

Retina Blood Vessel Segmentation

Group 5

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31 March, 2025

① Introduction

② Datasets

③ Model Architecture

④ Workflow

⑤ Result

1 Introduction

2 Datasets

3 Model Architecture

4 Workflow

5 Result

Overview

- 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

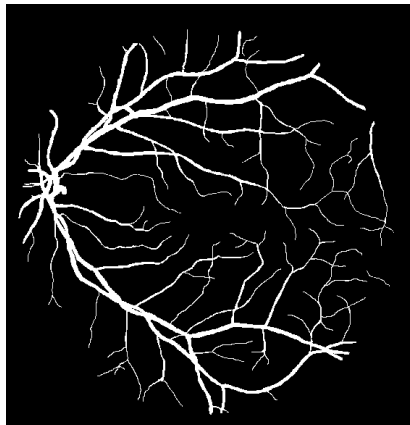
Input

- 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)



1 Introduction

2 Datasets

3 Model Architecture

4 Workflow

5 Result

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

1 Introduction

2 Datasets

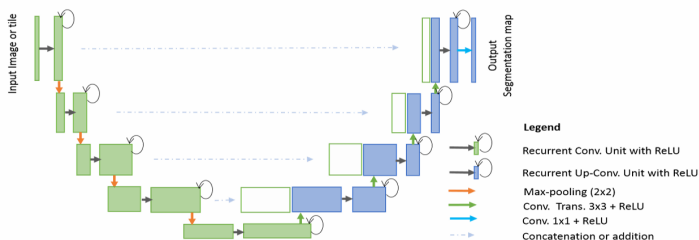
3 Model Architecture

4 Workflow

5 Result

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



1 Introduction

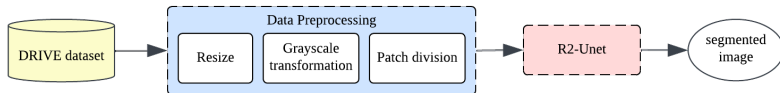
2 Datasets

3 Model Architecture

4 Workflow

5 Result

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.

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

1 Introduction

2 Datasets

3 Model Architecture

4 Workflow

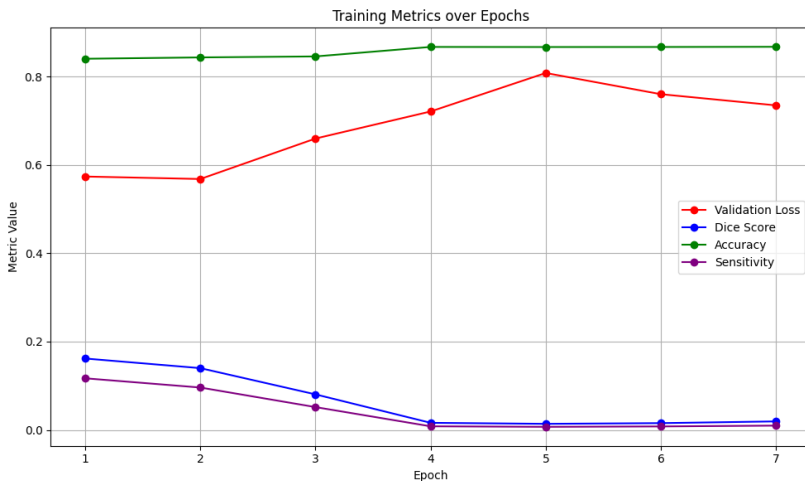
5 Result

Training result

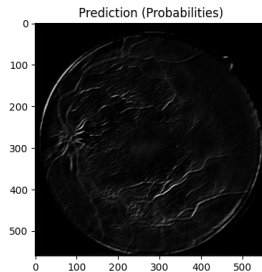
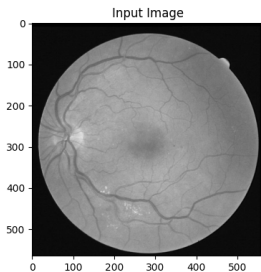
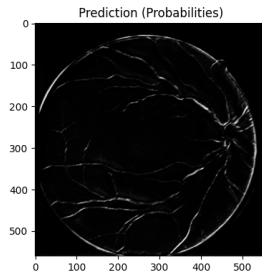
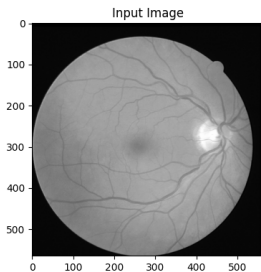
Epoch	Val Loss	Dice Score	Accuracy	Sensitivity
1	0.5737	0.1617	84.03%	11.69%
2	0.5681	0.1399	84.34%	9.60%
3	0.6597	0.0805	84.56%	5.17%
4	0.7210	0.0161	86.71%	0.82%
5	0.8081	0.0138	86.69%	0.70%
6	0.7601	0.0154	86.70%	0.79%
7	0.7348	0.0193	86.74%	0.98%

Table 1: Validation Metrics Across Training Epochs

Training result (Visualization)



Prediction



Thank you for Listening!