# Covariance matrix prior distribution on hierarchical Linear models

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**Abstract**

Covariance matrix estimation is a common and usually difficult task in statistics. We present a comparative study for some covariance matrix prior choices on the context of Bayesian hierarchical linear models. In Bayesian analysis an inverse Wishart distribution is the natural choice for a covariance matrix prior because its conjugacy on normal model and simplicity, is usually available in Bayesian statistical software. However inverse Wishart distribution presents some undesirable properties from a modeling point of view. It can be too restrictive because assume the same amount of prior information about every variance parameters and, more important, it shows a prior relationship between the variances and correlations.

Two alternatives distributions has been proposed. The scaled inverse Wishart distribution, which give more flexibility on the variance priors conserving the conjugacy property but does not eliminate the prior relationship between variances and correlations. Secondly, it is possible to fit separate priors for individual correlations and standard deviations. This strategy eliminates any prior relationship within the covariance matrix parameters, but it is not conjugate and therefore computationally slow.

The objective of this study is to understand the impact of these prior choices on the covariance matrix posterior.

We applied a hierarchical model with the different covariance priors using a forest bird monitoring program data provided for the Natural Resources Research Institute as an example. Data consist in the yearly bird count for 73 species on three National Forest from 1995 to 2013.