A Novel Optimization-Based Reconstruction Algorithm for Multivalued Discrete Tomography

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Transmission tomography [1, 2] is the reconstruction of objects from their projections. This is usually done by exposing the object of study to some type of radiation, and measuring the transmitted energy on the other side. The object will absorb some fraction of the radiation and from this, one can derive the summed density of the object along the paths of the beams. By taking such projections from many different directions it is possible to reconstruct the inner structure of the object.

In discrete tomography [3, 4] one also assumes that the object of study consists of only few known materials. With this information it is possible to reduce the number of required projections significantly. This can be useful in practical applications since the projection acquisition can be cost-, or time-consuming, or in some cases the high amount of radiation caused by taking many projections can damage the object [5].

We developed a new reconstruction algorithm that can provide accurate reconstructions of objects in the binary and non-binary case of discrete tomography, by minimizing an energy function with a novel optimization process.

We also tested the algorithm by comparing it to other reconstruction methods, in a series of software test.

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