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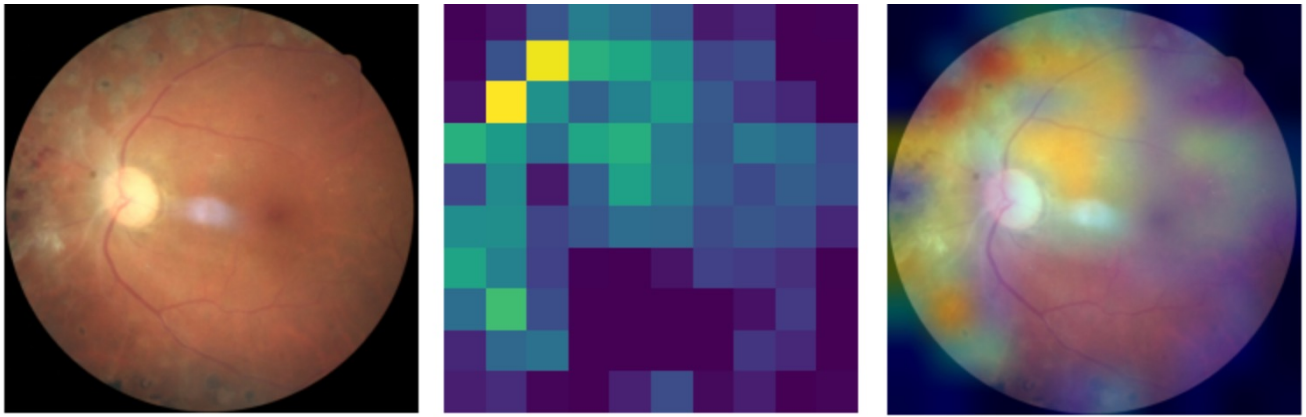

› Image Classification of Diabetic Retinopathy with CNN

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Agenda

- Introduction
    - Diabetic Retinopathy
    - Project Goal
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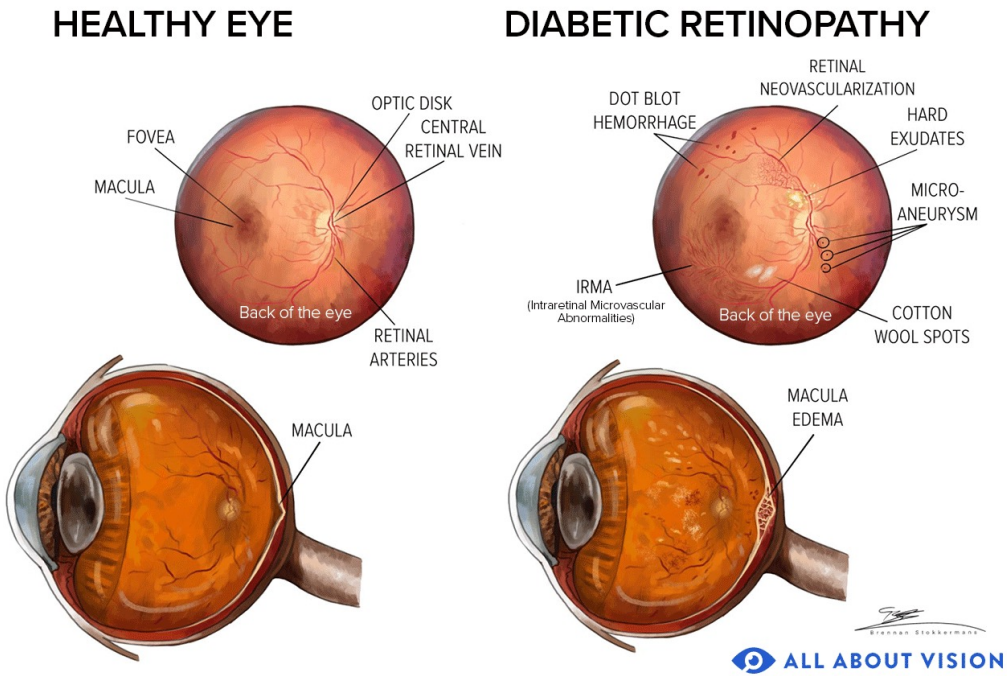
- Discussion
- Conclusion

Introduction

Diabetic Retinopathy:
Vision-threatening damage to the retina of the eye caused by diabetes.

