LTCC course on Advanced Computational Methods in Statistics

- Basic details:
  - relevant audience: Statistics, Machine Learning, Applied Probability and Numerical Analysis
  - course format: advanced/optional (10h)

- Description
  - keywords: Simulation, Variance reduction, Monte Carlo methods, Importance Sampling, Markov Chain Monte Carlo, Sequential Monte Carlo
  - syllabus:
    1. Introduction to simulation
       - ❖ basics of Monte Carlo
       - ❖ variance reduction
       - ❖ stochastic approximation
    2. Importance Sampling
       - ❖ some basics, asymptotic variance,
       - ❖ sequential importance sampling
    3. Markov Chain Monte Carlo (MCMC)
       - ❖ Metropolis-Hastings, Gibbs sampling
       - ❖ some basics on theory and practice
    4. Sequential Monte Carlo (SMC)
       - ❖ particle filtering for state space models
       - ❖ sampling for fixed dimensional state spaces
       - ❖ particle MCMC

  - Reading list:
    - ❖ Robert and Casella (1999) Monte Carlo Statistical Methods, Springer
    - ❖ Liu (2001) Monte Carlo strategies in scientific computing, Springer.
    - ❖ Doucet, de Freitas, Gordon (2001) Sequential Monte Carlo Methods in Practice, Springer.
    - ❖ Gillks, Richardson, Spiegelhalter (1996) Markov Chain Monte Carlo in Practice, Chapman Hall

  - Prerequisites:
    - ❖ Basic knowledge of Statistics and Probability.
    - ❖ Familiarity and exposure to Markov Chains or stochastic processes will be useful.
    - ❖ Some basic knowledge of programming in any language appropriate for scientific computing.

- Format:
  - There will be exercises/mini-courseworks posed as homework. There will be no separate problem sheets. The problems will require the use of some programming.
  - Lecture/computer session/tutorial/discussion split: 10/0 /0 /0

- Lecturer details
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