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Optical Glaucoma Detection using Deep Learning Andstreamlit

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Abstract: *The Project "Glaucoma is a disease that relates to the vision of the human eye". This disease is considered as the irreversible disease that results in the vision deterioration. Much deep learning (DL) models have been developed for the proper detection of glaucoma so far. So this paper presents architecture for the proper glaucoma detection based on the deep learning by making use of the convolutional neural network (CNN). The differentiation between the patterns formed for glaucoma and non-glaucoma can find out with the use of the CNN. The CNN provides a hierarchical structure of the images for differentiation. Proposed work can be evaluated with a total of six layers. Here the dropout mechanism is also used for achieving the adequate performance in the glaucoma detection. The datasets used for the experiments are the SCES and ORIGA.*
Glaucoma is a group of related eye disorders that cause damage to the optic nerve that carries information from the eye to the brain which can get worse over time and lead to blindness. It is very important that glaucoma is detected as early as possible for proper treatment. In this paper, we have proposed a Convolutional Neural Network (CNN) system for early detection of Glaucoma. Initially, eye images are augmented to generate data for Deep learning. The eye images are then pre- processed to remove noise using Gaussian Blur technique and make the image suitable for further processing. The system is trained using the pre-processed images and when new input images are given to the system it classifies them as normal eye or glaucoma eye based on the features extracted during training..

Keywords: Convolutional Neural Network, feature classification, image identification, Gaussian blur

I. INTRODUCTION

The project " Glaucoma is often linked to a build-up of pressure inside the eyes". Glaucoma tends to run in families and one usually doesn't get it until later in life. The increased pressure in eyes, called intraocular pressure, can damage the optic nerve, which sends images to the brain. If the damage worsens, glaucoma can cause permanent vision loss or even total blindness within a few years. Most people with glaucoma have no early symptoms or pain. One must visit the eye doctor regularly so they can diagnose and treat glaucoma before one has long-term vision loss. If a person loses his vision, it can't be brought back. But, lowering eye pressure can help keep the sight that he has. Most people with glaucoma who follow their treatment plan and have regular eye exams are able to keep their vision. An optic disc and cup are present in all individuals but an abnormal size of the cup with respect to the optic disc is a characteristic of a glaucoma infected eye. Traditional methods of detecting glaucoma include an eye doctor analysing the images and finding the abnormalities in it. This method is very time consuming and not always accurate because the image contains noise and other factors which make it difficult for proper analysis. Also, if a machine trained for analysis it becomes more accurate than human analysis. Most of the literature works present mainly focus on optic cup and disk segmentation and some focus on Cup/Disk ratio. Through our analysis we have found using Convolutional Neural Network model to be better than other literature works proposed. Convolution neural networks are one of the most popular deep learning techniques for image analysis. In this technique, training data sets of previously classified images are used to develop the system. This deep learning technique implies that computers can perform feature learning and classification simultaneously. In deep learning algorithms, a model is formed using many layers which transform the given input data to an output.

As claimed by the World Health Organization, glaucoma is a permanent eye disease representing the second cause of blindness around the world. With the aging population as one of the main risk factors, it was predicted that glaucoma will affect approximately 80 million people by 2020 and 112 million by 2040. One of the main reasons for which approximately 90% of people remain undiagnosed, even in the developed countries is that glaucoma remains asymptomatic until severe. Glaucoma is produced by an increased level of intraocular pressure (IOP) which produces the decreasing of the blood flow and the damage the optic nerve.

Because IOP was proven not to be very relevant for glaucoma diagnosis (many patients with glaucoma have a low level of IOP at the time of diagnosis while non-glaucoma patients have a high level of IOP) a complex eye procedure is recommended by the American Academy of Ophthalmology for an accurate diagnosis of glaucoma.

Introduced by, convolutional neural networks (CNN) have proven to recognize very subtle changes on medical images, as they are based on feature learning and not on feature design.

II. LITERATURE SURVEY

TITLE: “Glaucoma Diagnosis"

AUTHOR: II Bussel, G Wollstein, JS Schuman-2019

DESCRIPTION:

Optical coherence tomography (OCT) is a commonly used imaging modality in the evaluation of glaucomatous damage. The commercially available spectral domain (SD)-OCT offers benefits in glaucoma assessment over the earlier generation of time domain-OCT due to increased axial resolution, faster scanning speeds and has been reported to have improved reproducibility but similar diagnostic accuracy. The capabilities of SD-OCT are rapidly advancing with 3D imaging, reproducible registration, and advanced segmentation algorithms of macular and optic nerve head regions. A review of the evidence to date suggests that retinal nerve fibre layer remains the dominant parameter for glaucoma diagnosis and detection of progression while initial studies of macular and optic nerve head parameters have shown promising results.

