Teachers
Professor Anthony Christopher Davison, Institute of Mathematics, EPFL – Swiss Federal Institute of Technology, Lausanne, Switzerland

Professor David V Hinkley, Dept. of Statistics and Applied Probability, University of California, USA

Jun Yu, Department of Forest Economics, SLU, Umeå, Sweden

Professor Dietrich von Rosen, Dept. of Energy and Technology, Swedish University of Agricultural Sciences, Uppsala, Sweden

Language
The language of the course will be English

National contact persons
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Course homepage:
http://www.dina.dk/phd/s/s11/

SLU, Faculty of Forestry, Umeå Campus, Summer school Venue

How to get there?
The easiest way to get to the Faculty of Forestry is by taxi. The taxi cost (from the airport, the bus station, or the railway station) will be between 100-150 SEK, depending on how you travel to Umeå (by plane, bus, submarine or train). The site map of the faculty can be found on www.sfak.slu.se/.
On the 16/6 we will provide some kind of Limousine service.

Centre of Biostochastics
The centre will host you during your stay. For more information about the centre; http://biostochastics.slu.se/.
The course will use the facilities of the university.

Umeå – The City of Birches
Umeå is situated in Norrland about 700km north of Stockholm. There are more than 100.000 inhabitants and 3000 birches. Umeå has two universities, Umeå University and SLU, and 25.000 students. In summer you will see the sun day and night. Nature is wonderful. You can find a huge amount of interesting animals such as reindeers, capercaillie, seals and mosquitoes. To learn more about Umeå you could start by visiting www.umea.se.

Accommodation
Housing will mainly take place at Umeå camping http://www.firstcamp.se/umea/english. Umeå camping site and chalet village is located in beautiful natural surroundings by lake
Nydalsjön on walking distance from SLU. It is possible to rent
bikes. Participants will mostly share rooms (a number of single rooms are available on request) in cottages with cooking facilities, WC, shower and TV.

Bootstrap Methods and Their Applications

Nordic PhD course financed by NOVA

at Swedish University of Agricultural Sciences Umeå

June 16th-27th, 2008

Organized by

Centre of Biostochastics, Swedish University of Agricultural Sciences

On behalf of

Nordic Informatics Network in the Agricultural Sciences

Background
Bootstrap methods introduced by Bradley Efron (1979) belong to the class of computer-intensive methods useful for statistical analysis. They are based on simulation techniques and can be used to calculate standard errors, confidence intervals and significance tests.

The methods are today not only used by statisticians, but also applied by researchers in the life sciences, medical sciences, social sciences, business, econometrics, and other areas where by tradition statistics is used. The methods apply for any level of modelling, and can be used for parametric, semi-parametric, and nonparametric analysis.

This course will present a broad and up-to-date coverage of bootstrap methods with many applied examples.

The explicit recognition and understanding of uncertainty is essential to statisticians and to the statistical sciences in general. One works with probability models, likelihoods, estimation procedures, tests and often one need variances as a measure of uncertainty or natural variation.

Sometimes it is possible to do explicit calculations, or perform approximations but an alternative which Efron pointed out was to use simulations. Moreover, simulations can be used in much more complicated problems than approximate or explicit methods can handle.

The key idea in Bootstrap is to resample from the original data, either directly or via a fitted model. In this way one creates replicated data sets from which uncertainty for those objects of interest can be obtained. The use of Bootstrap methods gives researchers a good chance not to use over-simplified models.

This course
The course starts with a discussion of properties of Bootstrap/resampling methods which includes methods for single samples in parametric and nonparametric models. In particular it is focused on practical issues such as the numbers of replicate data sets needed.

The delta method for variance approximations based on different forms of the so called jack-knife method will be presented.

It will be discussed how the basic ideas of Bootstrap sampling can be extended to several samples. Semi-parametric and smooth models, simple cases where data have hierarchical structure or are sampled from finite populations and missing/censored data will be discussed.

The course will consider basic principles of significance testing, in particular Monte Carlo tests and tests using parametric Bootstrap. The problem of constructing confidence intervals has a long history in the Bootstrap literature. It will be described how simple intervals based on simulations can be used but also more complex methods such as studentized Bootstrap, percentile methods and the double Bootstrap.

The course will also focus on regression models: linear, non-linear semi- and nonparametric regression which for example are of wide use in the agricultural sciences. Special attention will also be on survival analysis and generalized linear models.

Some time will be devoted to how variance reduction techniques such as balanced control varies and importance sampling can be adapted to improve simulations with the aim to reduce the number of simulations.A lot of practical training will be carried out during the course. In particular will several data sets be analysed with the help of the S-Plus language or R.

Aim of the course
The participants should be familiar with programs for applying Bootstrap techniques on estimation and testing problems. In particular participants should know how to construct Bootstrap confidence intervals. Moreover, participants should know how to use the R-program for Bootstrap calculations.

Moreover it is the aim to resample from original data in order to estimate measures of uncertainty is an important issue in data analysis. The course should present a balanced account of both theoretical statistical ideas and the potential of bootstrap methods in applications when analytic solutions are difficult or impossible to obtain. The course should present a number of techniques how the methods can be used and evaluate their performance.

Required knowledge
Familiarity with computers at user level, with basic probability calculus and with basic statistics.

Topics and Key Words
Bootstrap methods
Construction of confidence intervals
Construction of tests
Variance reduction techniques
Semiparametric models
Regression models
S-Plus and R
Throughout the course, the theory will be supplemented with exercises and computer assignments. At the end of the course, the students will work on a two-day project that involves both modelling and computing aspects.

Teaching methods and examination
Lectures alternating with intensive use of computer exercises. The availability of network connected computers is therefore essential for the benefit of the students. A small project is carried out by the students at the end of the course (individually or preferably in small groups). Examination will be based on a written project report handed in at the end of the course in combination with an oral presentation.

Financial support
The course in general is financed by NOVA. Thus course fee as well as accommodation and meals for Ph.D. students from NOVA universities are covered by these general grants. There will be no reimbursement of travel costs. A course fee will be charged from all other participants than NOVA university students.

Further information and registration
A preliminary programme and registration information are available on http://www.dina.dk/phd/s/s11/