-pattern. One might be to create a grid of equally spaced points and then use the `jitter` function on the coordinates to add a bit of noise.
- See `?ppp` and/or `?as.ppp` to coerce data frames to a `ppp` object as needed for the G-, K- and F-tests and the analyses of the Harvard Forest data.