Refining Spatial Autocorrelation Analysis for Dasymetrically Disaggregated Spatial Data

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Dasymetric mapping is a special cartographic technique that is mostly used in mapping populations or redistributing the value of any spatial population into smaller zones. Aside from its use in mapping and visualization, the dasymetrically disaggregated spatial data can also be used to analyze a variable's spatial segregation through spatial autocorrelation analysis.

This study proposes a refinement in the spatial autocorrelation analysis techniques to enhance its appropriateness when using dasymetrically disaggregated data.

WHAT IS…

DASYMETRIC MAPPING?

Dasymetric mapping has two steps. First, *disaggregation*, where geographic area units, called "choropleth zones" are disaggregated into smaller subareas called "dasymetric zones"; and second, *allocation*, where the value of a quantitative attribute is redistributed into the resulting dasymetric zones. The allocation of the attribute can be done using either the binary, or the three-class approach.

SPATIAL AUTOCORRELATION?

The term refers to the tendency of a spatial variable to exhibit spatial segregation or dispersion. Measuring the degree of spatial autocorrelation is equivalent to measuring the presence and the intensity of spatial segregation of the variable in question. It can be measured either globally, i.e. to singly characterize autocorrelation over an entire area; or locally, i.e. to detect localized spatial clusters or outliers.

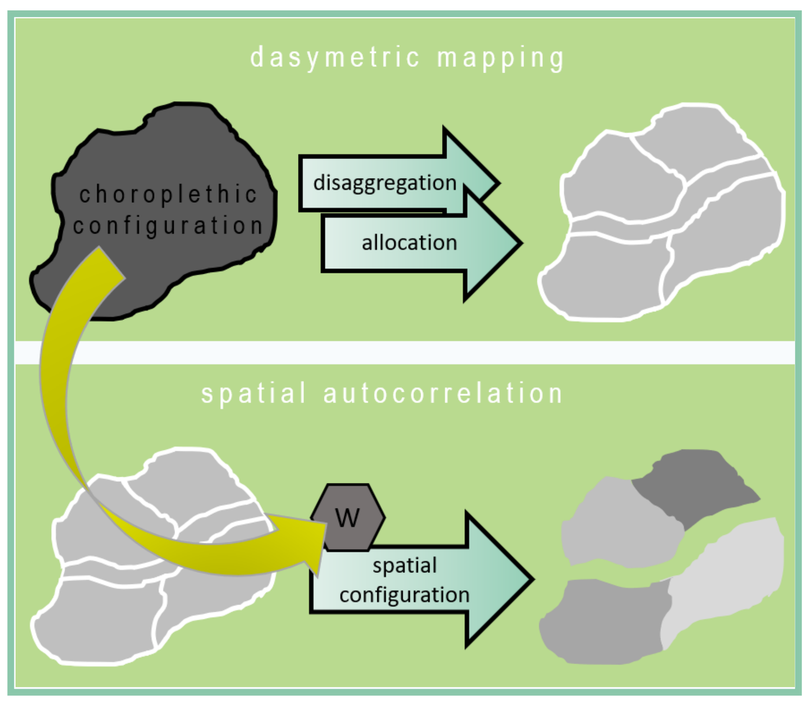

Figure 1. Conceptual framework for the revised spatial matrix incorporating choroplethic and spatial configuration of dasymetrically disaggregated spatial data.

