

Research on deep learning methods applied to cell image processing

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Abstract: This study presents a deep learning-based approach for the automated analysis of cellular images, addressing key challenges in medical diagnostics and biological research. Traditional image processing methods often struggle with the inherent variability, noise, and complex morphology of cell structures. We propose a novel convolutional neural network (CNN) architecture designed to enhance both segmentation accuracy and classification performance. The model integrates attention mechanisms to focus on salient cellular features and employs a multi-scale feature extraction strategy to handle variations in cell size and shape. Extensive experiments were conducted on a diverse dataset of stained microscopy images. The results demonstrate that our method achieves superior performance compared to conventional techniques, with significant improvements in intersection-over-union (IoU) for segmentation and F1-score for classification. Furthermore, the model exhibits robust generalization across different cell types and imaging conditions. This work provides a reliable and efficient tool for high-throughput cellular analysis, with potential applications in cancer screening, drug discovery, and personalized medicine.

Keywords: Deep learning, image processing, cell image, medical imaging