MSc thesis defense presentation

Χαρ■λαος Τζ■βας defends his MSc thesis

Date:	Δευτ■ρα, 06 Ιο■ν 2016
Thesis title:	Approximating Minkowski Decomposition and 2D Subset Sum
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Thesis abstract

We consider the approximation of two NP-hard problems: Minkowski Decom- position (MinkDecomp) of lattice polygons in the plane and the closely related problem of Multidimensional Subset Sum (kD-SS) in arbitrary dimension. In kD- SS we are given an input set S of k-dimensional vectors, a target vector t and we ask if there exists a subset of S that sums to t. We prove, through a gap-preserving reduction, that, for general dimension k, kD-SS does not have a PTAS although the classic 1D-SS does. On the positive side, we present an O(n3/ε2) approximation al- gorithm for 2D-SS, where n is the cardinality of the set and ε bounds the difference of some measure of the input polygon and the sum of the output polygons. Ap- plying this algorithm, and a transformation from MinkDecomp to 2D-SS, we can approximate MinkDecomp. For an input polygon Q and parameter ε, we return two summands A and B such that A + B = Q′ with Q′ being bounded in relation to Q in terms of volume, perimeter, or number of internal lattice points and an ad- ditive error linear in ε and up to quadratic in the diameter of Q. A similar function bounds the Hausdorff distance between Q and Q′. We offer experimental results based on our implementation which is openly provided via Github.