GST 102: Spatial Analysis Lab Series

Lab 8: Raster Data Analysis – Density Surfaces

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Contents

Introduction

This lab is part of a series of lab exercises designed through a grant initiative by the National Information, Security & Geospatial Technologies Consortium (NISGTC), funded by the United States Department of Labor in partnership with the Department of Education under the Trade Adjustment Assistance Community College and Career Training Grant Program (TAACCCT).

In this lab, the students will learn about density analysis on points and lines. Density analysis can be used to show areas where there is a high occurrence of data. The lab will also look at converting between vector and raster data.

Your instructor may require that you provide screen captures and/or exported files. Please check with your instructor for the requirements specific to your class.

This lab includes the following tasks:

1. Point Density Analysis
2. Using the Line Density Tool
3. Using the Kernel Density Tool
4. Vector to Raster Conversion
5. Raster to Vector Conversion

Objective: Learn Density Analysis Methods

The objective of this lab is to learn about the different kinds of density analysis methods and look at the conversion between the raster and vector data models.

Lab Settings

Required Virtual Machines and Applications

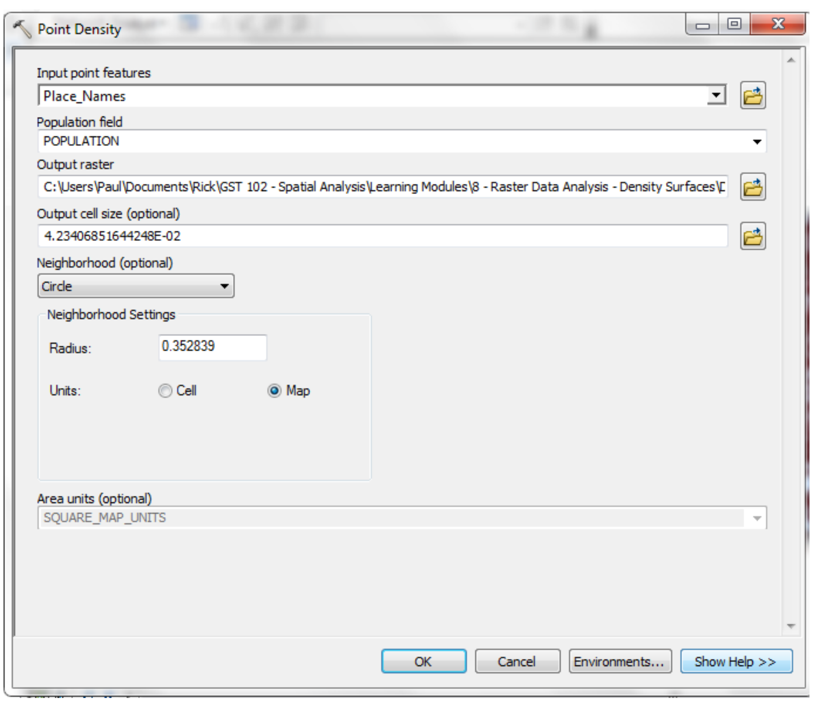
Windows Machine User Account	Train
Windows Machine User Password	Train1ng$

1 Point Density Analysis

Point Density Analysis can be used to show where there is a concentration of data points. Using point data, we can see where the points are concentrated in an area.

The area around the point is known as a *neighborhood*. In the Point Density tool, we can define several neighborhoods, each having different results. We can define a circular neighborhood (the default), rectangular or wedge neighborhoods. The annulus allows us to define two separate circles with two different distances. When conducting irregular or weighted analyses you will require the use of a kernel file that specifies weights or an area. For this lab, we will be using the circle as it fulfills our requirements.