TITLE: “Optic disc and cup segmentation

TITLE: " Glaucoma detection based on deep convolutional neural network."

AUTHOR: X. Chen, Y. Xu, D. W. K. Wong, T. Y. Wong and J. Liu-2015

DESCRIPTION:

Deep learning systems, such as convolutional neural networks (CNNs), can infer a hierarchical representation of images to discriminate between glaucoma and non-glaucoma patterns for diagnostic decisions. The proposed DL architecture contains six learned layers: four convolutional layers and two fully-connected layers. Dropout and data augmentation strategies are adopted to further boost the performance of glaucoma diagnosis. Extensive experiments are performed on the ORIGA and SCES datasets.

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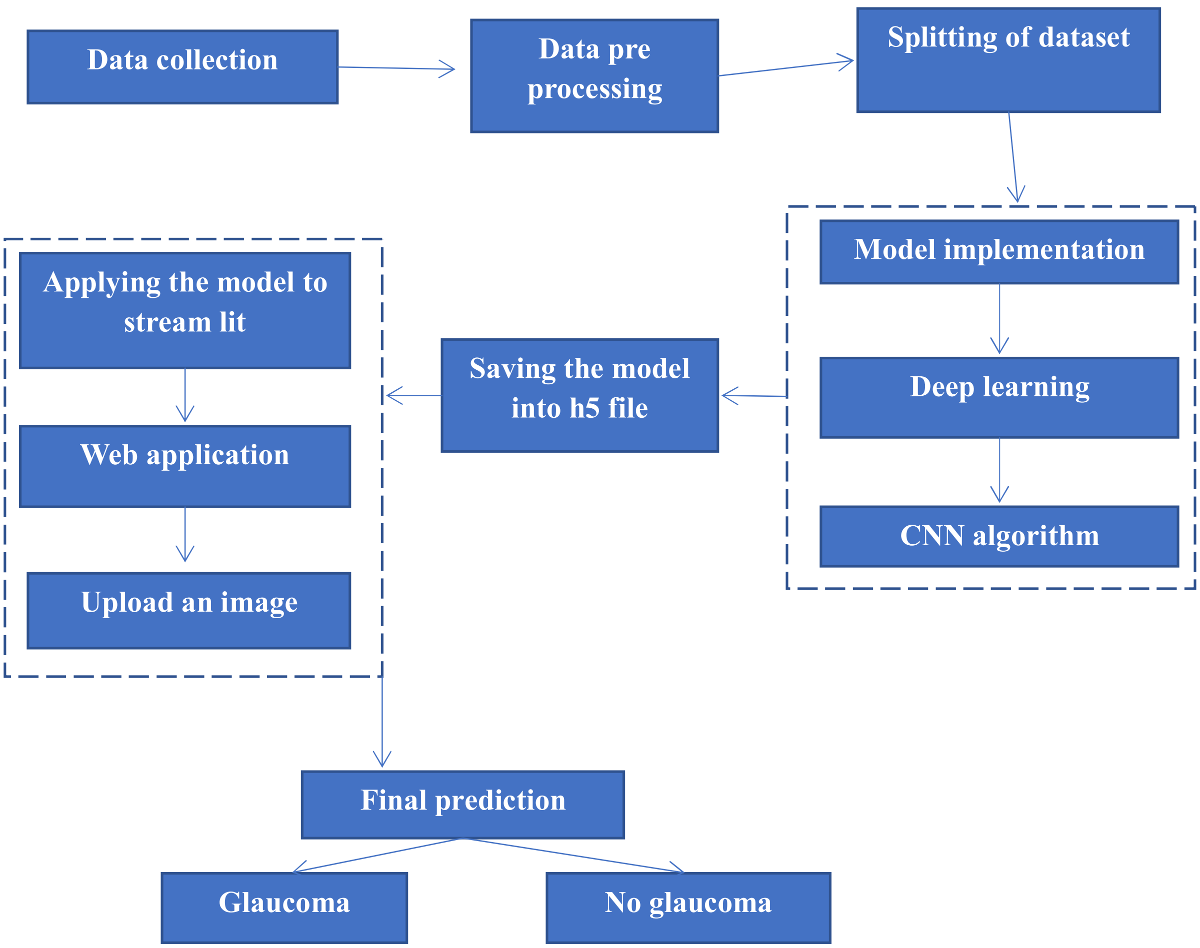
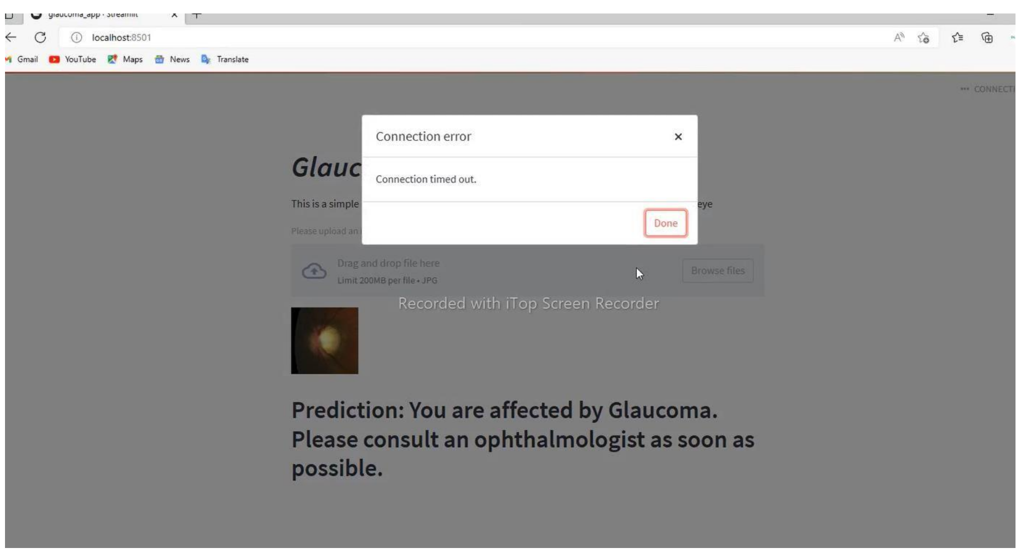
SYSTEM ARCHITECTURE





