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A New Approach for Diabetic Retinopathy Disease Classification Using Multiple Instance Learning

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ABSTRACT: Diabetic retinopathy (DR) is a serious eye disease originating from diabetes mellitus and the most common cause of blindness in the developed countries. Early treatment can prevent patients to become affected from this condition or at least the progression of DR can be slowed down. The key to the early detection is to recognize microaneurysms (MAs) in the fundus of the eye in time. Thus, mass screening of diabetic patients is highly desired, but manual grading is slow and resource demanding. Microaneurysms (MAs) are early signs of DR, so the detection of these lesions is essential in an efficient screening program to meet clinical protocols. Early micro aneurysm detection can help reduce the incidence of blindness and Micro aneurysm detection is the first step in automated screening of diabetic retinopathy. A reliable screening system for the detection of MAs on digital fundus images can provide great assistance to ophthalmologists in difficult diagnoses. This project presents image processing techniques such as dark object detection to analyze the condition or enhance the input image in order to make it suitable for further processing and improve the visibility of Microaneyrysm in colorrfundus images. The correlation coefficient between each processed profile and a typical microaneurysm profile is measured and used as a scale factor to adjust the shape of the candidate profile. Each candidate is then classified based on spread spectrum analysis features. We implement this retinal imaging in real time environments.

I. INTRODUCTION

Diabetic retinopathy is a condition that affects the eyes as a complication of diabetes. It is caused by damage to the blood vessels in the retina due to high blood sugar levels. The condition is a leading cause of blindness in adults aged 20-74 years in the United States. In the early stages of diabetic retinopathy, there may be no symptoms, but as the condition progresses, symptoms may include blurred vision, floaters, and loss of vision. It is diagnosed through a comprehensive eye exam that includes a visual acuity test, dilated eye exam, and retinal photography. Treatment options depend on the stage of the disease and may include lifestyle modifications, medications, laser therapy, intraocular injections, and vitrectomy surgery. Prevention involves managing blood sugar levels, blood pressure, and cholesterol, as well as regular eye exams for early detection and treatment. Overall, early detection and treatment are essential for preserving vision and preventing complications

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II. LITERATURE SURVEY

2.1 In this paper propose a new pipeline for diabetes prediction from the PIMA Indians Diabetes dataset. Pre-processing, in the proposed pipeline, is the heart of achieving the state-of-the-art result, which consists of outlier rejection, filling missing values, data standardization, feature selection, and K-fold cross-validation. We consider the mean value in the missing position of attribute rather than median value, as it has a more central tendency toward the mean of that attribute distribution. The folding of the dataset for cross-fold validation is performed carefully to preserve the percentage of class proportion, as same as in the original dataset. Different ML classifiers (k-nearest Neighbour (k-NN), RF, DT, NB, AB, and XGBoost (XB)) and MLP were implemented in our proposed pipeline. We apply the grid search technique for selecting the number of hidden layers, number of neurons in each hidden layer, activation function, neuron initializer, batch size, learning rate, epoch, percentage of dropped neurons, loss function, an optimizer of MLP and hyperparameters of ML models. To ensemble the ML models, soft weighted voting is employed, where the weight for the individual model was estimated from the respective AUC. The AUC of the ML model is chosen as the weight of that model for voting ensembling rather than accuracy since AUC is unbiased to the class

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distribution. Extensive experiments on different combinations of the ML models are accomplished for searching the best ensemble classifier where the best performing preprocessing from the previous experiments is employed

2.2 One of the global health issues is to identify the risk of diabetes at its early phase. This study attempts to structure a framework which forecasts the risk pertaining to diabetes mellitus type 2. In this paper, six machine learning classification methods were implemented, and their results were compared with different statistical measures. Tests were performed on the dataset collected through online and offline questionnaires consisting 18 questions relevant to diabetes. Also, same algorithms were applied on PIMA database. The experimental result shows that the accuracy of Random Forest of our dataset is 94.10% which is the highest among the rest. Random forest is also giving highest accuracy for PIMA dataset. Among six different machines learning algorithms applied, all the models produced good results for some parameter like precision, recall sensitivity etc. The observation made by figure 7 that 'Age', 'Family diabetes', 'Physically active', 'Regular Medicine' and 'Diabetes' orgestation diabetes has highest significance among all variables. These parameters have greater impact on predicting diabetes than the rest. Generally, for a normal human being, glucose levels range from 70 to 99 milligrams per deciliter. A person is considered diabetic only if the fasting glucose level is found to be more than 126 mg/dL. In the medical practice, a person having a glucose concentration of 100 to 125 mg/dL isconsidered as pre-diabetic [4]. Such a person is prone to the development of type 2 diabetes.

2.3 Diabetes is a metabolic disorder that causes a lack or resistance to insulin, which is a hormone critical for the regulation of blood sugar levels. The common symptoms are polyuria, polydipsia, rapid weight loss, vision blurriness and fatigue. This leads to severe complications like strokes, blindness, miscarriages and organ failures. Traditional methods of chronic disease management use rule-engines or score estimations for diabetes risk identification, which are not as effective as machine learning techniques in detecting patient health conditions. Recent developments in machine learning and feature engineering, present new possibilities to improve early diagnosis and treatment outcomes of chronic diabetes patients. Recent studies in diabetes management presented the most common types of systems, which are insulin self-management apps, wearable blood glucose monitors, automated SMS risk alerts and virtual diagnostician coaching. Diabetes is a metabolic disease that affects millions of people each year. It is associated with an increased likelihood of vital organ failures and decreased quality of life. Early detection and regular monitoring are crucial for managing diabetes. Remote patient monitoring can facilitate effective intervention and treatment paradigms using current technology. This work proposes an end-to-end remote monitoring framework for automated diabetes risk prediction and management, using personal health devices, smart wearables and smartphones. A support vector machine was developed for diabetes risk prediction using the Pima Indian Diabetes Database, after feature scaling, imputation, selection and augmentation

