International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

Earlier Detection of Eye Diseases - A Saviour of Vision Problems

D.Sri Harsha[1], N.Geethika[2], H.Bhavana[3], Prasanna[4], K.Suvarna Vani[5]

[1,2,3,4]Dept. of Computer Science and Engineering, VR Siddhartha Engineering College, Vijayawada
[5]Professor, Dept. of Computer Science and Engineering, VR Siddhartha Engineering College, Vijayawada

---

Abstract - *Medical health systems have been concentrating on new techniques for speedy diagnosis. As the amount of image data in imaging centre of ophthalmology is increasing, analysing and processing these data is in need. The aim of this study is to develop a general User Interface for recording diagnostic data to facilitate auto-prediction of eye diseases. It is to ensure error-free data entry by developing a user - friendly interface. Furthermore, Machine Learning algorithms were used to analyse patient data based on multiple parameters and clinical observations. This data will be structured according to hierarchies designed by medical experts. Furthermore, the system is designed to evolve by adding new features and classifications for both symptoms and diagnosis. As many of individuals doesn't care much about their vision for this reason, there is a need for a system thereby digitise the examination by capturing images of an eye on regular basis and to facilitate auto-prediction of eye diseases so there by redirecting to the corresponding specialised and localised doctors there by preventing the misdiagnosis upto some extent.*

Key Words: vision problem, image acquisition, Machine learning, Artificial Intelligence, Intelligent data analysis.

1. INTRODUCTION

In today's global economy, assisting medical experts with early disease diagnosis plays a challenging role amplified by the technicalities associated with the identifying type of eye diseases. There are many applications and technologies for identifying the diseases using the symptoms. However, correlating the actual symptoms and clinical observations with the corresponding diseases is missing in most of these systems. This is perhaps owing to the variety of observation recording methods by medical experts. For example, some use symbols for diagnosis, whereas others give a textual description; hence, there is no standard method. Therefore, this data should be manually converted into a standard format so that machines can use it for analysis. This limits the size of data used in any analytical study, which is the main cause of current gaps in human-knowledge-based diagnosis and machine-intelligence-based predictions. Therefore, any machine-based solution should concurrently consider observations, symptoms and standardised test results for predictions.

Improve and prepare the treatment for diagnosis - A team of professionals will suggest and oversee diagnosis improvements so to maximise the accuracy and treatment. The extent to this is creating an mobile application for collecting the patients eye specific data and store them in persistent manner so that it would help for further examinations and other experimentations also it would help when the patient not discuss straight forwardly with the doctor, this generally utilised in when the patient and specialist are in some various areas.

The primary motivation and main purpose of developing a mobile application is to gather the error free data (eye images) at an easier extent. Furthermore, the use of a standard description for clinical data and medical test results can be the key to success. The first step toward this is the use of health records or eye images of a particular patients in electronic form. Moreover, the use of standard Taxonomies for patient data recording can further improve its quality, accuracy and consistency. By gathering all this data this focuses on developing a general framework for the standardised recording of patient symptoms and clinical observations, thus assisting medical experts in keeping up with the exponential development of medical knowledge arising from clinical trials and logical advancements in the field.

To make use of eye specific data such that to improvise the present medical solutions that are provided and to gather regional acquisitions for further predictions and to make use at research fields. These gathered data are stored in the database of the respective hospitals to improvise standard solutions for vision problems.

In the present day scenario images have become the most suitable way to provide solutions for many problems in various. In day to day life every individual is very busy in surviving and earning their livelihood, Images would play a key role in almost all the fields like medical, sports, social networking and many more. It is the necessity of your time to understand how the pictures are being captured and stored into memory. To deal with images and before analysing them the most important thing is to capture the image and it is formally known as Image Acquisition. Image Acquisition is achieved by a suitable camera and it is needed to use the corresponding camera that reflects our solution in that respective situation.

In this Presence, the application of both ML and AI is been needed to transform all the solutions and allows better

solutions with high performance and accuracy[1]. The inclusion of these technologies will play an important key role in providing efficient solutions for the problems in various fields to make use of these technologies in the ophthalmology domain that it increases the approaches and provide the solutions with high end performance and would lead to improvise the existing solutions to the present causes.

