

MSc thesis defense presentation

Tzovas Harilaos defends his MSc thesis

Date:	Monday, 06 Jun 2016
Thesis title:	Approximating Minkowski Decomposition and 2D Subset Sum
Committee:	<ul style="list-style-type: none">• Ioannis Emiris• Dimitris Fotakis• Vassilis Zissimopoulos

Thesis abstract

We consider the approximation of two NP-hard problems: Minkowski Decomposition (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 $O(n^3/\epsilon^2)$ approximation algorithm 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. Applying 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 additive 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.

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