ASM591/ILS595 GEOSPATIAL PROGRAMMING AND DATA SCIENCE

Introduction to Geospatial Data Science – Spatial Analysis and Statistics

Week 6 Lecture 2, Spring 2021

"*Information is the oil of the 21st century, and analytics is the combustion engine.*" – **Peter Sondergaard, Senior VP, Gartner Research**

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Content:

- Raster analysis part 2/2
- NumPy demo continued

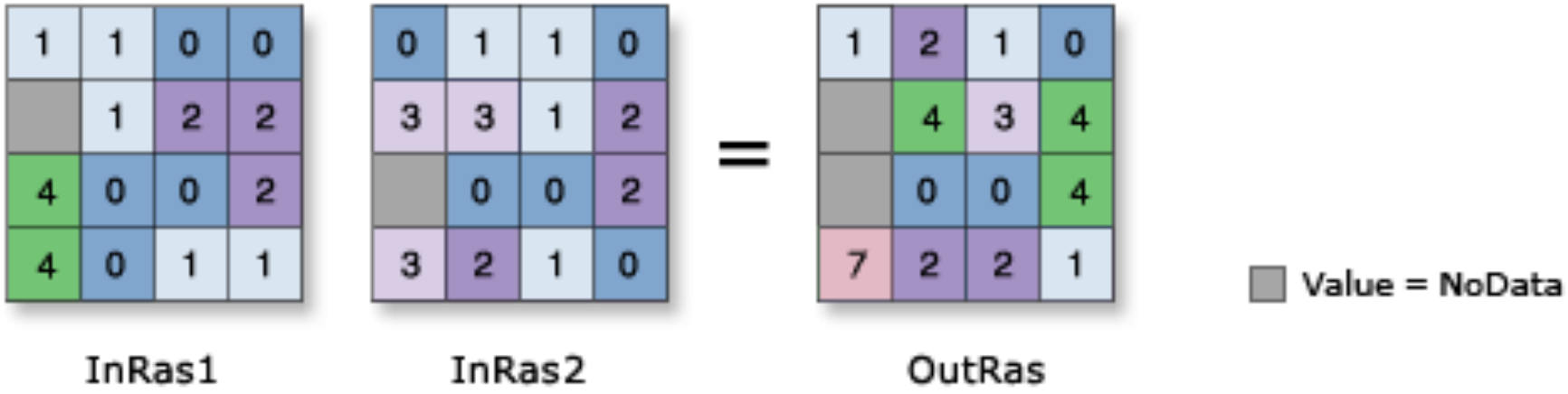
Raster Analysis part 2/2

Reference : https://ltb.itc.utwente.nl/498/concept/81774

Raster analysis

Missing data is a data science challenge.

NoData != Missing Data , Why?



OutRas = Raster("InRas1") + Raster("InRas2")

