Approximate Bayesian Computation, 7.5 hp

Course period:
Jan 15, 2018 - Mar 17, 2018

Last day for application:
13 Dec, 2017

Course leader / Address for applications:
Magnus Röding / magnus.roding@ri.se

Course description (Advertisement for Ph.D. students):
Approximate Bayesian Computation (ABC) is an increasingly popular inference paradigm in applications where traditional (Bayesian or frequentist) inference is difficult because the likelihood function is e.g. computationally costly to evaluate or unavailable in closed, tractable form. In the course, we will start by briefly studying traditional Bayesian inference and different kinds of simulation-based inference methods in general. Then we proceed to ABC, covering theoretical and computational aspects including summary statistics for likelihood approximation, posterior sampling methods including rejection, markov chain monte carlo, and population monte carlo methods, as well as model selection. The course topics will to some extent be decided during the course because part of the examination will be through lectures given by the participants.

The schedule will be decided together with the participants. It may be distributed over the entire study period but may also be given as an intensive course over a small number of longer sessions.

Responsible department and other participation departments/organisations:
Mathematics Department

Teacher:
Magnus Röding

Examiner:
Johan Tykesson

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1. Confirmation
The syllabus was confirmed by the Head of the Department of Mathematical Sciences 2017-09-15.

Disciplinary domain: Science
Department in charge: Department of Mathematical Sciences
Main field of study: Mathematics

2. Position in the educational system
Elective course; third-cycle education

3. Entry requirements
Basic probability, basic Bayesian statistics, and computer programming.

4. Course content
The course will cover a suitable subset of the following topics. The final curriculum will be decided upon during the course.

- Brief history of simulation-based inference and other methods that eventually led to Approximate Bayesian Computation
- Approximate Bayesian Computation in relation to traditional Bayesian inference
- Posterior sampling methods: rejection, markov chain monte carlo, population monte carlo, and more
- Summary statistics for likelihood approximation
- Model selection

5. Outcomes
At the end of the course, the students will have acquired knowledge about some of the main results, techniques, and applications of Approximate Bayesian Computation, including when and for what problems the method is useful for inference and the pitfalls and remedies of its application. Further, the students will have gained practical experience in computer implementation of the method.

6. Required reading
There will be no course book. The course will be based on a large number of articles. A list of recommended reading will be provided later.

7. Assessment
Examination will be through lectures given by the participants as well as a small programming project.

A Ph.D. student who has failed a test twice has the right to change examiners, if it is possible. A written application should be sent to the Department.

In cases where a course has been discontinued or major changes have been made a Ph.D. should be guaranteed at least three examination occasions (including the ordinary examination occasion) during a time of at least one year from the last time the course was given.

8. Grading scale
The grading scale comprises Fail, (U), Pass (G)

9. Course Evaluation
The course evaluation is carried out together with the Ph.D. students at the end of the course, and is followed by an individual, anonymous survey. The results and possible changes in the course will be shared with the students who participated in the evaluation and to those who are beginning the course.

10. Language of instruction
The language of instruction is English.