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Optimized Retinal Vessel Segmentation Using IS-Net and High-Resolution Dataset

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Abstract

Segmentation of the retinal vessels is extremely useful and very important in the diagnosis and management of various diseases associated with the eye, including diabetic retinopathy and glaucoma. The work has presented an improved methodology using an IS-Net model trained on the high-resolution FIVES dataset, including 800 annotated images of the retina. This paper therefore resolves the proposed approach by pre-processing, which consists of normalizing and performing horizontal flipping, followed by enhancement using IS-Net and histogram-based thresholding criteria for vessel structure binarization. The IS-Net architecture is designed with multi-scale RSU blocks to capture both fine and broad vessel details comprehensively for segmentation. Results have shown that IS-Net achieves a good balance in recall and specificity, with the F1 score high enough to outperform other models in terms of specificity by reducing false positives. These findings underlined the effectiveness of IS-Net for clinical applications and emphasized the value of high-resolution data for refinement in the performance of segmentation. © 2025 The Authors.

Author Keywords

automated diagnosis; deep learning; encoder-decoder architecture; FIVES dataset; high-resolution fundus imaging; IS-Net; medical image analysis; ophthalmic diagnostics; Otsu's thresholding; pixel-wise annotation; recall; Retinal vessel segmentation; RSU blocks; specificity; vessel enhancement

Index Keywords

Eye protection, Image analysis, Image annotation, Image coding, Image enhancement, Image segmentation, Medical image processing; Automated diagnosis, Deep learning, Encoder-decoder architecture, FIVES dataset, Fundus imaging, High resolution, High-resolution fundus imaging, IS-net, Medical image analysis, Ophthalmic diagnostic, Otsu thresholding, Pixel-wise annotation, Recall, Retinal vessel segmentations, RSU block, Specificity, Vessel enhancement; Ophthalmology

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