Seminar on Combinatorial Computing
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Room 6417, Graduate Center
365 Fifth Avenue, New York

On testing congruence of higher-dimensional point sets

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Abstract

It is a classical problem of computational geometry to decide for two given sets of n points each whether they are congruent. In dimensions two and three, this problem was solved in optimal $O(n \log n)$ time long ago. But for higher dimensions, the situation is much less clear: the lower bound is always only $\Omega(n \log n)$, but the currently best upper bound is $O(n^{\lceil d/3 \rceil} \log n)$. And this exponential dependence on d is unavoidable with the current techniques, since up to now all higher-dimensional congruence tests are based on dimension-reduction techniques, reducing one d-dimensional problem with n points to $O(n)$ lower-dimensional (currently $d-3$) problems. For $d = 4$, the first open case, this gives an $O(n^2 \log n)$-algorithm. In this talk I will present a new method, which improves the four-dimensional case to $O(n^{5/3} \log n)$. In itself, this is a minor improvement, although it reduces the exponent for all higher dimensions, since it improves the base case for the dimension reduction techniques. But I will also show why this new method gives hope to solve the congruence test problem for all fixed dimensions in $O(n \log n)$ time.

This is joint work with Christian Knauer (FU Berlin).

For further information contact Janos Pach at pachcims.nyu.edu, or visit our website: http://cs.gc.cuny.edu/~pach/