2. LITERATURE SURVEY

As every individual ageing has become a major demographic trend around the world, patients suffering from eye diseases are expected to increase steeply. Upon Early detection and with an appropriate treatment of disease symptoms are of great significance to prevent vision loss and promote living quality. The Conventional diagnostic methods depend on physician's knowledge and professional experience, which lead to high misdiagnosis rate and huge waste of medical data [2]. Deep integration of ophthalmology and Machine Learning has the potential. The inclusion of these technologies will play an important key role in providing efficient solutions for the problems in various fields to make use of these technologies in the ophthalmology domain that it increases the approaches and provide the solutions with high end performance to revolutionise current disease diagnose patterns and generate a significant clinical impact. Vikas Kumar Mishra, Shobhit Kumar and Neeraj Shukla proposed some of the Image Acquisition methods and Techniques and this can be used for capturing of Eye Images [3]. For an Example Eye care - Ampler Grid Eye Test is a smart phone application which is designed for personal monitoring for vision loss from macular degeneration. With daily use of this Application, even for small changes in visual function are often identified electronically which can otherwise have gone unnoticed and caused long lasting damage. The Eye care Amsler Grid uses proprietary technology to spot any changes in your personal Amsler gird and personally notify you of that change soon. With this information you'll get the medical aid you would like and ideally prevent vision loss with the assistance of your eye care professional. If you do not have an eye fixed care professional to assist, then I becomes a lost cause that one cannot recognise these diseases till it comes to an individuals realisation. Sadaf Malik, Nadia Kanwal, Mamoona Naveed Asghar, Mohammad Ali A. Sadiq, Irfan Karamat and Martin Fleury proposed that the efforts were made to ensure error-free data entry by developing a user-friendly interface. Furthermore, multiple machine learning algorithms including Decision Tree, Random Forest, Naive Bayes and Neural Network algorithms were used to analyse patient data based on multiple features, including age, illness history and clinical observations [4]. A large amount of research has been conducted on developing medical expert systems to automate diagnostic processes. These expert systems can produce accurate responses based on pre-defined rules; however, the use of static rules results in restricted learning and therefore failure to respond to new situations.

In order that machine learning be performed in accordance with medical rules, pre-processing is required that involves data cleaning and normalisation, noisy data filtering and handling of missing values. It is important to mention that data pre-processing highly affects the performance of machine-learning algorithms and, if not performed properly, it may produce biased output [5] . The Weka knowledge analysis tool provides various pre-processing and transformation algorithms. Ignoring a small symptom may have serious consequences. The performance of the classification algorithms was evaluated using several statistical measures, namely, kappa statistics, root mean squared error (RMSE), accuracy, precision, recall and area under the curve (AUC) of receiver operating characteristics (ROC) graphs.Optical coherence tomography (OCT) images are used for its diagnosis and therefore they should be classified for computer-aided glaucoma detection. Similarly, imaging data was used for identifying intraocular lenses and refractive surgery. EyeView was used to optimize vision quality. Furthermore, computing solutions have been presented for identifying specific eye diseases such as age-related macular degradation, for the auto-detection of a diabetic retina and for automatic localization of the optic disc using image classification with support vector machines.

For Example:

Cornea —> Keratitis —> Neurotrophic kerato conjunctivitis.Here "Cornea" represents a first-level diagnosis, "Cornea —> Keratitis" represent second-level diagnoses, whereas complete diagnosis will be considered "Cornea —> Keratitis —> Neurotrophic Kerato conjunctivitis". To relate data frequency and to verify system reliability by prediction level, accuracies were calculated. This was important because in case of a rare disease, the system should be able to give a reliable diagnosis.

