International Journal of Research in Engineering, Science and Management
Volume 5, Issue 6, June 2022
https://www.ijresm.com | ISSN (Online): 2581-5792


# Detection of Glaucoma and Diabetic Retinopathy Using Machine Learning

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***Abstract*: Among the most frequent metabolic disorders (DMs), Glaucoma relates to the vision of the human eye. This disease is irreversible, affecting the vison. Diabetes mellitus is one of the most common DMs, affecting the quality of life. DM associated with secondary complications, which can lead to vision loss, including diabetic retinopathy (DR). DL models have been developed to detect glaucoma and diabetic retinopathy.Using the convolutional neural network (CNN)architecture, the paper proposes a methodology for correct glaucoma and diabetic retinopathy detection based on deep learning (DL). A CNN can be used to figure out the difference between the patterns formed.in order to differentiate images, the CNN creates a hierarchical structure. Six layers of evaluation can be applied to the proposed work.**

***Keywords*: Machine learning, Glaucoma, Diabetic retinopathy, Open CV, Convolution neural network, Deep learning.**

## 1. Introduction

Glaucoma is an eye disease that damages the optic nerve over time and becomes severe. It is characterized by elevated intraocular pressure. The longer a person has diabetes, the higher his or her chances of developing diabetic retinopathy. In this proposed method. We examine the structure, such as cup-to-disc ratio, neuro-retinal rim, and hybrid texture features to determine glaucomatous pictures. Extracted features are applied to multiple machine learning algorithms for effective classification. The purpose of this work is to design an easy-to-detect, simple, microcontroller-based circuit that records the variation of affected eye images. This process is being done by the machine learning and deep learning processes. Glaucoma is a progressive eye disease that progresses rapidly. we experience an increase in eye pressure with increased fluid levels, causing damage to the optic nerves. There are typically no symptoms at the beginning stages of glaucoma, as the disease progresses internally.

## 2. Literature Survey

### *A. Survey Paper 1*

By the guidance of Tehmina Khalil, Samina Khalid, Adeel M. Syed an algorithm was developed which is a detailed literature survey of preprocessing, feature extraction, feature selection, machine learning techniques and data sets used for testing and training for glaucoma and diabetic retinopathy.

### *B. Survey Paper 2*

By the guidance of Namita sengar, Malay Kishore Dutta, Radim Burget. The present paper proposes an algorithm is presented for detecting suspected glaucoma and diabetic retinopathy by looking for hemorrhages near the optic disc in fundus images.

## 3. Proposed Methodology

- Glaucoma can be detected using Image processing and machine learning techniques using retinal fundus images.
- The optic disc and cup are extracted, and considering that image for Cup to disc region calculation which is given by ratio of area of cup to the area of disc. Based on this value the decision is taken whether the person is glaucoma affected or not.
- Classification of glaucoma is employed using Image Processing techniques by calculating the cup to disc ratio.
- By employing deep learning models, detection process will be automated.
- After evaluating the trained model, we can test our model for different test image. It will give the result as whether the given fundus image is Glaucoma or Non-glaucoma.
- After combining the results of image processing and machine learning, results are pinged to ophthalmologist and patient for further treatment if the person is affected by glaucoma or diabetic retinopathy.

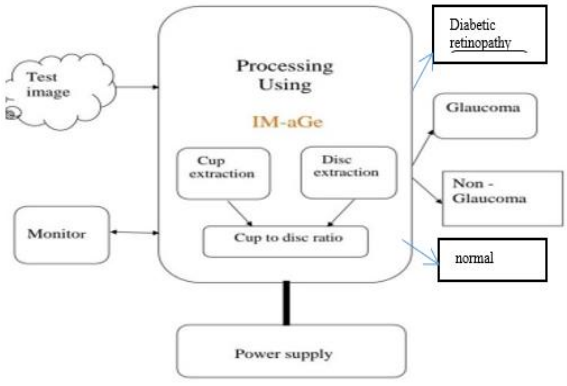


Fig. 1. Block diagram of the proposed system

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## 4. Requirements

### A. *Software Requirements*

- OS: Windows 7.
- Software tool: Open Cv.
- Coding: Python.
- Toolbox: Image processing toolbox.

### B. *Hardware Requirements*

- System: Pentium IV 2.4 GHz.
- Hard Disk: 40 GB.
- Monitor: 15 VGA.
- RAM: 512 megabytes.

