

Geographic Information System

Vector Data – Part II

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Outline

- Extract (Clip/ Select)
- Overlay (Union/ Intersect/ Identity/ Erase)
- **Proximity** (Buffer/ Near/ Create Thiessen Polygon)
- Dissolve
- **Density** (Point/ Kernel/ Line)
- Polygon To Line/ Join Features/ Feature To Point
- Symbology



Objectives

- Today, we would like to demonstrate a case:
 - How does debris flow affect our electric infrastructure?
 - The spatial distribution of population in Taipei City



Extract :: Clip

• Extracts input features that overlay the clip features.

 Use this tool to cut out a piece of one dataset using one or more of the features in another dataset as a cookie cutter. This is particularly useful for creating a new dataset—also referred to as a study area or area of interest (AOI)—that contains a geographic subset of the features in another, larger dataset.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/clip.htm

~ 4 ×

Extract :: Select

- Extracts features from an input feature class or input feature layer, typically using a select or **Structured Query Language (SQL) expression**, and stores them in an output feature class.
- The select or SQL expression is built with the Query Builder or is typed in. For details on the expression syntax, see Write a query in the query builder or SQL reference for query expressions used in ArcGIS.

Overlay :: Union

• Computes a geometric union of the input features. All features and their attributes will be written to the output feature class.



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| Gaps Allowed | | |

Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/union.htm

Overlay :: Intersect

• Computes a geometric intersection of the input features. Features or portions of features that overlap in all layers or feature classes will be written to the output feature class. Geoprocessing



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| The Pairwise Intersect tool provides enhanced functionality or performance. Parameters Environments | × |
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| Same as input | ~ |

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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/intersect.htm

Overlay :: Identity

 Computes a geometric intersection of the input features and identity features. The input features or portions thereof that overlap identity features will get the attributes of those identity features.



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| Keep relationships | | |

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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/identity.htm

Overlay :: Erase

• Creates a feature class by overlaying the input features with the erase features. Only those portions of the input features falling outside the erase features are copied to the output feature class.



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| Output Feature Class | | | | |
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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/erase.htm

Proximity :: Buffer

• Creates buffer polygons around input features to a specified distance.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm

Proximity :: Near

• Calculates distance and additional proximity information between the input features and the closest feature in another layer or



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/near.htm

Proximity :: Create Thiessen Polygon

- Creates Thiessen polygons from point features.
- Each Thiessen polygon contains only a single point input feature. Any location within a Thiessen polygon is closer to its associated point than to any other point input feature.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/create-thiessen-polygons.htm

Dissolve

- Aggregates features based on specified attributes.
- An alternate tool is available for dissolve operations. See the Pairwise Dissolve tool documentation for details.







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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/dissolve.htm

Density :: Point Density

• Calculates a magnitude-per-unit area from point features that fall within a neighborhood around each cell.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/point-density.htm

Density :: Point Density

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| Output cell size | | | | |
| 500 | | | | |
| Neighborhood | | Circle | | ~ |
| | Radius | | | 500 |
| | Units type | Map | | ~ |
| Area units | | | | |
| Square meters | | | | ~ |

| Annulus | A torus (donut shaped) neighborhood defined by an inner and outer radius. |
|-----------|--|
| Circle | A torus (donut shaped) neighborhood defined by an inner and outer radius. |
| Rectangle | A rectangular neighborhood with the given height and width. |
| Nedge | A wedge-shaped neighborhood. A wedge is specified by a start angle, an end angle and a radius. The wedge extends counterclockwise from the starting angle to the ending angle. Angles are specified in arithmetic degrees (counterclockwise from the positive x-axis). Negative angles may be used. |

Cell | Map

Defines the units of the selected neighborhood measurements in either cells or map units (based on the linear unit of the projection of the output spatial reference). Chun-Hsiang Chan (2024) | Geographic Information System

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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/point-density.htm

Density :: Kernel Density

• Calculates a magnitude-per-unit area from point or polyline features using a kernel function to fit a smoothly tapered surface to each point or polyline. A barrier can be used to alter the influence of a feature while calculating kernel density.



OutRas = KernelDensity(InPts, None, 30)

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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/kernel-density.htm

Density :: Kernel Density

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| Output cell size | | |
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| Search radius | | 500 |
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| Output cell values | | |
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| Method | | |
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| Input barrier features | | |
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| Densities | The output values represent the calculated density value per unit area for each cell. This is the default. |
|-----------------|--|
| Expected counts | The output values represent the calculated density value per cell area. |
| Planar | The planar distance between features will be used. This is the default. |
| Geodesic | The geodesic distance between features will be used. |
| | |

Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/kernel-density.htm

Density :: Line Density

• Calculates a magnitude-per-unit area from polyline features that fall within a radius around each cell.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/line-density.htm

Polygon To Line

 Creates a feature class containing lines that are converted from polygon boundaries with or without considering neighboring polygons.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/polygon-to-line.htm

Join Features

 Joins attributes from one layer to another based on spatial, temporal, or attribute relationships, or a combination of those relationships.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/big-data-analytics/join-features.htm

Join Features

| Spatial Relationship | Intersects Equals Planar Near—Uses planar distances. Geodesic Near—Uses geodesic distances. Contains | WithinTouchesCrossesOverlaps |
|--------------------------|--|--|
| Temporal Relationship | Meets Met by Overlaps Overlapped by During Contains Equals Finishes | Finished by Starts Started by Intersects Near Near Before Near After |

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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/big-data-analytics/join-features.htm

Feature To Point

• Creates a feature class containing points generated from the centroids of the input features or placed within the input features.



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Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/feature-to-point.htm

Symbology :: Polygon (example)

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|------------|--|---------------|--------------|--------------|
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| Graduat | ed Colors | Purples | | |
| Symbo | blize your layer using one symbol | Blues | | |
| | | Greens | | |
| | Single Symbol | Oranges | | |
| | Draw using single symbol. | Reds | | |
| Symbo | plize your laver by category | YlOrBr | | |
| | | YlOrRd | | |
| | Unique Values | OrRd | | |
| L 1 | Draw categories using unique values of one or multiple fields. | PuRd | | |
| Symbo | lize your laver by quantity | RdPu | | |
| Symbo | hize your layer by qualitity | BuPu | | |
| | Graduated Colors | GnBu | | |
| | Draw quantities using graduated colors. | PuBu | | Continuous |
| | | YlGnBu | | continuous, |
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| 5 | Draw quantities using proportional symbols. | gist stern | | |
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| Symbo | olize your layer using symbol attributes | rainbow | | |
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Qualitative colormaps



The Enc

Thank you for your attention!

Email: chchan@ntnu.edu.tw Web: toodou.github.io