The most challenging thing for the ophthalmologists is to examine all the diabetes. Such specialist physicians require extensive training and equipment. Due to this scarcity the people need to travel long distances to get their eyes examined [6]. The problem is particularly in low and middle –income countries. Over Several decades Abramoff developed IDx-DR, an artificial intelligence system that can treat the diabetic person and tell whether that person has a more-than-mild case of diabetic retinopathy. IDx-DR is the first device that is approved by the US Food and Drug Administration(FDA) which provides the diabetes screening decision so that they need not go to clinic. This device contains large data sets of retinal images which will be helpful for detect the retina related diseases for the diabetes and it also detects other common diseases such as age-related macular degeneration(AMD) and glaucoma. This system improve the ac-

cess to the eye examinations in the areas where there are less medical centres and with less equipment for testing.

Bastawrous designed a smartphone application called Peek Acuity which is similar to an eye test conducted by a specialist [7]. This app is based on the Snellen eye chart which is the traditional approach introduced by the Herman Snellen, an ophthalmologist from the Netherlands. This traditional testing process consists of many drawbacks such as confusion between the similarly shaped letters such as F and P or C and O . And there is also another drawback that young children and adults cannot be able to read those letters due to lack of educational knowledge. Because of these drawbacks he use the simplified version of the Snellen test to build that application which relies only on the letter E. The letters will appear on the mobile screen in the sequence and the person is asked to identify the direction in which they perceive the E to be pointing [8]. The whole test takes only span of 77 seconds which is few seconds less than conventional eye test. This system provides better results than the traditional eye test and can be used by even non-specialists.

Automated and computerised diagnosis of eye conditions through colourant photography of the retina and optical coherence tomography imaging using artificial intelligence (AI) is gradually making a headway with technology [9].Soon, AI-based systems can even replace physicians altogether. Taking diabetic retinopathy as central objective, for all the people suffering with diabetes, exami nations are to be done to detect eye problems and can be treated if caught early. If not it may lead to an irreparable loss of vision. Approximations from 2017 show that 451 million people worldwide have diabetes [10] — making screening an untenable burden for ophthalmologists, instead AI machines can do that. In April 2019, the US Food and Drug Administration gave a rubber-stamp regarding an AI system to be used in a clinical setting.AI systems extremely show that they are useful in resource-limited conditions where medical care is unavailable or costly. But, the problem occurs in using the accurate AI algorithm. The question we need to consider here is bias [11] i.e., AI systems derived could contain inherent biases along the lines of gender, race or a condition's severity limiting the accuracy of the resulting algorithms in populations the technology wasn't trained on and also AI systems may not perfectly detect more than one eye conditions of a particular image. Because of this without any doubt more research must be done before fully automated AI systems can be safely deployed, and safeguards must be put firmly in place before widespread adoption.But once AI systems reach people they might never visit an ophthalmologist, a huge number of people could be prevented from going blind.

3. PROPOSED METHODOLOGY

A method and system that combines data obtained from the various medical domains and Hospital management with generic information to achieve an improved and informative and interactive image acquisition system to store and gather as much using a user-friendly application. This includes the following steps: user will be allowed to access all the information under that particular user by providing user credentials later on by providing the respective client/case data along with the acquisition will be stored under that user such that security is been implemented to restrict the access of outsources and later on for every user can access the data that is store under that user node and based upon the data treatment and other activites been done and make use of analytics part in future.

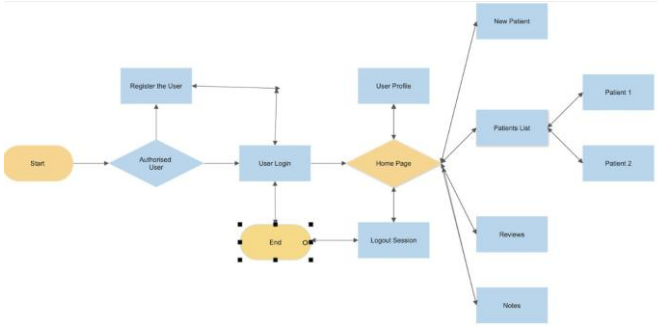

Fig. 1. Process flow diagram

The prototype model requires that before carrying out the development of actual software, a working prototype of the system should be built. A prototype is a toy implementation of the system. A prototype usually turns out to be a very crude version of the actual system, possible exhibiting limited functional capabilities, low reliability, and inefficient performance as compared to actual software. In many instances, the client only has a general view of what is expected from the software product. In such a scenario where there is an absence of detailed information regarding the input to the system, the processing needs, and the output requirement, the prototyping model may be employed. yield.

