8102 Lab 5 Yue Lin

Assignment I

The bar plot linking the number of neighbors and the number of cases is presented in Figure 1. The census tracts in Columbus are well-connected, because there are no census tracts without any neighbors, and most of the census tracts have three to six neighbors.

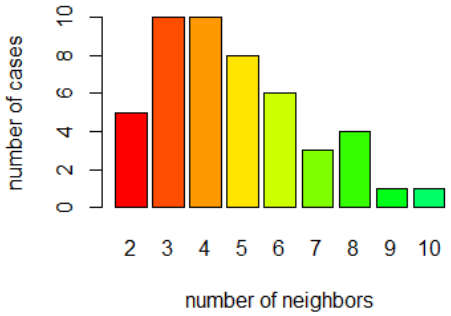

Figure 1. The bar plot linking the number of neighbors and the number of cases.

Assignment II

The plot for k nearest neighbors is presented in Figure 2. To interpret the plots, we can examine how many links are reaching out from one census tract to another.

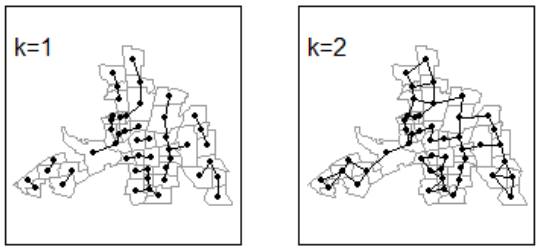

Figure 2. The plot for k nearest neighbors (k = 1, 2).

Assignment III

The plot for distance-based neighbors is presented in Figure 3. To interpret the plots, we can examine the distance between two census tracts when there is a link between them.

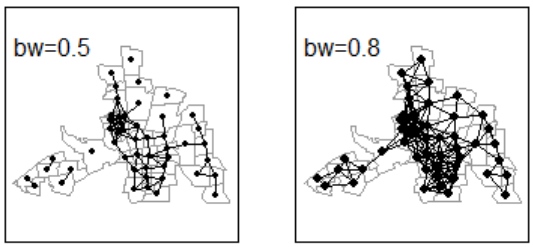

Figure 3. The plot for distance-based neighbors (band width = 0.5, 0.8).

Assignment IV

The Moran's I scatterplot is presented in Figure 4. Based on the Moran's I value (0.637), the crime rate shows spatial autocorrelation.

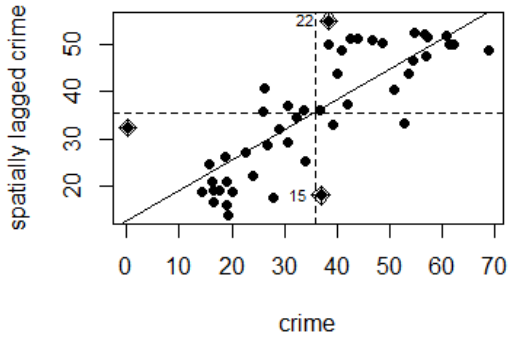

Figure 4. The Moran's I scatterplot.

Assignment V

The LISA cluster map is presented in Figure 5. The high-high clusters are located in the center of Columbus, while the low-low clusters are in the southeast and the southwest.

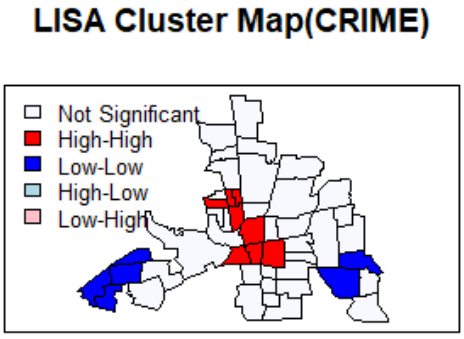

Figure 5. The LISA cluster map.

Assignment VI

The G_i and G_i^* cluster maps are presented in Figure 6. Similar to the LISA map, the high-high clusters are located in the center of Columbus, while the low-low clusters are in the southeast and the southwest. Twos small differences are that the high-high clusters in both the G_i and G_i^* cluster maps cover a larger area than those in the LISA map, and the low-low clusters in the G_i^* cluster map cover a larger area than those in the LISA map.