1. Log into the computer, using the information provided in the Lab Settings section.
2. Copy the data folder for this lab from its location on the lab machine into your *C:\GST 102 folder*
3. Click **Start->All Programs->ArcGIS->ArcMap 10.1**. ArcMap will open. Create a blank map.
4. Be sure you are connected to your GST102 folder you created on the C: drive.
5. Add the *Texas.shp* and the *Place_Names*.shp from your Lab 8 folder to ArcMap. Ignore the GCS warning if one shows up.
6. **Open** the search bar and search for `Point Density`. Or, you can open ArcToolbox and click on **Spatial Analyst->Density->Point Density.**
7. **Open** the tool and as the Input point features, choose **Place_Names**. In the Population field, choose POPULATION. This will count the population of each point and calculate the density based on that field adding all those values together. Call the output `Pt_pop_den`. Leave the output cell size at its default. Leave the rest the fields at their default values and click **OK.**

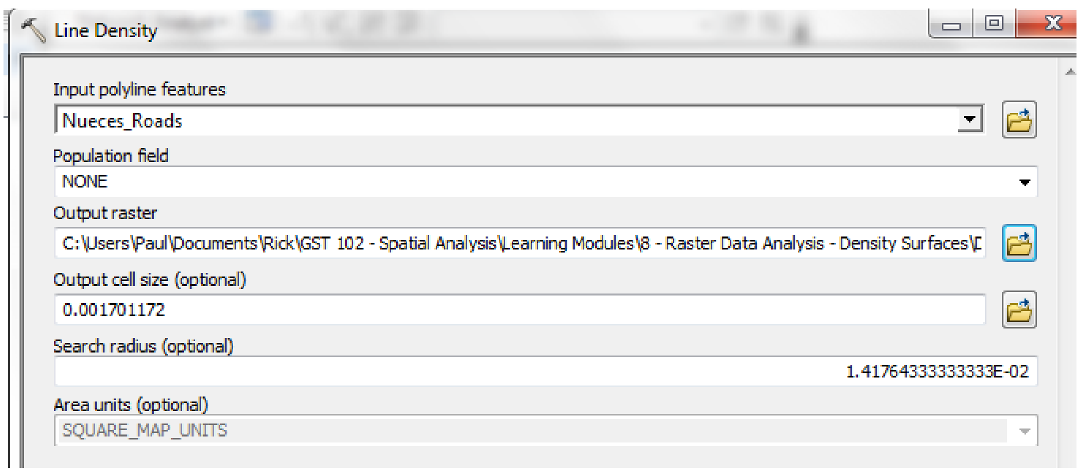


8. Run the point density tool again but this time for the Population options, choose NONE from the dropdown. Look at the difference. This time the density is based solely on the concentration of points as opposed to the addition of all the population values of the points.

2 Using the Line Density Tool

The Line Density tool works similarly to the Point Density tool, in that it calculates the concentration of lines and line features in a neighborhood. We can use line density analysis to map density of a road network, showing areas where there are more roads, in comparison with areas with fewer roads.

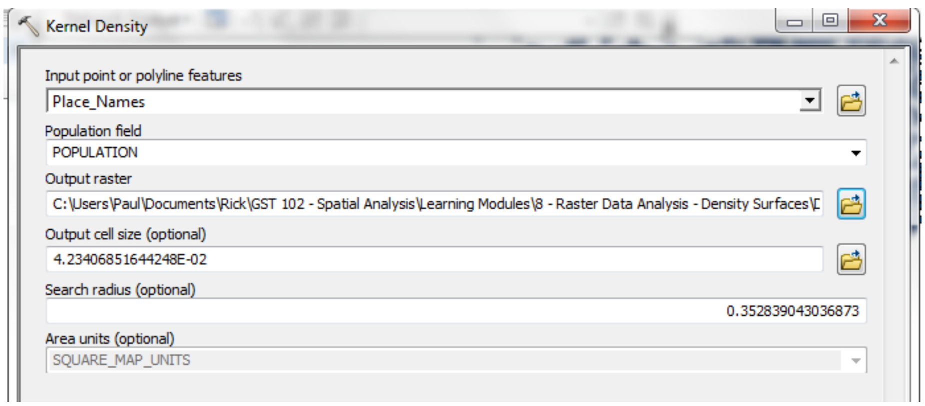
1. **Add** the *Nueces_Roads* to the map view. Right-click on the layer in the Table Of Contents to Zoom To Layer.
2. **Search** for the `Line Density` tool (**Spatial Analyst->Density**) and open it.
3. Set the input to *Nueces_Roads*, and name the output `Ln_Road_Den`, set the population to NONE and click **OK.**

