Modeling transport mode decisions using hierarchical logistic regression models with spatial and cluster effects

Abstract:
This work is motivated by a mobility study conducted in the city of Munich, Germany. The variable of interest is a binary response, which indicates whether public transport has been utilized or not. One of the central questions is to identify areas of low/high utilization of public transport after adjusting for explanatory factors such as trip, individual and household attributes. For the spatial effects a modification of a class of Markov Random Fields (MRF) models with proper joint distributions introduced by Pettitt et al. (2002) is developed. It contains the intrinsic MRF in the limit and allows for efficient Markov Chain Monte Carlo (MCMC) algorithms. Further cluster effects using group and individual approaches are taken into consideration. The first one models heterogeneity between clusters, while the second one models heterogeneity within clusters. A naive approach to include individual cluster effects results in an unidentifiable model. It is shown how a re-parametrization gives identifiable parameters. This provides a new approach for modeling heterogeneity within clusters. Finally the proposed model classes are applied to the mobility study.

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