

Short course
An introduction to INLA and spatial models

February 4, 2013

Research Group on Statistics, Econometrics and Health (GRECS),
University of Girona, Girona

Lecturer

[Daniel Simpson](#)

Department of Mathematical Sciences
Norwegian University of Science and Technology

Abstract

In these lectures, I will discuss approximate Bayesian inference for a class of models named 'latent Gaussian models' (LGM). LGM's are perhaps the most commonly used class of models in statistical applications. It includes, among others, most of (generalized) linear models, (generalized) additive models, smoothing spline models, state space models, semiparametric regression, spatial and spatiotemporal models, log-Gaussian Cox processes and geostatistical and geoadditive models.

The concept of LGM is intended for the modeling stage, but turns out to be extremely useful when doing inference as we can treat models listed above in a unified way and using the *same* algorithm and software tool. Our approach to (approximate) Bayesian inference, is to use integrated nested Laplace approximations (INLA). Using this new tool, we can directly compute very accurate approximations to the posterior marginals. The main benefit of these approximations is computational: where Markov chain Monte Carlo algorithms need hours or days to run, our approximations provide more precise estimates in seconds or minutes. Another advantage with our approach is its generality, which makes it possible to perform Bayesian analysis in an automatic, streamlined way, and to compute model comparison criteria and various predictive measures so that models can be compared and the model under study can be challenged.

In these lectures I will introduce the required background and theory for understanding INLA, including details on Gaussian Markov random fields and fast computations of those using sparse matrix algorithms. I will end these lectures illustrating INLA on a range of examples in R (see www.r-inla.org).

Course program

- 9:15 - 12:30 - Introduction and outline of the course, background.
- Latent Gaussian models:
 - INLA method:
 - An introduction to Gaussian Markov random fields.
 - Fast computation using sparse matrix algorithms
 - R-INLA: Bayesian inference using Integrated Nested Laplace approximations.
- 12:30 - 13:30 *Lunch*
- 13:30 - 16:30 - R-INLA package to solve computationally efficient Markovian spatial models (Lindgren *et al.* JRSSB, 2011).
- Examples and case-studies in R.

Practical informations

Organiser: Research Group on Statistics, Econometrics and Health (GRECS), University of Girona, CIBER of Epidemiology and Public Health (CIBERESP), <http://www.udg.edu/greecs.htm>
Statistics and Operation Research Unit, Department of Mathematics, University Jaume I, Castellón,

Location: Faculty of Business and Economics, University of Girona, Campus de Montilivi, Girona, Spain.

Fee: Participation is free, but registration is required

Registration: Registration is done by e-mailing Laura Serra: laura.serra@udg.edu

Maximum number of participants is 30!

Bring a laptop! Participants are encouraged to bring a laptop with the most recent version of R and of R-INLA installed.

Dead-line for registration is December 14, 2012.