Geometry Seminar
May 8, 2007, Tuesday, 6:00 p.m.
Room 613, Courant Institute
251 Mercer Street, New York

Bit-thrifty evaluation of geometric predicates

David Kirkpatrick
University of British Columbia, Vancouver

Abstract

Let S is a sequence of n points whose coordinates are given initially only to some limited precision, with additional precision available at some additional cost per bit. Suppose that we wish to determine some property P of S: for example, does one distinguished point of S lie in the interior of the convex hull of the rest, or (more generally) are the red points in S linearly separable from the blue points in S. For some problem instances, many bits of all (or most) of the points need to be determined in order to establish P; for other instances P can be established with the knowledge of only a relatively small (total) number of bits. In general, we would like to design algorithms whose cost (number of bits examined) adapts to the intrinsic cost (shortest computation or "proof" of the property P) for a given instance. The problem of constructing such algorithms for certain simple geometric predicates was posed by Leo Guibas at the 2003 Dagstuhl Workshop on Computational Geometry. This talk describes some results concerning some very basic questions of this type, focusing primarily on point sets in 1-d. Specifically, for the separability question in 1-d, we define a notion of *intrinsic cost* $c(I)$ of an instance (input *set*) I and show that (i) any algorithm can be forced to examine $c(I)$ bits in the worst case (over all presentations of I as an input sequence), even if I is known, (ii) there is an algorithm that examines only $O(c(I) \lg c(I)$ bits in the worst case, even if I is not known, and (iii) any algorithm can be forced to examine $O(c(I) \lg c(I)$ bits in the worst case (over all presentations of inputs with intrinsic cost $c(I)$), even if $c(I)$ is known. [Based on joint work with Raimund Seidel.]

For further information contact {pach,pollack}@cims.nyu.edu, or visit our website: http://www.math.nyu.edu/seminars/geometry_seminar.html