MTG 7396: Topological Data Analysis and Machine Learning
Advanced Topics in Topology 1
University of Florida, Department of Mathematics
Course Syllabus, Fall 2019

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Class meetings: MWF 7th period (1:55–2:45pm), Little Hall 305

Course description. This course is an introduction to the use of topological tools in data analysis and to combining these tools with methods from statistics and machine learning.

Course Objectives. This course straddles pure mathematics, applied mathematics, and data science. Students will learn the theory of topological data analysis (TDA) as well as how to use its computational tools. They will then apply TDA to analyze actual data.

Course schedule.
Weeks 1–4 Persistent Homology
Weeks 5–8 Machine Learning
Weeks 9–10 Statistics
Weeks 11–13 Other TDA methods (time permitting)
Weeks 14–16 Presentations

Course structure. We will start by learning the mathematics of topological data analysis, then learn some of the important tools and ideas in modern statistics and machine learning, and also see how all of these methods may be combined. Along the way we will learn how to use computational tools to apply what we have learned to the analyze both synthetic and real-world data.

Expectations.
• Students will be responsible for using available resources (notes from class, discussions with classmates, internet resources, books, and the mathematical literature) to learn the necessary concepts.
• Starting with the fourth week of class, students will bring their laptops to class every Friday to learn how to use computational tools for TDA, and then to apply these tools in their projects.
• Students will be prepared to explain what they’ve learned.

Course work and assessment. The main part of the course will be a computational project in topological data analysis. The grading for the course will be based on a presentation of this project (40%) and an accompanying written report (40%). The remainder of the grade will be based on smaller homework assignments (20%).
Resources. All of the following can be downloaded in PDF form from the UF library.


Grading scheme. A: 90% – 100%, A-: 85% – 89%, B+: 80% – 84%, B: 75% – 79%, B-: 70% – 74%, C+: 65% – 69%, C: 60% – 64%, D+: 57% – 59%, D: 54% – 56%, D-: 50% – 53%, E: 0% – 49%.

Class demeanor. Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom. Other students should be respected in discussion.

Class attendance. “Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Course evaluation. Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/

Disabilities statement. Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, http://www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Academic honesty. UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.” On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Grade points. For current UF grading policies for assigning grade points see https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/.
Campus resources.

Health and wellness.
- U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352-392-1575 so that a team member can reach out to the student.
- Counseling and Wellness Center: http://www.counseling.ufl.edu, 352-392-1575.
- Sexual Assault Recovery Services (SARS) Student Health Care Center, 352-392-1161.
- University Police Department, 392-1111 (or 9-1-1 for emergencies). http://www.police.ufl.edu/

Academic resources.
- Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. http://teachingcenter.ufl.edu/