A Fast Algorithm for Reconstructing hv-convex 8-connected but not 4-connected Discrete Sets

Péter Balázs, Attila Kuba, and Emese Balogh

One of the most frequently studied area of discrete tomography is the problems of the reconstruction of 2-dimensional (2D) discrete sets from their row and column sum vectors. Reconstruction in certain classes of discrete sets can be NP-hard. Since applications require fast algorithms, it is important to find algorithms in those classes of 2D discrete sets where the reconstruction can be performed in polynomial time.

An important class of discrete sets where the reconstruction problem can be solved in polynomial time is the class of hv-convex 8-connected sets. The worst case complexity of the fastest algorithm known so far for solving the problem describing it by a 2SAT expression is $O(mn \cdot \min\{m^2, n^2\})$. However as it is shown, in the case of 8-connected but not 4-connected sets we can give an algorithm with worst case complexity of $O(mn \cdot \min\{m, n\})$ by identifying the so-called $\mathcal{S}_4$ -components of the discrete set. We also show that our algorithm can be generalized to solve the reconstruction problem in a broader class than the hv-convex 8-connected sets. Experimental results are also presented.