

2020 STAT 555

Statistical Methods for Spatial Epidemiology

Assignment 4

To be submitted to the canvas site by the start of class on Monday 9th March, 2020.

Hand in your R code as an appendix.

1. Assessment of Clustering for the Ohio lung cancer data. First fit the model

$$Y_i \sim \text{Poisson}(E_i \exp(\beta_0)),$$

$i = 1, \dots, n$ and extract the residuals.

- (a) Examine the level of clustering of the residuals using Moran's statistic.
- (b) Examine the level of clustering of the residuals using Geary's statistic.

Is there evidence of clustering for these data?

2. Cluster Detection for the Ohio lung cancer data.

- (a) Perform cluster detection on these data using the SatScan method of Kulldorff. Use a significance level of 0.05, and a maximum population size of 20%.

3. In the `geoR` library there are data `ca20` which we will explore/model using various geo-statistical techniques.

- (a) Examine cloud and binned semi-variograms and comment on the evidence for spatial dependence.
- (b) Using the semi-variogram examine Monte Carlo intervals for no spatial dependence.
- (c) Fit an exponential variogram model to these data, using least squares, maximum likelihood and restricted maximum likelihood.
- (d) Carry out kriging and examine the resultant surface, both in terms of the mean and the standard deviation.