YData: ExoStatistics: Exploring Extrasolar Planets with Data Science
Course policies and syllabus

Spring 2019 YData Seminar
Course Number: S&DS 170/570, ASTR 445/545

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Teaching Fellow: TBD
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Lectures: Tuesdays: 3:30PM – 5:20PM, Location: TBD

Course Website: `http://canvas.yale.edu/`

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza.

Find our class page at: `https://piazza.com/yale/spring2019/sds170/home`

Objectives: Extrasolar planets, or exoplanets, are planets orbiting stars outside our Solar System. The past decade has lead to a proliferation of exoplanet discoveries using various detection methods. Through the lens of data science, we will investigate exoplanet datasets to learn how to find exoplanets, examine the population properties of observed exoplanets, estimate probabilities of another Earth-like exoplanet in our Universe, and probe other questions about exoplanets. This course will provide students with an introduction to exoplanet astronomy, an introduction to data science tools necessary for studying exoplanets, and opportunities to practice the data science skills presented in YData (S&DS 123/523).

Eligibility: This course can be taken concurrently with YData (S&DS 123/523) or after successfully completing YData.

Course Materials:

- Textbook: *Computational and Inferential Thinking: The Foundations of Data Science* by Ani Adhikari and John DeNero, which is freely available at `https://www.inferentialthinking.com`
- Software: Python 3

COURSE DESCRIPTION

There will be two main components to most class meetings: (ii) a lecture portion on exoplanets and/or data science methods necessary for exploring and analyzing exoplanet data, and (ii) a lab portion where we will be working on real data analysis, programming, and developing computational skills.

This course is designed to be accessible to students with little or no background in exoplanet astronomy, computing, programming, or statistics, but will also be engaging for more technically oriented students through the extensive use of examples and hands-on data analysis. Python 3 is the computing language

that we will be using, which is a popular and widely used computing language in the data sciences. The computing materials will be hosted on a special purpose web server.

We will cover topics such as detecting exoplanets using the transit method or the radial velocity method (along with other detection methods), characterizing exoplanet populations, how stellar activity affects detection of exoplanets, calculating the probability of detecting an Earth analog, and classification of exoplanets.

COURSE WORK AND GRADE DISTRIBUTION

Undergraduate level		Graduate level	
Lab assignments (weekly)	40%	Lab assignments (weekly)	40%
Midterm exam 1	15%	Midterm exam 1	15%
Midterm exam 2	15%	Midterm exam 2	15%
Final project	20%	Final project and presentation	20%
Participation	10%	Participation	10%
Total	100%	Total	100%

COURSE STRUCTURE AND POLICIES

Getting help. The instructor is here to help you throughout the semester. If you have any questions, please attend any of the scheduled office hours noted above to get your questions answered. We will also be using `https://piazza.com` (an online question and answer platform) to address questions.

Computing infrastructure. The computing platform for the course is hosted at `hub.ydata123.org`. It is recommended that you bring a personal computer to the class so you can work on the lab assignments during the designated time. If you do not have access to a personal computer, please let the instructor know.

Lab assignments. There will be approximately 10 lab assignments throughout the semester. Each class period around half the time will be devoted to working on the lab assignments after learning about the relevant exoplanet and data science topics necessary to complete the lab. You may be able to complete an entire lab assignment during the class period, but if not then it can be completed as homework. The lab assignments should be submitted by the specified due date.

Late submission of lab assignments are not accepted and will receive a score of zero. However, at the end of the semester, your lowest lab assignment grade will be dropped and will not count toward your final course grade. The remaining lab assignments will contribute equally to the lab assignment portion of the final grade.

Midterm exam. There will be two in-class midterm exams. The exam will be closed-book, closed-notes, and closed-computer.

Final project. The final project is an opportunity for you to explore, in more detail, a question of interest related to exoplanets and data science. It is expected that the topic of the question will be related to exoplanets and the project will include an analysis using data science methods. The final project will culminate in a 5 - 10 page written report introducing your question, describing the methodology you employ to answer the question, a discussion of the results, and finally the conclusions you can draw from the analysis. In addition to the written report, graduate students will present the results of the final project during one of the final class periods (the length will depend on the number of graduate students enrolled).

Participation. Participation will be evaluated based on attendance, engagement in class discussions (through listening or asking/answering questions), actively working on the lab assignments during the lab portion of the class, and usage of Piazza (asking, answering, and discussing questions and topics related to the course). Students who (i) attend class weekly and participate in the class activities, and (ii) post on Piazza about once every two weeks will receive full credit. Circumstances can arise during a semester when attendance is not possible (e.g. due to health issues) and so a student can miss one class without it affecting the participation portion of the grade; students who miss a class are still expected to complete the lab assignment and turn it in on time. Half of the total participation portion of the grade will be evenly distributed across the class meetings minus the one allowed absence, and the other half will be based on Piazza participation.

Grades and regrades. Course grades will appear on the course website. Each student is responsible for verifying his or her recorded scores during the semester.

Your overall course score will be determined as a weighted average of each element as noted above. A letter grade will be assigned based on:

A: 93 - 100	**A-:** 90 - 93	**B+:** 87 - 90	**B:** 83 - 87	**B-:** 80 - 83
C+: 77 - 80	**C:** 73 - 77	**C-:** 70 - 73	**D:** 60 - 70	**F:** Below 60

Honors: 90 - 100 **High Pass:** 80 - 90 **Pass :** 70 - 80 **Fail:** Below 70

Although we strive for consistency and accuracy in grading, we understand that grading errors can occur.

- We will gladly correct all errors in tabulation or overlooked material.
- All regrading requests must be accompanied by a written statement carefully highlighting and explaining the items that were mis-graded. *Note that regrading requests can end in a positive, negative, or no change in points.*
- All regrade requests should be submitted to the instructor within one week of when the graded work is returned.

Honor Code. You are encouraged to be helpful to your classmates and to work together, but the work you turn in must be your own. Any student who turns in work for credit that is identical, or similar beyond coincidence, to that of another student may face appropriate disciplinary action at the department, college, or university level. *Cheating and/or plagiarism will not be tolerated.*

If you get ideas or words from a website, journal article, book, another person, etc., cite the source in your work at the location where you use the idea. Then include a bibliography or list of sources cited at the end of your document.

For more information about plagiarism and how to avoid it, please see Yale's Center for Teaching and Learning website on the topic:
`https://ctl.yale.edu/writing/using-sources/understanding-and-avoiding-plagiarism`

Attendance. Because of the interactive nature of this course, attendance is required and you will need to bring your laptop to work through the lab assignments during the class period. Be respectful to your peers by being on time and silencing your cell phone.