III.PROPOSED SYSTEM

Diabetes is a well-known disease that may cause abnormalities in the retina (diabetic retinopathy) and nervous system (diabetic neuropathy). Also, diabetes can retinopathy is a micro vascular complication caused by diabetes which can lead to blindness in the working age population. Blood vessels providing blood supply to the retina when blood make a major risk for cardiovascular diseases. Diabetic vessels gradually weaken due to diabetes, it can be swelled and blocked. The disordered and weak small blood vessels are not able to maintain the right blood supply, they can be burst, and thereby exudate and blood can leak out to the vitreous part. The blood flown to vitreous part obstructs the path of light to the retina, thereby worsens vision. Diabetic retinopathy is one of the leading disabling diseases in eye; it will be leading causes of preventable blindness in the world. Early diagnosis of diabetic retinopathy enables

3.1 Home Page

The home page includes information about login user.

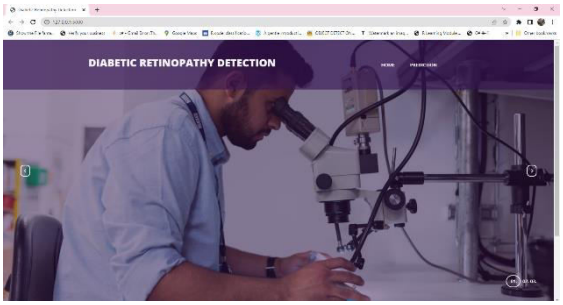

FIGURE 1: HOME PAGE

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3.2TESTING PHASE

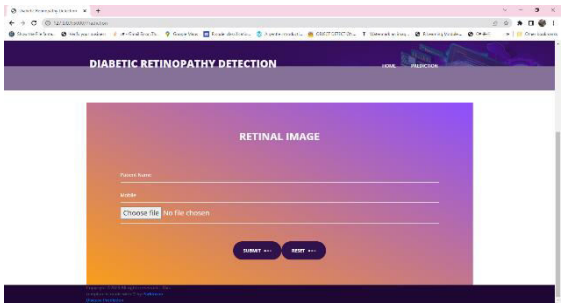

FIGURE 2: TESTING PHASE

3.3IMAGE SELECTION

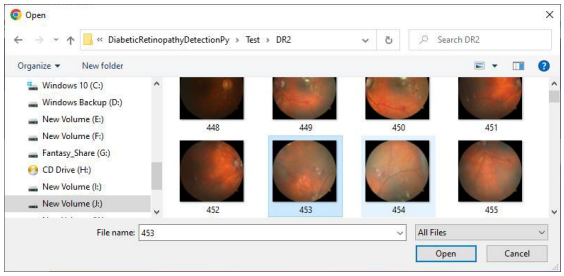

FIGURE.3. IMAGE DELECTION

3.4CLASSIFICATION

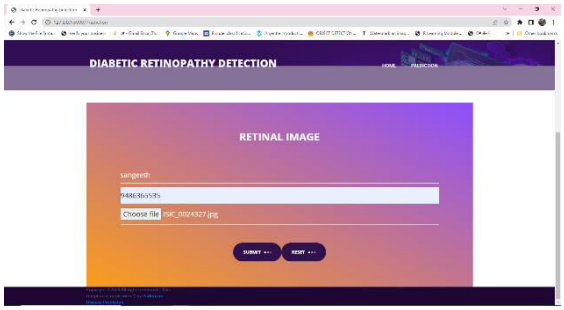

FIGURE 4: CLASSIFICATION

3.5PREDICTION RESULT

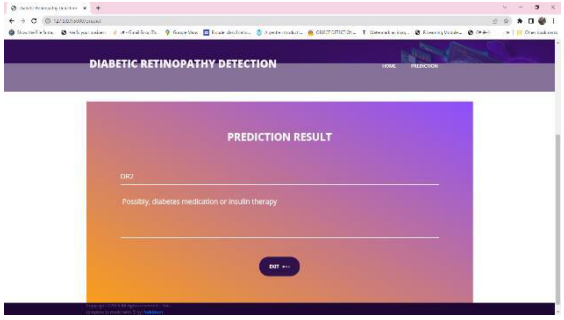

FIGURE 5: PREDICITION RESULT

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IV.METHODOLOGY

4.1SOFTWARESYSTEMCONFIGURATION

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS,Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server : WampServer 2i
- OS : Windows10 bit

4.2HARDWARE SYSTEM CONFIGURATION

- Processor : Intel core processor 2.6.0 GHZ
- RAM : 4 GB
- Hard disk : 160 GB
- Keyboard : Standard keyboard
- Monitor : 15-inch colour

V. USECASE DIAGRAM

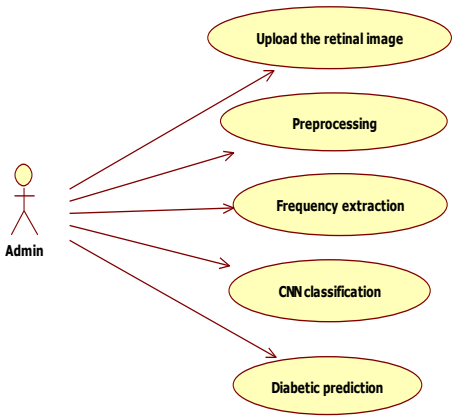

FIGURE6: USECAS EDIAGRAM

VI. CONCLUSION

Diabetic retinopathy cannot be cured. To prevent vision loss, laser analysis (photocoagulation) is usually very effective if it is done before it adversely harms the retina. