IndyGeoTools Documentation and User Guide

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Accessibility Calculator

The Accessibility Calculator computes cumulative opportunity auto accessibility and attractiveness to people, retail jobs, and nonretail jobs, as well as transit accessibility to jobs for travel analysis zones (TAZs). For an input TAZ shapefile, the number of people, retail jobs, and nonretail jobs that the TAZ can reach within a specified drive time, the number of people, retail jobs, and nonretail jobs that can reach the TAZ within a specified driving time, and the number of jobs that the TAZ can reach within a specified transit time are added as fields.

Parameters

Auto Skim File (string)

Csv file with auto travel times between each TAZ pair

Transit Skim file (string)

CSV file with transit travel times between each TAZ pair

Auto Time Threshold (numeric)

Maximum auto travel time for a location to be considered accessible

Transit Time Threshold (numeric)

Maximum transit travel time for a location to be considered accessible

TAZ file (Feature class)

Shapefile with TAZs

TAZ Field (field)

Field in TAZ file that indicates the TAZ's ID

Population Field (field)

Field in TAZ file that indicates TAZ's population

Employment Field (field)

Field in TAZ file that indicates the number of jobs in the TAZ

Retail Employment Field (field)

Field in TAZ file that indicates the number of retail jobs in the TAZ

Procedure

First, the input skims are converted to Boolean "skims," whose entries are equal to one if the corresponding entry in the skim is less than the travel time threshold and zero if it is not. This skim is then used in matrix-vector multiplication with fields in the TAZ file to calculate the number of people and jobs that can reach or can reach a zone within the threshold.

Add Excel Data

The AddExcelData tool adds data from a Microsoft Excel file to a shapefile's attribute table. The data in the Excel file must be a table beginning in cell A1. NOTE: This tool requires Pandas to be installed.

Parameters

Shapefile (feature class)

Shapefile to add data to

ID Field (field)

Field in shapefile that identifies each feature

Excel File (string)

Filepath of the Excel file

Sheet (string)

Sheet in the Excel file with the data.

Convert Geography

The ConvertGeography tool converts data for one polygonal geography to another covering the same area. NOTE: This tool requires Pandas to be installed.

Parameters

From Feature Class (Feature Class)

The feature class containing the source data

From ID Field (Field)

Field in the from feature class that identifies each polygon

To Feature Class (Feature Class)

The feature class containing the polygons

To ID Field (Field)

Field in the to feature class that identifies each polygon

New Feature Class (String)

New Feature class to be created. If it doesn't end in .shp, then the extension will be added

Matrix File (String)

Matrix file to be created. If it doesn't end in .csv, then the extension will be added

Data Fields (Field)

Field(s) that will be converted.

Remove Temporary Directory When Successfully Completed (bool)

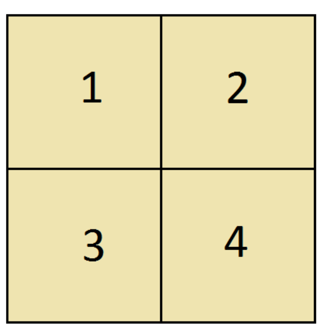
Indicates whether or not to remove the temporary directory created while the area matrix is being computed if that tool is successfully run.

Remove Temporary Directory If Error Occurs (bool)

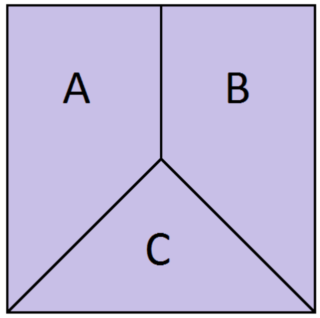
Indicates whether or not to remove the temporary directory created while the area matrix is being computed if an error occurs while running that tool.

Procedure

To demonstrate how this tool works, here is an example. Let's say you need data on population, households, and jobs for the following 4-zone region:



Such data is not directly available, but it is available for the same region but divided up into the following 3 zones:



Here is the data:

Zone	Population	Households	Jobs
A	3522	1615	821
B	2478	1325	1411
C	1927	823	3524

The first step is to compute a matrix to convert the data using the Get Area Conversion Matrix tool. For more detailed information on how that matrix is computed, see that tool's documentation. Here is the computed matrix:

	A	B	C
1	0.667	0	0
2	0	0.667	0
3	0.333	0	0.5
4	0	0.333	0.5

To get the data for the 4-zone system, the following matrix multiplication is then performed:

$$\begin{pmatrix} 0.667 & 0 & 0 \\ 0 & 0.667 & 0 \\ 0.333 & 0 & 0.5 \\ 0 & 0.333 & 0.5 \end{pmatrix} \begin{pmatrix} 3522 & 1615 & 821 \\ 2478 & 1325 & 1411 \\ 1927 & 823 & 3524 \end{pmatrix}$$
$$= \begin{pmatrix} 0.667 \times 3522 + 0 \times 2478 + 0 \times 1927 & 0.667 \times 1615 + 0 \times 1325 + 0 \times 823 & 0.667 \times 821 + 0 \times 1411 + 0 \times 3524 \\ 0 \times 3522 + 0.667 \times 2478 + 0 \times 1927 & 0 \times 1615 + 0.667 \times 1325 + 0 \times 823 & 0 \times 821 + 0.667 \times 1411 + 0 \times 3524 \\ 0.333 \times 3522 + 0 \times 2478 + 0.5 \times 1927 & 0.333 \times 1615 + 0 \times 1325 + 0.5 \times 823 & 0.333 \times 821 + 0 \times 1411 + 0.5 \times 3524 \\ 0 \times 3522 + 0.333 \times 2478 + 0.5 \times 1927 & 0 \times 1615 + 0.333 \times 1325 + 0.5 \times 823 & 0 \times 821 + 0.333 \times 1411 + 0.5 \times 3524 \end{pmatrix}$$
$$= \begin{pmatrix} 2348 & 1076.667 & 547.333 \\ 1652 & 883.333 & 940.667 \\ 2137.5 & 949.833 & 2035.667 \\ 1789.5 & 853.167 & 2232.333 \end{pmatrix}$$

So the results for the four zones are:

Zone	Population	Households	Jobs
1	2348	1076.667	547.333
2	1652	883.333	940.667
3	2137.5	949.833	2035.667
4	1789.5	853.167	2232.333

Count Assumed Transit Stops

The CountAssumedTransitStops tool takes a transit route shapefile, a polygon shapefile, an assumed stop spacing, and counts the number of assumed stops in each polygon.

Parameters

Polygon Feature Class (Feature Class)

Feature class with the polygons to count the stops in

Polygon ID Field (Field)

Field in feature class with the name of each polygon

Route Feature Class (Feature Class)

Line feature class with transit routes

Assumed Lane Width (Linear Unit)

Assumed width of half of the right-of-way. The linear units must be the same as the linear units in the polygon feature class

Assumed Stop Spacing (Linear Unit)

Assumed stop spacing of the transit routes. The linear units must be the same as the linear units in the polygon feature class

New Field Name (String)

Field name of the new field with the assumed number of stops. The default is “Stops”.

Return Integer (bool)

Determines whether or not to return an integer

Remove Temporary Directory When Successfully Completed (bool)

Indicates whether or not to remove the temporary directory created while the number of stops are being computed if the tool is successfully run.

Remove Temporary Directory If Error Occurs (bool)

Indicates whether or not to remove the temporary directory created while the number of stops are is being computed if an error occurs while running the tool.

Procedure

This tool works by first creating a buffer around the transit routes. This buffer is then intersected with the polygons, and the intersection area is divided by the product of the assumed lane width and assumed stop spacing to get the number of stops.

EJ Accessibility Comparison

The EJ Accessibility Comparison tool compares accessibility of environmental justice (EJ) areas to non-EJ areas.

Parameters

TAZ File (Feature class)

TAZ shapefile. The tool Accessibility Calculator must have been previously run on this file.

Household Field (field)

Field in the TAZ file with the number of households.

EJ TAZ List (file)

Text file containing a list of the EJ TAZs.

Results File (file)

Text file with results. This must be created before the tool is run, but it can be empty.

Procedure

The tool computes the average auto and transit job accessibility using households as weights for both EJ and non-EJ TAZs. It then calculates the difference between the two values and writes them to the Results File.

Example of Results

```
Non-EJ average job auto accessibility: 3.694
EJ average job auto accessibility: 7.934
Difference: -4.239


Non-EJ average job transit accessibility: 0.073
EJ average job transit accessibility: 0.613
Difference: -0.539
```

Get Area Conversion Matrix

The GetAreaConversionMatrix tool calculates a matrix that can be used to compute data from one polygonal geography to another, such as converting between different TAZ systems. This tool is an intermediate step in running the tool Convert Geography. NOTE: This tool requires Pandas to be installed.