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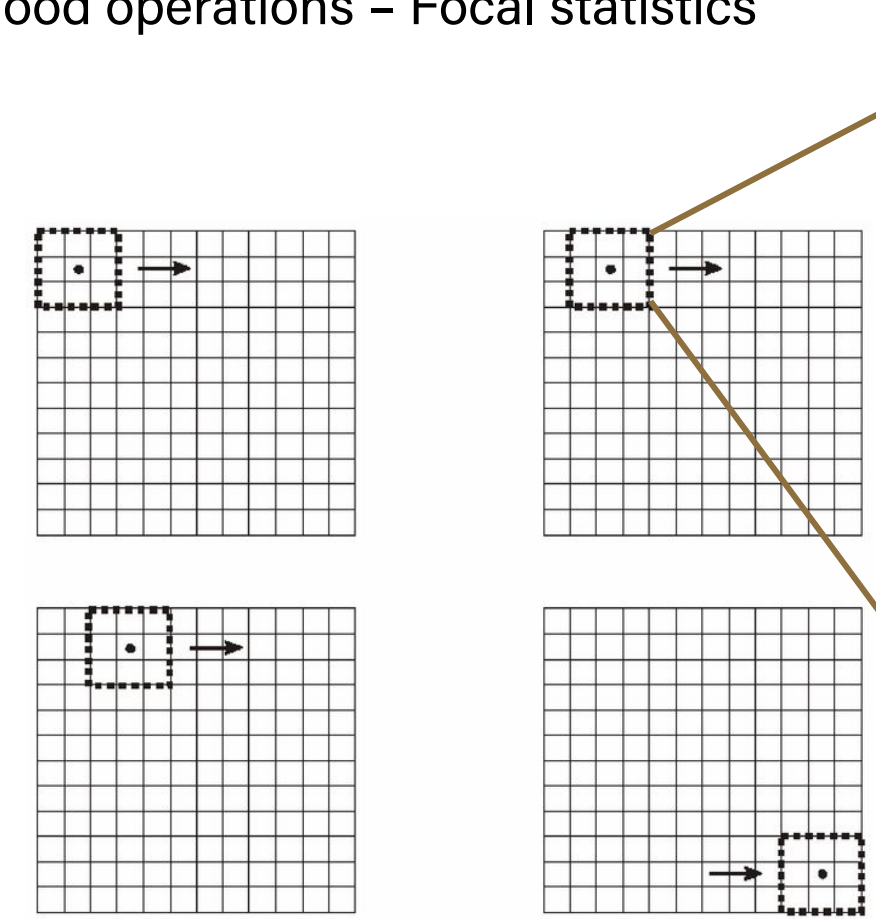
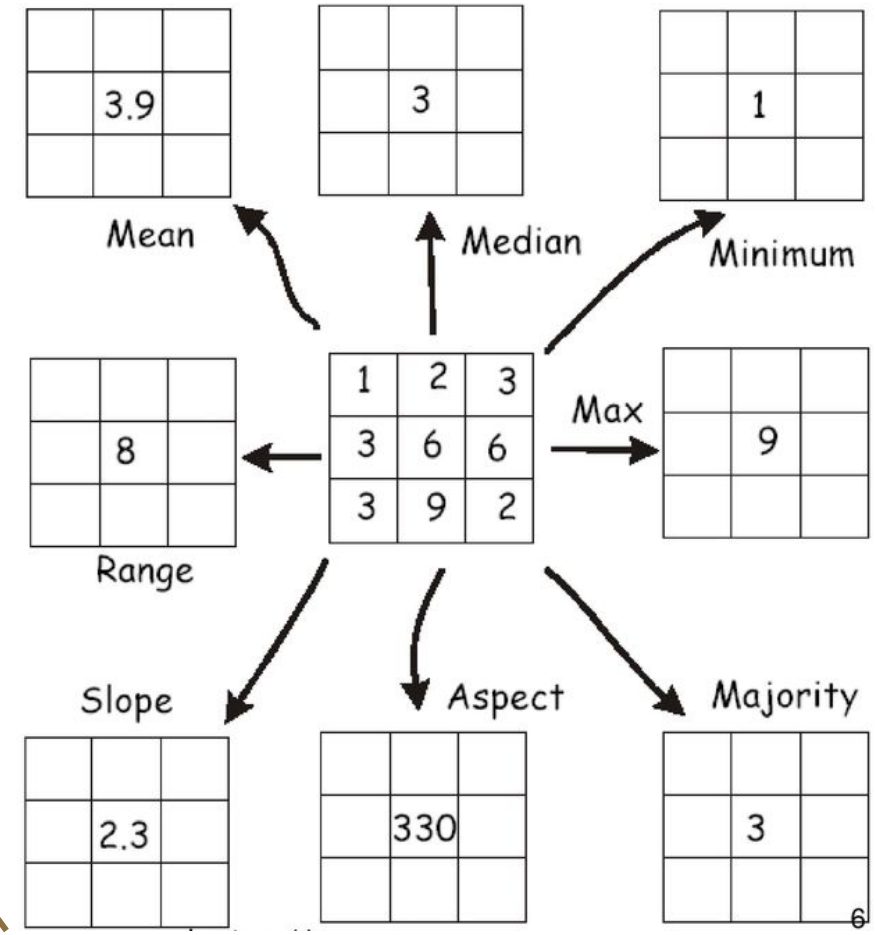
Reference https://thewinnower.com/papers/2847-some-methods-for-measuring-and-correcting-for-spatial-autocorrelation

