

Scientific report of Panos Giannopoulos

Name: Panos Giannopoulos
Supervisor(s): Helmut Alt
Field of Research: Computational Geometry
Topic: Shape Matching
PhD Fellow at the program from September 2002 to November 2002

Field of Research

During these three months I worked in the field of Computational Geometry, in the topic of Shape Matching. I examined the following problem:

Given two sets of discs P, Q in the plane, each of them treated as unions of discs, find the translation that maximizes the area of overlap. I considered the special case of disjoint and unit discs (in each set).

Results

Working on previous ideas about approximating the maximum area of overlap, that were initiated in my home university in Utrecht, and new refinements inspired from discussions with people in Berlin. I managed to prove that there is a translation that aligns the two centers of some two discs - one in P and the other in Q , that achieves a constant factor approximation of the maximum overlap. This result implies that the running time for such a constant-factor approximation algorithm is improved by a factor of $n \log n$, where n is the number of discs in both sets (asymptotically).

We also managed to improve the approximation factor of an existing algorithm by a factor of almost 100, to 0.39.

Several other independent results - which could prove useful to further research were proven. For example we found a nice geometric condition-characterization of the “relative” critical positions of the two sets of discs that ensure that in such position the function of the area of overlap could attain, a local maximum-minimum or neither (just a saddle point).

Activities

In these three months – actually four since I have stayed one more in Berlin working with the group of Helmut Alt, I have followed:

- A course in discrete topology given in the mathematics department at Freie Universität.
- Lectures and seminars of the graduate program CGC every monday.
- Noon-Seminars, twice a week, in my department-group.
- Learn and work-shop on Markov chains organized by CGC, given by Prof. Sinclair.
- The annual CGC workshop at Hiddensee in October, where I have presented part of my work on the topic described earlier.
- I have been a sub-referee for two important conferences – STACS 2003, STOC 2003.

Preview

In my home institute in Utrecht I will write up all the current results and ideas. They should lead to a nice paper in a forth coming conference. There are numerous promising ideas on how to extend this work. I will continue working, with the people here in Berlin – I am planning to visit them again soon.