Astrostatistics (L24)

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This course will cover applied statistical methods necessary to properly interpret today's increasingly complex datasets in astronomy. Particular emphasis will be placed on principled statistical modeling of astrophysical data and statistical computation of inferences of scientific interest. Statistical techniques, such as Bayesian inference, sampling methods, hierarchical models, Gaussian processes, and model selection, will be examined in the context of applications to modern astronomical data analysis. Topics and examples will be motivated by case studies across astrophysics and cosmology.

Pre-requisites

Students of astrophysics, physics, statistics or mathematics are welcome. Astronomical context will be provided when necessary. Students without a previous statistics background should familiarise themselves with the material in Feigelson & Babu, Chapters 1-4, and Ivezić, Chapters 1, 3-5, by the beginning of the course. (Note that the two textbooks cover many of the same topics). These texts are freely available online to Cambridge students via the library website.

Literature

1. E. Feigelson and G. Babu. *Modern statistical methods for astronomy: with R applications.* Cambridge University Press, 2012.

2. Z. Ivezić, A. Connolly, J. VanderPlas & A. Gray. *Statistics, Data Mining, and Machine Learning in Astronomy.* Princeton University Press, 2014.

3. C. Schafer. *A Framwork for Statistical Inference in Astrophysics.* 2015, Annual Review of Statistics and Its Application, 2: 141-162.

4. C. Bishop. *Pattern Recognition & Machine Learning.* Springer-Verlag, 2006.
   Also available at

   https://www.microsoft.com/en-us/research/people/cmbishop/#!prml-book

5. D. MacKay. *Information Theory, Inference, and Learning Algorithms.* Cambridge University Press, 2003. Also available at

   http://www.inference.org.uk/mackay/itila/book.html

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a one-hour revision class in the Easter Term.