

TOPICS IN STATISTICS: GRAPHICAL MODELS IN SCIENCE

ACMS 40950 – Syllabus Fall 2025

Professor

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Class Times & Location

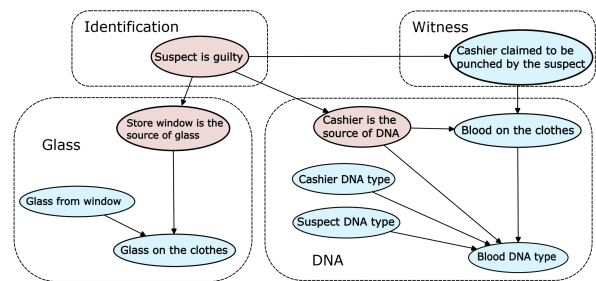
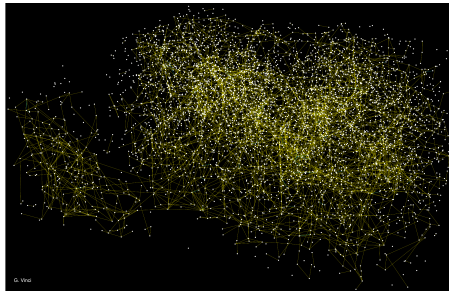
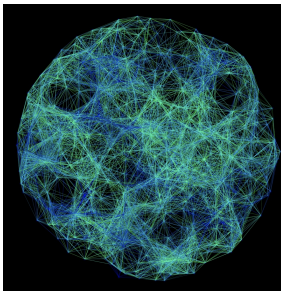
Mon&Wed 11:00am–12:15pm in DeBartolo Hall 118.

Course Description

This course provides an overview of probabilistic graphical models and their applications to various scientific fields. Probabilistic graphical models let us illustrate the dependence structure of several random variables by means of a graph, where nodes represent the random variables and edges or arrows connect pairs of nodes to describe the dependence structure of the random variables. Topics of study include: correlation, conditional independence, undirected and directed graphical models, inference of graphical models, model selection, high-dimensionality, sparsity, optimization, and statistical reproducibility. These topics will be discussed alongside real scientific data applications, including neuroscience, genomics, astronomy, forensic science, and psychology.

Course Objectives & Outcomes

Upon successful completion of this course, you will be able to infer probabilistic graphical models to interpret the dependence structure of thousands of variables. Honesty is a fundamental virtue of good statisticians, and you will learn about how to report data analysis results with accuracy and transparency, thereby allowing for the reproducibility of your results.



Prerequisites

Basic knowledge of probability and statistics. Knowledge of R and/or Python programming is recommended but not a prerequisite.

Textbook

No textbook required. All study materials will be provided by the instructor via Canvas.

Online Course Materials

The professor will provide the following course materials via Canvas: syllabus, up-to-date class schedule, lecture slides, quizzes and solutions, readings, and additional materials to help students complete their project.

Attendance Policy

Students are expected to attend all lectures in person. During class, students will have the opportunity to understand the topics of study deeply, by directly interacting with their professor and classmates while solving occasional in-class problems. Tablets or laptops can be used ONLY to take notes.

Grading Policy (Note: NO EXAMS)

ONLINE QUIZZES (80%)

Online quizzes are short take-home problem sets assigned on Canvas, typically involving true/false and multiple choice questions that are easy to solve if you attend class and study the topics. An online quiz will be assigned about every week.

PROJECT (20%)

Students will form groups to work on a semester-long, multi-step project. The project may involve different aspects of graphical models, such as theory, methods, real-world applications, and coding, to varying extents, depending on the interests of the students. Thus, for example, a project could be exclusively focused on reviewing theoretical aspects of graphical models, or exclusively focused on graph estimation from real data. Great importance will be given to students' honesty in reporting their findings and appropriately citing sources.

Honor Code

Plagiarism will NOT be tolerated. As established by the University of Notre Dame Honor Code, as members of the Notre Dame community, we are all required *to learn and abide by principles of intellectual honesty and academic integrity, and therefore will not participate in or tolerate academic dishonesty.*

Generative AI

Generative AI tools MAY NOT be used to solve quizzes or completing project tasks.

See <https://honorcode.nd.edu/generative-ai-policy-for-students-august-2023/>.

Appeals and grade adjustments

All appeals related to quizzes and project grades must be submitted within 1 week after they are returned. To appeal, the student must submit to the professor the following: written or typed note explaining which questions are being appealed, and the basis for the appeal. The professor will review each appeal and make appropriate changes. Note that during this process the entire quiz or project will be regraded.

Accommodations

It is the policy and practice of The University of Notre Dame to provide reasonable accommodations for students with properly documented disabilities. Students who have questions about Sara Bea Accessibility Services or who have, or think they may have, a disability are invited to contact Sara Bea Accessibility Services for a confidential discussion by emailing at sarabeacenter@nd.edu or by phone at 574-631-7157. Because the University's Academic Accommodations Processes generally require students to request accommodations well in advance of the dates when they are needed, students who believe they may need an accommodation for this course are encouraged to contact Sara Bea Accessibility Services at their earliest opportunity. Additional information about Sara Bea Accessibility Services and the process for requesting accommodations can be found at <https://supportandcare.nd.edu/for-students/current-students/accessibility-support/>.

Student Health and Wellness

Care and Wellness Consultants at ND provide support and resources to students who are experiencing stressful or difficult situations that may be interfering with academic progress. Please, visit <https://studenthealth.nd.edu> for more information.

Copyright for all course materials and content

All materials created by the instructor are copyrighted material of the instructor. Re-posting copies of any of these materials to any location will be considered both an honor code violation and a violation of copyright law. This includes but is not limited to lectures, slides, scripts, assignments, exams, handouts, etc. All materials are to be used solely for the purpose of this course at this semester by the registered students.

NOTE: This syllabus is subject to change with reasonable advance notice by the professor. The most recent version of this syllabus can be found on Canvas.