CS506 Class Project

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1 Overview

A significant part of this class is the class project. In this project, you will apply tools learned in this class to a problem in computational geometry. The project can be either: (1) analytical, where you make use of some of the mathematical tools covered in class and homeworks; or (2) empirical/implementation, where you do empirical tests on some algorithm(s) or tool(s) we've discussed in class.

You are encouraged to do this project in groups of no more than three students.

2 Project Deliverable

The main deliverable for the class project is a paper no more than ten pages in length (not including bibliography and appendix). This paper should be structured as a standard research paper in that it should have an abstract (a paragraph or two), an introduction, a related work section, a body, and a conclusion and future work section.

A good goal is for this paper to be of publication quality in that it contains at least one new, interesting, non-trivial idea. However, I do not expect all the class papers to be at this level. Learning to write good papers is a life-long process. There are links to several good references for this process on my home page in the Student Advice section. I recommend discussing your project with other students both inside and outside of your group and getting other students to review a copy of your paper before you turn it in. I also recommend that you come by my office hours at least once to discuss your progress on the project.

3 Some Project Ideas

1. Distributed computation of convex hull, in parallel, in CONGEST model.

2. Efficiently estimating area of a convex polytope via Monte Carlo algorithms. For example, see the paper "Ants estimate area using Buffon's needle".

3. Different lifting techniques for different types of Voronoi diagrams or Delaunay triangulations. For example, to compute a weighted Voronoi Diagram, can one lift points to different types of paraboloids based on the weight of the point? A literature search on Bregman Vornoi diagrams may be a good place to start on this.

4. Applications of singular value decomposition (SVD) or Johnson-Lindestrass projection from high dimensional to low dimensional spaces. Possible application areas can include machine learning, motion planning, data structure design, etc.

5. Distributed gradient descent in a physical space. For example, say that n robots are searching a space to find the source of a gas leak. They have sensors detecting the concentration of a gas. How can they most efficiently find the maximum concentration? Assume that the concentration function and search space are convex.