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CNN-Based Ocular Disease Identification in Retinal Images

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Abstract: Approximately 15 million people across India suffer from blindness, and unfortunately, 75% of these instances were treatable at one point in time. There are 10,000 patients for every doctor in India. Vision can be affected by a variety of eye diseases, such as cataracts, corneal ulcers, and trachoma, among others. Research indicates that untreated early-stage diseases are the primary causes of blindness in India. Only by receiving a proper diagnosis early on in the progression of these eye conditions can they be prevented. There are many different symptoms that can be seen with these eye conditions. Analyzing a wide variety of symptoms is necessary in order to make an appropriate diagnosis of eye conditions. With the use of deep learning techniques like convolution neural networks and digital image processing techniques like segmentation and morphology, we offer a novel approach to automatically identify eye diseases based on visually perceptible symptoms. The suggested approach is used to analyze and classify seven eye conditions: Diabetic retinopathy (DR), glaucoma, cataract, and age-related macular degeneration(AMD) are the most common ocular illnesses. Early detection of eye problems is facilitated by the proposed deep neural network model. In case that screening is necessary, the model advises people to contact an ophthalmologist.
Keywords: Deep Learning, Convolutional Neural Network, Deep Neural Network, Cataracts, Diabetic retinopathy, Crossed eyes, Uveitis and Conjunctivitis.

I. INTRODUCTION

Every human being depends on their eyes for their sense of the world around them, thus making them an important component of existence. Sight is one of the most important senses since it provides us with 80% of the information we take in. By maintaining good eye health, we can reduce our chance of being blind and losing our eyesight while also monitoring the occurrence of disorders like cataracts and glaucoma. Most people will eventually have eye problems. While minor eye conditions can be treated easily at home and resolve on their own, more serious conditions require medical care from experienced professionals. Only when these eye conditions are appropriately recognized in their early stages can their progression be halted. The symptoms of these eye conditions vary widely and are observable to the human eye. Analyzing a wide variety of symptoms is necessary in order to make an appropriate diagnosis of eye disorders. In this paper, our proposed model analyses and classifies eye diseases namely Diabetic retinopathy (DR), glaucoma, cataract, and age-related macular degeneration(AMD) .

II. LITERATURE REVIEW

Vision can be affected by a variety of eye disorders, such as corneal ulcers, cataracts, and trachoma. The only way to prevent the advancement of these eye conditions is to get an early diagnosis that is accurate. There are many different readily apparent symptoms associated with these eye conditions. Analyzing a wide variety of symptoms is necessary in order to make an appropriate diagnosis of eye disorders.

Thus, paper [1] proposed a novel strategy in order to create an automated eye illness recognition system using visually observable symptoms, using machine learning techniques like deep convolution neural network (DCNN) and support vector machine. From experimental findings, it is observed that the DCNN model performs better than SVM models. .. under the study [2], the authors employed high-resolution retinal pictures acquired under a range of imaging conditions, together with a deep neural network model to distinguish between various diseases such as diabetic retinopathy, which helps in the early diagnosis of glaucoma and diabetic retinopathy. Patients may be prompted to get in touch with an ophthalmologist if Deep Learning is used for screening Eye Disease Identification. The developed model attained an accuracy of 80% and a lesser degree of complexity. Using a deep learning model, the paper's author [3] created a technique for automatically identifying any retinal fundus image as either healthy or diseased. Using CNN, they developed a system called LCD Net that could perform binary classification.

Eight testing datasets were built using images from two sources of retinal fundus. The author of the research [4] created a model for the automated identification of diabetic eye disease using preexisting datasets, image preprocessing techniques, deep learning models, and performance evaluation criteria. It contains studies that developed DL network design, employed TL, and combined DL and ML techniques for their classification algorithms. Based on medical images, we can infer that CNN is currently the most often used deep neural network, particularly for diagnosing various clinical indications and identifying diabetic eye disease. The research effort has looked at how well various modern models, such as neural networks and deep learning algorithms, detect eye disease[5]. Using retinal pictures, the process of diagnosing eye illnesses is divided into multiple smaller steps, such as feature extraction, classification, and image pre-processing. This paper presents an overview of deep learning, its algorithms, the functioning of convolution neural networks, and its applications to deep learning, machine learning, and image processing methods that are used to identify eye diseases based on retinal images. Artificial intelligence solutions have been the focus of medical health systems in order to facilitate rapid diagnosis. However, health data needs to be documented in a standard manner in order for machine learning to account for many variables and become more reliable and accurate.

III. PROBLEM DEFINITION

Research indicates that since around the turn of the century, diabetes has become more common in older people worldwide, increasing the risk of eye problems and diseases.

When it comes to the human eye, people typically ignore other irritations or changes in the eye until they become an emergency. In the current scenario, however, any type of irritation in any part of the body can be described to get instant details regarding it from Google (basically for non-medical purposes). This is most likely because there isn't a specific app designed to identify eye disorders in their early stages and provide users with comprehensive information about them. Our methodology addresses this problem by directing the user to examine his own eye to determine the specifics of the eye ailment and the state of his eye at the time.

