How to Maximize the Total Area of Rectangles Packed into a Rectangle?

TUE/AE01
17:00–17:20

Nikhil Bansal (IBM T.J. Watson Research Center), *Alberto Caprara* (Univ. Bologna), *Klaus Jansen* (Univ. Kiel), *Lars Prädel** (Univ. Kiel), *Maxim Sviridenko* (IBM T.J. Watson Research Center)

We study an interesting geometric optimization problem called Rectangle Packing with Area Maximization (RPA). We are given a set of rectangles and a rectangular target area called bin. The goal is to find a feasible packing of a subset of the given rectangles into the bin, i.e. an orthogonal packing without rotation and overlap. The objective is to maximize the total area of rectangles packed. This problem is a generalization of the Subset Sum problem, which is one of the most fundamental and well-known problems in combinatorial optimization and has many practical applications, such as VLSI layout and the cutting problem.
RPA is strongly *NP*-hard even for squares, therefore there is no fully polynomial time approximation scheme (FPTAS) for this problem, unless $P = NP$. The previously best result is a $\left(\frac{1}{2} - \varepsilon\right)$-approximation by Jansen & Zhang for our problem. We present a polynomial time approximation scheme (PTAS) for this problem, i.e. a family of algorithms which compute for any accuracy $\varepsilon > 0$ in polynomial time a solution with ratio $(1 - \varepsilon)$.

[1] N. Bansal, A. Caprara, K. Jansen, L. Prädel and M. Sviridenko: A Structural Lemma in 2-Dimensional Packing and its Implications on Approximability. Unpublished

[2] K. Jansen and G. Zhang On rectangle packing: maximizing benefits In: Algorithmica, volume 4, pages 323-342, 2007