STA 4634: Applied Machine Learning

Fall 2022

Instructor: Dr. Indrabati Bhattacharya	**TA:** Xinyu Zhou
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Office Hours: TTH 1:30pm-2:30pm	**Office Hours**: MW 2pm-3pm

Course Information

1. Course Meeting Place: OSB 0327

2. Course Meeting Time: T/TH 4:50-6:05pm

Textbook and reading materials:

- **The Elements of Statistical Learning (2nd Edition)** by J. James, D. Witten, T. Hastie and R. Tibshirani (publisher: Springer). Link to download the book
  This is the book we'll closely follow for lectures and homeworks.

- **(Optional) Notes from CMU machine learning class**. http://www.cs.cmu.edu/ epxing/Class/10701/

- **(optional) ML books by T. Hastie**. https://hastie.su.domains/pub.htm

Objectives: At the end of the course, the student should be able to

- compare and contrast many machine learning methods with their advantages and disadvantages

- implement the methods or know where to find their implementation

- use existing library software

- determine the most appropriate learning method for a specific application

Prerequisites: STA 3032 and knowledge of Matlab, R, Python, C++ or other programming language, or consent from instructor.

Course Outline (tentative). We will cover the following topics:

- Linear regression (simple, multiple)

- Classification (logistic regression, discriminant analysis, naive Bayes classification, K-nearest neighbors, Poisson regression)

- Resampling methods (cross validation, bootstrap)

- Model selection (subset selection, shrinkage methods, dimension reduction methods)

- Tree-based methods (regression tree, classification tree, bagging, random forests, boosting)

- Support vector machines

- Deep learning (single layer neural networks, multilayer neural networks, convolutional neural networks)

- Unsupervised learning (principal components analysis, clustering methods)

I'll use R in class for demonstration of the above techniques. However, students are free to use whatever softwares they are comforatable with (e.g., Python, Matlab) for homeworks.

Grading: There will be 10 homeworks each worth 10 points, and one final project worth 20 points. The lowest two homework scores will be dropped. Homeworks will be a mixture of conceptual and programming exercises. The following scheme will be used to convert the percentage points to letter grades: [93-100]–A, [90-93)–A-, [87-90)–B+, [83-87)–B, [80-83)–B-, [77-80)–C+, [73-77)–C, [70-73)–C-, [67-70)–D+, [63-67)–D, [60-63)–D-, [0-60)–F.

Course policy

- **Homework:** Homeworks will be due one to two weeks from the date they are announced. No late homeworks will be accepted. Computer code and output should be kept to a bare minimum. Codes downloaded from internet can be accepted, provided a reference to the appropriate website and/or the package has been added to the homework report.

- **Final project:** For the final project, you can pick any topic they wish as long as there is some connection to machine learning. For example, you can compare performances of different learning algorithms on a dataset. You can work individually or in groups of two. Each group should submit a short report clearly describing the methods used and results. More information on the project will be posted later.

- **Office hours:** You are strongly encouraged to come to the instructor/TA during their office hours. If your schedule conflicts with the office hours, you can make an appointment for an online or in person meeting. You may ask the instructor brief questions by e-mail, but you may be asked to come to office hours or meet in a video-conference session if the instructor thinks that the questions are better answered in person.

- **University attendance policy:** Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

- **Academic honor policy:** The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://fda.fsu.edu/Academics/Academic-Honor-Policy).

- **Americans with Disabilities Act:** Students with disabilities needing academic accommodation should:

  1. register with and provide documentation to the Student Disability Resource Center; and
  2. bring a letter to the instructor indicating the need for accommodation and what type.

  Please note that instructors are not allowed to provide classroom accommodation to a student until appropriate verification from the Student Disability Resource Center has been provided. This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact

  Student Disability Resource Center
  874 Traditions Way

108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdrc@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/

- **Free Tutoring from FSU:** On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options at http://ace.fsu.edu/tutoring or contact tutor@fsu.edu. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

- **Syllabus Change Policy:** Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.