Research on some contour detection algorithms and application to support detection of ground-glass opacity and consolidation regions on chest X-ray images of Covid-19 patients

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Abstract: This study investigates contour detection algorithms and their application in supporting the identification of ground-glass opacities (GGOs) and nodular opacities in chest X-ray (CXR) images of COVID-19 patients. Given the critical role of chest radiography in diagnosing and monitoring COVID-19, accurate delineation of pathological lung regions is essential. The research evaluates several classical and advanced contour detection methods, including Canny, Sobel, and active contour models (snakes), to determine their efficacy in segmenting hazy and ill-defined opacities characteristic of viral pneumonia. A preprocessing pipeline incorporating histogram equalization and noise reduction is developed to enhance image quality. The algorithms are tested on a dataset of confirmed COVID-19 CXR images. Performance is assessed using metrics such as Dice coefficient and Intersection over Union (IoU) against manual annotations by radiologists. Results indicate that active contour models, when initialized with region-based priors, provide superior segmentation accuracy for GGOs compared to gradient-based methods. The findings suggest that optimized contour detection can serve as a reliable computer-aided diagnostic tool, assisting clinicians in quantifying disease extent and monitoring progression in COVID-19 patients.

Keywords: contour detection, lung X-ray, nodule detection, COVID-19