Project Goal:
Train a classifier to distinguish between the different stages of Diabetic Retinopathy and Evaluation.



https://www.allaboutvision.com/conditions/diabetic.htm

Introduction

Data set:

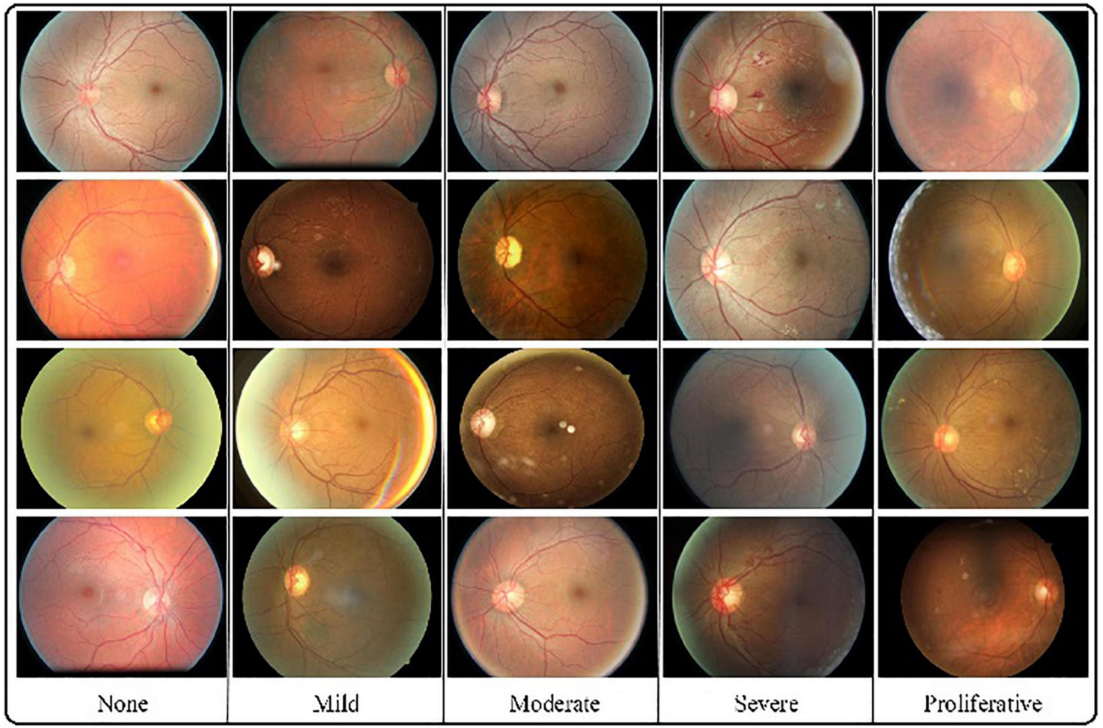
Classes: 1 normal and
4 classes of Diabetic Retinopathy's images

Training Set:

600 – 900 images per class

Test Set:

100 images per class



Task

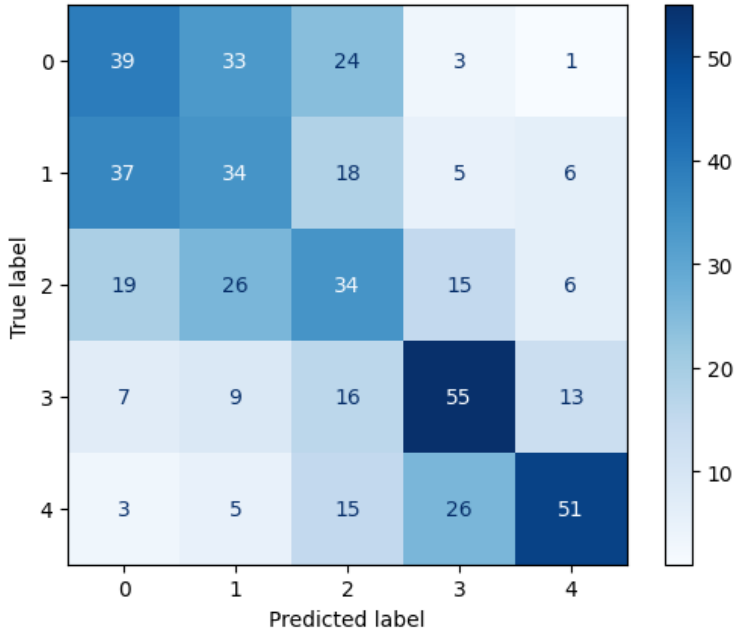
- Prepare the data using **data augmentation**
- Train the model using **transfer learning**
- Evaluate the model by **losses and accuracies**
- Generate the **confusion matrix** and the **heat map**

