Percent Volume Contour Toolbox for ArcGIS 10.x

Description

The toolbox complements the material described in:

Lewis D. 2015. Kernel Density Estimation and Percent Volume Contours. Chapter 10 in Brunsdon C., and Singleton A. (eds.) Geocomputation: A Practical Primer. Sage, London. pp 169-184.

This toolbox has 3 tools:

1) **Calculate Bandwidths**: A script which calculates the rule of thumb bandwidths discussed in Lewis (2015) p. 175.

2) **Calculate Percent Volume Contours (PVC):** A script which outputs PVCs as polyline and polygon shapefiles for a user specified set of percentages. There is an option to automatically remove holes, should any exist, although it should be noted that this functionality is beta.

3) **Calculate KDE and PVC**: A model which allows for a Kernel Density Estimate and set of Percent Volume Contours (PVCs) to be made as part of a single workflow.

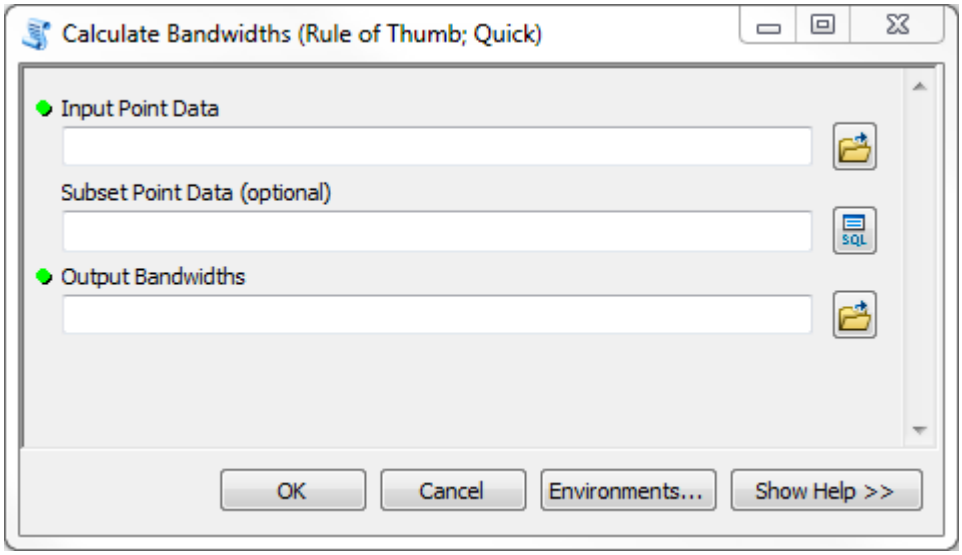
NB: Ability to use the tools may be limited by ArcGIS license level, and access to extensions such as Spatial Analyst. However, the core of the module which concerns manipulating rasters relies only on Python and NumPy, so this part of the script, which generates thresholded raster files can always be extracted for use independently.

The tool is intended for use only with projected data, results obtained with data based on a geographic coordinate system may be spurious.

How to use the Toolbox

The following are suggestions for use of the tools, and descriptions of the output.

Calculate Bandwidths



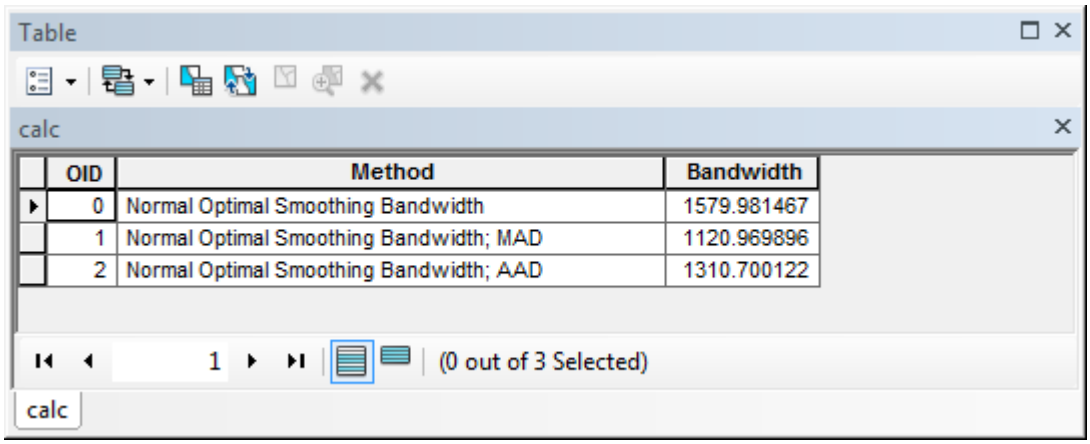
Input Point Data: A point shapefile.

Subset Point Data: An opportunity to make a selection on the **Input Point Data** as an SQL query (as in the Select Layer By Attribute tool).

Output Bandwidths: The location to save a table of the output bandwidths generated.

