Stockholm University

Department of Statistics
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Graduate course in statistics/mathematical statistics 2019:

Some asymptotic methods in statistical inference

Course description

The course is planned to be given during the second half of the Spring Term 2019 at the Department of Statistics, Stockholm University. (A more detailed teaching plan will be posted later.)

Credits: 7.5

Prerequisites
What is *not* needed is knowledge of measure theory. Basic stochastic convergence concepts and results (with proofs) such as the Lindeberg-Lévy central limit theorem should have been covered in previous courses.

Aim
To provide some theory with notation concerning asymptotic methods of statistics and probability with applications to inference problems.

Teaching
Around 7 sessions (4 hours of lectures each).

Examination
The examination will be a combination of problem solving during the course and a concluding mini-project that could be directed towards each student's own research interests.

Contents

Asymptotic theory of statistics and probability is a huge topic, therefore we will concentrate upon a few situations of interest, while also providing some general results. A detail of particular interest is the rate of convergence (e.g. in distribution) which is reflected in the remainder term of an asymptotic expansion. The order of this remainder term is then of importance to specify and the notation of O_p and o_p will be dealt with separately. This knowledge enables us to among other things manage a rigorous proof of the Delta Theorem. We will start with the classical problem of finding a transformation of a statistic, leading to better behaviour for further analysis such as interval estimation or hypothesis testing. Variance stabilizing and symmetrizing methods will be demonstrated and on top of this there is also room for bias corrections. This is presented in Chapter 4 of DasGupta (2008), a book which will be the main source of information for the course. This is more of an encyclopedia than an ordinary textbook with short and concise chapters for each topic, but it also includes exercises. In order to fully appreciate the contents in Chapter 4, bits and pieces from the previous chapters need to be picked up. Then we can move forward to Edgeworth expansions (Chapter 13), which is an important tool to evaluate statistics with respect to closeness to the normal distribution. (This is also related to the famed Berry-Esseen inequality (bound) in Chapter 11.) For e.g. tail areas another technique is preferable, namely saddlepoint approximation (Chapter 14). Furthermore, some general asymptotic theory with results is covered in chapter 5 of Bickel and Doksum (2001). In addition to the books by DasGupta and Bickel & Doksum there are of course numerous articles and books related to these issues.

Main list of course literature

DasGupta, A. (2008). Asymptotic theory of statistics and probability. Springer, New York.

Bickel, P.J. and Doksum, K.A. (2001). Mathematical statistics: Basic ideas and selected topics, vol I, second edition. Prentice Hall, New Jersey. (Chapter 5: Asymptotic approximations, including exercises)

Hall, P. (1992). The bootstrap and Edgeworth expansion. Springer-Verlag, New York. (Chapter 2: Principles of Edgeworth expansion)

Brown, L., Cai, T. and DasGupta, A. (2014). On selecting a transformation: with applications. Preprint.

Course application
To sign up for the course send an e-mail to *per.gosta.andersson@stat.su.se*