

Tree-Based Inference for Regionalization: A Comparative Study of Global Topological Perturbation Methods

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Abstract : In this paper, a tree-based perturbation methodology for regionalization inference is presented. Regionalization is a constrained optimization problem that aims to create groups with similar attributes while satisfying spatial contiguity constraints. Similar to any constrained optimization problem, the spatial constraint may hinder convergence to some global minima, resulting in spatially contiguous members of a group with dissimilar attributes. This paper presents a general methodology for rigorously perturbing spatial constraints through the use of random spanning trees. The general framework presented can be used to quantify the effect of the spatial constraints in the overall regionalization result. We compare several types of stochastic spanning trees used in inference problems such as fuzzy regionalization and determining the number of regions. Performance of stochastic spanning trees is juxtaposed against the traditional permutation-based hypothesis testing frequently used in spatial statistics. Inference results for fuzzy regionalization and determining the number of regions is presented on the Local Area Personal Incomes for Texas Counties provided by the Bureau of Economic Analysis.

Keywords : regionalization, constrained clustering, probabilistic inference, fuzzy clustering

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