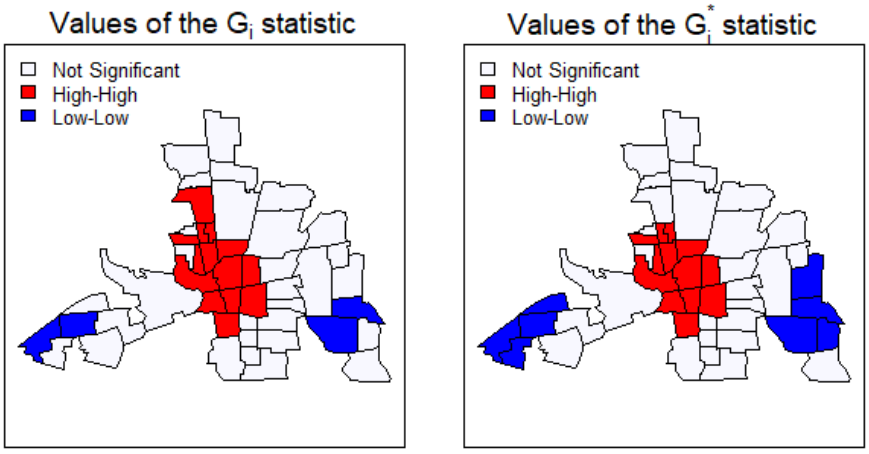

Figure 6. The G_i and G_i* cluster maps.

Assignment VII

The residual plot is presented in Figure 7. The map of residuals indicates moderate spatial dependence and thus suggests dependent errors. The results of the Moran's I test indicate a significant Moran's I of 0.3131, which reject the hypothesis of independence in the residuals. The Moran's I and p-value of the residuals are both lower than those of the variable CRIME itself.

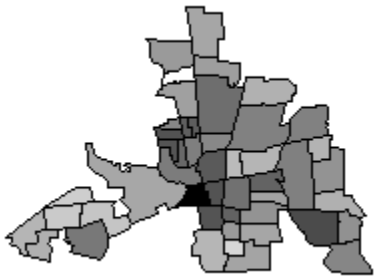

Figure 7. The residual plot.

Assignment VIII

The fitted results for SAR and CAR models are presented in Figure 8 and Figure 9. In comparison with the CAR model, the SAR model reports a lower value of AIC, which suggests a higher quality of the model.

```
Call: spautolm(formula = CRIME ~ INC + HOVAL, data = ColData, listw = col.listw,     family = "SAR")

Residuals:
      Min        1Q    Median        3Q       Max
-14.89326  -5.35509  -0.91684   6.41438  23.95142

Coefficients:
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) 57.813077   5.065341 11.4135 < 2.2e-16
INC         -1.183000   0.267770 -4.4180 9.963e-06
HOVAL       -0.134633   0.076312 -1.7643   0.07769

Lambda: 0.71628 LR test value: 16.308 p-value: 5.3834e-05
Numerical Hessian standard error of lambda: 0.11077

Log likelihood: -168.9448
ML residual variance (sigma squared): 56.949, (sigma: 7.5465)
Number of observations: 48
Number of parameters estimated: 5
AIC: 347.89
```

Figure 8. The fitted results for SAR model.

```
Call: spautolm(formula = CRIME ~ INC + HOVAL, data = ColData, listw = col.listw.sym,
    family = "CAR")

Residuals:
       Min         1Q     Median         3Q        Max
-14.419609  -4.577687   0.023987   4.907780  23.572021

Coefficients:
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) 58.046959   5.071918 11.4448 < 2.2e-16
INC         -1.256222   0.279372 -4.4966 6.905e-06
HOVAL       -0.143153   0.078354 -1.8270    0.0677

Lambda: 0.94815 LR test value: 15.583 p-value: 7.8978e-05
Numerical Hessian standard error of lambda: 0.063242

Log likelihood: -169.3076
ML residual variance (sigma squared): 55.316, (sigma: 7.4375)
Number of observations: 48
Number of parameters estimated: 5
AIC: 348.62
```

Figure 9. The fitted results for CAR model.