

# Binary Tomographic Reconstruction with an Object-Based Evolutionary Algorithm

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The aim of *Binary Tomography (BT)* is to determine the interior of homogeneous objects from their projections, without destroying or damaging them. In BT usually only few projections are available – in our work we used only four angles to take the projection data. Owing to the limited number of projections some a priori information is also necessary to ensure accurate reconstruction. In our work we suppose that the two-dimensional cross-sections of the studied objects consist of disjoint disks inside a ring. This special feature inspires us to represent the image using an object-based model. Each image is represented by a list containing the center and the radius of the disks and the outer ring. With such representation the reconstruction can be performed with an evolutionary algorithm.

*Evolutionary Algorithms* have an initial population and they usually use two kinds of operators, *Mutation* and *Crossover*. With their aid the further generations are created. Mutation can modify a disk by moving or resizing it or, it also can increase or decrease the number of disks in the image. Crossover interchanges the disk-list-segments of the two images. We work with a fixed number of entities in all generations (we evaluate them with the so-called fitness-function and only keep the bests). The fitness function is based on the projection values, objects having projections similar to the ones of the original object have better fitness value.

To improve the algorithm the fitness function can be modified to hold additional prior information such as the number of disks constituting the image. To predict this number we used the well-known C4.5 *Decision Tree* classifier and then, the fitness of the entities in the population was biased according to the (uncertain) classification.

In this paper we present the details of the above-mentioned reconstruction method and our experimental results. This paper is based on our previous work [1].

## References

- [1] P. Balázs and M. Gara. An Evolutionary Approach for Object-Based Image Reconstruction Using Learnt Priors, *Lecture Notes in Comput. Sci.*, 5575:520–529, 2009.