

Raster Data Operations

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Raster Data Analysis

- Based on cells
- Raster data analysis can be performed on
 - Individual cells
 - Groups of cells
 - An entire raster
- Operations can use a single or multiple rasters
- Cell value is important when determining the type of statistic, as some are designed for numeric values, while others are designed for numeric and categorical values (Majority, minority)

Data Analysis Environment: The area for analysis and the output cell size

- Area extent can correspond to
 - A specific raster
 - An area defined by its minimum and maximum x-y coordinates
 - A combination of rasters
 - An analysis mask (analysis is not performed on cells with a value of "no data")
- Output cell size
 - Typically set to be equal to, or larger than, the largest cell size among the input rasters

Types of Raster Operations

- Local
- Neighborhood
- Zonal
- Physical distance measures (straight line distance away from a source cell)
- Mosaic, extraction, generalization, overlay, buffering

Local Operations

- Cell-by-cell based
- Creates a new raster from either a single or multiple input rasters
- Includes Reclassification and Map Algebra

Reclassification: Using classification to create a new output raster

- One-to-one: each cell value of the input raster is assigned a new value in the output raster
- A second method is to assign a new value in the output raster to a range of values from the input raster

a)

15.2	16.0	18.5
17.8	18.3	19.6
18.0	19.1	20.2

Slope Raster (%)

b)

8.64	9.09	10.48
10.09	10.37	11.09
10.20	10.81	11.42

Degrees

Map Algebra: performed with multiple rasters using algebraic operations

Types of operations include:

- Summary statistics (max, min, sum, mean, median, standard deviation, etc.)
 - Numeric data only
- Minority, majority, number of unique values
 - Numeric or categorical data
- Combine: creates an output value for each unique combination of values from the input raster

a)

5	2	3
2	2	2
3	1	1

b)

1	3	2
4	7	5
1	1	2

c)

3	4	1
4	3	2
2	1	1

d)

3	3	2
2	4	3
2	1	2

Mean

Neighborhood Operations

- Uses a focal cell and its surrounding cells based on their distance and/or directional relationship (neighborhood)
- Common neighborhood types include rectangle, circle, annulus, and wedge
- Neighborhood statistics uses the values of the cells within a neighborhood to compute a new value for the focal cell (the focal cell value may or may not be included in the computation)
- Block Operation: uses a rectangle (block) to assign the calculated value to all of the block cells in the output raster
 - Moves from block to block rather than cell to cell

Neighborhood Operations

a)

1	2	2	2	2
1	2	2	2	3
1	2	1	3	3
2	2	2	3	3
2	2	2	2	3

b)

1.56	2.00	2.22
1.67	2.11	2.44
1.67	2.11	2.44

Neighborhood Means

a)

1	2	2	2	2
1	2	2	2	3
1	2	1	3	3
2	2	2	3	3
2	2	2	2	3

b)

2	2	2
2	2	3
2	2	3

Neighborhood Majority

Zonal Operations

- Uses groups of cells that have the same value or like features
- Can be contiguous or noncontiguous
- For single rasters zonal operations measure the geometry of each zone (area, perimeter, thickness, centroid)
- For two rasters (an input raster and a zonal raster) a summary of values for the input values in each zone of the zonal raster is generated in an output raster (summary statistics and measures)

a)

1	2	2	1
1	4	5	1
2	3	7	6
1	3	4	4

Input Raster

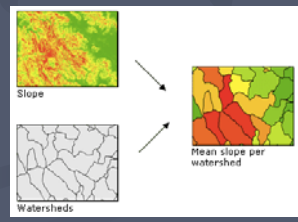
b)

1	1	2	2
1	1	2	2
1	1	3	3
3	3	3	3

Zonal Raster

c)

2.17	2.17	2.25	2.25
2.17	2.17	2.25	2.25
2.17	2.17	4.17	4.17
4.17	4.17	4.17	4.17



References

Chang, K. 2008. *Introduction to Geographic Information Systems and Science*. McGraw-Hill.

Longly, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. 2005. *Geographic Information Systems and Science*. John Wiley & Sons, Ltd.