UPPSALA UNIVERSITY
Department of Psychology

Course plan for “A Practical Introduction to Bayesian Statistics”

Optional PhD course, 7.5 credits

Aims

After successfully finishing this course, the student will:

1. Have an intuitive understanding of the differences between the frequentist and Bayesian approach to doing statistics;
2. Have an intuitive understanding of Bayesian alternatives to common frequentist statistical tests;
3. Be equipped with the practical skills to apply Bayesian statistical tests to their own data.

Contents

The course will cover the following topics:

1. Differences between the frequentist and Bayesian approach to doing statistics;
2. A Bayesian alternative to the 95% confidence interval;
3. A Bayesian alternative to the student t-test;
4. A Bayesian alternative to ANOVA;
5. A Bayesian alternative to the Pearson correlation coefficient;
6. A Bayesian alternative to linear regression;
7. How to report Bayesian statistics for publication.

Teaching

The course is given in English and consists of seminars and lab sessions. Each seminar covers one of the course topics listed above. The seminars are mandatory for students who take the course for credit points. The general structure of each seminar is as follows. First, the relevant theory behind a frequentist method (e.g., computing of confidence intervals) will be reviewed and the method will be illustrated by applying it to one or more toy problems. Thereafter, the main shortcomings of the method will be discussed. Next, a Bayesian alternative (e.g., computing credible intervals) will be presented and the method will be illustrated by applying it to the same toy problems as mentioned above. Since the main aim of the course is to enable students to use Bayesian statistics themselves, every step in the analyses will be demonstrated.

Lab sessions form the heart of the course and cover the same topics as the seminars. Most importantly, students will extensively practice using the Bayesian methods that were discussed in the preceding seminar, by applying them to example problems. In addition, they will compare the results of the Bayesian methods with results from frequentist methods.

Mathematical theory will be kept to a minimum: instead of presenting students with abstract proofs and formulas, mathematical concepts will be explained as much as possible in graphical ways. The aim is to provide students with an understanding of the intuition behind the methods, not with abstract knowledge of the mathematical foundations.

Examination

Students are obliged to attend all seminars and have to hand in short reports with solutions to the lab exercises. In addition, there will be a take-home exam at the end of the course. The exam will consist of a final set of practical exercises as well as questions that test the student's intuitive understanding of the covered methods. Grading will be done in terms of pass or fail.

Literature

Scientific papers, consisting of around 150 pages in total.