Simplified INLA, automatic differentiation and adaptive Gauss-Hermite quadrature for fast and accurate approximate inference

Integrated nested Laplace approximations for extended latent Gaussian models, with application to the Naomi HIV model

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The Naomi model

Inference procedure

Laplace approximation
Adaptive Gauss-Hermite Quadrature

Approximate integrals by

$$\int_{\Theta} p(\theta) \mathrm{d}\theta \approx |L| \sum_{z \in \mathcal{Q}(m,k)} p(\hat{\theta} + Lz)\omega(z)$$

with **Gauss-Hermite quadrature** rule $z \in \mathcal{Q}(m, k)$ **adapted** based upon the mode $\hat{\theta} = \mathrm{argmax}_{\theta \in \Theta} \in p(\theta)$ and lower Cholesky $LL^\top = -\partial^2_\theta \log p(\theta)|_{\theta=\hat{\theta}}$ of the target.

Our algorithm

Given C++ user template for $-\log p(y, x, \theta)$:

Comparison
Conclusions

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References