# Two-dimensional Intrinsic Gaussian Markov Fields in blood pressure data

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**Abstract:**
Raised blood pressure is a key risk factor for non-communicable diseases, and is estimated to affect 1.13 billion people worldwide. A Bayesian hierarchical model for the variables of diastolic blood pressure (DBP), systolic blood pressure (SBP) and especially the interaction (INT) of these two is proposed. We separate the globe into groups of countries whereas each country is a member of a region and super-region. This structure allows to borrow strength across regions and super-regions when no data exist. Within each country, data are correlated temporally and within each region and super-region data have temporal and between-countries correlation. A two dimensional second order Intrinsic Gaussian Markov Fields (IGMRF) will be used as a covariance matrix in a prior for DBP and SBP accounting for the interaction of these two as well. Hence, every possible combination between the years of DBP and SBP variables will be taken into account having the possibility to observe their INT. For the computational process, we use canonical parametrisation for the Block-Metropolis' updates and Cholesky factorisation for the Gibbs' sampler updates. Age, diet types, urbanization and studies' coverage are also included. Performance is demonstrated with simulation studies and real data.

**Key words:** Intrinsic Gaussian Markov Random Fields; B-splines; Block-Metropolis sampling; MCMC

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