

Astronomy 688S: Practical Astrostatistics

Instructor:

Professor: Cole Miller

PSC 1114

(301) 405-1037

miller@astro.umd.edu

Class web page: <http://www.astro.umd.edu/~miller/teaching/astrostat>

Schedule:

Lectures on Mondays from 5:00-5:50, ATL 1109.

Textbooks:

None. We will use my online notes on the website. As appropriate, we will suggest alternate online references.

Course Grading

The class will be graded pass-fail. There will be no exams, and no graded homework. Reasonable participation in the classes will guarantee you a passing grade; significant disruption of the class could result in a failing grade, but this would be a very extreme situation!

For all but the first class, there will be suggested coding exercises, along with sample data sets, on the class website, which I recommend that you do prior to the class in question. Use any programming language you like, and feel free to work as much as you like with others in the class; in fact, I encourage this strongly. If you do not have time to do the coding exercise for a given class that's fine, but you will certainly get more out of the class if you do the exercises.

I do expect you to read the online notes in advance of each class, and to come prepared with questions about the material. That will drive the first ~ 20 minutes of a given class, with the rest being devoted to finishing the coding exercise and consulting with others about the results. Please read the notes before reading and trying the coding exercise; I will often go through a similar example in detail in the class notes.

Course content and philosophy

The content of the class will be largely fluid. At the start of the course I have prepared the first seven lectures, with six associated coding exercises (none for the first lecture). What we have so far is:

1. Introduction and statistical sins
2. Is it Gaussian?
3. Bayesian statistics 1, parameter estimation for discrete distributions
4. Bayesian statistics 2, parameter estimation for continuous distributions
5. Bayesian statistics 3, model comparison
6. Fitting a straight line to data part 1: no uncertainties on independent variable
7. Fitting a straight line to data part 2: uncertainties in both variables

I intend to have a lecture on how to determine whether two quantities are correlated, and one on Markov chain Monte Carlo techniques. But other subjects will be left to class votes, long enough in advance that I can prepare good lectures on them. I want this class to be driven by your interests.

Fundamentally, the main thing I want you to get from this course is the ability to ask yourself:

How would I perform my task if I had unlimited time and computer resources, and then

How *should* I perform my task given my finite time and computer resources?

I want you to avoid becoming another astronomer who uses statistical techniques blindly, and who therefore risks producing meaningless results! I look forward to sharing this semester's journey with you.