Space-Time Clustering and Regionalization of Small Areas with Bayesian Methods

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Consider a map composed by n small areas and a vector of characteristics Y measured in each one of them. Many applications have problems that can be formulated as the aggregation of the small areas into few larger regions with spatial contiguity constraints. For example, health districting is commonly used to obtain economic efficiency due to scale-effects. Problem-specific regionalization, leading to ad-hoc partition of the space, can be the appropriate method when public health intervention is the main concern.

As a result of spatial clustering the small areas, the few regions created should be as homogeneous as possible with respect to the Y characteristics. Hence, the problem is one of clustering objects (or areas) with spatial contiguity constraints. The major technical difficulty is the same of clustering in general: the huge (but finite) number of possible partitions that should be considered to choose a reasonable one.

This talk presents a Bayesian method based on MCMC methods to solve this problem. The main novelty compared with other proposals is the use of generating trees rather than the entire neighborhood graph and the allowance for slightly different distributions for Y within a spatial cluster. The method drastically reduces the state space of all possible spatial graph partitions by considering partitions of all possible generating trees. It also avoids the use of reversible jump MCMC to draw inference. An example with data from a large Brazilian town is presented to illustrate the method. We also discuss the extension of the method to space-time situations.