Parameters

From Feature Class (Feature Class)

The feature class containing the source data

From ID Field (Field)

Field in the from feature class that identifies each polygon

To Feature Class (Feature Class)

The feature class containing the polygons

To ID Field (Field)

Field in the to feature class that identifies each polygon

Outfile (String)

Matrix file to be created. If it doesn't end in .csv, then the extension will be added

Show Matrix When Finished (bool)

Determines whether or not to have the matrix file open when the tool is done being run

Remove Temporary Directory When Successfully Completed (bool)

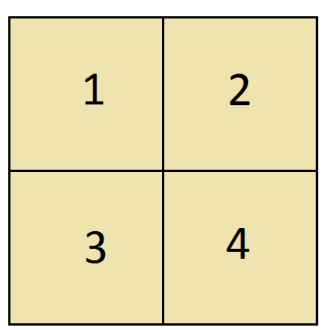
Indicates whether or not to remove the temporary directory created while the area matrix is being computed if the tool is successfully run.

Remove Temporary Directory If Error Occurs (bool)

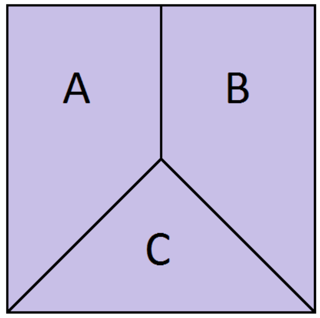
Indicates whether or not to remove the temporary directory created while the area matrix is being computed if an error occurs while running the tool.

Procedure

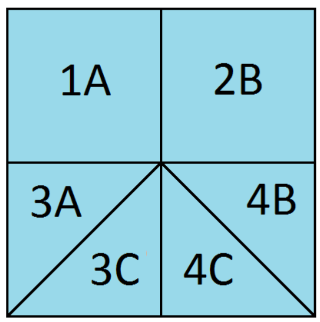
In this example, we want data for the following four-zone region, with each zone having an area of one square mile:



However, we have the data for the region divided up into the following three zones:



The first step of computing the area conversion matrix is to perform an intersection of the two polygon shapefiles:



After that, the area for each intersected polygon is computed:

Polygon	Area	Polygon	Area
1A	1	3C	0.5
2B	1	4B	0.5
3A	0.5	4C	0.5

The values for the areas are placed into the following matrix:

	A	B	C
1	1	0	0
2	0	1	0
3	0.5	0	0.5
4	0	0.5	0.5

In the final step, the columns are then normalized so that they all add up to one.

	A	B	C
1	0.667	0	0
2	0	0.667	0
3	0.333	0	0.5
4	0	0.333	0.5

This matrix can now be used to convert data from the 3-zone system to the 4-zone system. For an example of that, see the documentation on the Convert Geography tool.

Measure Difference

The Measure Difference tool compares two feature classes with the same fields and features, but different data.

Parameters

Shapefile 1 (Feature Class)

The subtrahend feature class

Shapefile 2 (Feature Class)

The minuend feature class

New Shapefile Name (string)

The filepath of the difference feature class. If it does not end in .shp, it will be added to the end.

Static Fields (Field)

Fields in the feature classes that are the same in both (such as ID)

Procedure

For each feature, the values in the non-static fields for Shapefile 2 are subtracted from the corresponding values in Shapefile 1.

Regional Connectivity Calculator

The Regional Connectivity Calculator computes values of a regional connectivity index (description below). Indices are computed for each specified TAZ as well as an overall average.

Parameters

TAZ File (Feature Class)

TAZ shapefile

Skim File (File)

CSV file with an auto skim containing the travel times between each TAZ pair

TAZ Subset File (File)

Text file containing a list of the TAZs to use when calculating regional connectivity

Output Text File (File)

Text file for writing the results. It must be created before the tool is run but it can be empty.

New Field Suffix (string, optional)

Suffix to add to the new fields that are created.

Procedure

To compute the regional connectivity, a subset of the skim matrix is created that only contains the TAZs specified in the subset file. For each TAZ, it calculates the average travel times to and from other TAZs (as well as standard errors), which is the index for each TAZ. The regional index is the average of all of the travel times within the TAZ. The values for each TAZ are added to the TAZ shapefile, and the overall index is written to the Output Text File.

Example of Results

```
Average = 35.605761
Standard Error = 0.304819
```