

Homework 4

Stat 597a: Spatial Models

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Due Nov 14, 2017

Problem 1a:

Load the data and create two ppp objects from it, one for affected and one for unaffected individuals. A key question is: what is the window? It is not available for this data. For now, take the window to be the same for each ppp object: use a rectangular region based on the range of x and y for both datasets. (Have a look at the help file for `owin`.)

Problem 1b:

For each dataset separately, create Monte Carlo simulation envelopes for the F and G functions and plot them. Clearly label your plots and turn in a few sentences describing any choices you made in creating the envelopes. Is their evidence against CSR in this dataset? If so, what type of violation is suggested?

Problem 1c:

Now let's consider a more likely window: that these graves represent a complete excavation of the area in which they appear, and that area is irregularly shaped. Since we don't know what it is, we can choose a rough polygon outline to surround the points. You can create such an outline by plotting the locations and using the `locator` function; again, see `help(owin)` for the details of how to specify a polygon boundary. Create two new ppp objects with this new window.

Problem 1d:

Repeat step (b) for the new datasets. What changes? Can you explain the reason for this, based on the form of the test statistics?

Problem 2:

Simulate four datasets on the unit square, from a homogeneous Poisson process with a rate λ of your choosing. For each one, fit a kernel estimate of the intensity function and plot it with the points overlaid. What do you conclude about interpreting the results of this estimator? In other words, what can go wrong if we fit a spatial point process model without checking for CSR first?

Problem 3:

Read through sections 15.2 and 15.3 of the notes by Adrian Baddeley about fitting point process models in R with the `spatstat` package (you can find it on Canvas). In 15.3, follow along

with the R code example for the bei dataset. In particular, find the MLEs for inhomogeneous models with intensity functions:

$$\text{Model 1: } = \exp\{\beta_0 + \beta_1 Z(x)\}$$

$$\text{Model 2: } = \beta Z(x)$$

Plot a kernel density estimate of $\lambda(x)$, ignoring covariates, as well as the fitted intensities under the two models. Put them all on the same color scale, and include a sentence or two comparing them. Note: the data for this problem are available from the spatstat package.