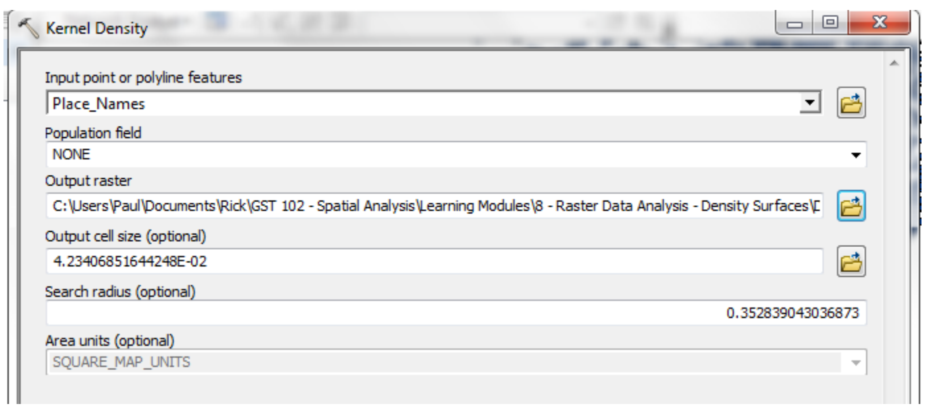


3 Using the Kernel Density Tool

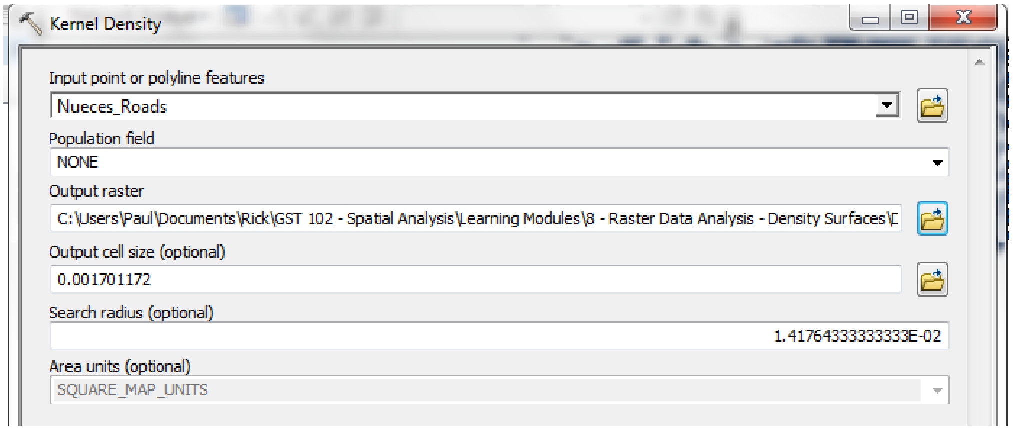
Kernel Density is similar to the Point and Line Density tools. The difference is that the kernel density tool allows us to give features that are being calculated different weights. This way if one point or line in your dataset is of greater significance than another is, you can assign it a higher weight (e.g., crime event points include a homicide event versus a robbery). It also produces a smoother result.

1. **Search** for the `Kernel Density` tool (**Spatial Analyst->Density**) and open it.
2. Run the **Kernel density** tool twice on the points (*Place_Names*) layer. First, use POPULATION in the Population field dropdown box and the second time use NONE in the same box.





