

# Identification of the Variance Components in the General Two-Variance Linear Model

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## **Abstract:**

Bayesians frequently employ two-stage hierarchical models consisting of two variance parameters: one controlling measurement error and the other controlling the degree of smoothing implied by the model's higher level. These analyses can be hampered by poorly-identified variances which may lead to difficulty in computing and in choosing reference priors for these parameters.

In this presentation, we introduce the class of two-variance hierarchical linear models and characterize the aspects of these models that lead to well-identified or poorly-identified variances. These ideas are illustrated with a spatial analysis of a periodontal data set and examined in some generality for specific two-variance models including the conditionally autoregressive (CAR), one-way random effects, and multiple membership models. We also connect this theory with other constrained regression methods and suggest a diagnostic that can be used to search for missing spatially-varying fixed effects in the CAR model.