Retina Blood Vessel Segmentation

Group 5

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- Introduction
- 2 Datasets
- **3** Model Architecture
- 4 Workflow
- 6 Result

- 1 Introduction

Introduction •000

Overview

Introduction

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- Objective: Develop a segmentation system for retinal blood vessels using R2U-Net model
- Goal:
 - Accurately detect vessel structures
 - Support early diagnosis and reduce clinical workload

Result

0000 Input

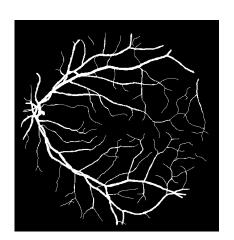
Introduction

- Retinal fundus image, in color
- Including key structures like the retina, optic disc, and the complex web of blood vessels



Output

- Segmentation mask
- Vessel pixels are marked (white)



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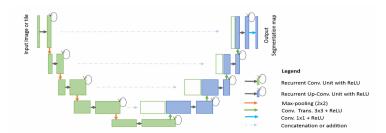
DRIVE dataset

- 40 high-quality color fundus images with 584 x 565 pixels
- Each image has a circular FOV mask 540 pixels in diameter
- 20 training images with manual segmentations
- 20 test images; the first observer's annotation is used as ground truth

- Introduction
- **3** Model Architecture

Recurrent Residual U-Net

- Based on an encoder-decoder structure, similar to U-Net
- Recurrent connections (RCL): Enable iterative feature refinement within each block
- Residual connections: help gradients flow during training



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Workflow



Preprocessing

- Cropping: Center crop from 584 x 565 to 565 × 565 px for uniform size
- Grayscale: Convert images to grayscale to simplify data.
- Patching: Split 20 images into 114,000 small patches.

Result

Training setup

- 90% training set 10% validation set
- Consists of:
 - 3 encoder blocks
 - 1 bottleneck block
 - 3 decoder blocks
- Optimizer: Adam optimizer for efficient parameter updates
- 10 training epochs
- Early stopping: Patience = 5
- Loss Function: BCE loss
- Evaluation Metrics:
 - Accuracy
 - Recall
 - Dice coefficient

Testing & Visualization

- Test on a sample image from the test set
- The segmented mask is visualized next to the original image for qualitative inspection

Result

- Introduction

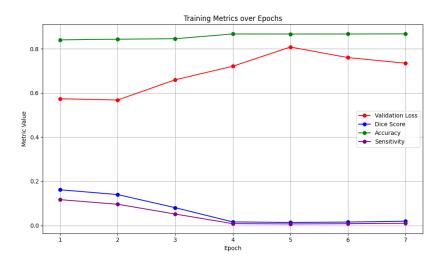
- **6** Result

Training result

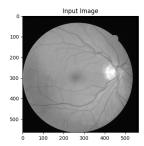
Epoch	Val Loss	Dice Score	Accuracy	Sensitivity
1	0.5737	0.1617	84.03%	11.69%
2	0.5681	0.1399	84.34%	9.60%
3	0.6597	0.0805	84.56%	5.17%
4	0.7210	0.0161	86.71%	0.82%
5	0.8081	0.0138	86.69%	0.70%
6	0.7601	0.0154	86.70%	0.79%
7	0.7348	0.0193	86.74%	0.98%

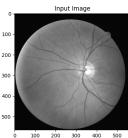
Table 1: Validation Metrics Across Training Epochs

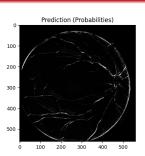
Training result (Visualization)

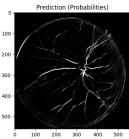


Prediction









Thank you for Listening!