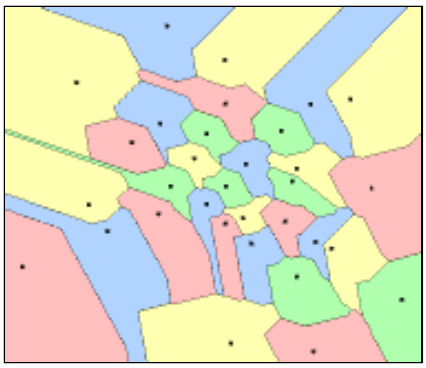

CS 497 JE, Spring 2000

Computational Geometry

TuTh 11:00-12:15, 159 Altgeld Hall
Instructor: Jeff Erickson
http://www.uiuc.edu/~jeffe/cs497/

Computational geometry is the field of theoretical computer science devoted to the design, analysis, and implementation of algorithms and data structures to solve geometric problems. These problems arise in several different areas, including computer graphics, robotics, databases, data mining, parallel computing, statistics, and pure mathematics. Their solutions combine traditional algorithmic techniques with beautiful results from combinatorics, geometry, and other areas of mathematics. Computational geometry was the initial breeding ground for several important techniques that later spread to the broader algorithms community - for example, dynamic data structures, randomized algorithms, and external memory computing - and continues to be one of the most active, interesting, and applicable areas of algorithms research today.

Topics:

The exact topics will depend on the interests of the participants, but here is a sample of possibilities. Please let me know if there's something specific you want to talk about!

Objects:
- Polygons
- Convex polytopes
- Triangulations
- Voronoi diagrams
- Convex decompositions
- Arrangements
- Visibility graphs

Problems:
- Convex hulls
- Nearest neighbors
- Point location
- Range searching
- LP-type problems
- Intersection
- Lower bounds

Techniques/Paradigms:
- Sweep
- Divide and conquer
- Prune and search
- Random sampling
- Dynamization
- Kinetic data structures
- Perturbation

Applications:
- Mesh generation
- Simplification
- Reconstruction
- Motion planning
- Collision detection
- Hidden surface removal
- Clustering

Administrivia

- **UI Direct call number:** 01698
- **Credit:** 1 unit
- **Prerequisite:** CS 373 or equivalent, or my permission. Mathematically and/or algorithmically mature undergraduates are welcome!!
- **Textbook:** *Computational Geometry: Algorithms and Applications* by Mark de Berg, Marc van Kreveld, Mark Overmars, and Otfried Schwarzkopf (Springer-Verlag, 1997). In addition, several recent conference and journal papers will be distributed in class.

I talk in pictures not in words.

- Peter Gabriel
"...And Through the Wire"
Peter Gabriel III (Melt) (1980)

I have no arguments to offer, my figures are my proofs.
Laugh away these truths and facts if you can.

- Theodore Heisel
The Circle Squared Beyond Refutation (1934)