Topics in Topology and Geometry - Math 40960
Computational Topology

with a view towards Topological Data Analysis

Instructor: Gábor Székelyhidi
MWF 9:25 – 10:15, Spring 2017
Hayes Healy 125

Topology is a very classical area of mathematics that can be thought of as a "flexible" study of shapes - for instance a donut and a coffee cup are not distinguished since they both have one "hole". Computational Topology is a much more recent development where these ideas are put into practice in a wide range of applications, for instance in analyzing the shape of large data sets. This course will be an introduction to some of the mathematical ideas in this area, motivated by example applications, in particular from topological data analysis.

Textbook:
In the first few weeks we will use *Munkres - Topology*, in order to introduce basic concepts of point set topology, such as connected sets.
The remainder of the the course will follow *Edelsbrunner, Harer - Computational Topology*.

Grading policy: There will be roughly biweekly homework sets, a midterm, and a term paper. The final grade will be broken down as follows:
Homework 40%,
Midterm 25%,
Term paper and presentation 35%.

Term paper and presentation: This will be quite flexible, depending on each student's interests. It could be something more theoretical, going beyond what we cover in the class, or for those interested primarily in applications it could be an explanation of an application found in the literature, or even original analysis of a data set obtained by the student. The paper should be around 8-10 pages, although of course the exact length will vary.

At the end of the semester you will give a short presentation on your work in class. You will be allowed to work alone or in pairs, but each student must have their own writeup, and must take part in the presentation. I will give more details on this as the course progresses.

Office hours: I will have regular office hours on Wednesdays, 1-2:30pm, in 277 Hurley Hall, or by appointment.