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Automated Detection of Age Macular Degeneration and Retinal Abnormalities Based on Age

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ABSTRACT

Performance of an algorithm that automatically identifies DR and Age related macular degeneration (AMD) pictures based on their pathological properties. Age related macular degeneration (AMD) is the subject of this research, which proposes an automated categorization system for telemedicine purposes. The analyzing fundus photos, the most important elements for AMD characterization were identified using texture, color and visual context analysis. The Age-Related Eye Disease (ARED) protocol and the Support Vector Machine (SVM) and Random Forest (RF) algorithms were used to categorize pictures according to the various AMD phases, and the FCN method was utilized to assess the features importance. According to the findings, independent of the classifier utilized (DCNN) or the feature selection method (PDA), local binary patterns in multiresolution are the most significant for AMD classification. In addition, the suggested automated DCNN classification system using FCN is resilient to picture quality changes.

INDEX TERMS: Drusen, Constant False Alarm Rate, Support Vector Machine, Oculus Dextrux , Region of Interest, Fluorescien Angiography.

I. INTRODUCTION

A new method for detecting anomalies in retinal images. An age-related macular degeneration (AMD) pathology is the topic of this research, and it is a pathology that frequently goes unnoticed in the early or middle stages and may end in blindness if left untreated. In order to identify retinal anomalies, we use fundus imaging and a single class classifier. A multiresolution, locally-adaptive approach is used to identify both normal and abnormal retinal areas[1]. A hybrid parametric/non-parametric representation of the support for normal retinal tissue's probability distribution in color and intensity feature space is used to accomplish this. Patients may be automatically screened for retinal problems using this method. In this study, AMD is the primary emphasis because of its prevalence and clinical significance: Many countries in Western Europe and North America have a high prevalence of AMD, which is a primary cause of blindness. Central vision may be

substantially reduced in advanced AMD, affecting tasks like reading, driving, or recognizing faces. This is mainly caused by the development of choroidal neovascularization (CNV).

In the United States alone, nearly 200,000 adults over the age of 50 acquire the advanced stage of AMD each year. 70% of these patients will have significant vision loss in one eye within two years if left untreated in the following five years, about half of these patients will experience significant vision loss in both eyes. In recent clinical studies, anti VEGF has shown promising results in slowing the progression of cancer. Identifying people who are most at risk for developing advanced AMD, particularly those with the intermediate stage of AMD, is crucial. The appearance of drusen, or little aberrant structures in the fovea, is the primary sign of intermediate AMD. It is common for drusen to go undetected over long periods of time. When it comes to AMD's intermediate stage there is no visual loss and hence no external indicators of its existence.

II. EXISTING SYSTEM

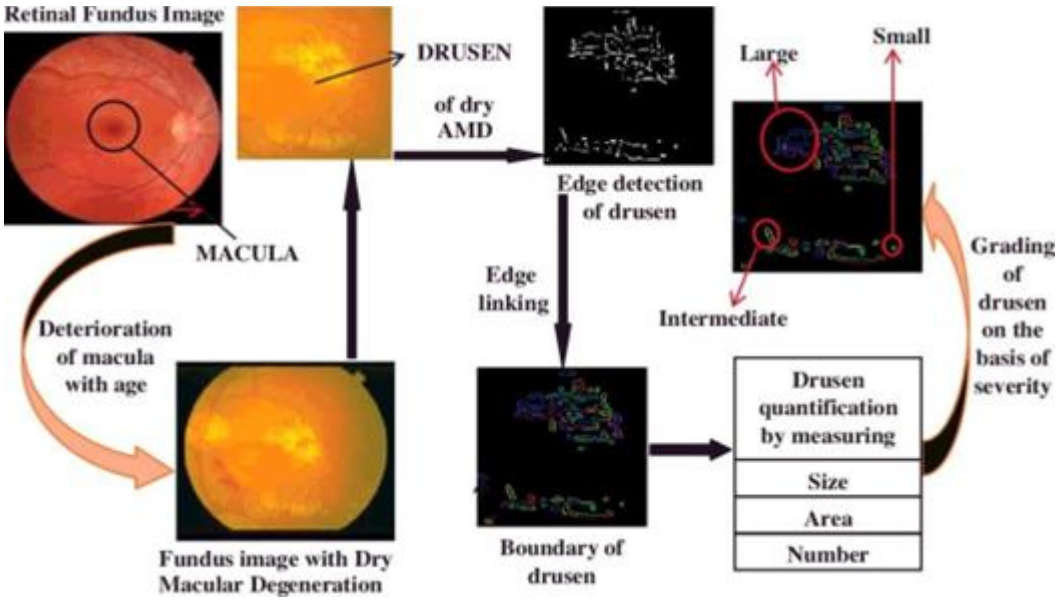
A fair amount of work has been devoted to the design of automated detectors for specific retinal pathologies such as diabetic retinopathy. However, despite its prevalence, much less has been done for AMD. Exploitation of digital fundus image processing for AMD was first reported by the study. Early AMD detection methods such as the study reported required user intervention. Recently, researchers have turned their attention to automated approaches: used adaptive equalization and wavelets; employed mathematical morphology on angiographic images with fluorescein injection; used adaptive thresholding; exploited a probabilistic boosting approach for the classification of non-homogeneous drusen textures; used probabilistic modelling and fuzzy logic; employed histogram normalization and adaptive segmentation; finally, exploited texture discrimination and the intensity topographical profile[5].