Raster analysis

Neighborhood operations – Focal statistics

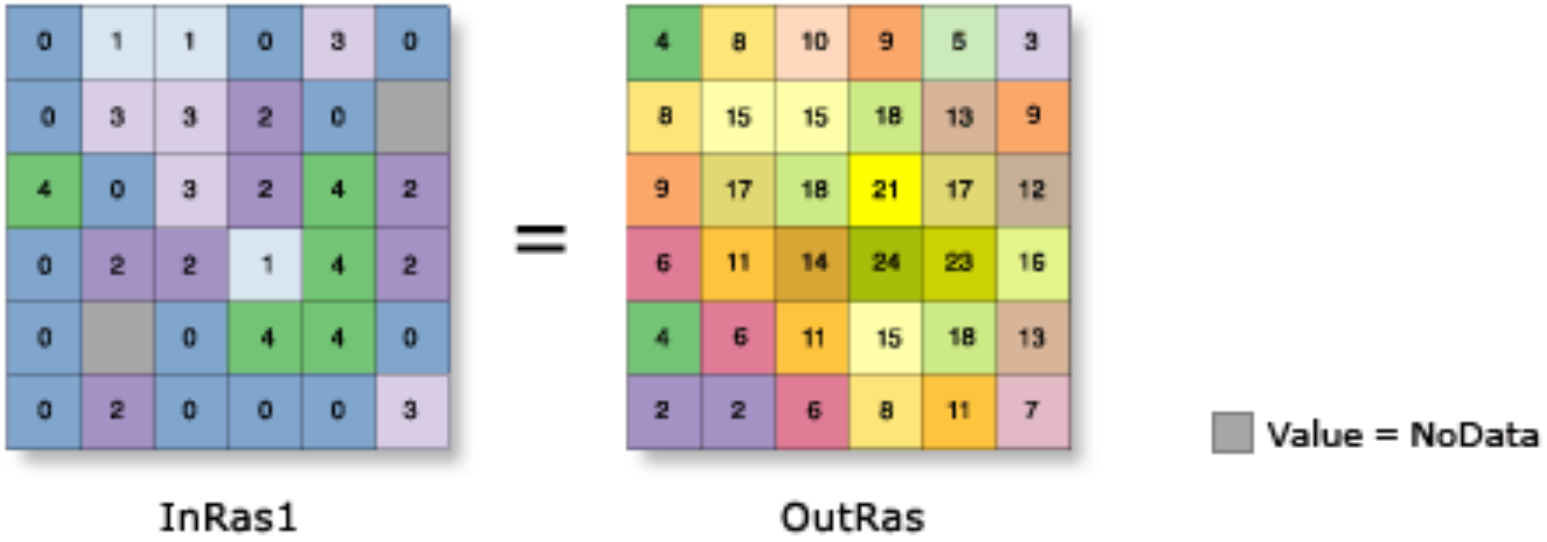
Moving Windows
(Windows can be any size; often odd to provide a center)





Raster analysis

Neighborhood operations – Focal statistics



OutRas = FocalStatistics(InRas1, NbrRectangle(3,3,MAP), "SUM", "")

Raster analysis

Neighborhood operations – Filter

5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	9.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0

Input with anomaly

5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.4	5.4	5.4	5.0
5.0	5.0	5.4	5.4	5.4	5.0
5.0	5.0	5.4	5.4	5.4	5.0
5.0	5.0	5.0	5.0	5.0	5.0

Output smoothed by using Low option of Filter

5.0	5.0	5.0	9.0	9.0	9.0
5.0	5.0	5.0	9.0	9.0	9.0
5.0	5.0	5.0	9.0	9.0	9.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0

Input with edge where cell values change from 5.0 to 9.0

0.0	0.0	-9.6	9.6	0.0	0.0
0.0	0.0	-9.6	9.6	0.0	0.0
0.0	0.0	-6.8	16.4	9.6	9.6
0.0	0.0	-2.8	-6.8	-9.6	-9.6
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

The HIGH option has detected the edge.

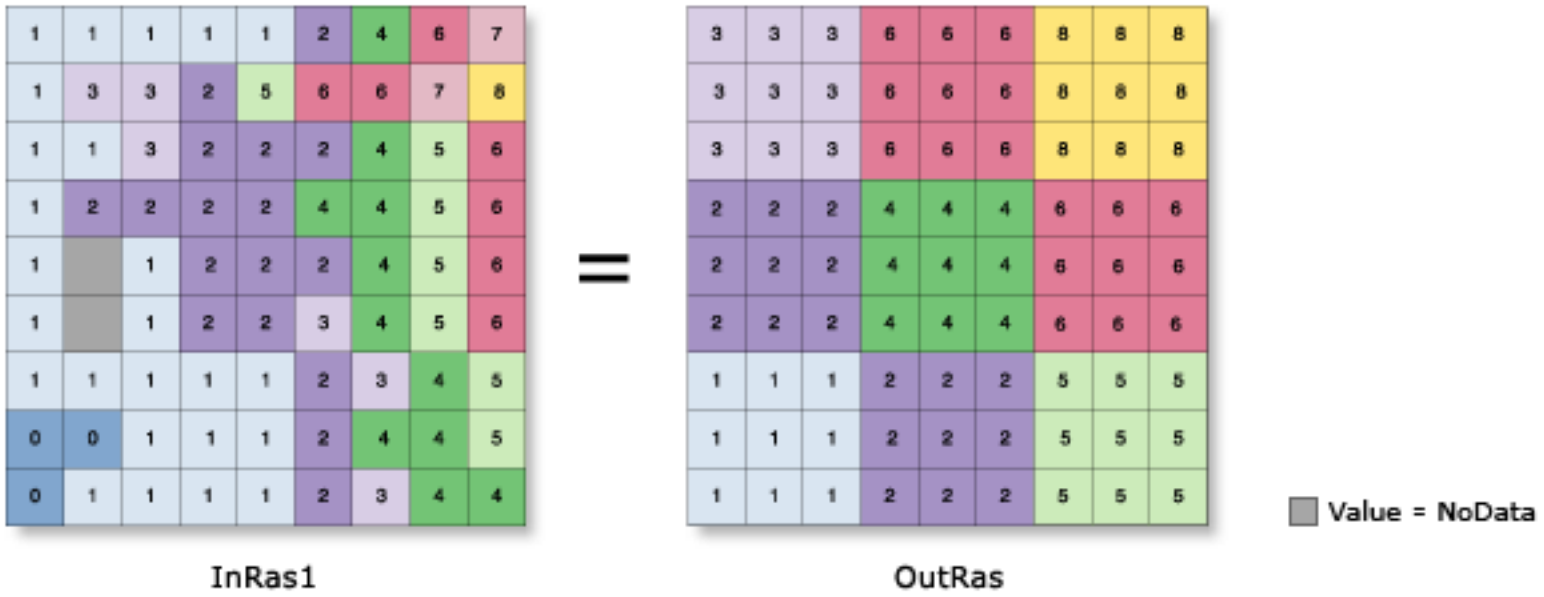
Note that the output values have no relation to the input values.

