Research Proposal by
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Enhancing Early Retinal Disease Diagnosis Through Advanced Machine Learning and Deep Learning Approaches

Introduction:

Retina, a layer of nerve tissue that covers the rear two-thirds of the eyeball provides the experience of vision. The crucial structures of the retina frequently undergo some damage, which can result in several kinds of illnesses including eye redness, vision blurring, vision weakening, and blindness. There are several retinal disorders. Age-Related Macular Degeneration, diabetes-related retinopathy, Retinal detachment, retinal tears or holes, retinal vein occlusion (including branch and central retinal vein occlusion), infectious retinopathy, central serous retinopathy, birdshot chorioretinopathy, and various inflammatory disorders, Retinitis Pigmentosa etc. Over 300 million people worldwide are at risk of vision loss due to retinal disease, and this number is rising. And for some retinal conditions, treatments don't exist at all. [1]

Machine Learning & Deep learning, a subfield of artificial intelligence, has produced astonishing achievements in various picture identification and classification applications. Machine Learning & Deep learning, models have achieved cutting-edge performance in several medical imaging applications by utilizing the strength of convolutional neural networks. Deep learning models have shown promise in retinal diseases setting in identifying and categorizing the condition based on retinal pictures.

Retinal Diseases has become a significant public health issue as its spreading worldwide increases alarmingly. Early identification and prompt intervention are crucial to avoid vision loss and enhance patient outcomes. Manual Retinal diagnosis and screening, however, can be labor- and time-intensive and depend on inter-observer variability. Consequently, there is a growing need for automated and precise Retinal disease detection system.

Research Questions:

Is it possible to create a system using machine learning models to detect retinal diseases with few possible false positive cases?

This above-mentioned primary research question is then divided into several sub research questions.

RQ1. How successfully can deep learning models work for identifying and categorizing the various phases of retinal diseases?

RQ2. How successfully the machine learning and deep learning approaches can be integrated with a system?

RQ3. How can deep learning models be effectively utilized and used in medical centers to support medical practitioners in making an accurate and prompt diagnosis of diabetic retinopathy?

Objectives:

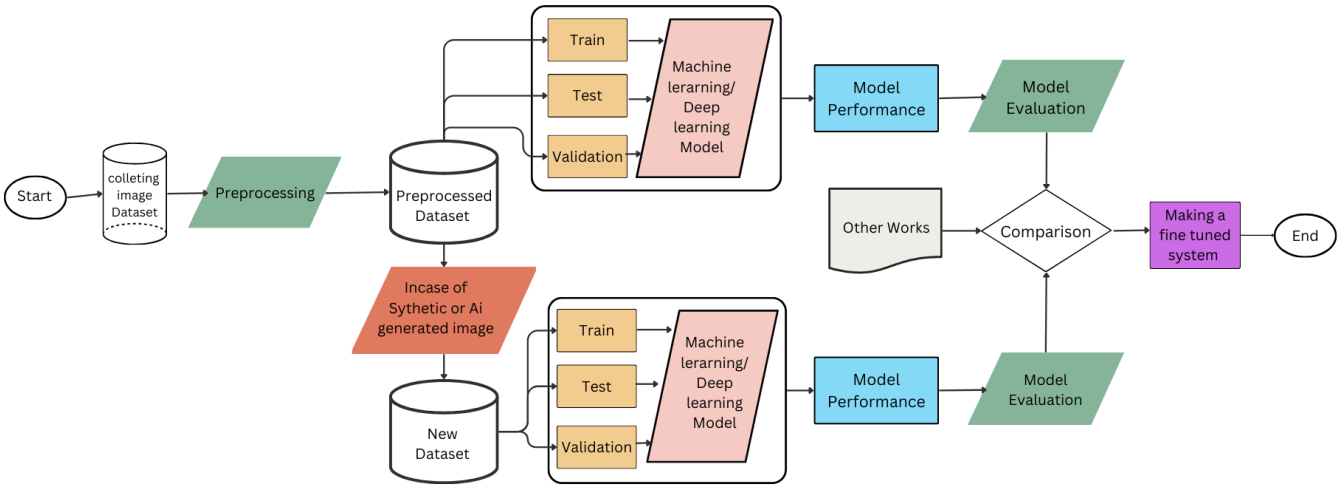
1. To improve the training of machine learning models for the detection of retinal diseases, real retinal image data should be gathered and, if it is not adequate for all necessary attributes, synthetic images should be Generate through artificial intelligence.
2. To Develop a highly accurate and efficient ai model for the Early Retinal Disease Diagnosis
3. To Train and optimize the deep learning models using the collected dataset, aiming for high accuracy and robust performance.

Literature review:

In [2], a new mixture loss function for the identification of eye diseases is put out. When evaluated against a real-world ophthalmology dataset, the proposed model exhibits excellent performance. The suggested model is a possible technique for diagnosing eye disorders and might be applied to improve the accuracy and efficacy of diagnosis. With 92.7% accuracy, this model performed well.

[3] proposes an innovative approach for automatically identifying eye diseases from enhanced fundus images. The model is composed of many deep CNNs to improve the detection's accuracy; it obtained a test set accuracy of 95.2%. Using a dataset of 5,000 fundus images, the method was evaluated, and the results showed that it can accurately diagnose a variety of ocular diseases.

Methodology:



Conclusion:

The proposed research goes Beyond exploring theories, research also integrates practical application and observable results by drawing on real-world experience. Subsequently, various models will be implemented to identify the most effective ones for detecting and classifying different retinal diseases. This approach is designed to contribute to early diagnosis and intervention, crucial in mitigating the impact of diabetic retinopathy on individuals' vision.

Reference:

[1] (https://www.boehringer-ingelheim.com/human-health/retinal-diseases/clear-vision).

[2] X. Luo, J. Li, M. Chen, X. Yang and X. Li, "Ophthalmic Disease Detection via Deep Learning With a Novel Mixture Loss Function," in IEEE Journal of Biomedical and Health Informatics, vol. 25, no. 9, pp. 3332-3339, Sept. 2021, doi: 10.1109/JBHI.2021.3083605.

[3] I. A. Khan, A. Sajeeb and S. A. Fattah, "An Automatic Ocular Disease Detection Scheme from Enhanced Fundus Images Based on Ensembling Deep CNN Networks," 2020 11th International Conference on Electrical and Computer Engineering (ICECE), Dhaka, Bangladesh, 2020, pp. 491-494, doi: 10.1109/ICECE51571.2020.9393050.