February 2010

CS Talk by MADALGO visitor Shervin Daneshpajouh, Sharif University of Technology

Computing minimum-link homotopic simplification

Abstract:

We study the well-known problem of approximating a polygonal path P by a coarse one, whose vertices are a subset of the vertices *of P*. For a given error, our goal is to find a path with the minimum number of vertices while preserving the homotopy in presence of a given set of extra points in the plane. De Berg *et al.* (1995) presented an $O(n(m+n) \log n)$ time algorithm which works on x-monotone paths, where n is the number of points of the path and m is the number of extra points.

Here, we improve the running time and present a method for homotopy-preserving simplification under any desired measure. Our algorithm runs in $O((n+m) \log(n+m)+k)$ time, where in the worst case k can be $O(n^2)$. Using this method we obtain an $O(n^2 + (n+m) \log(n+m))$ time algorithm for simplification under the Hausdorff measure.

To our knowledge this is the first quadratic homotopy-preserving simplification algorithm for a given error finds the minimum number of vertices.

Joint work with: Mohammad Ghodsi