

TOPOLOGICAL DATA ANALYSIS

Augmester 2021

listed under

MATH 4810/5810, Special Topics in Mathematics

Course Instructor: Dr. Markus Pflaum

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Lecture Hours: MTWThF 9:00 a.m. – 12:00 p.m., August 2 – 19, 2021 (Augmester)

Targeted Audience: The course is intended for upper-division undergraduate and graduate students in mathematics, applied mathematics, statistics, computer science or the sciences and engineering with an interest in data sciences and/or applied topology.

Basic knowledge of Linear Algebra and Analysis is recommended.

Course Homepage: <http://math.colorado.edu/courses/TopologicalDataAnalysis>

Course Contents: The goal of the course is to give an introduction to the abstract methods of applied algebraic topology and how they can be used to study data sets as they appear in the sciences, engineering and economical life. Particular emphasis will be given to understand how topology can be used to study the shape of data. In the first part of the course, an elementary introduction to topology and homology theory will be given. This is followed by an overview of fundamentals of data analysis and corresponding software tools. In the third and last part of the course students will work on particular data analysis projects.

Course Literature:

- ADAMS & FRANCOVA, *Introduction to Topology: Pure and Applied*, Pearson.
- EDELSBRUNNER & HARER, *Computational Topology: An Introduction*, AMS.
- GHRIST, *Elementary Applied Topology*, Ed. 1.0, Createspace, 2014.
- GRUS, *Data Science from Scratch: First Principles with Python*, 2nd Ed., O'Reilly.

The following online textbooks can be used to recall the prerequisites from Linear Algebra and Analysis and are available under an open document license.

- HEFFERON, *Linear Algebra*
- TRENCH, *Introduction to Real Analysis*

Credits: This is a 3 credit hours course. Every student who intends to take the course with less than the standard 3 credit hours should contact the instructor.