A common route employed by the most promising of the previously cited approaches consisted in using a two-class or multiclass classifier (drusen vs. vessels vs. retinal background tissue vs. other tissue). Because of variations in imaging conditions (fundus image quality, illumination, blur, background uniformity) and variations in patient specific appearance (variability in pigmentation and drusen appearance within and across subjects), it is difficult to identify stable image features characteristic of drusen that can be used to build a robust classifier that will perform reliably over a large dataset. Because of this, we explore an alternate route, and investigate the use of a one-class classifier[9]: we characterize the statistical distribution of 'normal' background retinal tissue, and search for areas exhibiting abnormalities. The salient features of the proposed algorithm are as follows: (a) Intensity, color, and gradient information is exploited. (b) A hybrid parametric Constant False Alarm Rate (CFAR) detector (for the fundus image intensity value) is used in conjunction with a non-parametric (adapted to color space features) CFAR detector based on Support Vector Machine (SVM). (c) The algorithm uses a multiscale and locally adaptive approach. In addition, our approach addresses other challenges in drusen detection including the presence of a background intensity gradient in retinal fundus imagery, the presence of various anatomical features (vessels, optical nerve, etc) and artifacts (flashes) resulting from specific Illumination conditions. To address these issues we develop additional processing stages that identify appropriate regions for training and testing and eliminate some of these spurious features.

