ISYE 8803 Topics on High-Dimensional Data Analytics Course Syllabus

Instructor Information

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Weekly office hours via Zoom. Please see Canvas for more details.

General Course Information

Description

This course focuses on analysis of high-dimensional structured data including profiles, images, and other types of functional data using statistical machine learning. A variety of topics such as functional data analysis, image processing, multilinear algebra and tensor analysis, and regularization in high-dimensional regression and its applications including low rank and sparse learning is covered. Optimization methods commonly used in statistical modeling and machine learning and their computational aspects are also discussed.

Pre- &/or Co-Requisites

NONE

Course Learning Outcomes

By the end of the course, you will:

1. Learn machine learning and statistical methods for image processing and analysis of functional data;
2. Learn a variety of regularization techniques and their applications;
3. Be able to use multilinear algebra and tensor analysis techniques for performing dimension-reduction on a broad range of high-dimensional data.
4. Understand how to use well-known optimization methods to create efficient learning algorithms;

Course Materials

Course Text

This is no textbook for this course. Lecture notes and supplementary reading material will be provided via the course website.

Course Requirements, Assignments & Grading

Assignment Distribution and Grading Scale

Assignment	Release Date	Due Date*	Weight
Homework #1: Functional data analysis	**Jan 6**	**Jan 19**	**5%**

Assignment	Release Date	Due Date*	Weight
Homework #2: Image analysis	**Jan 20**	**Feb 2**	**5%**
Homework #3: Tensor data analysis	**Feb 3**	**Feb 16**	**5%**
Homework #4: Optimization I	**Feb 17**	**March 2**	**5%**
Exam I	**March 3**	**March 9**	**32.5%**
Homework #5: Optimization II	**March 10**	**March 23**	**5%**
Homework #6: Regularization	**March 24**	**April 6**	**5%**
Homework #7: Regularization applications	**April 7**	**April 20**	**5%**
Exam II	**April 21**	**April 27**	**32.5%**

*All homework assignments and exams are due at 11:59 pm EST on the due dates.

Late submissions of homework are allowed within three days after the deadline. However, if HW is submitted on the first day after the deadline, 10 points are deducted. If it is submitted on the second day after the deadline, 30 points are deducted and finally if it is submitted on the third day after the deadline, 50 points are deducted.

NO late submission is acceptable for Exams.

Exams are open-book and take-home style. They are unproctored, 1 week from open date to close date starting whenever and submitting prior to due date, and in format similar to homework assignments.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Assignment Due Dates

All assignments a will be due at the times listed above. These times are subject to change so please check back often. Please convert from UTC to your local time zone using a Time Zone Converter.

Timing Policy

- The Modules follow a logical sequence that includes knowledge-building and experience-building.
- You will have access to the course content for the scheduled duration of the course.

Grading and Feedback

- We try to grade your Homework within one week of the due date.
- Requests for re-grading HW or exams should be made within a week of returning HW/exams.

Technology Requirements and Skills

Computer Hardware and Software

High-speed Internet connection
Laptop or desktop computer with a **minimum** of a 2 GHz processor and 2 GB of RAM
Windows for PC computers OR Mac iOS for Apple computers.
Complete Microsoft Office Suite or comparable and ability to use Adobe PDF software (install, download, open and convert)
Mozilla Firefox, Chrome and/or Safari browsers
Matlab and R

Technology Skills

Basic programming knowledge in R and Matlab

Canvas

This class will use Canvas deliver course materials to online students.

Course Policies, Expectations & Guidelines

Communication Policy

- Email course questions and personal concerns, including grading questions, to me and TA's privately. Do NOT submit posts of a personal nature to the discussion board unless it is a private post on Piazza.
- Email will be checked at least once per day Monday through Friday. During the week, I will respond to all emails within 24 hours; on weekends and holidays, allow up to 48 hours. If there are special circumstances that will delay my response, I will make an announcement to the class.
- Student Forum/Q&A discussion boards will be checked once per day.
- Virtual office hours will be held using the Bluejeans. I will hold Virtual Office Hours every [day, time].

Online Student Conduct and (N)etiquette

Communicating appropriately in the online classroom can be challenging. In order to minimize this challenge, it is important to remember several points of **"internet etiquette"**
that will smooth communication for both students and instructors:

1. *Read first, Write later*. Read the ENTIRE set of posts/comments on a discussion board before posting your reply, in order to prevent repeating commentary or asking questions that have already been answered.

2. *Avoid language that may come across as strong or offensive*. Language can be easily misinterpreted in written electronic communication. Review email and discussion board posts BEFORE submitting. Humor and sarcasm may be easily misinterpreted by your reader(s). Try to be as matter-of-fact and professional as possible.
3. *Follow the language rules of the Internet*. Do not write using all capital letters, because it will appear as shouting. Also, the use of emoticons can be helpful when used to convey nonverbal feelings.
4. *Consider the privacy of others.* Ask permission prior to giving out a classmate's email address or other information.
5. *Keep attachments small*. If it is necessary to send pictures, change the size to an acceptable 250kb or less (one free, web-based tool to try is picresize.com).
6. *No inappropriate material*. Do not forward virus warnings, chain letters, jokes, etc. to classmates or instructors. The sharing of pornographic material is forbidden.

***NOTE**: The instructor reserves the right to remove posts that are not collegial in nature and/or do not meet the Online Student Conduct and Etiquette guidelines listed above.*

University Use of Electronic Email

A university-assigned student e-mail account is the official university means of communication with all students at Georgia Institute of Technology. Students are responsible for all information sent to them via their university-assigned e-mail account. If a student chooses to forward information in their university e-mail account, he or she is responsible for all information, including attachments, sent to any other e-mail account. To stay current with university information, students are expected to check their official university e-mail account and other electronic communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

Plagiarism & Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Collaboration & Group Work

- You are encouraged to discuss homework problems with your fellow students. But your final answers should be based on your own understanding. Copying others' work is NOT acceptable and violates the honor code.
- You are not allowed to discuss exam problems with anybody under any circumstances.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

- NO late submission is acceptable for Exams.
- Late submissions of HW are allowed within three days after the deadline. However, if HW is submitted on the first day after the deadline, 10 points are deducted. If it is submitted on the second day after the deadline, 30 points are deducted and finally if it is submitted on the third day after the deadline, 50 points are deducted.
- Exceptions might be made for special cases (e.g., illness, accidents, family emergency). In such cases student must present valid documents.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be communicated via the Canvas announcement tool. It is the responsibility of students to check email messages and course announcements to stay current in their online courses.

Course Schedule

Week	Topic	Assignment	Release Date	Due Date*
		All assignments due by 11:59 pm EST on the date listed in this column.		
1,2	Homework #1: Functional data analysis	Homework #1	**Jan 6**	**Jan 19**
3,4	Homework #2: Image analysis	Homework #2	**Jan 20**	**Feb 2**
5,6	Homework #3: Tensor data analysis	Homework #3	**Feb 3**	**Feb 16**
7,8	Homework #4: Optimization I	Homework #4	**Feb 17**	**March 2**
9	Exam I	Exam I	**March 3**	**March 9**
10,11	Homework #5: Optimization II	Homework #5	**March 10**	**March 23**
12,13	Homework #6: Regularization	Homework #6	**March 24**	**April 6**
14,15	Homework #7: Regularization applications	Homework #7	**April 7**	**April 20**

Week	Topic	Assignment	Release Date	Due Date*
17	Exam II	Exam II	**April 21**	**April 27**