Low pass filter (smoothing)

High pass filter (sharping)

Reference https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/how-filter-works.htm

Neighborhood operations – Block Statistics

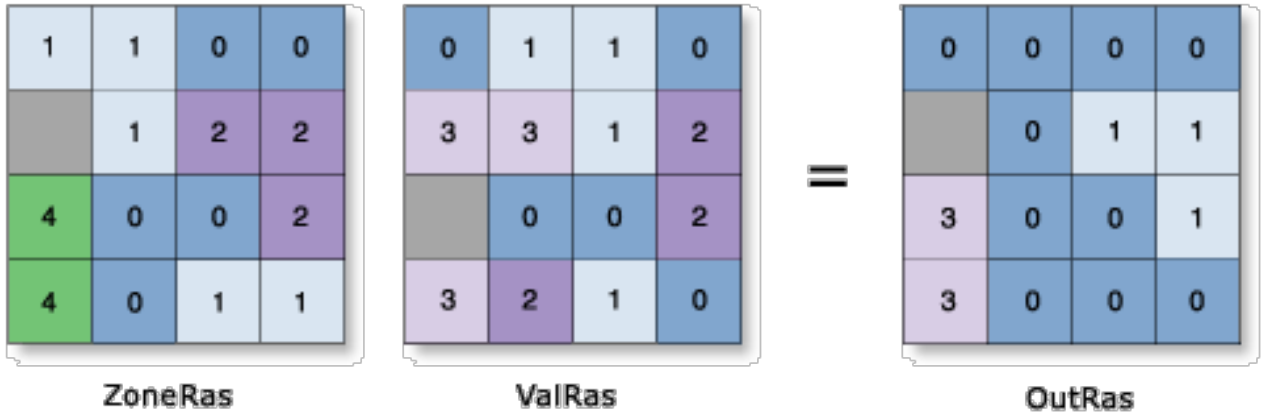


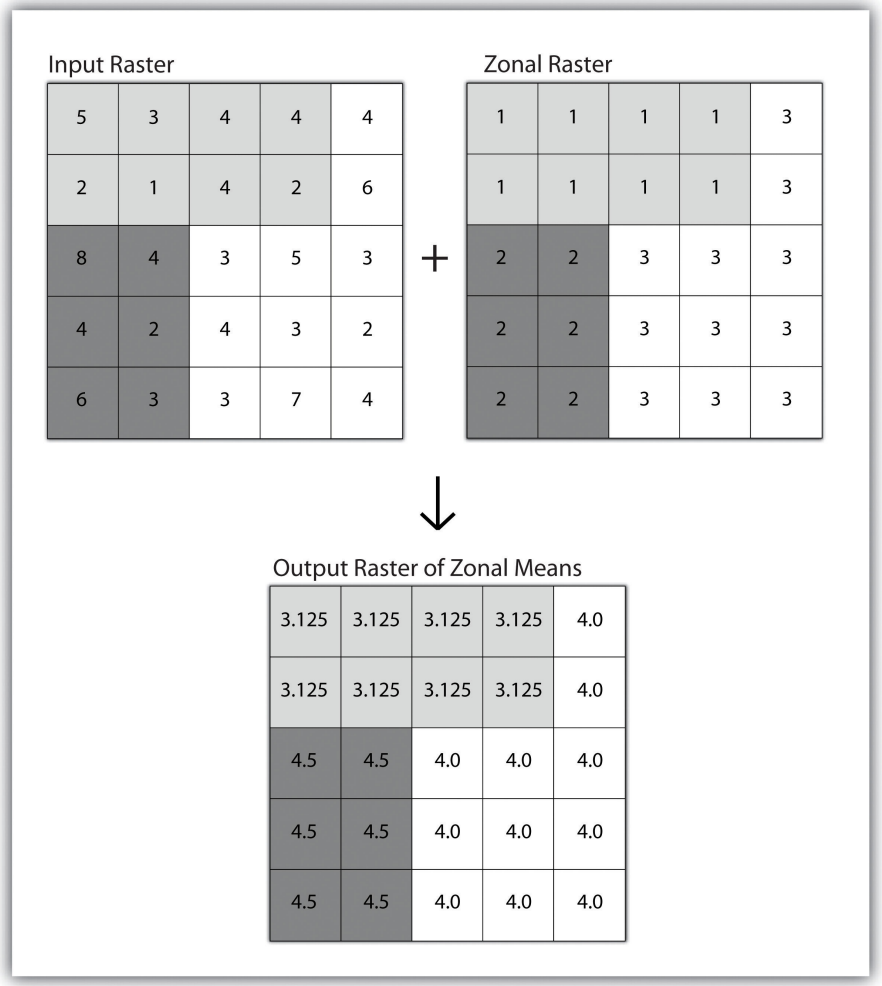
OutRas = BlockStatistics(InRas1, NbrRectangle(3,3,MAP), "MAXIMUM", "")