IV. METHODOLOGY

There are various classes of image processing, such as "image upgrade," "image compression," and "reclamation and measurement extraction." It contributes to lowering the memory requirements for storing complex images. It is possible to steal the image. Issues with the digitizing process and other causes could lead to the images being thrown away. Neglected images can be fixed with image enhancement techniques. We first conducted an informational collection assortment, information resizing, information planning, and information expansion before using this model's preparation approach after testing and accepting the information. In this work, we integrated the image processing capacity with our custom-designed CNN architecture.

A. Background of CNN

Convolutional networks are a type of sophisticated neural network. Deep learning was utilized in its calculation. In order for the computer to decide which argument or point of view in an input image is more important than another, it must first analyze the image and then use that analysis to determine which classes to split. The primary prerequisite for this approach is owning. Network representations of the neurons found in the human brain are included in CNN's layout. Furthermore, information picture 2D structures have preferred locations. Slope-based augmentation is applied in this case. This model consists of multiple layers, such as subsampling and convolutional layers.

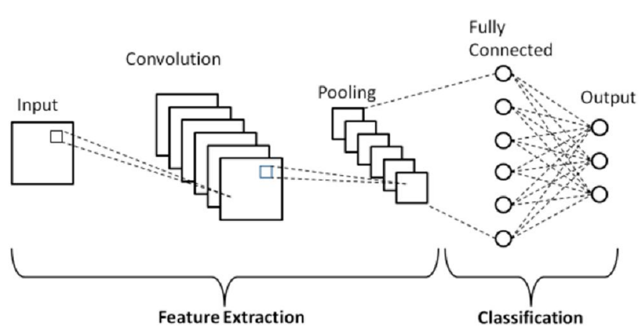

Fig.1 : CNN Architecture

B. Dataset Collection

An organized ophthalmic database called Ocular Disease Intelligent Recognition (ODIR) has 5,000 patient records, including age, color fundus photos of the left and right eyes, and doctor's diagnostic keywords. The purpose of this dataset is to depict the "real-life" set of patient data that Shanggong Medical Technology Co., Ltd. collected from various Chinese hospitals and medical centers. A range of cameras, including Canon, Zeiss, and Kowa, are used in these institutions to take fundus photographs, which yields a variety of image resolutions. With quality control management, annotations were annotated by human readers with training[2]. Eight labels are used to categorize patients: normal (N), diabetes (D), glaucoma (G), cataract (C), AMD (A), hypertension (H), myopia (M), and other conditions/alterations (O).

C. Data Augmentation

In order to prevent overfitting, we enhanced the amount of data we gathered. We expanded the amount of genuine information we collected using five different approaches in order to increase the size of our significant dataset and inspire us to categorize our model. 1. Perform a 90-degree turn. 2. Make a 90-degree turn Shading 3. A salt and pepper grind 4. Flipping horizontally.

Fig. 2 : Exemplary data augmentation results

The blockchain-based smart contract also addresses critical issues of security, transparency, and authentication among the diverse stakeholders in the organ donation and transplantation network. By providing a decentralized and transparent platform, the smart contract ensures that information related to organ transactions, medical records, and consent forms is securely stored and accessible only to authorized individuals. This heightened level of security and transparency instills confidence among donors, recipients, medical professionals, and regulatory bodies, thereby fostering a more accountable and ethical organ donation framework.

Furthermore, the smart contract includes a consent mechanism designed to obtain explicit approval from the donor's family. This feature recognizes the ethical importance of informed consent in organ donation and transplantation. The blockchain-based consent process ensures that the donor's family is involved in the decision-making process, thereby upholding the principles of autonomy and respect for the wishes of the donor.

In conclusion, the suggested blockchain-based smart contract system for organ donation and transplantation management presents a holistic solution to address the challenges prevalent in the current organ transplantation landscape. Through its functionalities of early scam detection, security, transparency, authentication, and consent management, the system not only enhances the efficiency of organ allocation but also establishes a foundation for a more trustworthy and ethically sound organ donation ecosystem.

V. PROPOSED ARCHITECTURE

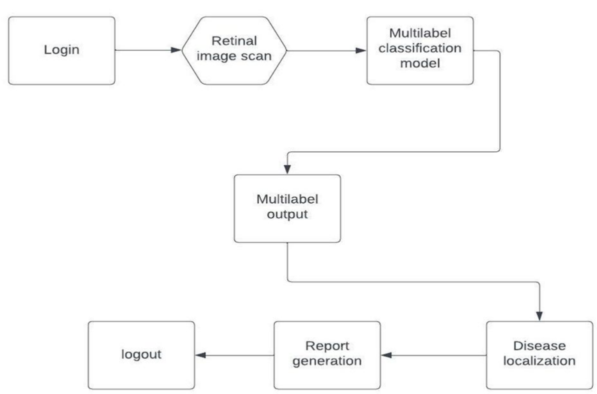

Fig- 3 : System Architecture

The system architecture is the model that conceptually defines the views, structure, and behavior of the system. System architecture in other words is the representation and description of how the system works and communicates with other system components in general. The whole system is composed of the components and the subsystems that work together to make the system it should be in the first place. This diagram gives us an abstract view of the components and their relationship with the system that makes the system work.

