MATH 373 Introduction to Machine Learning (Spring 2018)

Class Time and Location: MWF 10:30 - 11:35; LS 210

Instructor: James D. Wilson **Office:** 107B Harney Science Building **Email:** jdwilson4@usfca.edu

Office Hours: MW 1:30 - 3:00

Course Website: Canvas website

Textbooks: Each of the books for this class are available free online. Aside from these books, we will also be utilizing many resources online such as Coursera and lecture notes from Stanford.

- *An Introduction to Statistical Learning with Applications in R* by James, Witten, Hastie, and Tibshirani (**Primary**)
- *The Elements of Statistical Learning* by Friedman, Tibshirani, and Hastie (**Secondary but Recommended**)

Learning Outcomes: By the end of this course, you will be able to implement and mathematically justify the following concepts and methodologies of machine learning

- Basic Statistical Concepts
  - The Learning problem
  - Training vs. testing
  - Resampling and cross validation
  - Model assessment
- Supervised Learning
  - Regression: partial least squares, principal components regression, LASSO, Ridge regression
  - Discrete Classification: k-Nearest Neighbors, Linear discriminant analysis, logistic regression, naive Bayes classifiers, support vector machines
  - Tree-based methods: random forests, regression and classification trees
- Unsupervised Learning
  - Clustering: k-means, hierarchical clustering, spectral clustering
  - Goodness of fit and method assessment
  - Biclustering (if time permits)
- Introduction to Neural Networks (if time permits)

What you should bring to Class:

A pencil or pen, paper, a laptop, and a sunny disposition :)

Homework

- Homework assignments will cover both theory and computation. The overall purpose of this course is to provide you with the knowledge to know *how* and *when* to implement machine learning algorithms to a given problem. Homework will account for 30% of your course grade.
- **No late homework will be accepted.** Homework cannot be submitted electronically. **Missed homework will receive a grade of zero.** To receive full credit for your assignment, show all work to each problem clearly and be sure to write your name at the top of the page.

Important Dates:

- Friday, January 26th - Last day to add classes
- Friday, February 9th - Census date
- Monday, February 19th - Presidents' Day (no class!)
- M-F, March 12th - 16th - Spring break (no class!)
- Friday, March 30th - Easter holiday (no class!)
- Wednesday, May 9th - Last day of class!
- Monday, May 14th - Final Exam: 10:00 AM - 12:00 PM

Attendance: Attendance is required every day and will be recorded and worth 10% of your final grade. It is your responsibility to catch up on any lecture material, homework, or programming lesson that you miss due to an absence.

Assessment: Grades will be assigned according to the following assessment.

- **Homework Assignments** (35%) For each assignment, you will be required to upload a .pdf file to the Canvas site that contains your R code, any analyses, and any visualization used to answer the questions on the assignment. This .pdf file must be a result of compiling R code in RStudio using the knitr package. These must be submitted before the deadline set on github.
- **Case Studies** (35%) There will be several in- and out- of class case studies throughout the class. These are to be completed using RStudio.
- **Final Exam** (30%) The final exam will be comprehensive and cover all material provided in class.

Academic Integrity

As a Jesuit institution committed to cura personalis - the care and education of the whole person - USF has an obligation to embody and foster the values of honesty and integrity. USF upholds the standards of honesty and integrity from all members of the academic community. All students are expected to know and adhere to the University's Honor Code. You can find the full text of the code online at `www.usfca.edu/academic_integrity`. The policy covers:

- Plagiarism: intentionally or unintentionally representing the words or ideas of another person as your own; failure to properly cite references; manufacturing references.
- Working with another person when independent work is required.
- Submission of the same paper in more than one course without the specific permission of each instructor.
- Submitting a paper written by another person or obtained from the internet.
- The penalties for violation of the policy may include a failing grade on the assignment, a failing grade in the course, and/or a referral to the Academic Integrity Committee.

Students with Disabilities

If you are a student with a disability or disabling condition, or if you think you may have a disability, please contact USF Student Disability Services (SDS) at 415 422-2613 within the first week of class, or immediately upon onset of disability, to speak with a disability specialist. If you are determined eligible for reasonable accommodations, please meet with your disability specialist so they can arrange to have your accommodation letter sent to me, and we will discuss your needs for this course. For more information, please visit: http://www.usfca.edu/sds or call (415) 422-2613.

Behavioral Expectations

All students are expected to behave in accordance with the Student Conduct Code and other University policies (see http://www.usfca.edu/fogcutter/). Open discussion and disagreement is encouraged when done respectfully and in the spirit of academic discourse. There are also a variety of behaviors that, while not against a specific University policy, may create disruption in this course. Students whose behavior is disruptive or who fail to comply with the instructor may be dismissed from the class for the remainder of the class period and may need to meet with the instructor or Dean prior to returning to the next class period. If necessary, referrals may also be made to the Student Conduct process for violations of the Student Conduct Code.

Learning & Writing Center

The Learning & Writing Center provides assistance to all USF students in pursuit of academic success. Peer tutors provide regular review and practice of course materials in the subjects of Math, Science, Business, Economics, Nursing and Languages. `https://tutortrac.usfca.edu`. Students may also take advantage of writing support provided by Rhetoric and Language Department instructors and academic study skills support provided by Learning Center professional staff. For more information about these services contact the Learning & Writing Center at (415) 422-6713, email: `lwc@usfca.edu` or stop by our office in Cowell 215. Information can also be found on our website at `www.usfca.edu/lwc`.

Counseling and Psychological Services

Our diverse staff offers brief individual, couple, and group counseling to student members of our community. CAPS services are confidential and free of charge. Call 415-422-6352 for an initial consultation appointment. Having a crisis at 3 AM? We are still here for you. Telephone consultation through CAPS After Hours is available between the hours of 5:00 PM to 8:30 AM; call the above number and press 2.

Confidentiality, Mandatory Reporting, and Sexual Assault

As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I also have a mandatory reporting responsibility related to my role as a faculty member. I am required to share information regarding sexual misconduct or information about a crime that may have occurred on USFs campus with the University. Here are other resources:

- To report any sexual misconduct, students may visit Anna Bartkowski (UC 5th floor) or see many other options by visiting our website: `www.usfca.edu/student_life/safer`.
- Students may speak to someone confidentially, or report a sexual assault confidentially by contacting Counseling and Psychological Services at 415-422-6352.
- To find out more about reporting a sexual assault at USF, visit USF's Callisto website at: `www.usfca.callistocampus.org`.
- For an off-campus resource, contact San Francisco Women Against Rape (SFWAR) (415) 647-7273 (`www.sfwar.org`).

Student Accounts - Last day to withdraw with tuition reversal

Students who wish to have the tuition charges reversed on their student account should withdraw from the course(s) by the end of the business day on the last day to withdraw with tuition credit (census date) for the applicable course(s) in which the student is enrolled. Please note that the last day to withdraw with tuition credit may vary by course. The last day to withdraw with tuition credit (census date) listed in the Academic Calendar is applicable only to courses which meet for the standard 15-week semester. To find what the last day to withdraw with tuition credit is for a specific course, please visit the Online Class Schedule at `www.usfca.edu/schedules`.

Ability to Change Syllabus - I, James D. Wilson, will do my best as an instructor to abide by the guidelines set forth in this syllabus throughout the year. I do, however, have the right to change components of this syllabus at my own discretion if I deem such changes as necessary.