Reference https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/block-statistics.htm

Raster analysis

Zonal operations – zonal statistics





OutRas = ZonalStatistics(ZoneRas, "VALUE", ValRas, "MINIMUM", "DATA", "CURRENT_SLICE")

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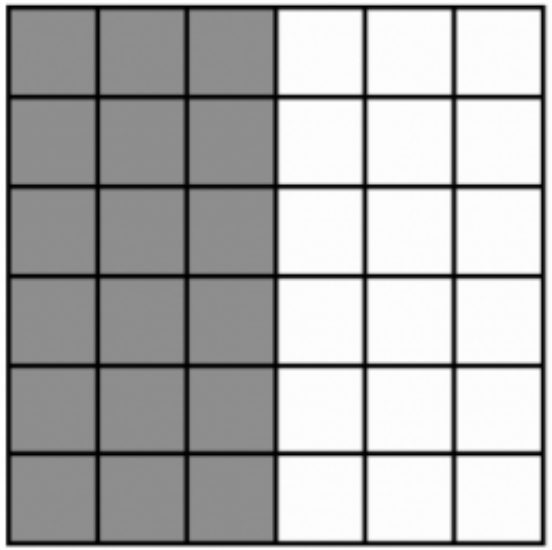
Reference https://saylordotorg.github.io/text_essentials-of-geographic-information-systems/s12-geospatial-analysis-ii-raster-.html
https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/zonal-statistics.htm

