Geometry Seminar
September 20, 2005, Tuesday, 6:00 p.m.
Room 613, Courant Institute
251 Mercer Street, New York

Sticks, French Fries and Potatoes in Polygons

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Abstract

We study a class of optimization problems in polygons that seeks to compute the "largest" subset of a prescribed type, e.g., a longest line segment ("stick") or a maximum-area triangle or convex body ("potato"). Exact polynomial-time algorithms are known for some of these problems, but their time bounds are high (e.g., $O(n^{1.5+\epsilon})$ for the longest stick, and $O(n^7)$ for the largest convex polygon in a *simple* n-gon). We devise efficient approximation algorithms for these problems. In particular, we give near-linear time algorithms for a $(1-\epsilon)$-approximation of the biggest stick, an $O(1)$-approximation of the maximum-area convex body, and a $(1-\epsilon)$-approximation of the maximum-area fat triangle or rectangle. In addition, we give efficient methods for computing large ellipses inside a polygon (whose vertices are a dense sampling of closed smooth curve). Our algorithms include both deterministic and randomized methods, one of which has been implemented (for computing large area ellipses in a well sampled closed smooth curve).

(This is joint work with Olaf Hall-Holt, Matthew Katz, Piyush Kumar, and Arik Sityon.)

For further information contact Janos Pach at pachcims.nyu.edu, or visit our website: http://www.math.nyu.edu/seminars/geometry_seminar.html