Bayesian inference: a guided tour from theoretical foundations to models' implementation

PhD programme in *Mathematics and Statistics*

Instructors: Antonio Lijoi and Eugenio Regazzini (University of Pavia)

Description

The course is composed of two parts. The first part is essentially of foundational nature and aims at providing a development of de Finetti's original ideas about induction. These ideas lead to a reconsideration of the classical Bayes-Laplace paradigm according to a rigorous subjectivistic intepretation of probability. The second part introduces some basic models commonly used in Bayesian nonparametric practice for survival analysis, density estimation and species sampling problems. This is supplemented by an overview of some computational methods that are adopted for an approximate evaluation of Bayesian inferences.

Syllabus

Part 1 (30 hours) **-** E. Regazzini

1. Bayes-Laplace paradigm
2. Bayesian calculus for observations taking values in metric spaces
3. The case of exchangeable sequences. De Finetti's representation theorem and de Finetti's measure.
4. Merging of opinions and other frequency properties of Bayesian procedures with increasing information.
5. Assessment of de Finetti's measure both for parametric models (the case of the exponential family) and for nonparametric ones (Dirichlet process and more general processes obtained from normalization of completely random measures)
6. Laws of means of random probability measures with a view to the statement of quantitative bounds for the validity of frequency properties mentioned in point 5.

Part 2 (20 hours) - A. Lijoi

1. Completely random measures (CRMs) and priors for survival analysis: neutral to the right processes, models for cumulative hazards and for hazard rates.
2. Discrete nonparametric priors: species sampling models and stick-breaking procedures. The two-parameter Poisson-Dirichlet and the normalized inverse-Gaussian processes.
3. Priors for density estimation: mixtures of the Dirichlet process and of more general normalized CRMs
4. Markov Chain Monte Carlo algorithms for Bayesian density estimation.

References

Part 1: Notes by Eugenio Regazzini

Part 2: Detailed references will be provided by Antonio Lijoi during the lectures.

Dates

Part 1: Lectures will be delivered on Wednesdays and Thursdays, at 2:30 pm, starting from February 13, at the Department of Mathematics, Aula "Beltrami" (University of Pavia).

Part 2: Lectures will start in October 2013.