Algorithms for Topological Kernel Extraction and Thinning

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A parallel reduction operation on binary images deletes a set of object points. There exist sufficient conditions for parallel reduction operations to preserve topology [3]. They provide a general method of verifying the correctness of topological algorithms.

There are two frequently applied topological algorithms. Reductive shrinking [1] is to extract topological kernels (i.e., minimal structures that are topologically equivalent to the original objects), and thinning that is a skeletonization technique [2]. All iterative parallel shrinking and thinning algorithms are composed of parallel reduction operations. The endpoints, some black points that provide relevant geometrical information with respect to the shape of the object, are preserved during the thinning process, in contrast to the reductive shrinking, where no endpoint criterion is taken into consideration.

In this work, we present new sufficient conditions for topology preservation. Then we propose 21 new algorithms, 7 for reductive shrinking and 14 for thinning. These algorithms are derived from our new sufficent conditions for topology preservation adapted to some parallel reduction techniques, hence their topological correctness is guaranteed. In addition, the possibility of the maximal reduction for the various algorithms is also examined.

References

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