

**Estimation of Isotonic Spatio-temporal Model
With Clustering**

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ABSTRACT

The concept of contagion has gained a foothold in mathematical epidemiology and the social sciences. Models which describe the transmission of a contagious entity have found applications in various disciplines. Spatio-temporal models are appropriate for describing transmission (of a disease, for instance) since they account for both the incidence of the disease from the time of its outbreak to the present, as well as the pattern of spreading from the source to the susceptible units. This study introduces a spatio-temporal model for contagion, with possible clustering of spatial units. In addition, the study proposes the backfitting algorithm as an estimation procedure for the model. The model assumes that the degree of contamination in a spatial unit is a function of the population, the incidence of the disease in the recent past, and the distance of the spatial unit from the source. FD-GMM bootstrap and monotone regression via integrated B -splines are embedded into the backfitting algorithm. The prediction performance of the estimation procedure is studied for varying cluster sizes, numbers of clusters, time series lengths, stationarity conditions, and degrees of misspecification. The results show that the procedure performs best when the model is correctly specified, the model is stationary. There are few clusters, the time series is long or the cluster sizes are much greater than the time series length.

Keywords: Spatio-temporal model, isotonic regression, FD-GMM bootstrap, backfitting algorithm, clustering, contagion