Analysis of Ocular Disease Using Multiple Information Domains

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Abstract: **Among all the beneficial applications of an IoT, Health Care can be said to be as one of its major application. IoT has an efficiency to consolidate the medical devices along with the various healthcare related applications through internet. Many researches have been done for the improvisation of ocular disease screening and with the provision of its diagnosis using advanced image supported by the data analysis techniques. However, the current scenario depicts lack of usage of developed systems because of their offline behavior and due to separation from medical devices. Here, a platform is being introduced that tends to connect medical devices, patients, ophthalmologists, and an intelligent system that analyses ocular disease through the provision of cloud. In order to offer both easy accessibility and enhanced security, the platform is designed to be in a hybrid cloud pattern. The facility to upload the retinal fundus images and patients' personal data is provided to the public cloud tier through various channels including web portals, retinal fundus cameras, mobile applications and APIs. By the provision to advanced pattern classification algorithms, the data will be transferred to the private cloud tier where automatic analysis and assessment will be performed. Further, in order to provide the easy accessibility to the analysis reports of the patient, they will be made available in the public tier using the mobile application or Web-Portals.**

Keywords: **Age-related Macular Degeneration(AMD), Computer Aided Diagnosis(CAD),Diabetic Retinopathy(DR), Model View Controller(MVC), Sparse Dissimilarity Constraint(SDC).**

1. Introduction:

This system allows easy and accurate detection of ocular diseases via automatic screening and monitoring[1]. Without any human intervention this system executes various image processing techniques on an eye image in order to detect the ocular disease. For further study and analysis purpose the patients are provided with the provision to store their data on the cloud. Mainly these diseases are found in old age people throughout the global population. The diseases such as Age-Related Macular Degeneration (AMD), Glaucoma, pathological myopia (PM) and diabetic retinopathy (DR) are the main causes for vision impairment [16].Recovery from these irreversible diseases tends to be more expensive. Currently, ocular diseases are detected only when a person experiences symptoms such as pain or blurred vision [12]. People suffering from irreversible diseases such as Glaucoma don't come across any symptoms until late stages. Hence, early detection and timely intervention is the only way to prevent visual impairment or blindness [9]. Thus, there is a need for a population-wide screening tool that is reliable, convenient to administer and fast enough to screen a large volume of users.

1.1 Cloud: Now-a-days storing the data on a network of remote servers available on internet is more in practice rather than storing it on a local server or personal computer. This, makes the data accessibility easier and large amount of data can be stored and retrieved.Cloud is used in our project for storage purpose. Patient records and ophthalmologist details are stored on cloud.

1.2 Image Processing: Image is the input fed to our system, this image further undergoes image processing steps like feature extraction, image segmentation, etc. These image processing steps are performed to get extra information of each pixel of the image which further helps in disease prediction.

Specialized image processing and data analysis techniques are used to improve the ocular disease diagnostics.However, the developed systems are not much usable since they are usually offline and separated from medical devices [13]. This system introduces a platform connecting all the medical devices, patients, ophthalmologists, and ocular disease detection systems with the help of cloud-based services. In order to provide easy accessibility and strong security, this system is implemented using a hybrid cloud pattern [8]. Patient's necessary details can be uploaded on Public cloud through various channels including retinal fundus cameras, web portals, mobile applications and APIs [2].This data will be further transferred to the private cloud for automatic analysis and assessment using advanced classification algorithms. After assessment, the analysis report will be generated onto the public cloud so that patients can access their own report through mobile applications or web portals.

2. Existing System:

2.1Automated Micro aneurysm Detection Using Local Contrast Normalization and Local Vessel Detection:

Previously, for thedetection of diabetic eye diseasesscreening programs using retinal photography were introduced. To reduce the human tasks, automatic grading of the images was considered by Health Boards. Since Micro aneurysms (MAs) are earliest sign for detection of retinopathy, hence they are used to identify the symptoms of disease through image classification [7]. This paper determines the automatic methods for MA detection and shows how image contrast normalization can be improved to distinguish between MAs and other spots that occur on the retina. Various methods for contrast normalization are analyzed. Watershed

transform method was implemented at a region where vessels were not present. Using a local vessel detection technique, dots within vessels were handled precisely. Results were examined for detection of individual MAs and for detection of images containing MAs.

