

10708: Probabilistic Graphical Models

Instructor:

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Teaching Assistants:

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Lectures:

DH 2302, Tuesdays and Thursdays, 1:25 – 2:45 PM

Office Hours:

Pradeep Ravikumar: After Class (In Class/Zoom), Tuesdays & Thursdays 2:45 – 3:00 PM

The office hours of the TAs, with all of the zoom links, will be posted on Piazza.

Key Course Links:

Website:

<http://www.cs.cmu.edu/~pradeepr/708>

Piazza:

<http://www.piazza.com/cmu/fall2021/10708>

Gradescope:

<https://www.gradescope.com/courses/296586>

Course Description:

Probabilistic Graphical Models are “generative models” that provide compact and analytically useful representations of joint distributions over a large number of variables, using graphs. Each graph represents a family of distributions -- the nodes of the graph represent random variables, the edges encode independence assumptions, and functions over the edges and cliques specify a particular distribution within the family. There are two main classes of tasks within this framework: the first is to inference marginal probabilities and other such functionals, given a specific graphical model distribution; and the second is to learn the graphical model distribution itself from data. The course will cover these fundamentals of probabilistic graphical models, as well as related specialized topics, such as causality.

Pre-requisites:

Basics of probability and statistical inference, and basics of machine learning.

This course is for students who have already taken introductory courses in machine learning and statistics, and who are interested in deeper foundations of machine learning, as well as advanced methods and frameworks used in modern machine learning.

Key Topics:

Undirected & Directed & Chain Graphical Models, Structural Causal Models, Exact & Approximate Inference, Learning, Deep Generative Models, Exponential Family Graphical Models

Class Website:

<http://www.cs.cmu.edu/~pradeepr/708>

The class schedule, and lecture materials will be posted there (and on Piazza).

Discussion, Announcements:

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. If you have any problems or feedback for the developers, email team@piazza.com.

We will also be using Piazza for announcements, and providing resource materials

Find our class signup link at: <http://www.piazza.com/cmu/fall2021/10708>

Textbooks:

Lecture notes will be posted for each class, which will be largely self-contained.

For further reference, we recommend the following textbooks:

- Probabilistic Graphical Models: Principles and Techniques, Daphne Koller and Nir Friedman.
- Graphical Models, Exponential Families, and Variational Inference, Foundations and Trends in Machine Learning, by Martin Wainwright, Michael Jordan:

https://people.eecs.berkeley.edu/~wainwrig/Papers/WaiJor08_FTML.pdf

Homeworks

There will be **five** homework assignments, approximately evenly spaced throughout the semester. The assignments will be posted on the course website, and on Piazza. You will get a late day quota of 10 days, which you can distribute among the five homeworks as you wish, subject to a maximum of 3 days per homework. Homeworks submitted after your late day quota will lose all points. The homework schedule is posted right at the beginning of the semester, so please plan in advance. We expect you to use the (very generous!) late day quota for conference deadlines and events of the like, so we cannot provide an additional extension for such cases. In the case of an emergency (sudden sickness, family problems, etc.), we can give you a reasonable extension. But we emphasize that this is reserved for true emergencies.

Gradescope

We will use Gradescope for submitting, and grading assignments. If you believe an error was made during manual grading, you'll be able to submit a regrade request on Gradescope. For each homework, regrade requests will be open for only 1 week after the grades have been published. This is to encourage you to check the feedback you've received early!

Exams:

There will no exams for the course.

Class project:

There will be a class project. You can form groups of up to 3 students. Further details on the project will be provided on the website.

Grading:

Homeworks	75%
Project	25%

Extensions

In general, we do not grant extensions on assignments. There are several exceptions:

- **Medical Emergencies:** If you are sick and unable to complete an assignment or attend class, please go to University Health Services. For minor illnesses, we expect grace days or our late penalties to provide sufficient accommodation. For medical emergencies (e.g. prolonged hospitalization), students may request an extension afterwards and should include a note from University Health Services.
- **Family/Personal Emergencies:** If you have a family emergency (e.g. death in the family) or a personal emergency (e.g. mental health crisis), please contact your academic adviser or Counseling and Psychological Services (CaPS). In addition to offering support, they will reach out to the instructors for all your courses on your behalf to request an extension.
- **University-Approved Absences:** If you are attending an out-of-town university approved event (e.g. multi-day athletic/academic trip organized by the university), you may request an extension for the duration of the trip. You must provide confirmation of your attendance, usually from a faculty or staff organizer of the event.

For any of the above situations, you may request an extension **by emailing your instructor**. The email should be sent as soon as you are aware of the conflict. In the case of an emergency, no notice is needed.

Lectures:

Lectures will be in-person. I will also be recording class sessions and making them available to you for your personal, educational use. Recordings of class sessions are covered under the

Family Educational Rights and Privacy Act (FERPA) and must not be shared with anyone outside your course-section. The purpose of these recordings is so students in this course (and only students in this course) can watch or re-watch past class sessions. Feel free to use the recordings if you would like to review something we discussed in class or if you are temporarily unable to attend class. I will make the links to the recordings available on Piazza as soon as possible after each class session.

