

Chapter 6

Object Selection in Computer Vision: From Multi-thresholding to Percolation Based Scene Representation



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Abstract We consider several approaches to the multi-threshold analysis of monochromatic images and consequent interpretation of its results in computer vision systems. The key aspect of our analysis is that it is based on a complete scene reconstruction leading to the object based scene representation inspired by principles from percolation theory. As a generalization of the conventional image segmentation, the proposed reconstruction leads to a multi-scale hierarchy of objects, thus allowing embedded objects to be represented at different scales. Using this reconstruction, we next suggest a direct approach to the object selection as a subset of the reconstructed scene based on a posteriori information obtained by multi-thresholding at the cost of the algorithm performance. We consider several geometric invariants as selection algorithm variables and validate our approach explicitly using prominent examples of synthetic models, remote sensing images, and microscopic data of biological samples.

Keywords Object selection · Multi-threshold analysis · Percolation · Hierarchical structure · Adaptive thresholding · CLSM imaging · Z-stack

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