

## MAT 500 Math Methods for Data Science - Fall 2016

**Course Instructor:** Yi (Grace) Wang, ywang392@syr.edu, 306C Carnegie Hall

**Lecture Meetings:** MW 2:15-3:35 PM, Carnegie 219

**Office Hours:** Mon 4:00-5:00 PM, Wed 10:30 - 11:30 AM, Carnegie 306C

**Course Description:** This course covers fundamental methods for data science. Topics include regression, classification (logistic regression, linear discriminant analysis,  $K$ -nearest neighbors, support vector machine and other methods), clustering (k-means, spectral clustering, etc.), linear (principal component analysis) and nonlinear dimension reduction, performance evaluation and model selection (cross-validation), and sparse recovery.

**Prerequisites:** MAT 331 and MAT 521.

**Textbook:** “An Introduction to Statistical Learning with Applications in R” by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani. Published by Springer. ISBN: 978-1-4614-7138-7.

A free online copy of the book and other supporting materials can be found here:

<http://www-bcf.usc.edu/~gareth/ISL/index.html>

**Grading:** The grades will be based on homework assignments (40%), two exams (20% each), and a final project (20%).

**Exams:** Two noncumulative exams will be given in class. There will be no make-ups.

Exam 1: Oct. 10 Monday

Exam 2: Nov. 16 Wednesday

**Final Project:** You may work on the final project in a team of two or three students. You need to analyze a real data set from the very beginning to the end, namely from loading the data to writing a report about your methods and results. You may choose a problem from the provided list or choose one by yourself. Details about the final project will be discussed in class shortly after Exam 1. In the end, you will need to submit your report and give an oral presentation for about 15 minutes as a team.

The project will be evaluated based on the following points:

- The goal, the methods and the results are clearly described.
- Selection of the models and parameters is well reasoned.
- Questions are appropriately answered.

**Homework:** Homework will be assigned in class and collected at the beginning of the Wednesday class every week (written part). The computational parts of the assignments are collected on Blackboard by 11:59 PM on Wednesdays. R and R Studio are required for computational assignments. Both are open source and can be obtained

from <https://www.r-project.org/> and <https://www.rstudio.com/home/>. R is the programming language and R Studio can be used to write a report with R codes using “R markdown”. Some sample homework solutions written in “R Markdown” will be provided. Group work is encouraged for homework. The computational problems can be submitted as a team, but the solutions to written problems must be written independently.

### **Tips for success:**

1. It is absolutely essential that you understand how to solve all the assigned problems. Once you understand how to solve a problem, write your solution down neatly and in full detail with explanations that make your reasoning clear.
2. Don't fall behind. If you are having difficulties keeping up with the material, see me to discuss the problem.
3. Ask questions: in class, during office hours and by email.
4. Discuss problems with a classmate/friend.
5. Expect to work hard. Don't get discouraged if you find some of the material difficult. Be persistent and patient.

**Students with disabilities:** If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS), <http://disabilityservices.syr.edu>, located in Room 309 of 804 University Avenue, or call (315) 443-4498 or TDD: (315) 443-1371 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue students with documented Disabilities Accommodation Authorization Letters, as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

**Religious observances policy:** Syracuse University Religious Observances Policy recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance provided they notify their instructors no later than the end of the second week of classes for regular session classes and by the submission deadline for flexibly formatted classes. Student deadlines are posted in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification.

**Academic Integrity:** Syracuse University academic integrity policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic

integrity expectations. The university policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same written work in more than one class without receiving written authorization in advance from both instructors. The presumptive penalty for a first instance of academic dishonesty by an undergraduate student is course failure, accompanied by a transcript notation indicating that the failure resulted from a violation of academic integrity policy. The presumptive penalty for a first instance of academic dishonesty by a graduate student is suspension or expulsion. SU students are required to read an online summary of the university academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice. For more information and the complete policy, see <http://academicintegrity.syr.edu>.