

STATISTICS COLLOQUIUM

MONDAY, MAY 5, 2014

TALK: 2:00 PM — SCIENCE CENTER RM. 705

RECEPTION: 3:30 PM — SCIENCE CENTER, 7TH FLOOR

“Advances in the Normal-Normal Hierarchical Model”

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ABSTRACT

Normal-Normal hierarchical models are widely used in a range of applied statistical problems where the data has a grouping or hierarchical structure. Confidence intervals for random effects that are based on MLE and REML estimates of shrinkage factors usually undercover substantially, as will be illustrated with data for eight schools, for 23 hospitals, etc. We have developed a fast procedure called Gaussian Regression Interactive Multilevel Modeling (GRIMM), by using Bayesian construction assuming Stein's uninformative harmonic prior at Level-II and an approximation for the distribution of shrinkage factors based on ADM (adjustment for density maximization). Our approximate Bayesian interval estimates are constructed to incorporate skewness present in the posterior distribution of the random effects and the approximation is compared to results via MCMC. The resulting intervals, interpreted as confidence intervals, are seen (via simulation) to improve substantially on those based on MLE and REML approximations and to meet their nominal 95% confidence levels. We refer to currently available software developed for this model and others in the form of an R package Rgbp (Kelly, Tak, Morris, 2014)

To fit such Normal-Normal hierarchical models, we propose the algorithm Adjustment for Density Maximization Data Augmentation (ADMMDA) as an alternative to current Newton-Raphson based methods. ADMMDA is based on EM and is shown never to decrease the adjusted likelihood at any iteration. Together, ADMMDA and EM algorithms for MLE and REML based on this data augmentation scheme are also shown to have substantial speed improvements for certain data compared to EM based methods that utilize other data augmentation schemes. Speed improvements are also shown under this data augmentation when undertaking MCMC via the Gibbs sampler.