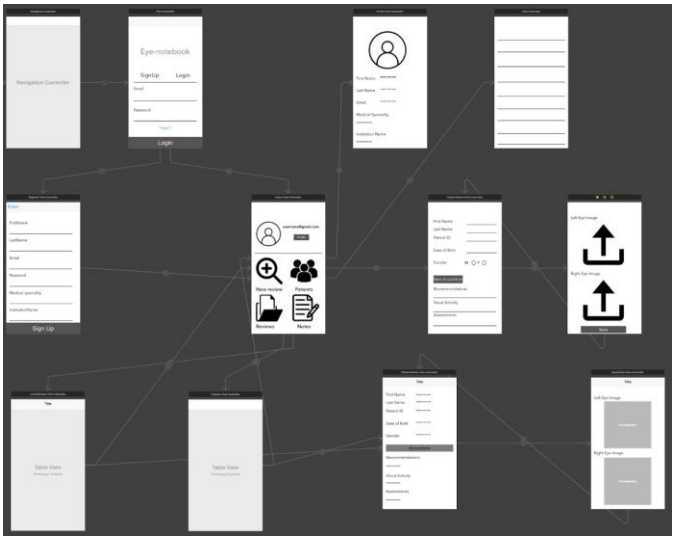

Fig 2. Prototype Design

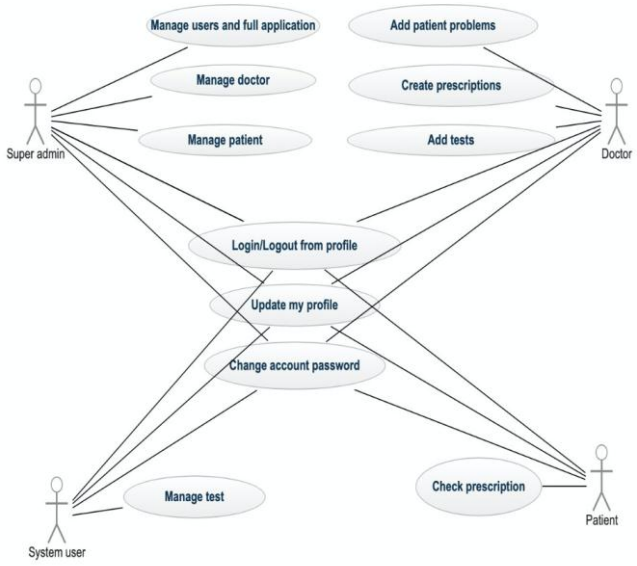

Fig 3. Use Case Diagram

Figure 3 describes that user will be allowed to access all the information under that particular user by providing user credentials later on by providing the respective client/case data along with the acquisition will be stored under that user such that security is been implemented to restrict the access of outsources and later on for every user can access the data that is store under that user node and based upon the data treatment and other activities been done and make use of analytics part in future is followed by the data processing mechanism module.

Some of the examples that are closely related : UllmanIndirect : A funds camera app is a smartphone application which control focus, exposure, and lightweight intensity to capture top quality funds photos that's designed by Georgetown University ophthalmology residents that provides the feature to export photos from video within the app and also allows to rotate the photos and videos for correct funds orientation.

Eye Examination : Eye Examination allows you to evaluate the state of your eyes through a spread of tests. While it is not intended to replace an optometrist's full eye examination, this app lets you discover any potential issues you may have with your eyes and if a visit to an optometrist or optician is indeed so.

PROPOSED APPROACH:

A method and system that combines data obtained from the various diagnose departments and database information to achieve an improved and informative Diagnose system using a user friendly application.

This includes the following steps:

1. At first the Organisation is needed to hold and maintain the database to store the Eye specific data along with the respective Image Acquisitions.

2. From the corresponding domain the doctors or medical professionals are needed to register and login with their credentials.

3. The application allows to provide the doctor information and his/her profile details of their qualifications and domains.

