Design based inference on spatial totals with Elastic-Net regularization

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Abstract

Recently, [1] and [3] have proposed a penalized spline regression estimator to estimate a spatial total. This estimator is capable of properly taking into account the spatial autocorrelation, which typically characterizes spatial populations. It can be implemented for finite spatial populations (the sample is drawn from a finite number of plots) as well as for continuous populations (the sample is made of a points selected from a compact and connected subset of the plane). Such estimator is approximately design unbiased and consistent. Furthermore, under certain conditions it can be superefficient, that is, the sampling variance is of order greater than $n^{-1}$ (see [3]).

In this work we explore the use of glmnet, implemented in the R programming system for Elastic-Net regularization proposed by [2]. This algorithm is based on the coordinate descendent technique and is quite efficient. It enables faster computation of the regression coefficients required by the penalized spline estimator of the spatial total. Furthermore, this function fits generalized linear models with Elastic-Net as penalties. Using this tool, we can quickly extend the penalized spline regression technique to estimate spatial total of dichotomous data, multinomial data, and count data.

Finally, through a simulation study, we compare ridge and Lasso based penalized spline regression estimators for different types of data to highlight the potentiality of this approach.

Key words: Penalized splines; Randomization distribution; Regression estimator.

References


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