

Spatial dependence is usually introduced into spatial models using measure of physical proximity. When analyzing COVID-19 case counts, this makes sense as regions that are close together are more likely to have more people moving between them, spreading the disease. However, using the actual number of trips between each region may explain COVID-19 case counts better than physical proximity. In this paper, we investigate the efficacy of using telecommunications-derived mobility data to induce spatial dependence in spatial models applied to two Spanish communities' COVID-19 case counts. We do this by extending Besag York Mollie (BYM) models to include both a physical adjacency effect, alongside a mobility effect. The mobility effect is given a Gaussian Markov random field prior, with the number of trips between regions as edge weights. We leverage modern parametrisations of BYM models to conclude that the number of people moving between regions better explains variation in COVID-19 case counts than physical proximity data. We suggest that this data should be used in conjunction with physical proximity data when developing spatial models for COVID-19 case counts.

Keywords: Bayesian hierarchical model, Besag York Mollie model, COVID-19, Gaussian Markov random field