Abstract

We illustrate how we combined standard computational geometry tools (biclique decompositions, cuttings, and the like) with some algebraic tools (multi-point polynomial evaluation, fast polynomial multiplication etc) to solve the following two problems.

Consider two piecewise-linear bivariate functions f and g defined over a common domain M, say the unit square. Suppose f and g are defined by linear interpolation over triangulations T_f and T_g, respectively, of M each with n triangles.

We consider the problem of computing the L_1- and L_2-distances between f and g, namely, $\|f-g\|_2 = \sqrt{\int_M (f-g)^2}$ and $\|f-g\|_1 = \int_M |f(x,y) - g(x,y)|$. If the triangulations T_f and T_g are drastically different, the natural way to compute both distances takes quadratic time.

We show how to compute the former in $O(n \operatorname{polylog} n)$ time and the latter in strictly subquadratic time by combining traditional computational geometry techniques with some algebraic tools.

The L_2-distance algorithm is joint work with Guillaume Moroz; L_1-distance one is joint work with Pankaj K. Agarwal, Olivier Devillers, Christian Knauer, and Guillaume Moroz.

Bio: Boris Aronov received his PhD from Courant Institute of Mathematical Sciences, New York University (NYU) in 1989. He is a professor of computer science at the Tandon School of Engineering, NYU, formerly Polytechnic University of New York. Over the years he has held visiting positions at MSRI in Berkeley, at Utrecht University, at the University of Illinois at Urbana-Champaign, at UPC in Barcelona, at ETH in Zürich, at JAIST in Japan, at EPFL in Lausanne, at ULB in Brussels, and at IST Austria, among others. He works mostly in computational and combinatorial geometry, with occasional detours to other subjects.