Empirical Studies of Reconstructing hv-Convex Binary Matrices from Horizontal and Vertical Projections

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Tomography is a method of producing a three-dimensional image of the internal structure of an object from its projections, without damaging it. In $binary\ tomography$ we assume, that the examined object is homogeneous. In order to reduce the number of projections needed to the reconstruction, we further assume that the image satisfies certain geometrical conditions, such as hv-convexity.

The reconstruction of hv-convex binary matrices from their horizontal and vertical projections is proved to be NP-hard. In this paper, we take a closer look at the difficulty of the problem. We investigate different heuristic reconstruction algorithms of the class, and study them from the viewpoint of runnung-time and reconstruction quality. In the experiments we use a large set of test data, with different size and number of components. We observe that for each studied algorithm the dissimilarity of the reconstucted and the original images depends on the number of the components, rather than the size of the image. Futhermore, the reconstruction time of the core-shell algorithm depends both on the size of the image and the number of its components, while the speed of the simulated annealing reconstruction is mostly determined by the number of so-called switching components present in the image.

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