Glaucoma Detection using Neural Network

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ABSTRACT

This work aims to observe the potential for the clinical implementation of artificial intelligence (AI) strategies to detect glaucoma and monitor the progression of glaucoma in medical patients. The results are promising.

INTRODUCTION

Glaucoma that affects the eyes and is a disease caused by eye pressure. It is a disease that has no cure and when left untreated it can lead to blindness. According to the World Health Organization (WHO), glaucoma is the second leading cause of blindness in the world, after cataracts. It is estimated that the prevalence of the disease in the world is approximately 1% to 2% in Brazil, and the forecast of the disease is that 90 thousand people are carriers.

There are several types. Chronic simple glaucoma or open-angle glaucoma, which represents about 80% of cases, affects people over 40 years of age and can be asymptomatic. It is caused by an anatomical change in the region of the anterior chamber angle, which prevents the outflow of aqueous humor and increases intraocular pressure. The main feature of angle-closure glaucoma is a sudden increase in intraocular pressure. Congenital glaucoma (a rarer form) affects newborns, and secondary glaucoma results from diseases such as diabetes, uveitis, cataracts, etc.

Right now, artificial intelligence is helping diagnosis, with the ability to identify diseases in a short period of time. To meet the doctor or learn to learn to detect glaucoma. The workflow for diagnosing glaucoma will be faster than usual. So accepted people treat the doctor during the first stage of glaucoma. However, glaucoma is preventable for early treatment and feasible for effective treatment. That's what motivated us to carry out these tests.

METHOD

In this approach, the algorithm, through training, learns to recognize the desired patterns in the images and the descriptors produced by them are called "learned attributes" [1]. This approach stands out for the ability of Deep Learning architectures to recognize more complex patterns in images than specialized algorithms [2].
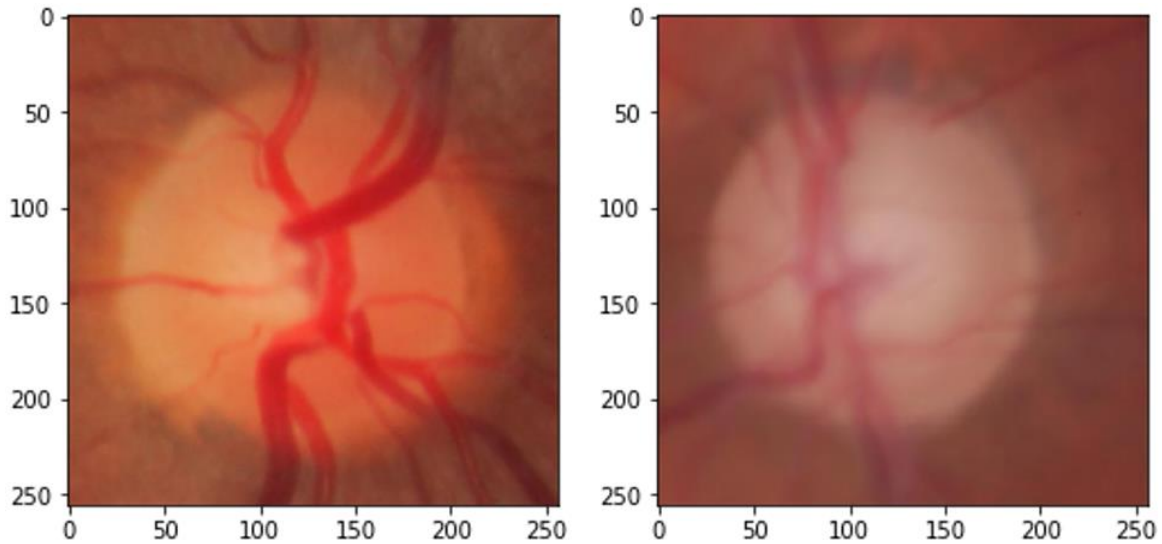
DATABASE

The dataset can be accessed from the Kaggle database. Glaucoma data contains 2 classes. A total number of 2664 images are used for glaucoma. Class 0 for non-glaucoma

(1488 images) class 1 for glaucoma (1176 images) (Figure 1) [3].

Figure 1: Glaucoma tests.

SUGGESTED MODEL

The proposed model was composed by the deep residual network (ResNet) architecture, with 50 layers of depth (ResNet-50) for feature extraction. 50 layers deep, available in the TensorFlow library (ABADI et al., 2015). For training, a batch size of 32 was used, and the data set was divided into images for training and testing.

The Adam optimizer (KINGMA; BA, 2017) was used, with a learning rate, learning-rate, of 0.00001, with 100 training epochs [4].

Figure 2 presents loss and accuracy. This image returns a list of the model's loss and accuracy for the dataset. Accuracy is a good general indication of how well the model performed.
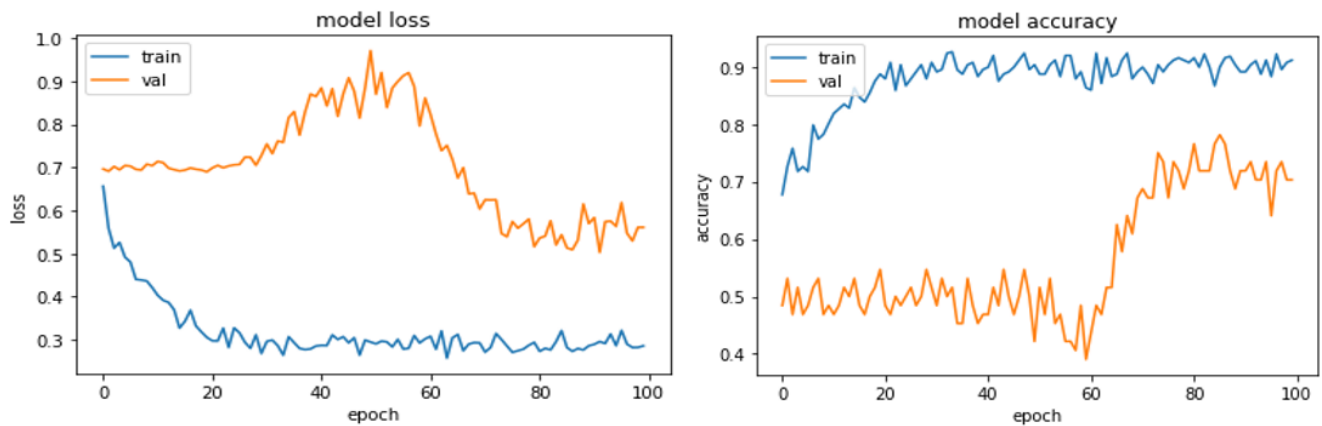
Figure 2: Loss and accuracy.

CONCLUSION

In conclusion, in this article we apply a network model on a color background image dataset consisting of early and advanced stages of glaucoma. This work proves that by applying a Neural Network we can diagnose early-stage glaucoma with an accuracy level of 94%. This is a good indicator that convolutional neural networks have great potential to become a reference for early detection of glaucoma [5].

Therefore, the complex procedure used in clinics today to diagnose glaucoma early can be eliminated by a computer-aided diagnostic system that uses deep learning algorithms. This study contributes to the advancement of the medical technology area, with Big Data and the tendency to increasingly improve the performance of AI models for the detection of Glaucoma [6-8].

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