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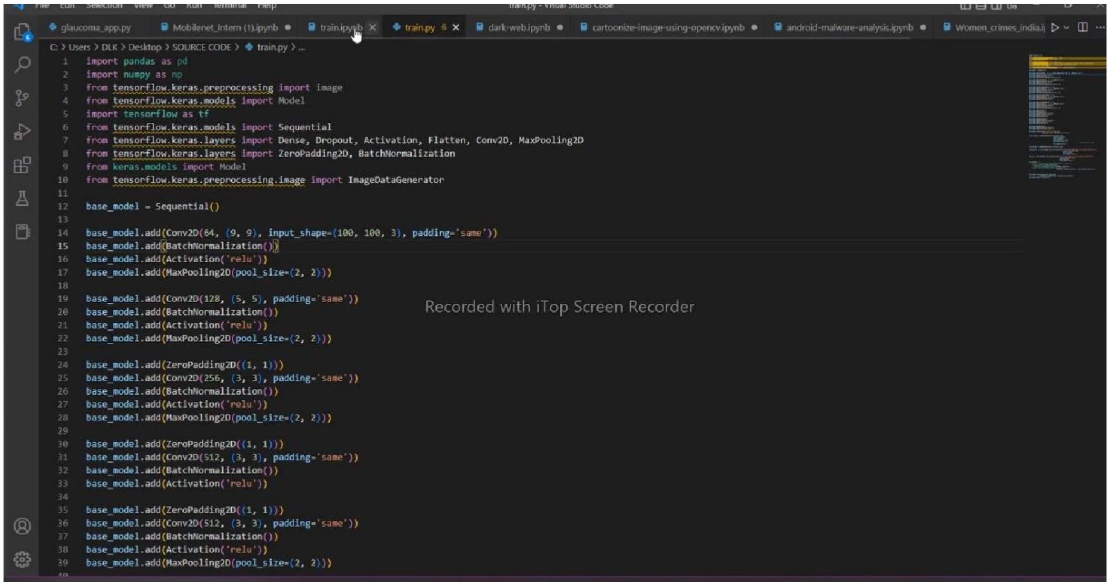

III. CONCLUSION

In this project, we have designed and implemented the project using Convolutional Neural Network. Our system will provide a better solution for detecting Glaucoma in the earlier phase in less time which will save the vision of many people. To implement this project we have used the Region of Interest (ROI) to take the only region of the image in which Glaucoma can be detected, also we have used Gaussian blur to remove noise from image and then pre-processed image is given to CNN. The results have proven that densely connected neural networks are capable of accurately diagnosis glaucoma by analysing the images (without the need for additional examinations). They proved to be capable for correct diagnosis of early glaucoma images, which have very subtle changes produced by glaucoma that are not visible by the human eye and usually need additional costly examination. In addition, the densely connected neural network used in this study gives better results in terms of accuracy then residual neural networks.

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