

Retinal Vessel Segmentation by Using Generative Adversarial Network and Convolutional Neural Network

Vishal Borate, Dr. Alpana Adsul, Pranav Ambekar, Alok Aute, Ganesh Shinde, Chirag Sherkar

Department of Computer Engineering

Dr. D.Y. Patil College of Engineering and Innovation Varale, Talegaon, Pune, India

vkborate88@gmail.com, hodcomputer@dypatilef.com

Abstract: *Accurate retinal vessel segmentation plays a vital role in the early detection and diagnosis of ophthalmologic diseases such as diabetic retinopathy, glaucoma, and hypertension. Traditional image processing and machine learning techniques often struggle to capture the fine vessel structures and complex variations present in retinal fundus images. To overcome these limitations, this study proposes a hybrid deep learning framework that combines Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANs) for precise retinal vessel segmentation.*

In the proposed method, the CNN component serves as the feature extractor, learning multi-scale spatial and contextual features from retinal images, while the GAN framework enhances segmentation accuracy by employing a discriminator network that distinguishes between real and generated vessel maps. This adversarial learning setup encourages the generator to produce vessel segmentations that closely resemble ground truth images. Additionally, preprocessing techniques such as contrast enhancement and noise reduction are applied to improve the visibility of retinal structures, and post-processing steps refine the vessel boundaries for higher accuracy.

Experimental results on publicly available retinal image datasets, such as DRIVE and STARE, demonstrate that the proposed GAN-CNN model outperforms conventional CNN-based segmentation methods in terms of accuracy, sensitivity, specificity, and Dice coefficient. The system achieves robust performance even under varying illumination and noise conditions.

These findings indicate that integrating adversarial learning with convolutional feature extraction can significantly enhance retinal vessel segmentation, paving the way for more efficient and automated retinal disease screening systems.

Keywords: Retinal Vessel Segmentation, Fundus Images, Convolutional Neural Networks (CNN), Generative Adversarial Networks (GAN), Deep Learning, Medical Image Processing, Diabetic Retinopathy Detection

