

CSCE-620/VIZA-670 Computational Geometry

Fall 2025

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Office Hours: MWF 2:40 pm–3:40 pm

Course Research Project

You can take one of the three options below for your course research project.

A. Paper Reading. The student picks a research paper in computational geometry that was suggested by the instructor or published in one of the following conference proceedings and journals:

Computational Geometry: Theory and Applications, Elsevier BV.

International Journal of Computational Geometry & Applications, World Sci.

The Annual Symposium on Computational Geometry (SoCG)

The student should discuss with the instructor on the paper of her/his choice. After reading the paper, the student should give a 10-minute presentation on the paper (using PowerPoint) to the class, and write a report of at least 6 pages on the paper.

B. Mini-Research Project. On this option, the student picks a research problem. The problem can be one questioned in existing research papers, or one that is closely related to the student's own research, or one suggested by the instructor in class. After discussing with the instructor and having his permission, the student will read related research work in the area and try to solve the problem. The student may expect to gain further direction and advice from the instructor during the research. A project report of at least 8 pages should be submitted that summarizes the new findings during the research.

C. Geometric Algorithm Implementation. Implementing highly non-trivial geometric algorithms may lead to deeper and better understanding of the algorithms. The student may choose (with the instructor's approval) to implement a non-trivial geometric algorithm. The implementation should include a nice graphic input/output interface. Write a report of at least 5 pages that explains the details of the implementation and gives analysis of algorithm performance on experiments.

A one-page project proposal is due October 20, which should be submitted via Canvas and present the plan (with some details) on the project. The project proposal should get approved by the instructor before the student starts the project. **The final submission of the project to Canvas is due December 1.**

Some Suggested Papers in Computational Geometry.

1. P. AFSHANI, E. BERGLIN, I. VAN DUIJN, AND J. NIELSEN, Applications of incidence bounds in point covering problems, *Proc. 32nd International Symp. on Computational Geometry*, Article No. 60, pp. 1-15 (2016).
2. T. CHAN AND Y. NEKRICH, Towards an optimal method for dynamic planar point location, *SIAM Journal on Computing* 47-6, pp. 2337-2361 (2018).
3. J. CHEN, Q. HUANG, I. KANJ, AND G. XIA, Near-optimal algorithms for point-line fitting problems, *Journal of Computational Geometry* 13-1, pp. 226-243, (2022).
4. J. CHEN, Q. HUANG, I. KANJ, AND G. XIA, Nearly time-optimal kernelization algorithms for the line-cover problem with big data, *Algorithmica* 86, pp. 2448-2478 (2024).
5. B. CHAZELLE, Triangulating a simple polygon in linear time, *Discrete & Computational Geometry* 6-3, pp. 485-524 (1991).
6. H. KAPLAN, W. MULZER, L. RODITTY, P. SEIFERTH, AND M. SHARIR, Dynamic planar Voronoi diagrams for general distance functions and their algorithmic applications *Discrete & Computational Geometry* 64, pp. 838-904 (2020).
7. Y. NEKRICH, Dynamic planar point location in optimal time, *Proc. 53rd Annual ACM SIGACT Symp. on Theory of Computing*, pp. 1003-1014 (2021).