Advanced Bayesian Methods

Teaching staff

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Aims

The objective is to provide students with the adequate tools to perform a tailor-made Bayesian inference for each statistical problem they have to solve. Therefore, we begin with general notions of statistical inference dicussing why we choose the Bayesian way, making the emphasis in the use of default priors and the basic notions of Bayesian inference which are applied to the inference for linear models.

Then, we deal with Bayesian computing presenting the MCMC methods for simulation which allow us to simulate from the posterior distribution in the case we are not able to analytically obtain it, this is what allow us to model in a tailor-made fashion keeping at the same time the capacity to solve the proposed model. Finally, we deal with the specific problems of Bayesian model selection and Bayesian inference for diffusion processes.

Programme

1. The general problem of statistical inference. Frequentist and Bayesian approximations.
2. Prior information. Default priors.
3. Elements of Bayesian inference.
4. Bayesian linear models.
5. Bayesian computing.
6. Bayesian model selection.
7. Bayesian inference for diffusion processes.

Bibliography

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- Gammerman, D. (1997). *Markov Chain Monte Carlo Stochastic Simulation for Bayesian Inference*. Chapman & Hall.

- Jeffreys, H. (1961). *Theory of Probability. Oxford University Press*, London.
- O'Hagan, A. (1994). *Bayesian Inference*. Kendall's Advanced Theory of Statistics 2B. Edward Arnold, London.
- Robert, C. P. and Casella, G. (1999). *Monte Carlo Statistical Methods*. Springer-Verlag.

Methodology

The course is double oriented, it is both theoretical and applied oriented. First, we develop the theory to perform a Bayesian analysis and then we use recent developments in Monte Carlo and MCMC methods which allow us to implement the above mentioned analysis along some practical lessons.

Assessment criteria

Practical part: students must present a relation of properly solved problems with different levels of difficulty about the items of the programme.

Theoretical part: students should pass a theoretical exam of the program, or alternatively, they have to present an advanced discussion about some item of the programme.

▲ *Panoramic view of the Athletics Stadium «Monte Romero», in whose interior a fitness room is located.*