4. For an individual the application allows to add the basic and generic information that is necessary for further go and list the patient on to the patient list of the corresponding doctor.

5. After entering information, the application provides the feature that allows the doctor to add the image acquisition of the Eye (left eye, right eye) along with the information that is provided.

6. The acquisitions along with the corresponding data that will upload to the central database that is maintained by the respective organisation.

7. The data with the provided information is used for further analysis to get knowledge and to provide solutions based on the respective cause.

8. The data that is stored is also used to improvise the existing solutions and can be organised and examine to extract the knowledge.

4. RESULTS AND ANALYSIS

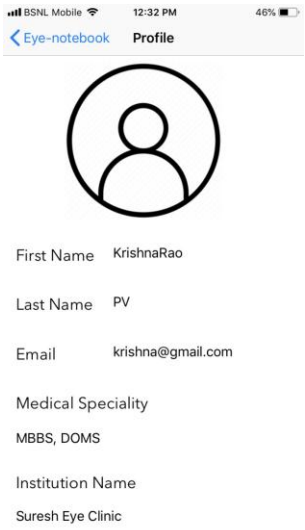

Fig. 4. About / Profile

The Fig. 4 shows medical expertise details in the profile screen which holds the basic information like name, email, medical speciality, institution name and other details.

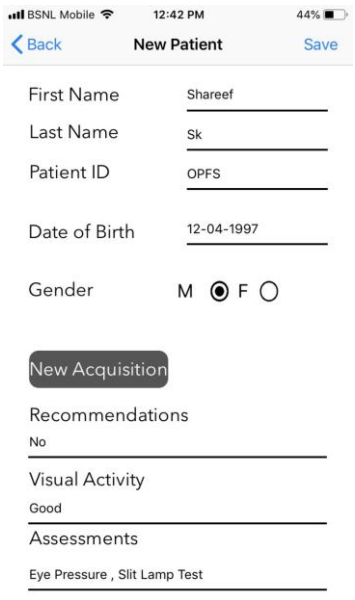

Fig. 5. New Patient and Examination Screen

The Fig. 5 describes about the patient generic information like name, patient ID, date of birth, gender and other specific details that are needed.

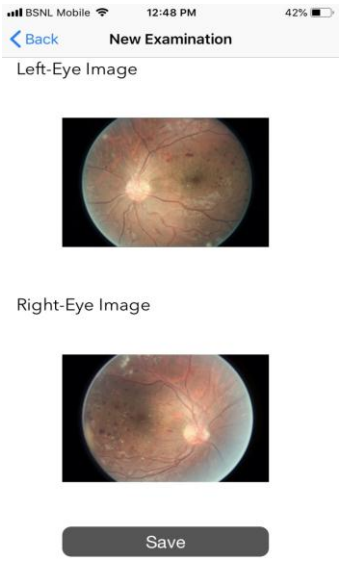

Fig. 6. Acquisition Review Screen

The Fig.6 describes about the patient generic information of left and right Eye Image acquisition.

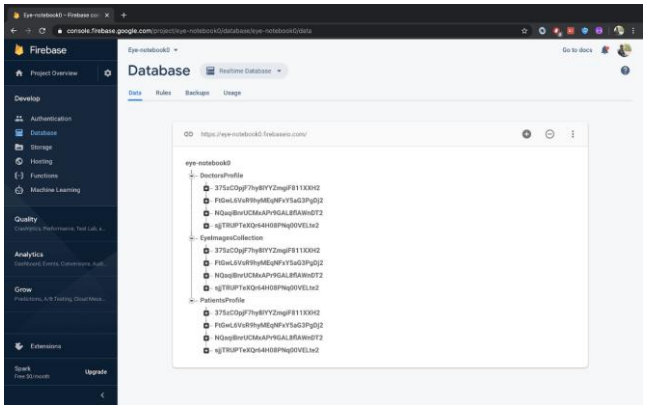

Fig. 7. Database hierarchical format

Fig. 7 represents how the data will be stored in the hierarchical format.

