

CSE/AMCS 60973: Topological Data Analysis

Paper chase assignment

This assignment is due on October 17, by 11:59pm.

Paper chase assignment:

For this paper, I'd like you to get in the mindset of a reviewer, and to practice the skills of hunting down references to find clarifications and explanations. I also want you to get an idea of what is currently trending in and around the world of TDA and computational topology - there's a lot of new papers to check out - and get a sense of topics you might like to consider for your end-of-semester project.

Assignment details:

- Find a research paper on computational topology/topological data analysis; let's call this Paper 1. Paper 1 can be something related to your own research that you'd like to examine more closely, or you can dive into a relevant conference/journal and pick something you find interesting. The only requirement is that it utilize TDA in some meaningful way, but you'll find a lot of cool topology in robotics, computer vision, graphics, geographic information systems, and many other areas.
- Now imagine that you were assigned Paper 1 as a reviewer. The first part of any paper review is a succinct summary (at most two short paragraphs) of the major contributions of the paper. **Write that summary.** Your summary should be objective; keep your opinions about the paper limited. (An actual paper review would also include your opinions about the paper after the summary, but they will not be a part of this assignment.) Your summary should also be easy for a program committee member / editor to read. Remember that even if they have more general expertise, they know less about the paper than you do!
- **Identify and explain the major technical or computational ingredients from TDA used in the paper, using up to one full page.** In short, how are the paper's results obtained?
- Skim the rest of the paper to get a general idea of what is going on, and then read as much detail as you can. **Describe where you got lost, using up to one full page.** (This is not normally part of a review.) I'm specifically looking for something you found confusing or overwhelming or unconvincing in the core of the paper, not merely background results that you find unfamiliar. Include enough context that your point of confusion is clear to someone who is not familiar with the paper. If you can't figure out the major contributions of the paper, start over with a different Paper 1. If you never get lost, start over with a different Paper 1.
- Identify another paper that would help enhance your understanding of Paper 1; let's call this Paper 2. This could be a paper that Paper 1 cites, a paper that cites Paper 1, or just a result of your mad googling skills. Read Paper 2, first skimming to get a general idea of its content, and then trying to read as much detail as you can. **Briefly summarize paper 2, describe its connection to where you got lost in paper 1, and describe where you got lost in Paper 2.** Use up to one full page.

- Repeat the previous step one more time. Identify yet another paper that would help your understanding of Paper 2; let's call this Paper 3. Read Paper 3. Briefly summarize Paper 3, describe its connection to where you got lost in previous papers, and describe where you got lost in Paper 3. Use up to one full page.

Your entire review should be clearly readable by a fictional reader with general expertise in TDA, but with no previous familiarity with your chosen papers or the problems they attack. (Imagine the PC member who assigned you Paper 1 to review, or you six months ago.) Altogether, your writeup should be roughly 3-5 pages long. Don't forget to properly cite the papers you read (and any other papers that you reference in your writeup).

Choosing papers:

You're welcome to choose any three related papers on any aspect of TDA, subject to the following restrictions:

- Make sure the paper studies, develops, applies, or uses some non-trivial tool in topological data analysis and/or computational topology! While other fields (i.e. data structures, or pure topology, or pure statistics) can have relevant connections, I'd like you to restrict to topics that are central to the class, especially for paper 1.
- Don't review papers that you already know well. I want you to deliberately go outside your comfort zone. I do not expect you to understand your papers in complete detail.
- In particular, don't review any papers written by either you or your advisor, if you have one; you have an obvious conflict of interest. (But you are welcome to use those papers to find other papers to read and review.)
- Similarly, don't review any of my papers; I have an obvious conflict of interest! (Again, you are welcome to use my papers to find other papers to read and review.)

If you have any questions for me about specifics, please message on slack, email, or come by office hours! I am happy to discuss and brainstorm some good options. You can also check venues that often publish relevant work - the conference Symposium on Computational Geometry (SoCG) and the journal Applied and Computational Topology are generally considered the top venues for TDA related work - but many other journals and conferences publish both applied and theoretical TDA papers as well.

Once you've chosen an initial paper to start with, there are several recommended strategies for finding additional papers to read, not only for this assignment or your project, but in your own research.

- By citation: Go backward in time: Look at the papers that your favorite papers cite. Or go forward in time: Look at the papers that cite your favorite papers, using an indexing service like Google Scholar or Scopus. These are often the most fruitful strategies, and the ones I recommend for this assignment.
- By keyword: Look for more papers (or lecture notes, or slides, or whatever) that use similar key terminology as your favorite papers. Try likely synonyms, even if you think they mean something completely different; different research communities use different words for the same concepts, and the same words for different concepts.

- By venue: Look at other papers in the venues (conference, journal, workshop, seminar series, arXiv category, Github . . .) that published your favorite papers.
- By author: Look at other papers (or lecture notes, or slides, or whatever) produced by the authors of your favorite papers, as well as their coauthors, students, and advisors.
- By recommendation: Ask people who are likely to know something about your favorite topics to suggest papers you might not otherwise think of.