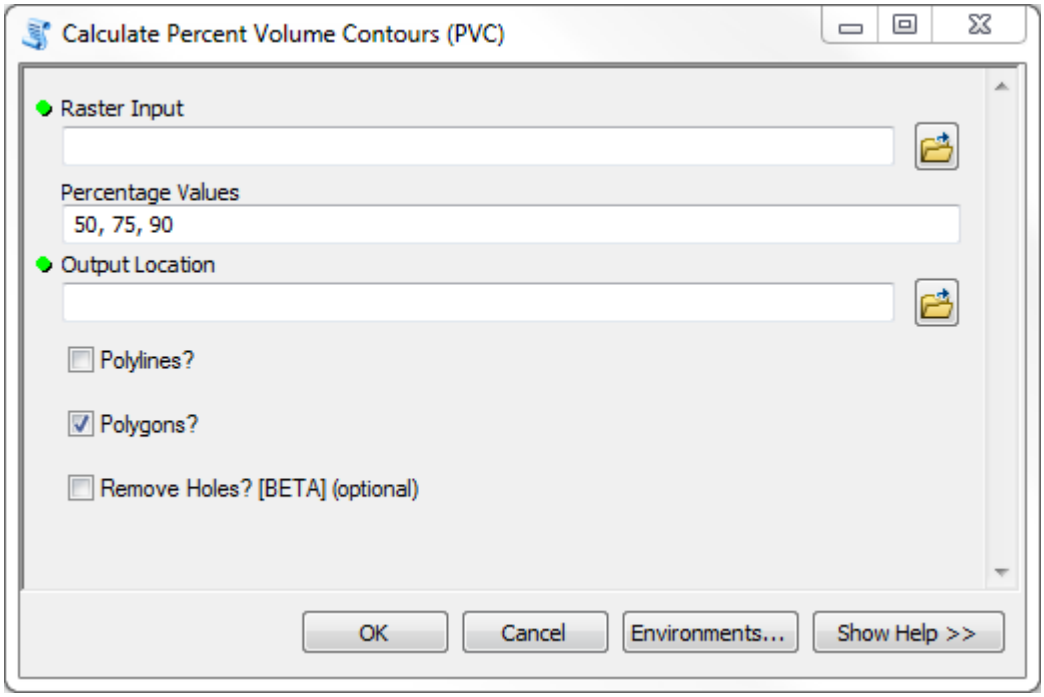
Process

The bandwidths created use the 'normal optimal smoothing' approach given in Lewis (2015 p. 175). Three outputs are returned depending on whether the standard deviation, average absolute deviation, or median absolute deviation is used.



Note that the bandwidths created are for use with the Epanechnikov kernel, implemented in the Kernel Density Estimation tool in ArcGIS. If you plan on using a Gaussian kernel, these bandwidths are applicable if divided through by 1.77.

Calculate Percent Volume Contours (PVC)



Raster Input: This allows you to input a pre-computed KDE surface.

Percentage Values: the percentages for which to compute a PVC. Must be in the range 1-100. Multiple PVCs can be calculated by separating the desired values with commas. Defaults to 50, 75, 90 – these values are simply a suggestion.

Output Location: The tool generates a number of outputs as shapefiles. This should point to a folder within which to save these outputs.

Polylines?: Option to return the PVCs as polyline contours.

Polygons?: Option to return the PVCs as polygon service areas.

Remove Holes?: If producing polygons, this gives the option of automatically removing any polygons which represent holes. If selected this option takes the bulk of the processing time. The procedure used is as follows:

1) Find a centroid for each polygon that lies inside of the polygon.

2) Draw a line from that centroid to an imaginary point that lies outside of the extent of the polygons file.

3) Count the number of intersections with PVC contours.

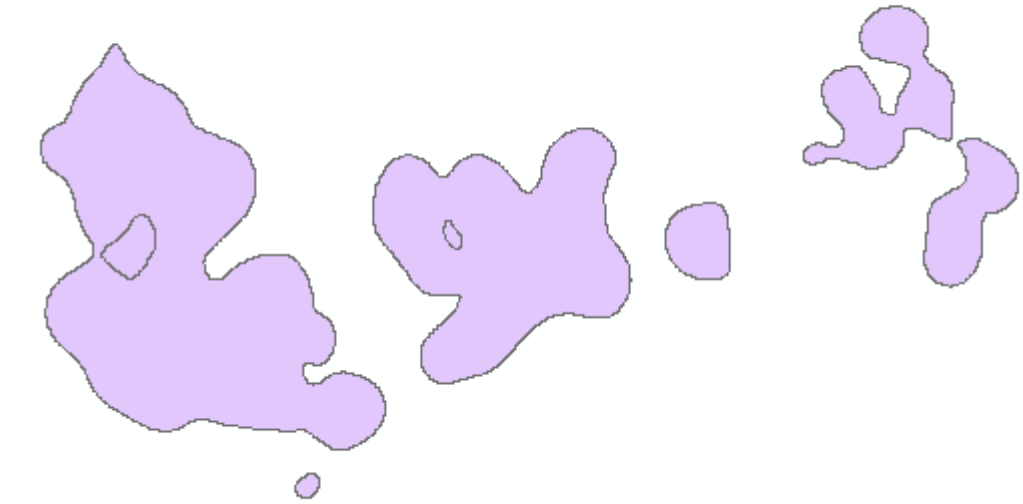
In most cases, an even number of intersections indicates a hole. These can then be selected and removed. However, there may be cases in which the algorithm fails to detect a hole, such as when the line drawn from a centroid is exactly coincident with a contour segment. Owing to the fact that the algorithm does not account for such special cases, it should be used carefully, and is listed as beta for this reason.

