

STA442H1 F LEC0101 20219:Methods of Applied Statistics

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STA442 Methods of Applied Statistics

Patrick Brown

Fridays 9-12, NF 003

- Head TA: TBA
- TA office hours: TBA
- Course web page: pbrown.ca/teaching/appliedstats (<http://pbrown.ca/teaching/appliedstats>), q.utoronto.ca/courses/236300
- Instructor's office hour: TBA

Course description

The course will focus the using and interpreting advanced statistical methods with applications in a number of different areas. The course is a mixture of theory and applications, and will include a number of assignments which will involve computing with R.

Statistical methodology to be covered includes:

- Reproducible research with R
- generalised linear models and maximum likelihood estimation
- Bayesian inference using INLA
- generalized linear mixed models
- semi-parametric regression
- survival analysis
- Spatial models and disease mapping

Prerequisites

- STA303 is the official prerequisite
- Material from the second year statistical theory courses which are prerequisites to STA302 will be drawn on extensively
- Knowledge of programming with R is essential

Grading

Four homework assignments will each account for 10% of the final grade, with a final exam providing the remaining 60%.

Homework

- 1 Oct: GLM's and Mixed models
- 22 Oct: Semi-parametric modelling
- 12 Nov: Survival analysis
- 3 Dec: Spatial models

Exam

The exam will consist of four questions very similar to the assignments. The exam will be designed to be easy for those who've completed and understood the assignments and extremely difficult for anyone who has not done the assignments themselves.

Practical details

Textbooks

The course will not adhere closely to any single text, though the following will be referred to frequently.

- Maindonald & Braun, *Data analysis and graphics using R: An example-based approach*, 2010
- Davison, *Statistical models*, 2003
- Wakefield, *Bayesian and frequentist regression methods*, 2013

Computing

Students will need to have access to a computer running a recent version of R, and several additional packages for R will be installed. Those not familiar with R are encouraged to become so within the first few weeks of the course.

Syllabus

- Applied statistics in practice
 - scientific writing
 - reproducible research
- Frequentist inference with Generalized Linear Models
 - Models and inference
 - Applications and interpretation
- Linear mixed models and longitudinal data
 - Mixed models, maximum likelihood estimation and REML
 - Applications and interpretation
 - Correlation in time
 - Random coefficient models
- Generalized Linear Mixed Models and Bayesian inference
 - Bayesian inference and INLA
 - Random effects models for non-Gaussian data
 - Applications and interpretation
 - Advanced INLA
- Smoothing and semi-parametric models
 - Penalised likelihood and spline smoothing
 - Random walks and Bayesian semi-parametrics
- Survival analysis
 - Parametric event time distributions
 - Censored data
 - Hierarchical models for survival data
- Spatial models
 - the disease mapping problem
 - Markov random fields
 - Binomial v Poisson models
 - Bayesian inference for spatial models

References

Davison, A.C. (2003). *Statistical models*. Cambridge University Press. <http://books1.scholarsportal.info/viewdoc.html?id=/ebooks/ebooks1/cambridgeonline/2012-11-08/1/9780511815850> [.\(http://books1.scholarsportal.info/viewdoc.html?id=/ebooks/ebooks1/cambridgeonline/2012-11-08/1/9780511815850\)](http://books1.scholarsportal.info/viewdoc.html?id=/ebooks/ebooks1/cambridgeonline/2012-11-08/1/9780511815850)

Maindonald, J. & Braun, W.J. (2010). *Data analysis and graphics using R: An example-based approach* (3rd edition). Cambridge: Cambridge University Press. <https://www.cambridge.org/core/books/data-analysis-and-graphics-using-r/E04AEC5BCEF09D2E51A63EB5A8CB0680> [.\(https://www.cambridge.org/core/books/data-analysis-and-graphics-using-r/E04AEC5BCEF09D2E51A63EB5A8CB0680\)](https://www.cambridge.org/core/books/data-analysis-and-graphics-using-r/E04AEC5BCEF09D2E51A63EB5A8CB0680)

Wakefield, J. (2013). *Bayesian and frequentist regression methods* [.\(https://doi.org/10.1007/978-1-4419-0925-1\)](https://doi.org/10.1007/978-1-4419-0925-1). Springer New York.

Course Summary:

Date	Details	Due
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