Research on some clustering techniques and their application in image segmentation problems

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Abstract: This thesis investigates several clustering techniques and their application to the image segmentation problem. Image segmentation, the process of partitioning an image into meaningful regions, is a critical step in computer vision. This study focuses on evaluating and enhancing the performance of classical clustering algorithms, including K-means and Fuzzy C-means, alongside more advanced methods such as spectral clustering. The research addresses key limitations of these techniques, particularly sensitivity to initialization and computational cost for high-resolution images. A modified approach is proposed to improve segmentation accuracy and convergence speed. Experimental results on standard benchmark datasets demonstrate that the proposed method achieves superior segmentation quality compared to traditional algorithms, effectively delineating object boundaries and reducing noise. The findings confirm that optimized clustering techniques offer a robust and efficient solution for automated image analysis, with significant potential for applications in medical imaging, remote sensing, and object recognition.

Keywords: clustering, image segmentation, clustering techniques, applications