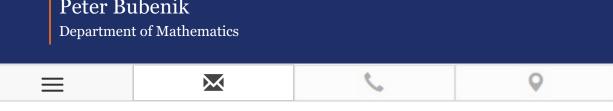# MTG 7396, Topological Data Analysis and Machine Learning (Advanced Topics in Topology 1)

Across academia and industry there is a huge appetite for new tools to make sense of the vast quantities of data being produced and recorded. Quantifying and organizing complicated structure is something that mathematics is very good at. The goal of topological data anlysis is to use modern mathematics to represent and learn from the shape of data.

The purpose of this course will to be twofold:

1. To introduce students to ways in which many topics from pure mathematics are used in data analysis.
2. To introduce students to some of the main ideas in data science.

Mathematical topics will include: homology, linear algebra, Morse theory, category theory, commutative algebra, representation theory of quivers, combinatorics, Hilbert spaces, and kernels.

In data science, we will learn some of the central ideas in modern statistics and machine learning. We will learn to use software used in data science, namely the programming language R.

Grading for the course will consist of one computational project.

This topic has much to offer the aspiring mathematician: interesting new mathematical problems, important applications, conferences with support for graduate students, demand from industry to hire graduates, and demand in acedemia for postdocs.

Time and Location
MWF Period 7 (1:55-2:45), Little Hall 305

Prerequisites
This course will be mostly self-contained. Any student ready for a 4000/5000 level math course is welcome. The main topological construction with which you will be expected to quickly familiarize yourself is simplicial homology.

Please contact me if you have any questions and/or requests!

Course Syllabus