Advantages:
The ability to distinguish between micro aneurysms (MAs) and other spots occurring on the retina can be improved through Image contrast normalization
Disadvantage:
1. The results for image classification are less understood.
2. Poor performance of method "F" requires some explanation.

2.2 Automatic Detection of Pathological Myopia using Variational Level Set:
Pathological myopia [16] is a condition caused by pathological axial elongation of eyes that deviates from the normal distribution curve of axial length, which results into vision impairment.
Risks associated with myopia should not be underestimated, to prevent the onset or progression of myopia.
Ocular risks associated with myopia should not be underestimated, and there is a public health need to prevent the onset or progression of myopia. Peripapillary atrophy (PPA) is one of the clinical indicators for detection of pathological myopia by means of variational level set.The proposed method has been tested on 40 images from Singapore Cohort Study Of the Risk factors for Myopia [16] (SCORM), producing a 95% accuracy of correct assessment, and a sensitivity and specificity of 0.9 and 1 respectively. The results highlights the potential of PAMELA as a possible clinical tool for objective mass screening of pathological myopia.

Advantages:
PAMELA is an automated system for the detection of pathological myopia with exact accuracy and can perform mass screening of pathological myopia.
Disadvantage:
The accuracy in the boundary location of the optic disc would be compromised.

2.3 Early Age-Related Macular Degeneration Detection by Focal Biologically Inspired Feature:
Age-related macular degeneration (AMD) is a major cause of vision loss. AMD is usually associated with the presence of drusen. Around the macular region of the retina there is a tiny yellowish-white extracellular buildup present called as drusen. To determine the existence and acuteness of drusen, ophthalmologists check the area around the macula. However, manual identification and acknowledgement of drusen is subjective, time consuming and expensive .It is important to identify drusen automatically in order to reduce the manual workload and to facilitate extensive AMD screening. For the purpose of AMD detection [14], in this paper we are using biologically inspired features (BIF). The optic disc and macula are detected for feature extraction which is used to determine a focal region around macula. Support vector machines (SVM) are a classifier which is used for feature extraction.

Advantages:
Easy, early and automatic detection of drusen is achieved.
Disadvantage:
Need to improve the accuracy as well as to compute the severity of the drusen.

2.4 Level-Set Based Automatic Cup-To-Disc Ratio Determination Using Retinal Fundus Images in Argali
Glaucoma is a prime cause of permanent blindness [1]. If the disease is identified early then it can be prevented from vision loss. The main clinical measure of glaucoma is optic cup-to-disc ratio (CDR), that is currently determined manually, limiting its potential to mass screening. Using a different set approach we determine an automatic CDR technique to segment the optic disc and cup from retinal fundus images. This technique is a key element of ARGALI [1], a system for automated glaucoma risk assessment. In preprocessing threshold analysis is used to determine the initial contour. Due to the presence of retinal vasculature traversing the disc and cup boundaries, an ellipse-fitting post-processing step is introduced which leads to inaccuracies in the detected contours.

Advantage:
Automatic CDR determination method for optic cup-to-disc ratio (CDR).
Disadvantage:
Proposed method has an error for glaucomatous retinal images.

2.5 Model-based Optic Nerve Head Segmentation on Retinal Fundus Images
In the diagnosis of retinal diseases, the optic nerve head (optic disc) plays a vital role. Automatic localization and segmentation of the optic disc is critical towards a good computer-aided diagnosis (CAD) system [6].For the detection of optic disc from retinal fundus images, in this paper, a method is proposed that combines edge detection, the Circular Hough Transform and a statistical deformable model

Advantage:
Automatic localization and segmentation of the optic disc.
Disadvantage:
Results of proposed method can be much worse for discs with non-circular shapes

3 Proposed System:

Here the patient will access this system by providing his personal details and eye images as an input. This information will be uploaded in the system for further processing. Here eye images are captured so as to detect the disorder and provide proper medication. The captured images will be forwarded to cloud and by analyzing those images, proper assessment and reporting on ocular diseases will be sent to the patient. In case of serious situation, the patient will be informed about it and an expert is consulted for further treatment that should be taken. After early detection of disease certain home remedies will be suggested.