3. Run the **Kernel density** tool using the *Nueces_Roads* dataset. Use NONE for the Population field dropdown box.

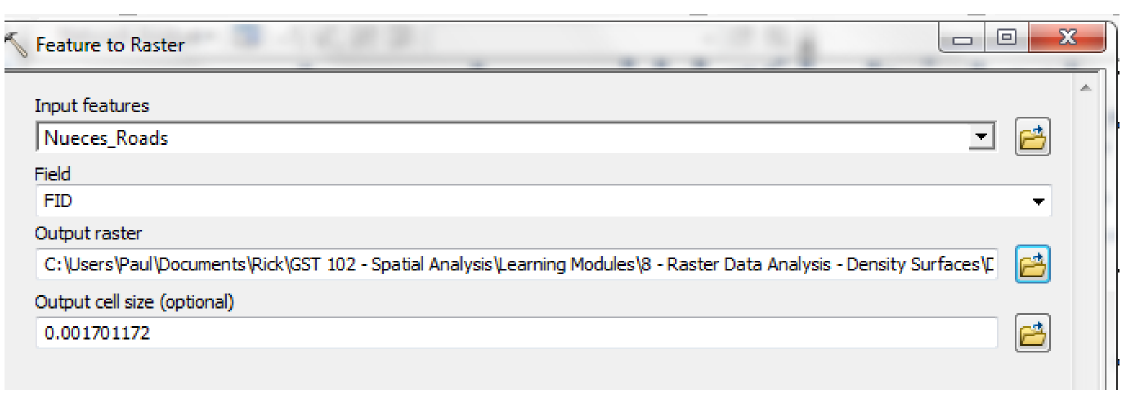


4. Notice the differences in the kernel density tool output versus the simple line and polygon density tools.

4 Vector to Raster Conversion

Vector to raster conversion is helpful when we need to combine raster features together. We can convert points, lines and polygons to a raster layer. However, the result may be misrepresentative of the feature; it depends on the way the feature is calculated with the grid.

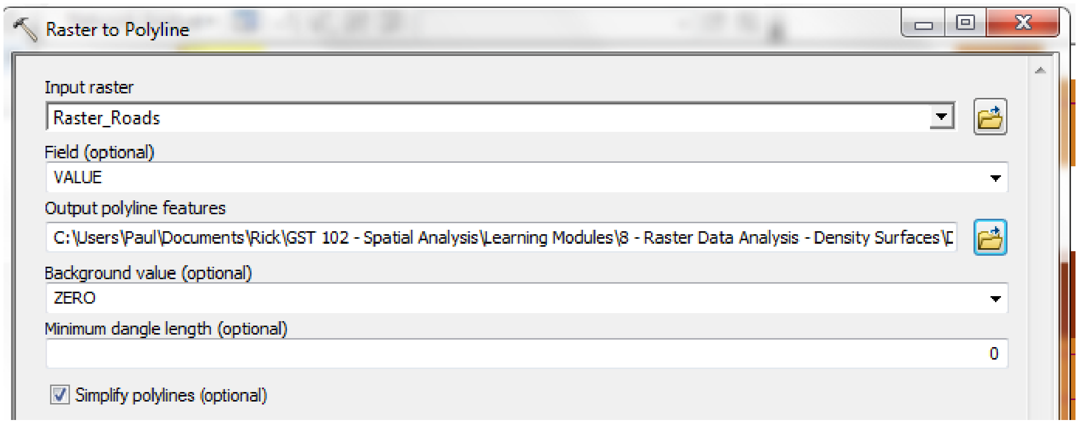
1. **Search** for the `Feature to Raster` tool in the Conversion toolbox (**Conversion Tools->To Raster->Feature To Raster**).
2. **Open** the tool and select the *Nueces_Roads* layer as input. For the Field select FID, the cell size will be calculated automatically based on the input feature. Name the output raster `Raster_Roads`. Click **OK.**



3. The result will be the vector converted to a new raster.

5 Raster to Vector Conversion

1. Now we are doing the opposite of what we just did in Task 4. We will be converting the *Raster_roads* into a vector polyline again. **Search** for the *Raster to Polyline* tool in the conversion toolbox (**Conversion Tools->From Raster->Raster to Polyline**). Open the tool.
2. For your Input raster choose *Raster_roads,* name your output *Nueces _Vector*. Leave the Simplify polylines checkbox checked. Click **OK.**



3. This will take your converted raster back to a vector format.

Conclusion

In this lab, we can see the use of the neighborhood functions in the form of density analysis and the conversion between the data models, raster and vector. The density analysis is useful in situations such as data related to crimes or data related to the number of fast food stores in an area. Density analysis provides a nice overview of the distribution of our data and if we weight significant values, we can customize the data in a way that is meaningful to our project. Finally, using the conversion tools we learned how to convert between raster and vector and demonstrated that there is some loss in accuracy and data. However, the ability to convert between data types allows us to be able to perform operations such as map algebra on the layer.

Discussion Questions

1. Discuss the different uses of point and line density. Provide some examples of how they might be used in a practical setting.

2. Explain how weighting a feature changes the outcome.

