Automated Detection of Diabetic Retinopathy using Deep Learning
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INTRODUCTION

• Diabetic retinopathy (DR) is a common eye disease which affects one in three Americans with diabetes.
• DR can progress to irreversible vision loss without early diagnosis.
• While binary classification of DR has achieved high accuracy, multinomial classification assessment has challenging, particularly for early stages of disease.

PURPOSE

Develop a DR grading system capable of classifying fundus images based on location, number and type of retinal lesion.

RESULTS

Preprocessing
Real-time rotation, flips, and translation to augment data

Binary Class Training
• Binary models (AlexNet, VGG16, and GoogLeNet) were trained and tested on the Kaggle and MMDR dataset
• GoogLeNet was the highest performing CNN.

Kaggle Dataset
(n=35k, public dataset)
0 - None, Mild (73%)
1 – Moderate or Severe (27%)

Messidor/Mild DR Dataset (MMDR)
(n=1555, mix of public and privately collected data)
• No DR (54%)
• Mild (23%)
• Moderate/Severe (23%)

Visualization
Feature importance heatmap from the sliding window method.

Multi Class Training
On MMDR dataset
75% overall sensitivity
74% overall PPV
Kappa = 0.536

CONCLUSIONS

• Histogram equalization enhances sensitivity of the classifier for mild cases of DR.
• GoogLeNet CNN as a binary classifier achieves 95% recall, while 3-ary classifier achieves 75% overall recall.
• Future steps to improve sensitivity in mild grades involve: boosting, segmentation, and localization steps.

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References