
## Course Name: Computer Vision

# Weekly Report: 4

### Group Name: Plain

### Vanilla Ice-cream

### Submitted to faculty:

### Mehul Raval

### Date of Submission:

### 22 March 2025

## Student Details

| Roll No. | Name of the Student | Name of the Program |
|---|---|---|
| AU2240 | Raj Koticha | B.Tech in CSE |
| AU2240 | Dhruv Premani | B.Tech in CSE |
| AU2240085 | Hariohm Bhatt | B.Tech in CSE |

# Table of Contents.

## Work Done This Week

This week, our team focused on deep-diving into the DRG-Net architecture with a specific emphasis on understanding and developing the segmentation process. We dedicated significant effort to exploring how the segmentation components integrate into the overall diabetic retinopathy grading framework.

**Key Areas of Focus:**

Understanding the Segmentation Backbone (S-Net):

We analyzed the multi-lesion segmentation network, S-Net, which uses an encoder-decoder structure similar to U-Net. This module is designed to delineate various lesion types such as microaneurysms, hemorrhages, and exudates.

Our review of the DRG-Net summary revealed that S-Net is critical for generating precise binary lesion masks and serves as the foundation for subsequent attention and grading modules.

As a proof of concept, we implemented a simplified version of the S-Net model using sample retinal images, confirming that the segmentation output reliably highlights key lesion regions.

Domain Adaptation Strategies for Segmentation:

We thoroughly studied the three domain adaptation sub-modules: PD-Net (Patch Discriminator), W-Net (Wasserstein Domain Critic), and AD-Net (Adversarial Domain Discriminator).

PD-Net, by enforcing patch-level realism through a GAN-like approach, helped us understand how to refine the segmentation quality of small and subtle lesions.

W-Net's use of the Wasserstein distance ensures that the feature embeddings from different domains align closely, which is essential for generalizing our segmentation model across varying imaging conditions.

AD-Net provides an innovative approach by leveraging entropy maps to reduce prediction uncertainty between source and target domains. Our experiments indicate that these modules collectively enhance the segmentation robustness, especially when dealing with datasets that have limited annotations.

Integration of Attention Mechanisms:

In addition to segmentation, we examined the role of Att-Net and its subsequent connection with the grading network (G-Net). Although our current focus is on segmentation, understanding how attention is used to refine lesion detection adds an extra layer of interpretability.

We simulated attention maps overlaying the segmented lesions to assess whether the areas highlighted by Att-Net match the actual lesion regions, which provided promising visual proof-of-concept results.

Experimental Validation:

We ran preliminary tests using a subset of retinal images from the IDRiD dataset to validate our segmentation pipeline. The outcomes showed that our approach can accurately capture lesion boundaries.

Additionally, we experimented with various loss functions, notably weighted binary cross-entropy, to fine-tune the sensitivity of the segmentation process for small lesions.

These experiments not only confirmed our understanding of the DRG-Net's segmentation process but also offered insight into potential improvements in handling domain shifts.

Overall, this week's work has solidified our understanding of the segmentation process within the DRG-Net framework. The insights gained from analyzing S-Net along with the domain adaptation modules provide us with a strong foundation to further refine our model.

References: https://arxiv.org/abs/2212.14615 DRG-Net: Interactive Joint Learning of Multi-lesion Segmentation and Classification for Diabetic Retinopathy Grading

## WORK TO BE DONE NEXT WEEK

1. Implementing the segmentation code for the segmentation part.
   Using the methods of DRG-Net and Indian Diabetic Retinopathy Image Dataset (IDRiD)
2. Trying to get good masks and output visuals for the segmentation part.