Diabetic Retinopathy Lesion Segmentation Using CNN

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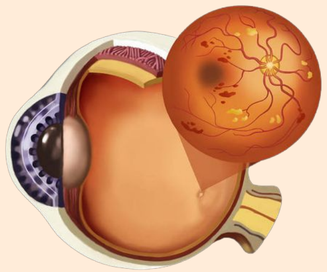
Introduction



Over 105 million impacted by high blood sugar damaging retinal blood vessels, causing swelling, leaks, blurred vision, and abnormal vessel growth, worsening vision.

Literature Review

The literature highlights the importance of Pathogenesis, risk factors, diagnostics, treatments, and the critical role of early intervention in preventing vision loss.

Current Challenges

- Patients must go to the hospital for a diagnosis of retinal conditions.
- Existing retinal detection devices are too expensive.
- Existing retinal detection devices are too bulky.

Research Objectives

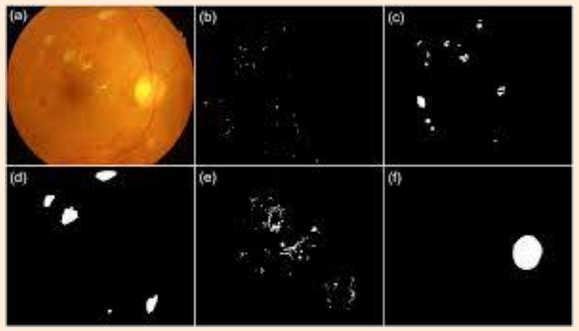
- Create a strong CNN model to segment retinal lesions in DR patients using the IDRID dataset for better diagnosis.

Research

Study Methodology

Utilizing the IDRID dataset, this study employs CNNs to train a model for diabetic retinopathy lesion segmentation, involving data loading, pre-processing, training, and testing, with evaluation metrics assessing its accuracy and performance.

Data Wrangling



Images: The IDRID dataset features diverse fundus images showcasing diabetic retinopathy lesions in detail.

Ground Truth: Precise ground truth annotations in the IDRID dataset facilitate accurate segmentation model development.

Model Architecture

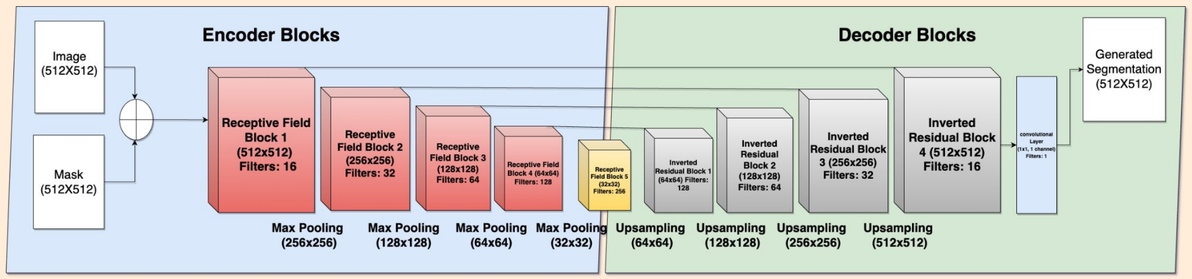
The lesion segmentation model, a modified U-Net, integrates receptive and inverted residual blocks for enhanced performance.

Employing downsampling and upsampling stages, it captures multi-scale features and combines low and high-level information.

Experimental Results

The experimental results demonstrate the model's strong performance in accurately segmenting various diabetic retinopathy lesions, with high AUC scores and accuracy, showcasing its effectiveness for the task.

Segmentation Class	Test_auc	Test_loss	Accuracy	Dice Score
Microaneurysms(MA)	0.4696	0.021	0.9935	0.4938
Hard_Exudates(EX)	0.7233	0.0645	0.9892	0.4946
Haemorrhages(HE)	0.6124	0.1031	0.9822	0.4947
Optic_Disc(OD)	0.882	0.1456	0.9829	0.4976
Soft_Exudates(SE)	0.4943	0.023	0.9978	0.4991



Conclusion

In conclusion, the proposed modified multi-tasking U-Net architecture demonstrates substantial improvement in accurately segmenting various diabetic retinopathy lesions in fundus images, outperforming existing techniques and offering potential for further enhancement through adversarial learning.

What does this study add?

- Enhances diabetic retinopathy diagnosis with an effective lesion segmentation model.
- Offers valuable parameter and training insights for image segmentation research.

Future Scope

- Design an Ultra-High Resolution Image Analysis algorithm.
- Build a platform on mobile phones that connect doctors and patients.
- Optimize the training algorithm and increase the number of training images

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