

Distance calculations using Spatial Analyst

Yosef Bodovsky

The simplest way to calculate distance from point feature to the closest point, line or polygon feature is to use tool called **Near**. It can be found in **Arc Toolbox -> Analysis Tools -> Proximity**. However, this tool calculates straight distance between 2 points, and doesn't take in account the road network in the specific area. In order to calculate cost weighted distance we must use **Spatial Analyst**. The following document describes list of steps that are necessary to get the result.

Open Arc Map.

First of all we need to decide what units we want this result to be in. Let's say we want it to be in *meters*. The simplest way is to change map units of Data Frame. Go to **Data Frame Properties -> General** and change **map units** to *meters*. However, in some cases we may want to set up specific projection. Lets say we are working only with shape files of North Carolina. In this case we would like to work with unique projection of North Carolina. Go to **Data Frame properties-> Coordinate System -> Predefined- -> Projected -> State Plane -> NAD1983** and choose *NAD 1983 State Plane North Carolina* from the list. Change map and display units to *meters*.

Lets say we have list of respondents and list of community assets and we need to calculate distances from each respondent to the closest community asset.

We need 4 shape files:

- 1.Asset shape file (for example *Sampson Doctors*)
- 2.Roads shape file of the specific area (for example *Sampson County Roads*).
3. Boundary shape file of the specific area (for example *Sampson County boundary*)
- 4.Respondents shape file (for example *Sampson Respondents*)

Note: do not perform any actions on the network, copy all files into your local disk.

Add shape files to the data frame. Warning message that says that data frame projection is not the same as shape files projections may show up. Click **OK to all**.

Make sure the **Spatial Analyst** extension is on. Go to **Tools->extensions** and make sure that **Spatial Analyst** checkbox is checked.

Open **Spatial Analyst** dropdown list and choose **Options**. Set up your working directory. Set up boundary shape file as **Analysis mask**. From **Analysis Coordinate system** choose option "*Analysis output will be saved in the same coordinate system as the active data frame*".

Go to **Extent**. Open **Analysis extent** dropdown list. Choose *Same as layer 'boundary shape file'*.

Go to **Cell size**. Open **Analysis cell size** dropdown list and choose **as specified below**. Choose the desired cell size (for example 400 meters).
Click **OK**.

Go to **Spatial Analyst->Convert->Features to raster**. Choose asset shape file in **Input features**. Choose field where all values are the same. If there is no such a field, you must create it (you may call this field *nothing* and set its values to *1*). Make sure **Output cell size** is 400. Define name for Output raster (for example *doctor grid*). Click **OK**. A new grid will be added into your data frame.

In the same way convert street shape file into raster. Define name for Output raster (for example *street grid*).

Go to Spatial Analyst -> Distances -> Cost Weighted. Choose asset grid (*doctor grid*) from **Distance to** list. And choose *street grid* from **Cost raster**. Define Maximum Distance. Define name for Output raster.
Click **OK**.

Open Arc Toolbox, go to **Spatial Analyst Tools -> Extraction -> Extract values to points**. Choose *respondent's shape file* from **Input Point Features** pull-down menu. Choose *cost weighted raster* from **Input Raster** pull-down menu. Define Output shape file name. If you want the distance value to be interpolated from surrounding cells values check **Interpolate values...** checkbox. Click **OK**.

Make sure the new shape file is added to your data frame. Open its attribute table and make sure that *raster value* field is there and all points have values. If not, value of the closest raster cell might be added manually.