3.5 Scope:

System will predict four ocular diseases according to the level of severity i.e. high, medium and low. Proper information regarding the diseases would be provided such as its symptoms, causes etc. According to the severity, physician (ophthalmologists) would be recommended but if disease is at initial stage than temporary home remedies would be suggested that must be followed before approaching the doctor. Provision would be provided to the patient to fix an appointment with the nearby ophthalmologist.

3.6 System Architecture:

To develop a system that detects ocular diseases with more accuracy and requires less time for disease prediction. The proposed system helps to avoid further complication that occur in patients due to delay in medical assistance.

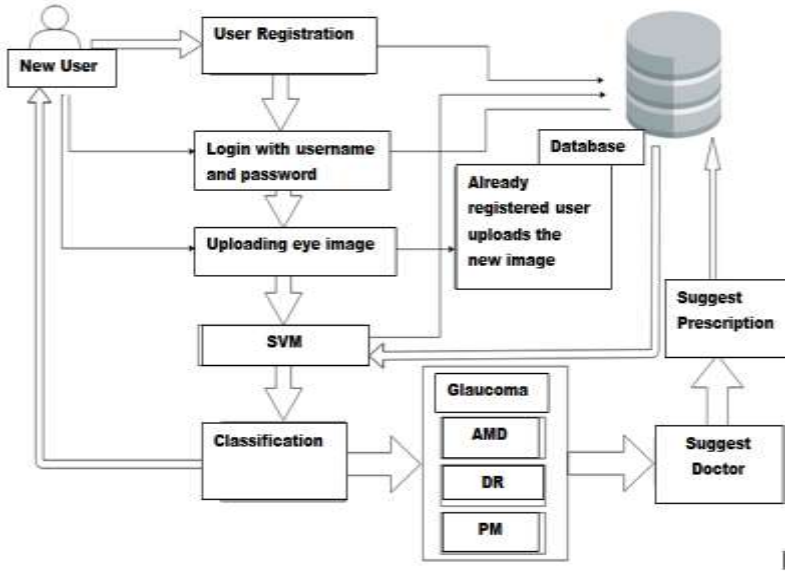

Fig-1 System Architecture

Above fig shows system architecture.In this system user enter the personal information and enter the Username and Password. After that Patient/user provides personal details, medical history (if any), eye image. The system accepts the input and performs feature extraction. Then the disease detection is being performed. Then the patient/user is informed with the disease that is being detected along with its severity. Also in-addition, medical prescription is given to patient who is at initial stage of disease and expert is consulted along with taking his/her appointment for further medical treatment for the patient at high risk.

4 Applications:

- The proposed system is very beneficial especially for the areas where there is lack of opthamologists, as the system will predict the disease that a patient is affected with. This saves the time of both the patient (user) and the opthamologist.
- The system also provides basic medicinal suggestion

to the patient according to the disease (s)he is affected with.

5 Advantages :

- Our system used for ocular disease detection is able to detect (predict) for a multiple disease i.e. either of glaucoma, pathological myopia, diabetic retinopathy, age related macular degeneration.
- The algorithms used for the prediction gives the better accuracy

6 Conclusion:

The system performs as an automatic ocular disease screening mechanism where the eye image is initially used to train the system so that it can predict the affected diseases. The system is trained in a way to predict the diseases after extracting the features from an image. Thus, our system efficiently predicts the ocular disease in negligible time and with more accuracy. And, as

the patient record is stored on cloud, it becomes easy for the ophthalmologist and also the patient to refer the patient record (history) to access it whenever required. Our system also provides a facility to book an appointment with the nearby Ophthalmologist and accordingly the patient's report is also shared with the respective ophthalmologist for further assistance.

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