## 5. Design and Implementation

The main purpose of CNN is to detect features or visual features in images. Layers of CNN

1. Convolution layer: The layer to extract features from an input fundus image for classifying the image into glaucoma or Non glaucoma.
2. Maximum pooling layer: Reduces the resolution of the features and makes them more robust against noise and distortion.
3. Non-linear layer: The output of the convolution is passed through the activation function called RELU.
4. Fully connected or dense layers: The input to this layer is flattened output from the previous layers. This layer transforms the output to two different classes.

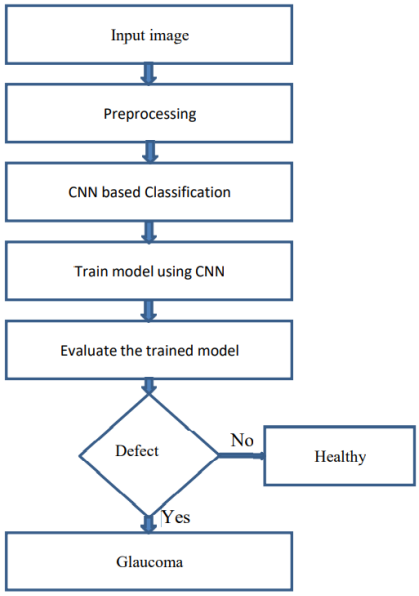


Fig. 2. Flow chart of the proposed system

*Training the model:*

- Augmenting image data is a method for artificially expanding a training dataset by creating modified versions of the images.
- Test the model for different test image.
- Result as whether the given fundus image is Glaucoma /DR or not.
- Results are pinged to ophthalmologist and patient for further treatment

## 6. System Outcomes

The method gives a brief view on the areas of eye that are more likely to get affected with glaucoma or diabetic retinopathy eye diseases, structural changes that occur in the internal eye can be easily analysed and correlated for Diagnosis of eye diseases, especially glaucoma. The condition of the patient at what percent the eye has been damaged is identified, which will also suggest whether the patient should undergo refractive surgery or to use intraocular lenses or can be treated with medication. Patients diagnosed and treated at an earlier stage of glaucoma or diabetic retinopathy are likely to save more money and reduce their healthcare burden significantly.

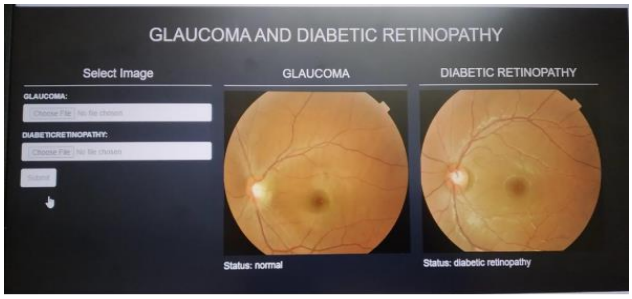


Fig. 3. Image showing normal eye & diabetic retinopathy

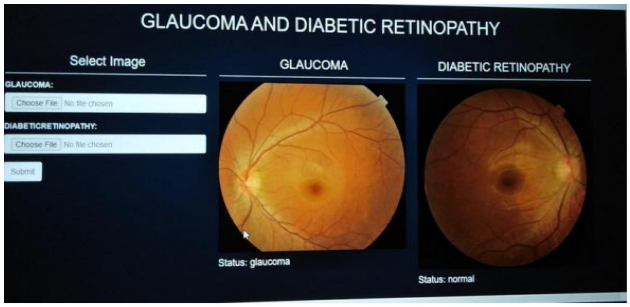


Fig. 4. Image showing glaucoma and normal eye

*Advantages and applications:*

- Non-invasive blood glucose monitoring device.
- Early Detection.
- Easy implementation.
- Cost Effective.
- Platform Independent

*Applications:*

- In Hospitals.
- In general application for predicting glaucoma, diabetic retinopathy in early Stages.
- This system will be in a faster way than manually being observed by eye specialist.
- The proposed system plays a major role in the future telemedicine.

## 7. Conclusion

- From our project we can find out glaucoma and diabetic eye disease.

- We have also analyzed the useful techniques that can be identified to detect DR based on deep learning model in this paper.
- We collected the eye fundus images of an extracted images from OCT data.
- Using convolution neural network algorithm, it easy to detect glaucoma and diabetic retinopathy in its early stages.
- Therefore, our findings should help to make more accurate to detect glaucoma using machine learning.

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