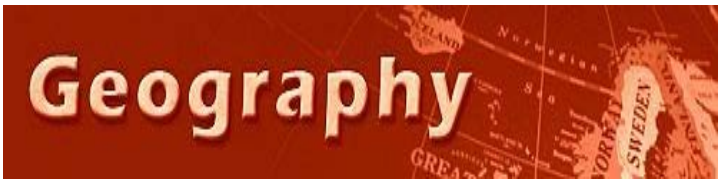


Steve Graves
Forensic Geography
Lab: Hot Spot Analysis 1
Nearest Neighbor /Clustering
(adapted from ESRI)

Background

Hot spot analysis is a commonly used tool in crime analysis and the goal of this technique is to identify clusters of criminal activity on a map. This would allow authorities to better allocate resources and protect potential victims of crime.

The null hypothesis, when you are testing for clustering in a map of point locations is a random distribution. If crime is spread randomly across a region, then resources should be deployed randomly. If on the other hand, clusters appear, then resources can be purposefully deployed. The first step in determining how to deploy resources is to determine if indeed clustering is occurring.

Skills

You will demonstrate an understanding of the principles behind nearest neighbor analysis as well as how to perform the statistical procedure in ArcMap10.

1. You will demonstrate the use the "collect" tool in ArcMap GIS.
2. You will demonstrate the use of the Nearest Neighbor tool in ArcMap in GIS.
3. You will correctly interpret the statistical output of the Nearest Neighbor tool.
4. You will correctly identify the reasons for using Nearest Neighbor analysis and how it works.

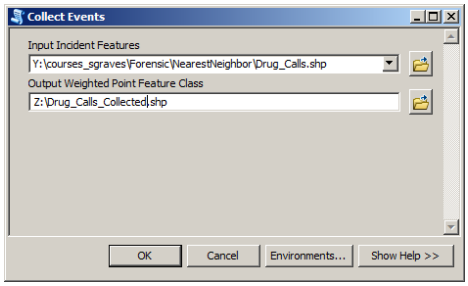
Your Task: Measure the Level of Clustering in a Point Map of Drug Busts in Pittsburgh.

Step 1: Open the HotSpot 1 map document

1. In the Forensic course folder on the Y: drive, open the ArcMap document (project file) HotSpot7-1.mxd…it's inside the ESRI folder (Y:/courses/courses_sgraves/Forensic/NearestNeighbor/Pittsburgh_NN)
2. Note that this map shows 911 drug calls for summer 2008 (June through August) in Pittsburgh, Pennsylvania. You can see what appears to be quite a bit of spatial clustering in several parts of the city. You can also see the city borders, police beats and census tracts, plus the three rivers.

Step 2: Create a graduated-size point map.

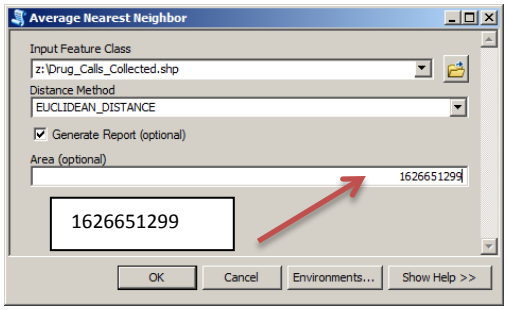
3. To make clustering look even more apparent on the map, you can start by counting the number of drug calls at each address, and then use size-graduated point markers to symbolize drug calls. The larger the point symbol, the more drug calls at the same location. Many drug-dealing locations have multiple calls for service.
4. On the Standard toolbar, click ArcToolbox.
5. In the ArcToolbox window, expand the Spatial Statistics toolbox and then the Utilities toolset. Then double-click the Collect Events tool.
6. For Input Incident Features, select Drug Calls (remember NOT to use the drop down menu option! See image right)
7. The file named Drug Calls can be found at Y:\courses_sgraves\Forensic\NearestNeighbor\Drug_Calls.shp
8. For Output Weighted Point Feature Class, save this output file to your Z drive and name it "Drug_calls_collected.shp".
9. Click OK> Close. Leave the ArcToolbox window open.
10. A new layer will appear in your map document and table of contents.
11. In the table of contents, right-click your new Drug_calls_collected layer, select Properties, and click the Symbology tab. Then click the Classify button and select Quantile for Classification Method. Click OK.