Attendance Policy:

For those not able to attend classes in person, I recommend you watch the recording within the next day, so that you do not fall behind and end up with a backlog of lecture videos.

Classroom Expectations related to COVID-19:

In order to attend class meetings in person, all students are expected to abide by all behaviors indicated in [A Tartan's Responsibility](#), including any timely updates based on the current conditions.

In terms of specific classroom expectations, whenever the requirement to wear a facial covering is in effect on campus, students are expected to wear a facial covering throughout class. Note: the requirement to wear a facial covering is in effect for the start of the Fall 2021 semester. If you do not wear a facial covering to class, I will ask you to put one on (and if you don't have one with you, I will direct you to a distribution location on campus, see <https://www.cmu.edu/coronavirus/health-and-wellness/facial-covering.html>). If you do not comply, you will be referred to the Office of Community Standards and Integrity for follow up, which could include student conduct action. Finally, please note that sanitizing wipes should be available in our classroom for those who wish to use them.

Academic Integrity Policies

Read this carefully!

(Adapted from Roni Rosenfeld's [10-601 Spring 2016](#) Course Policies.)

Collaboration among Students

- The purpose of student collaboration is to facilitate learning, not to circumvent it. Studying the material in groups is strongly encouraged. It is also allowed to seek help from other students in understanding the material needed to solve a particular homework problem, provided no written notes (including code) are shared, or are taken at that time, and provided learning is facilitated, not circumvented. The actual solution must be done by each student alone.
- The presence or absence of any form of help or collaboration, whether given or received, must be explicitly stated and disclosed in full by all involved. Specifically, each assignment solution must include answering the following questions:
 1. Did you receive any help whatsoever from anyone in solving this assignment?
Yes / No.

- If you answered ‘yes’, give full details: _____
 - (e.g. “Jane Doe explained to me what is asked in Question 3.4”)
- 2. Did you give any help whatsoever to anyone in solving this assignment? Yes / No.
 - If you answered ‘yes’, give full details: _____
 - (e.g. “I pointed Joe Smith to section 2.3 since he didn’t know how to proceed with Question 2”)
- 3. Did you find or come across code that implements any part of this assignment? Yes / No. (See below policy on “found code”)
 - If you answered ‘yes’, give full details: _____
 - (book & page, URL & location within the page, etc.).
- If you gave help after turning in your own assignment and/or after answering the questions above, you must update your answers before the assignment’s deadline, if necessary, by emailing the course staff.
- Collaboration without full disclosure will be handled severely, in compliance with [CMU’s Policy on Academic Integrity](#).

Previously Used Assignments

Some of the homework assignments used in this class may have been used in prior versions of this class, or in classes at other institutions, or elsewhere. Solutions to them may be, or may have been, available online, or from other people or sources. It is explicitly forbidden to use any such sources, or to consult people who have solved these problems before. It is explicitly forbidden to search for these problems or their solutions on the internet. You must solve the homework assignments completely on your own. We will be actively monitoring your compliance. Collaboration with other students who are currently taking the class is allowed, but only under the conditions stated above.

Policy Regarding “Found Code”:

You are encouraged to read books and other instructional materials, both online and offline, to help you understand the concepts and algorithms taught in class. These materials may contain example code or pseudo code, which may help you better understand an algorithm or an implementation detail. However, when you implement your own solution to an assignment, you must put all materials aside, and write your code completely on your own, starting “from scratch”. Specifically, you may not use any code you found or came across. If you find or come across code that implements any part of your assignment, you must disclose this fact in your collaboration statement.

Duty to Protect One’s Work

Students are responsible for pro-actively protecting their work from copying and misuse by other students. If a student’s work is copied by another student, the original author is also considered to be at fault and in gross violation of the course policies. It does not matter whether the author allowed the work to be copied or was merely negligent in preventing it from being copied. When overlapping work is submitted by different students, both students will be punished. To protect future students, do not post your solutions publicly, neither during

the course nor afterwards.

Penalties for Violations of Course Policies

All violations (even first one) of course policies will always be reported to the university authorities (your Department Head, Associate Dean, Dean of Student Affairs, etc.) as an official Academic Integrity Violation and will carry severe penalties.

1. The penalty for the first violation is a one-and-a-half letter grade reduction. For example, if your final letter grade for the course was to be an A-, it would become a C+.
2. The penalty for the second violation is failure in the course, and can even lead to dismissal from the university.

Accommodations for Students with Disabilities:

If you have a disability and are registered with the Office of Disability Resources, I encourage you to use their online system to notify me of your accommodations and discuss your needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

Take care of yourself:

This semester is unlike any other. We are all under a lot of stress and uncertainty at this time, which can take its toll on our mental health.

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle, and this semester is no exception.

There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call [412-268-2922](tel:412-268-2922) and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:

- CaPS: [412-268-2922](tel:412-268-2922)

- Re:solve Crisis Network: [888-796-8226](tel:888-796-8226)

If the situation is life threatening, call the police

- On campus: CMU Police: [412-268-2323](tel:412-268-2323)
- Off campus: 911

If you have questions about this or your coursework, please let me know. Thank you, and have a great semester.