

LTCC Proposed Course

- Title: **Advanced Computational Methods in Statistics**
- Basic Details:
 - Core Audience: stats
 - Course Format: advanced/optional (10 h)
- Course Description:
 - Keywords: MCMC, Perfect sampling, EM algorithm, Bootstrap, Sequential Monte Carlo, Parallel Computing
 - Syllabus:

The course will start from elementary methods and will move quickly to give an overview over several advanced computational techniques that are useful in statistics. The following topics will be covered:

 1. (Parallel) Random number generation and transformation methods
 2. Variance reduction techniques (e.g. quasi Monte Carlo, importance sampling)
 3. Dependent random variables (Brownian motion, Levy processes, Copulas)
 4. EM algorithm
 5. Bootstrap methods
 6. MCMC methods including reversible jump algorithms, parallel chains and perfect sampling (CFTP)
 7. Particle Filtering (Sequential Monte Carlo)
 - Recommended reading:

Any good book about Statistical Computing or Simulation for the more elementary topics, e.g. Ripley (1987) Stochastic Simulation, Wiley.
Monahan (2001) Numerical Methods of Statistics, Cambridge University Press.
 - Additional Optional reading:

Davison&Hinkley (1997) Bootstrap methods and their application, Cambridge University Press.
Doucet et al (2001) Sequential Monte Carlo Methods in Practice, Springer.
Wilkinson (2005) Parallel Bayesian Computation, in Handbook of Parallel Computing and Statistics, Springer.
 - Prerequisites: Some elementary knowledge about stochastic simulation will be helpful due to the fast pace of the course. Basic knowledge in programming (ideally R or S-Plus) will be needed to tackle the problem sheet.
- Format:
 - No of problem sheets: 1 sheet containing all relevant problems. The problems will require the use of computer packages (e.g. R).
 - Electronic lecture notes: lecture material will be made available for download.
 - Proposed timing: spring
 - Lecture/computer session/tutorial/discussion h split: 10/0 /0 /0 /0
- Lecturer Details:
 - Lecturer: Axel Gandy
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