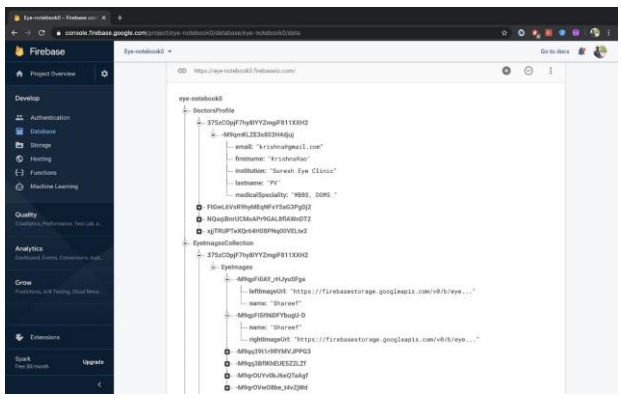

Fig. 8. Firebase containing Data

Fig. 8 represents how the data will be stored in the structural format of all the specific data which are related to both medical expertise and patients.

5. CONCLUSION AND FUTURE SCOPE

A typical Software is installed on a powerful computer i.e ML Server, which can be accessed through internet. Collecting data attributes from various data sources like hospitals, physical diagnoses, localised patients. The Input data is uploaded onto the ML Server and is stored at databases with corresponding structured format. The Input data is been formatted and structured according to hierarchies designed by medical expertise and physical diagnose professionals. Training is done on the data and been populated over the ML Server that the System is designed as like to evolve by adding new features and classifications for both symptoms and diagnosis. Depending on the complexity of data analysis and processing speed of the server the data is been classified and structured for both symptoms and diagnosis and is been stored in the central database. The analysed patient data based on multiple parameters and clinical data is displayed with progress of what's the occurrence and of diseases and symptoms. Based on the regular basis examining on the patient data to facilitate auto-prediction is done and allows the symptoms of the disease. The output can be accessed via internet and Redirecting the data to the localised and corresponding specialised doctors the patient is prescribed based on reachable symptoms of the disease and provided precautions to avoid increase of the suspected cause.

REFERENCES

1. Caixinha M., Nunes S. Machine learning techniques in clinical vision sciences. Current Eye Research. 2017;42(1):1–15. doi: 10.1080/02713683.2016.1175019.

2. Batchelor B.G., Foot G.E. (1988) Image Acquisition and Processing Techniques for Industrial Inspection. In: Turksen I.B., Asai K., Ulusoy

3. Image Acquisition and Techniques to Perform Image Acquisition Article in SAMRIDDHI A Journal of Physical Sciences Engineering and Technology · July 2017 DOI: 10.18090/samriddhi.v9i01.8333

4. Data Driven Approach for Eye Disease Classification with Machine Learning.c Sadiq , Irfan Karamat and Martin Fleury, Received: 21 May 2019; Accepted: 8 July 2019; Published: 11 July 2019

5. Case study research in information systems ,Graeme Shanks, Nargiza Bekmamedova, in Research Methods (Second Edition) , 2018

6. Intelligent Data Analysis for Medical Diagnosis: Using Machine Learning and Temporal Abstraction. Article in Ai Communications · January 1998

7. Multiple eye disease detection using Deep Neural Network TENCON 2019 - 2019 IEEE Region 10 Conference (TENCON) 17-20 Oct. 2019

8. Catania L. J., Nicolitz E. Artificial intelligence and its applications in vision and eyecare. AdvancesinOphthalmology and Optometry. 2018;3(1):21–38.doi:10.1016/j.yaoo.2018.04.001.

9. Clinically applicable deep learning for diagnosis and referral in retinal disease Jeffrey De Fauw, Joseph R. Ledsam,Bernardino Romera-Paredes..,Published: 13 August 2018

10. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045 N.H. Cho, J.E. Shaw ,S. Karuranga ,Y. Huang ,J.D. da Rocha Fernandes, A.W. Ohlrogge ,B. Malanda Published:February 26, 2018

11. Quantitative Fundus Autofluorescence in Healthy Eyes Jonathan P. Greenberg; Tobias Duncker; Russell L. Woods; R. Theodore Smith; Janet R. Sparrow; François C. Delori Published: August 2013