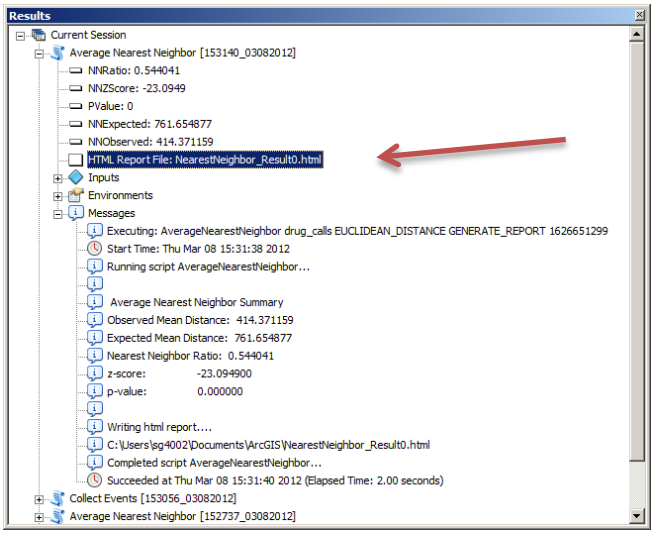


12. Now, with size-graduated point markers, it is even more evident that there is a lot of clustering. Try zooming in on a few police sectors that have clusters for a closer look.

Test for Spatial Clustering

13. In the ArcToolbox, in the Spatial Statistics toolbox, expand the Analyzing Patterns toolset and double-click the Average Nearest Neighbor tool. The tool needs the total area of the study region (Pittsburgh). If you were to open the Pittsburgh layer's attribute table, you would see that its area is 1,626,651,299 sq ft. (All the parameters in this lab are set to feet; look in the data frame properties to see the projection, etc.)
14. Enter selections as shown in the figure at right.
15. Click OK.
16. Click in the message window that appears after the tool runs and see what's inside. You should -+get a warning message that there were bad records that the tool ignored, which is fine. These are simply records that did not get geocoded from police records to points on the map, because they had invalid street addresses or the street centerline map was incomplete or inaccurate. Scroll down in the Results window where you'll also get the output of the test.
17. On the top tool bar, click on Geoprocessing and select from the drop down menu "Results". This will bring up the results of your most recent geoprocessing efforts. The top most result is the result you just got from running this Average Nearest Neighbor Test.
18. Click on the HTML report link in the results window (see right). That will cause a webpage to open.
19. Grab a screen capture of the this page, making sure you get the normal curve diagram and the statistical output. Paste your screen capture into a word document for 50 points of the credit on this assignment.
20. The other 50 points will be earned for well-crafted answers to the questions below, which you will copy and paste into the Word document and send to your instructor as an attachment.
21. Name the file 497_lab6_yourname.doc
22. The answers you provide should explain to the reader, who you assume knows little of statistics, information regarding the following points: (and you are even provided with sentence stems to help you get started.





1. Why did you run this test?
2. How does this test measure what you say it measures?
3. What did you find about the pattern of drug calls to the Pittsburgh Police Department?
4. What evidence or statistic in the test results explains the pattern visible on the map?
5. How confident are you in your results? Is this due to a random chance? Would it change next year?
   - Check the "help" in ArcMap 10 and search "average nearest neighbor" if you can't remember what you learned in class.

Sentence Stems to get you started.

- This test was conducted in order to determine if…
- This test compares…
- According to the results of the Average Nearest Neighbor test, the pattern of calls to the Police Department for drug related incidents was _____.
- The figure in the results window that is most important is the _____ and this is well below…..
- There is little chance that this result is…….(discuss the p value)