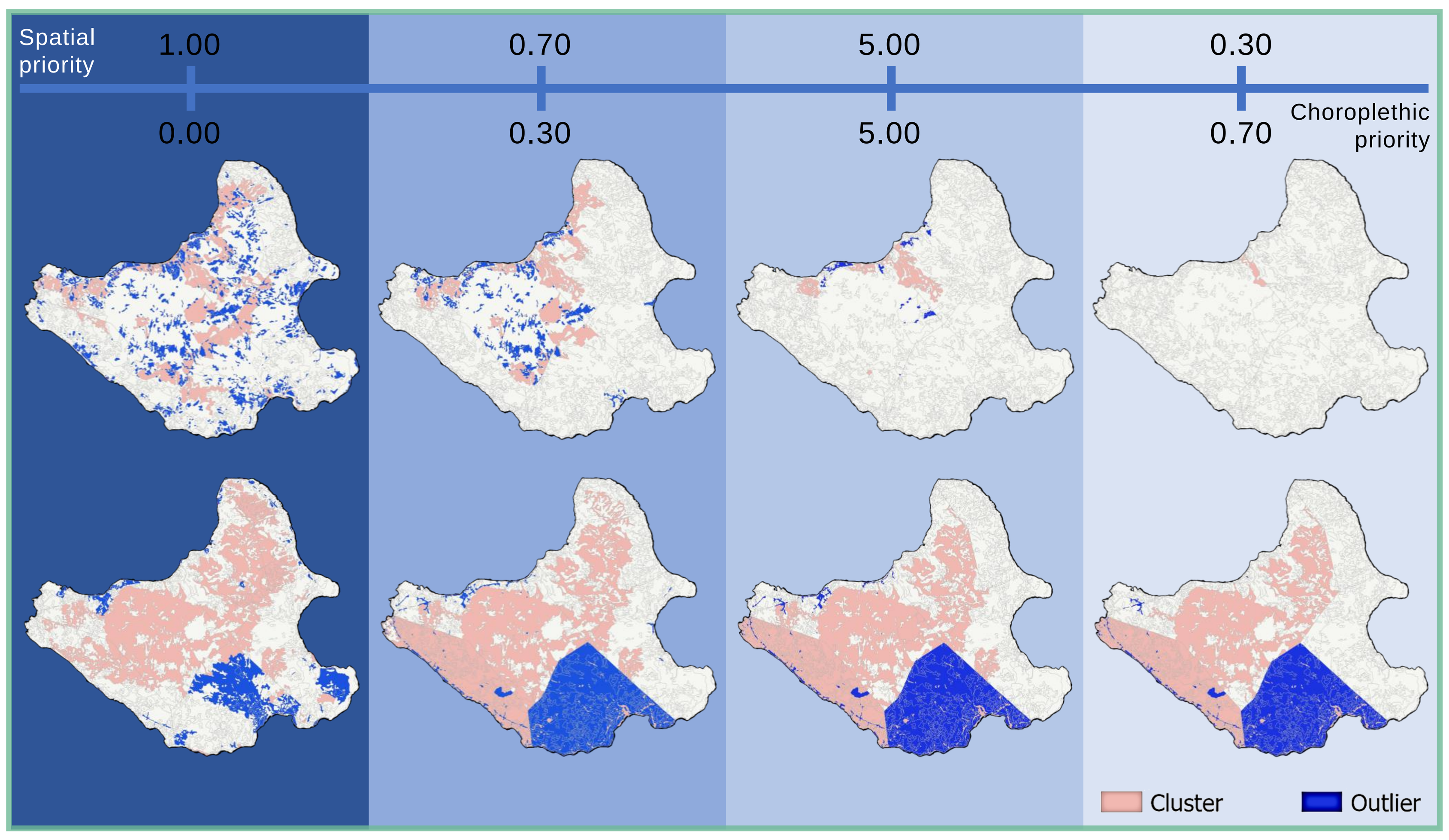

Figure 2: The twin effect of the revised spatial weight matrix on spatial autocorrelation analysis of dasymetric data. When the spatial priority decreases (thus, choropleth priority increases), detected spatial autocorrelation for raw counts decreases. On the other hand, when analyzing densities, the same priority definition results in an increase in detected spatial autocorrelation.

WHY REFINE?

Conventional spatial autocorrelation analysis measures spatial segregation based on the spatial configuration of area units. It is postulated here that this is not sufficient for dasymetrically disaggregated data and disregards neighborhood relationships that may exist among dasymetric zones originating from the same parent choropleth zones. Thus, the choroplethic configuration of the dasymetric zones must also be incorporated in the analysis.

HOW TO REFINE?

It is proposed here that information regarding the lineage of dasymetric zones with respect to their antecedent choropleth zones be supplied into the spatial weight assignment process. In other words, a revised spatial weight matrix must be used in the spatial weight assignment process when for the spatial autocorrelation analysis of dasymetrically disaggregated spatial data. This revised spatial weight matrix simultaneously takes into account the spatial *and* the choroplethic configuration of the dasymetric zones. This idea is illustrated in Figure 1.

The revised spatial weight matrix for dasymetrically disaggregated data can be implemented in a hierarchy-based approach, where the spatial and the choroplethic configuration of the dasymetric zones are defined based on relative spatial and choroplethic priority values.

WHAT ARE THE RESULTS?

Using the revised spatial weight matrix has two contrasting effects, depending on the input variable being analyzed.

1. For raw counts, an increasing priority for the choroplethic configuration results in decreasing levels of detectable spatial clustering or dispersion, reflected both on the spatial autocorrelation index, and the number of significant local spatial clusters and outliers.
2. Contrarily for densities, an increasing priority in the choroplethic configuration yields increasing levels of detected spatial clustering or dispersion. This again manifests as increasing absolute values in global spatial autocorrelation index, and a steep then plateauing increase in number of local spatial clusters and outliers.

CONCLUSION

It is concluded in this study that spatial autocorrelation analysis can possibly be refined when using dasymetrically disaggregated spatial datasets.

Substantial difference can be observed in the analysis output when applying the refined spatial autocorrelation analysis proposed here. The relative weighting or priority between the spatial and the choroplethic configuration can be variably defined, as long as the value for the spatial priority is either greater than or equal to that of the choroplethic priority.

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