Diabetic Retinopathy Detection Using Eye Images

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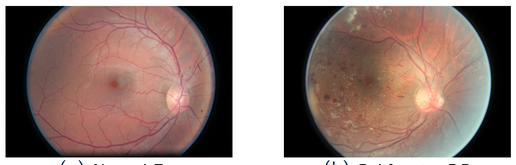
Introduction

Diabetic Retinopathy is an ocular manifestation of diabetes in which vision is hindered due to growth in size blood vessels and lack of oxygen in retina. My work is to classify the dataset in 5 classes according to different stages of retinopathy.

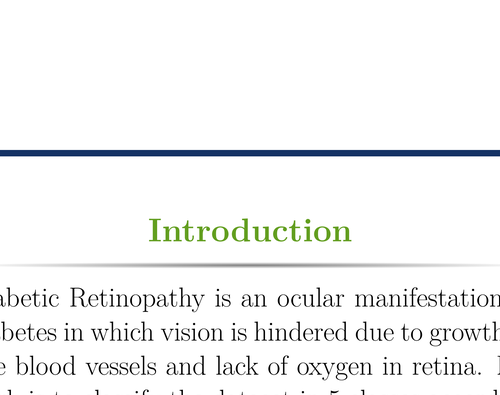


(a) Normal Eye (b) Poliferative DR

Figure 1: 2 Figures side by side

Challenges

Not much work has been done on general images of retina till now while research is going on fundus images and good results are obtained. Main challenge is to work with not so good images of retina which results in poor features.



(a) (b) (c) (d)

Dataset

Dataset is taken from ongoing kaggle challenge on retinopathy and is created by eyepacs. Dataset contains large number of images with expert ratings associated with them at a scale of 0-4(0:normal 4:poliferative)

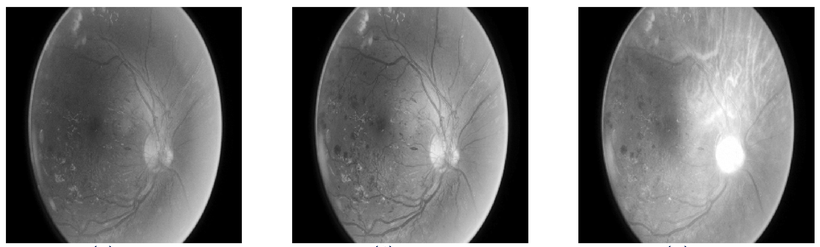
Methodology

Classification of these images can be divided in two steps

- Image Processing and Feature Extraction [1, 2]
- Training with Neural network

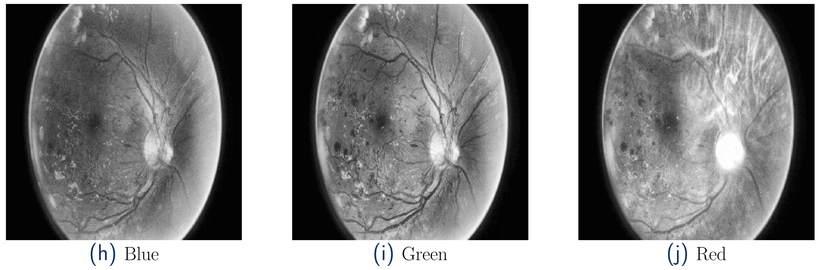
Image Processing and Feature Extraction

- Image compression and layer separation



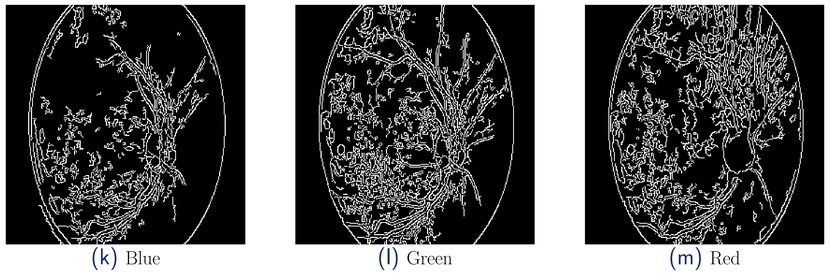
(e) Blue (f) Green (g) Red

- Equalization

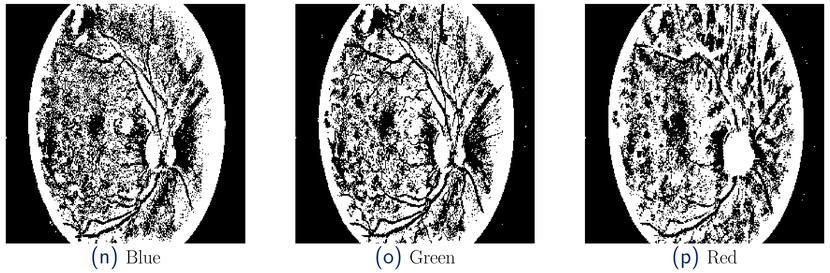


(h) Blue (i) Green (j) Red

- Morphological operations and feature extraction using canny edge detection and thresholding



(k) Blue (l) Green (m) Red



(n) Blue (o) Green (p) Red

Results

After running through neural network which consists of 3 convolution neural net layers we get below results. [3]

class 0	class 1	class 2	class 3	class 4
170	53	20	14	0
41	69	14	6	1
18	26	25	4	0
3	8	5	8	1
0	2	6	2	4
232	158	70	34	6

Table 1: Confusion Matrix

Presently I am getting around 55% accuracy but with better textures I expect around 10-20% more.

Future Work

- To use better morphological analysis algorithms to get clearer features.
- Better implementation of neural nets.
- To find better way to normalize images.

References

[1] Y.V. Venkatesh Caroline Chee Lim Choo Min E.Y.K. Ng Wong Li Yun, U. Rajendra Acharya. *Identification of different stages of diabetic retinopathy using retinal optical images.* Publisher, 2012.

[2] R.M anjulaSri M.Raghupathy R eddy and K.M.M.Rao. *83 Image Processing for Identifying Different Stages of Diabetic Retinopathy using retinal optical images.* Publisher.

[3] *Starter code,https://github.com/hoytak/diabetic-retinopathy-code.*

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