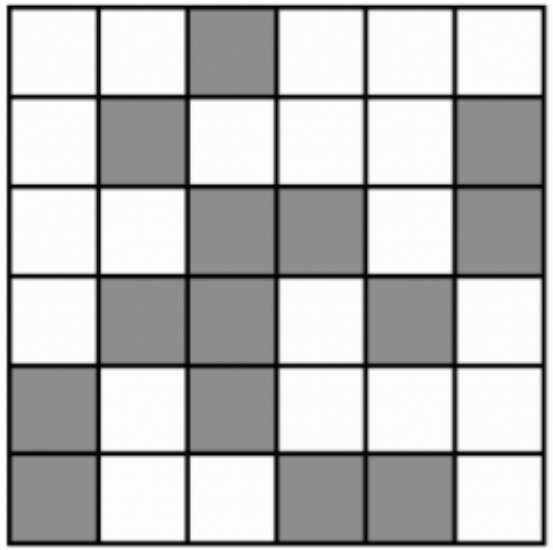
Raster interpolation

Reference : https://ltb.itc.utwente.nl/498/concept/81774

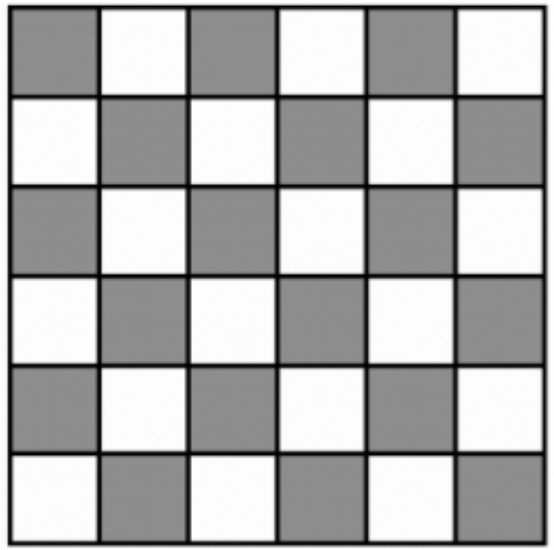
Raster Interpolation



Positive spatial autocorrelation



No spatial autocorrelation



Negative spatial autocorrelation

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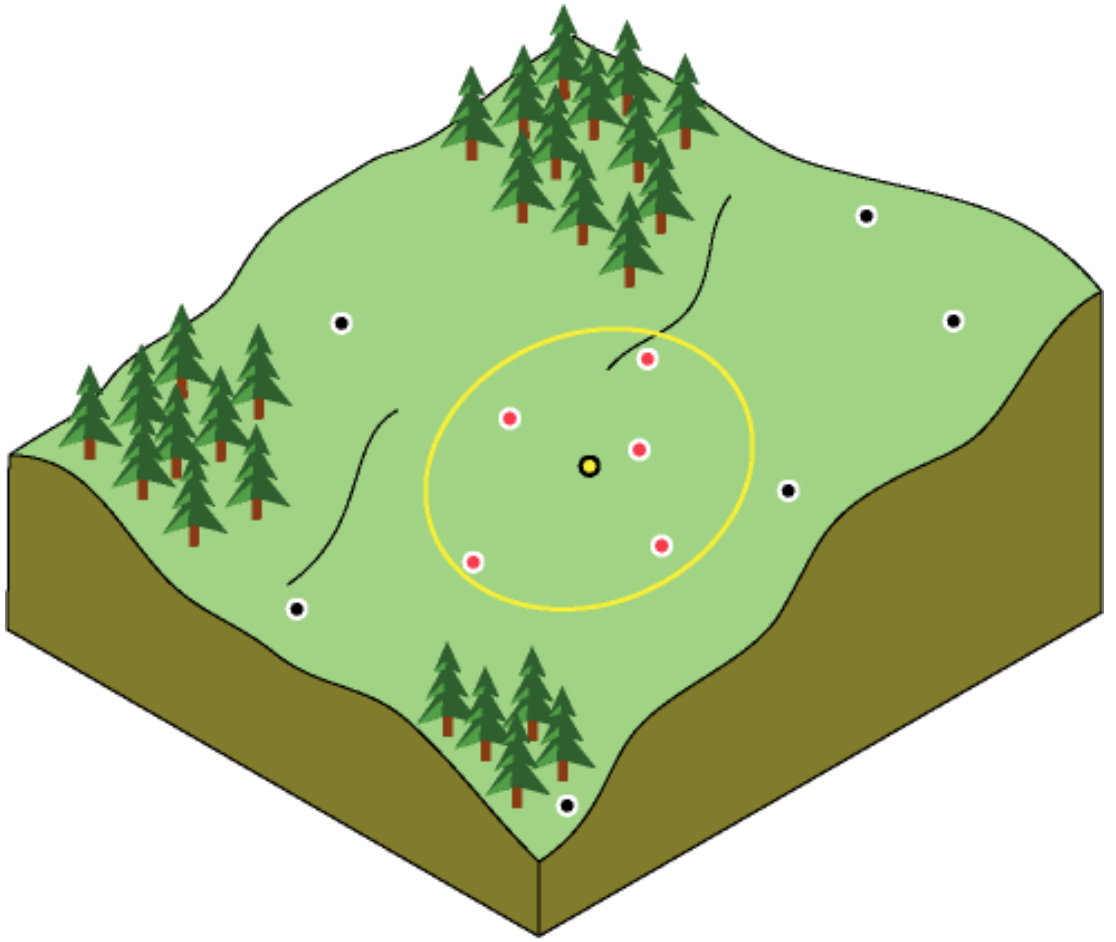
Reference https://thewinnower.com/papers/2847-some-methods-for-measuring-and-correcting-for-spatial-autocorrelation