Code Presentation

See the link below:
https://colab.research.google.com/drive/1MejtLdiBBzUWYpRxldBdfkGlMBLYRTFS#scrollTo=VdQhpkw1eqxD

Result

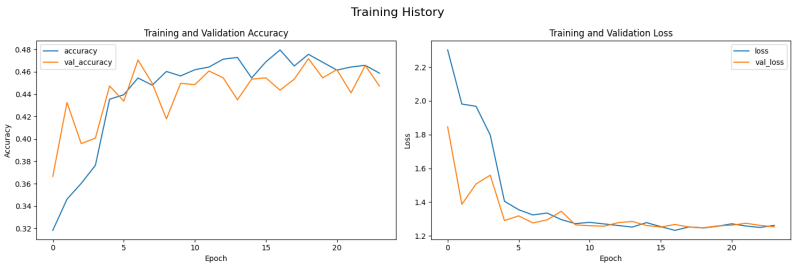
- Accuracy: 43.4%
- Confusion matrix:



Discussion

- Although the loss and accuracy improve with each epoch, there is no tendency to improve further

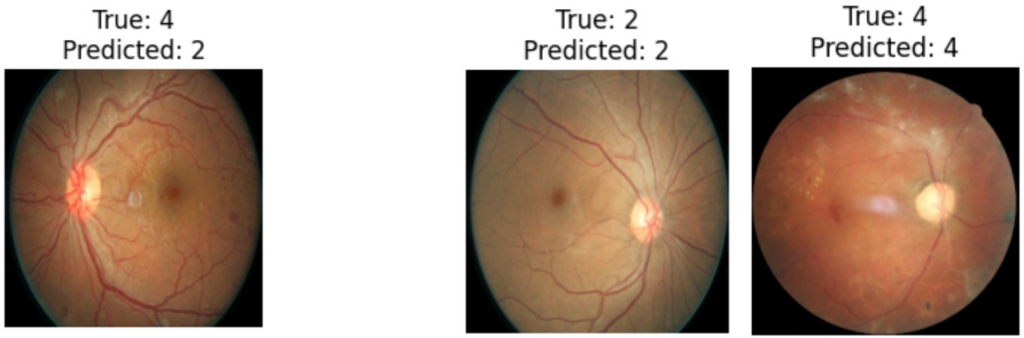
- To improve accuracy, consider the following:
  1. Ensure sufficient training data
  2. Adjust hyperparameters
     e.g. learning rate, epochs, batch size
  3. Adjust data augmentation parameter
  4. Consider using different base models
  5. Adjust the current architecture
     e.g. dropout rates, normalization



Discussion

- Review and exclude relatively ambiguous examples from the data

For example, the case of misclassification, where an image label as class 4 is detected as class 2 because the features are not easily distinguishable.



- Reducing the classification categories from five levels to two or three may also improve the model accuracy.

Conclusion

- Achieved 43% accuracy under the current training conditions

- To improve accuracy, ensure enough training data, adjust hyperparameters and data augmentation, try different base models, and tweak the architecture.

- If the accuracy enhanced, there is potential for using the model training in actual medical diagnoses, not only for eye conditions but also for other medical images like X-ray.

THANK YOU!

The severity of each grade of Diabetic Retinopathy

- None(0): no apparent retinopathy (no abnormalities).
- Mild(1): mild non-proliferative diabetic retinopathy (microaneurysms only).
- Moderate(2): moderate non-proliferative diabetic retinopathy (more than microaneurysms but less severe non-proliferative diabetic retinopathy).
- Severe(3): severe non-proliferative diabetic retinopathy (any extensive intraretinal hemorrhages in each of the four quadrants, definite venous beading in 2+ quadrants, prominent IRMA in 1+ quadrant, and no signs of proliferative retinopathy).
- Proliferative(4): proliferative diabetic retinopathy (one or more neovascularization and vitreous/preretinal hemorrhage).

As introduced in the datasets, the graders were CN-licensed ophthalmologists and had diabetic retinopathy diagnosis experience of at least 5 years.

Discussion

- Although the loss and accuracy on the training set improve with each epoch, the loss and accuracy on the validation set do not change, indicating **overfitting**

- To avoid overfitting, consider the following:
  1. Sufficient training data
  2. Adjust data augmentation parameter
  3. Consider using simple base model
  4. Adjust the current architecture by modifying dropout rates and adding normalization layers.

Discussion

- Synthetic Data Generation: Use generative models like GANs (Generative Adversarial Networks) or VAEs (Variational Autoencoders) to generate synthetic data and augment the dataset.

- Applying Sample Weights: Assign weights to specific samples in the dataset so that the model can pay more attention to important samples.