VI. CONCLUSIONS AND RESULTS

Through this research, we have demonstrated that convolutional neural networks can be used to detect a variety of eye illnesses. The most pleasing outcome is the 93% accuracy rate in cataract detection. The results of looking at every condition at once were noticeably worse. The final measurements are impacted by the fact that it was not always able to provide the training model with crucial variations of a particular disease from the ODIR dataset.

REFERENCES

[1] Gour, N., Tanveer, M. & Khanna, P. Challenges for ocular disease identification in the era of artificial intelligence. Neural Comput & Applic 35, 22887–22909 (2023). https://doi.org/10.1007/s00521-021-06770-5

[2] Dipu, N. M., Shohan, S. A., & Salam, K. (2021). Ocular Disease Detection Using Advanced Neural Network Based Classification Algorithms. Asian Journal For Convergence In Technology (AJCT) ISSN -2350-1146, 7(2), 91-99. https://doi.org/10.33130/AJCT.2021v07i02.019

[3] Sengar, N., Joshi, R.C., Dutta, M.K. et al. EyeDeep-Net: a multi-class diagnosis of retinal diseases using deep neural network. Neural Comput & Applic 35, 10551–10571 (2023). https://doi.org/10.1007/s00521-023-08249-x

[4] Rajagopalan, N., Narasimhan, V., Kunnavakkam Vinjimoor, S. et al. RETRACTED ARTICLE: Deep CNN framework for retinal disease diagnosis using optical coherence tomography images. J Ambient Intell Human Comput 12, 7569–7580 (2021). https://doi.org/10.1007/s12652-020-02460-7

[5] Chan, H.-N.; Zhang, X.-J.; Ling, X.-T.; Bui, C.H.-T.; Wang, Y.-M.; Ip, P.; Chu, W.-K.; Chen, L.-J.; Tham, C.C.; Yam, J.C.; et al. Vitamin D and Ocular Diseases: A Systematic Review. Int. J. Mol. Sci. 2022, 23, 4226. https://doi.org/10.3390/ijms23084226

[6] M. R. AHMED, S. R. AHMED, A. D. DURU, O. N. UÇAN, and O. BAYAT, "An Expert System to Predict Eye Disorder Using Deep Convolutional Neural Network", APJES, vol. 9, no. 1, pp. 47–52, 2021, doi: 10.21541/apjes.741194.

[7] Rajyaguru, V., Vithalani, C. & Thanki, R. A literature review: various learning techniques and its applications for eye disease identification using retinal images. Int. j. inf. tecnol. 14, 713–724 (2022). https://doi.org/10.1007/s41870-020-00442-8

[8] Demir, F.; Taşcı, B. An Effective and Robust Approach Based on R-CNN+LSTM Model and NCAR Feature Selection for Ophthalmological Disease Detection from Fundus Images. *J. Pers. Med.* **2021**, *11*, 1276. https://doi.org/10.3390/jpm11121276

[9] Mangla, A., Dhall, S., Gupta, N., Rastogi, S., Yadav, S. (2023). Ocular Disease Recognition Using Convolutional Neural Networks. In: Garg, D., Narayana, V.A., Suganthan, P.N., Anguera, J., Koppula, V.K., Gupta, S.K. (eds) Advanced Computing. IACC 2022. Communications in Computer and Information Science, vol 1781. Springer, Cham. https://doi.org/10.1007/978-3-031-35641-4_35

[10] Tayal, A., Gupta, J., Solanki, A. et al. DL-CNN-based approach with image processing techniques for diagnosis of retinal diseases. Multimedia Systems 28, 1417–1438 (2022). https://doi.org/10.1007/s00530-021-00769-7

[11] Pahuja, R., Sisodia, U., Tiwari, A., Sharma, S., Nagrath, P. (2022). A Dynamic Approach of Eye Disease Classification Using Deep Learning and Machine Learning Model. In: Gupta, D., Polkowski, Z., Khanna, A., Bhattacharyya, S., Castillo, O. (eds) Proceedings of Data Analytics and Management . Lecture Notes on Data Engineering and Communications Technologies, vol 90. Springer, Singapore. https://doi.org/10.1007/978-981-16-6289-8_59

[12] Dammak, A.; Pastrana, C.; Martin-Gil, A.; Carpena-Torres, C.; Peral Cerda, A.; Simovart, M.; Alarma, P.; Huete-Toral, F.; Carracedo, G. Oxidative Stress in the Anterior Ocular Diseases: Diagnostic and Treatment. Biomedicines 2023, 11, 292. https://doi.org/10.3390/biomedicines11020292