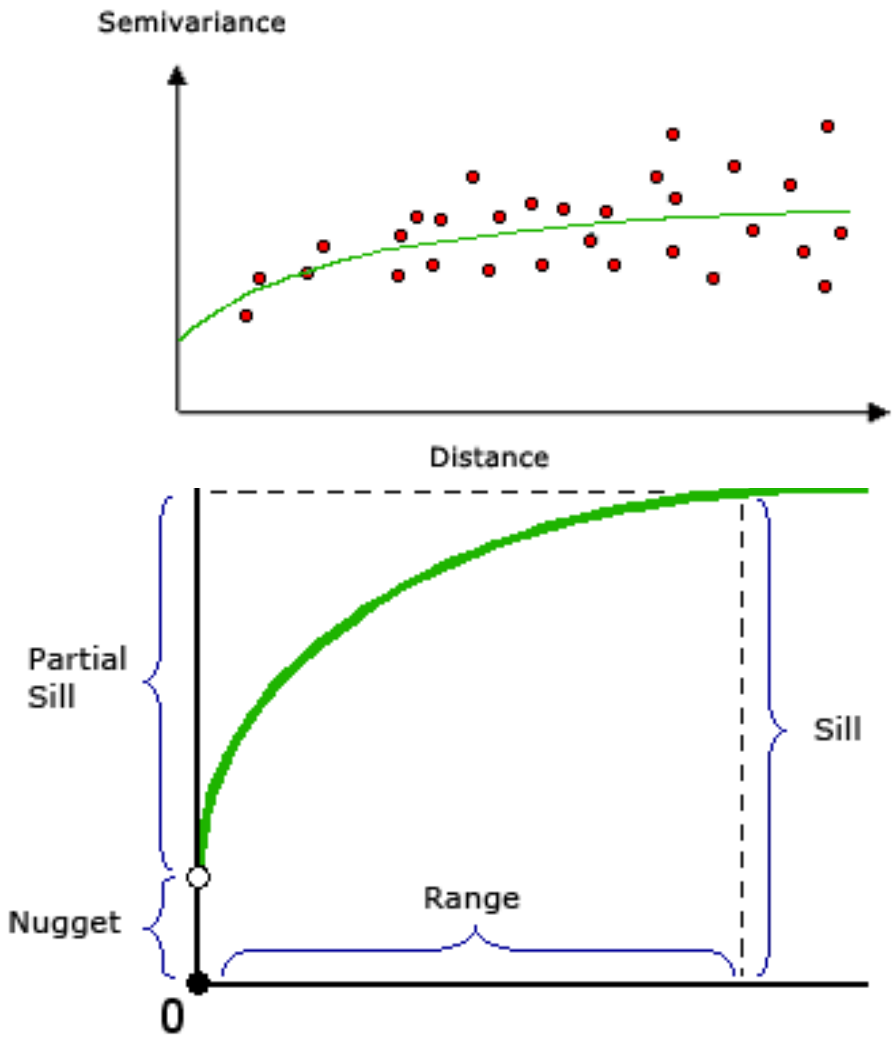
Raster interpolation -IDW

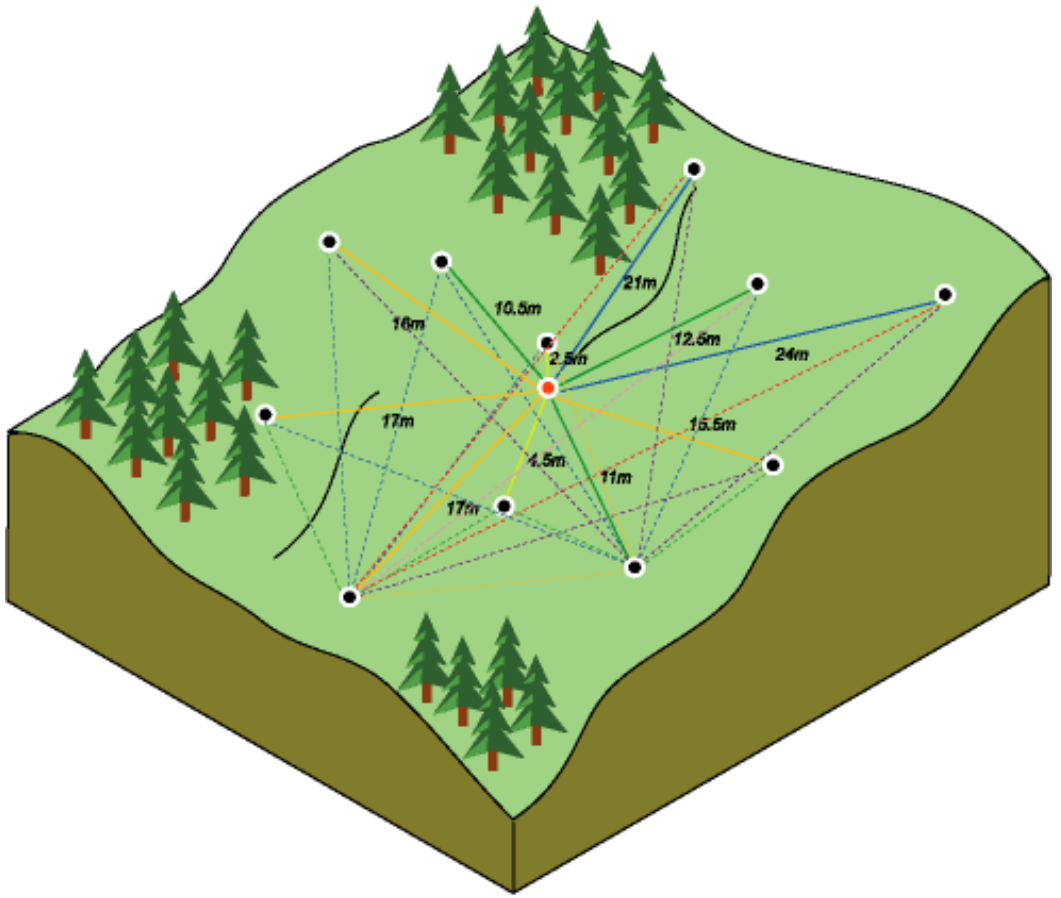


Reference https://pro.arcgis.com/en/pro-app/latest/help/analysis/geostatistical-analyst/how-inverse-distance-weighted-interpolation-works.htm