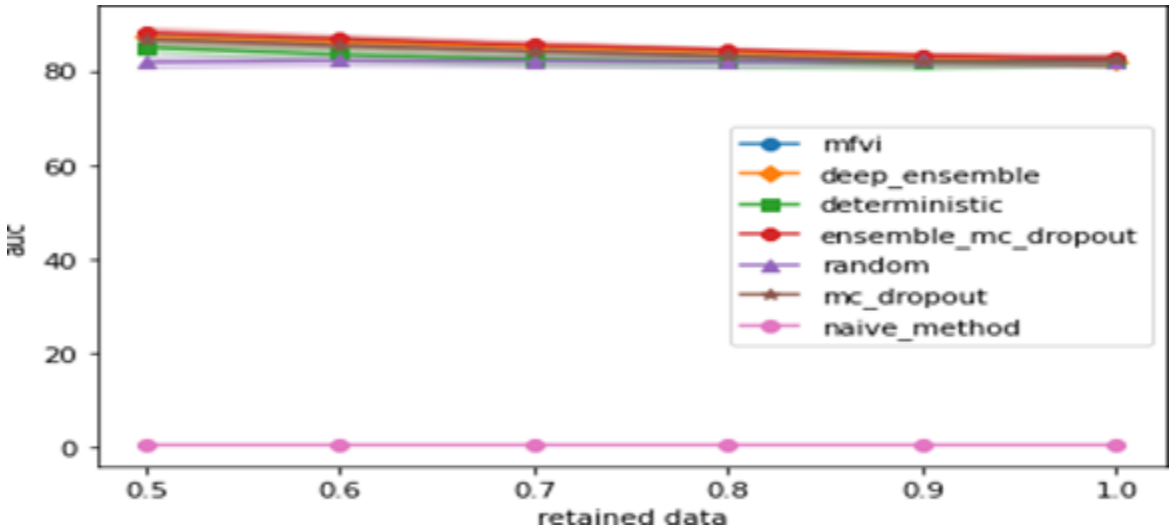
III. PROPOSED SYSTEM

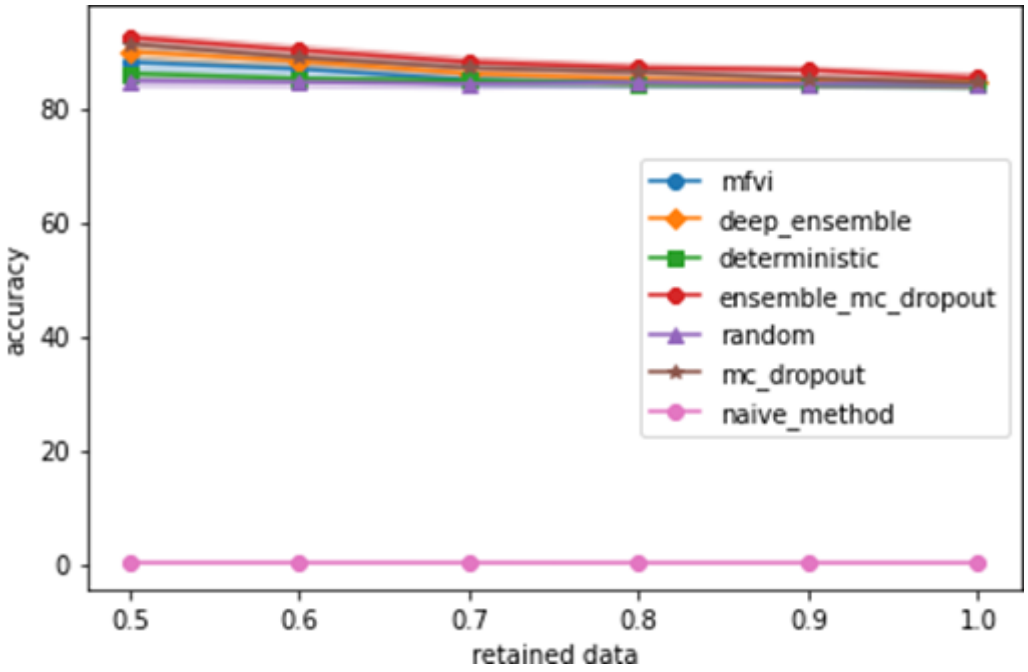
The proposed diagnostic system consists of different stages including preprocessing, OD localization, blood vessels detection and segmentation, and macula detection for the purpose of features set extraction from detected macular region. In preprocessing, image segmentation is performed to segment out background part of input image from its foreground and to remove noisy part of the input fundus image[7]. Background and noisy parts of image is not necessary for further processing and also increase processing time in later stages of processing. Based on mean and variance segmentation background elimination is performed. HSI channel is utilized for noise removal. Block diagram of retinal fundus image segmentation. Implementation details of used method generated background segmentation mask, noise removal mask, and final segmentation mask that were generated by combining background and noise removal masks, and final segmented retinal fundus images. For macula detection, OD localization is important as macula can be found at distance of 1.5 disk diameter from OD. OD can be notable in retina as a brightest yellowish rounded disk from where optic nerve and blood vessels arise. To localize OD, mean filter and histogram values of image are utilized to identify ROI. OD detection is further performed using circular Hough. OD detection of two randomly selected fundus images from STARE dataset is presented in blue circle around the macular part.

Due to similar intensity levels of blood vessels and macular region, macula detection can be confused. To eliminate chances of detecting forged regions as macula, reliable detection and extraction of retinal blood vessels is crucial. To this regard, blood vessels segmentation for macula detection is also vital step in automated diagnosis system of AMD. For vascular pattern detection and extraction, multilayered thresholding approach with the combination of Gabor wavelets method is used in our proposed system. These methods are very efficient to segment out delicate and tinny vessels. For macular region estimation, a template is formatted having same force intensity values as of macula, is utilized and adapted[10].



IV. RESULT





V. CONCLUSION

AMD is one of the regular retinal issues. If not treated timely can cause irreversible central vision loss. Automated diagnosis of AMD is important to help ophthalmologists in lowering their load and can also be used in tele-medicine systems for timely detection and diagnosis. In this project a diagnostic system for automatic and early identification of AMD by investigating the macular area with the assistance of various textural, color, and shape/structural features. The experimental results demonstrate the reliability of the proposed technique. In this proposed system has achieved 95.45% and 92.34%, accuracy for STARE and AFIO datasets, respectively.

Early detection of drusen may have substantial impact on the prevention of blindness due to AMD .The results presented here are still preliminary and the data set used to test our algorithm was relatively small and needs to be increased before definitive conclusions can be made regarding the robustness of the method. The goal is to continue characterizing and refining our algorithm on expanding datasets to eventually allow for large-scale deployment. Furthermore, we plan to construct ROC curves in order to quantify algorithm performance. In addition, This algorithm is to be applicable to image modalities other than standard fundus images (e.g. Optical Coherence Tomography (OCT) images). Finally, emphasize here that the algorithm we have presented should be viewed as an anomaly detector. Although we have explicitly applied it to the specific problem of drusen detection in early or intermediate stage AMD, it is not limited to just this application. It is applicable to screening for other retinal pathologies which entail the formation of abnormal tissue or bleeding such as diabetic retinopathy or geographic atrophy.

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