Example

Input – a raster showing the density of a phenomenon.

The 75% PVC polygons are created. Firstly without the “remove holes” option, and subsequently with holes removed.

Remove holes Off

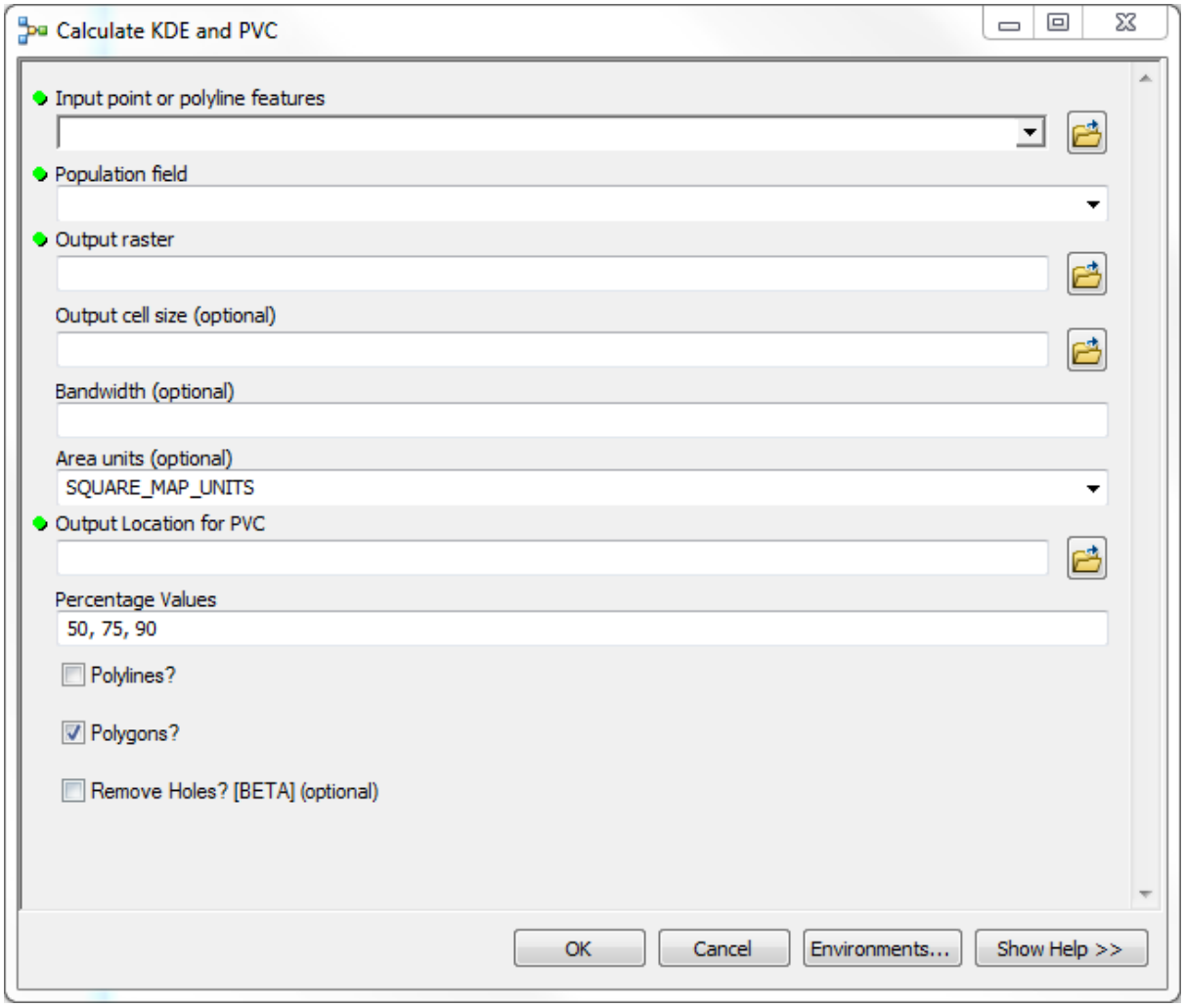


Remove holes On

Calculate KDE and PVC

This model simply appends the PVC script to the existing ArcGIS Spatial Analyst Kernel Density Estimation tool. More information of this tool can be found at: http://resources.arcgis.com/en/help/main/10.2/index.html#/Kernel_Density/009z0000000s000000/

As such, the tool's form is simply the inputs for a KDE with the inputs for the PVC script beneath.



<u>Disclaimer</u>

The author reserves the right not to be responsible for the topicality, correctness, completeness or quality of the tool, scripts and information provided. Liability claims regarding damage caused by the use of any tool, scripts and/or information provided, including any kind of tool, scripts and/or information which is incomplete or incorrect, will therefore be rejected.