Raster analysis

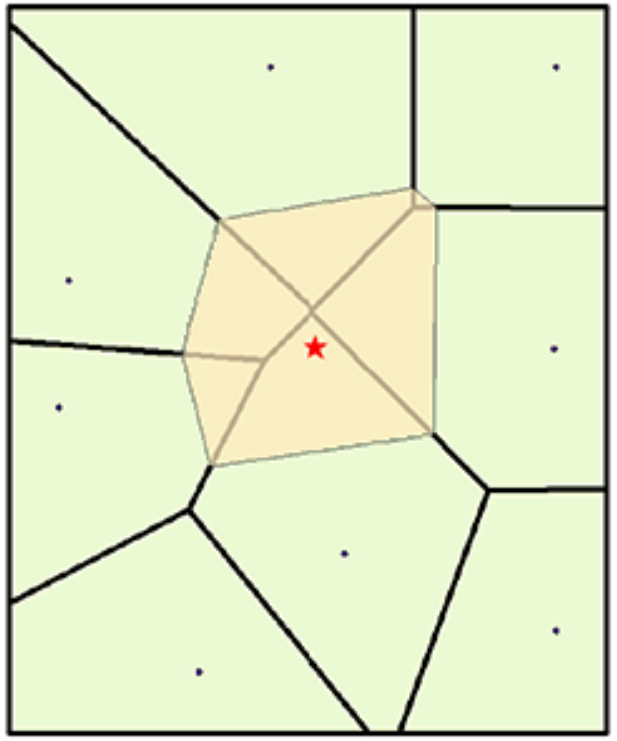
Raster interpolation -Kriging

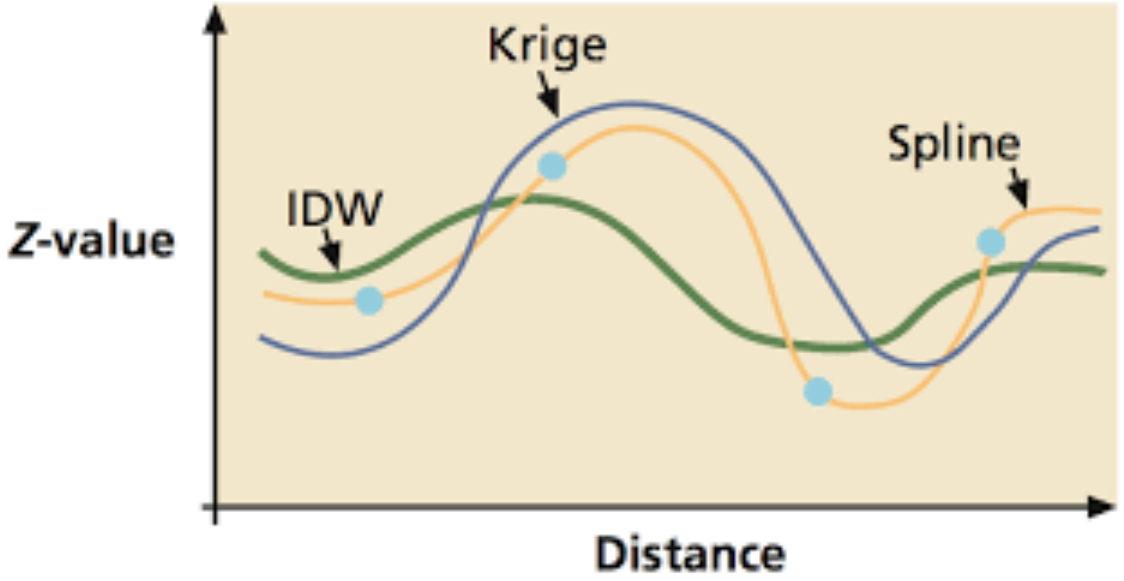




Reference How kriging works
https://pro.arcgis.com/en/pro-app/latest/tool-reference/3d-analyst/how-kriging-works.htm

Raster interpolation –Natural neighborhood and Spline





Reference https://pro.arcgis.com/en/pro-app/latest/tool-reference/3d-analyst/how-natural-neighbor-works.htm

http://giswin.geo.tsukuba.ac.jp/sis/tutorial/Creating%20a%20DEM%20from%20a%20Topographic%20Map_RCEstoque.pdf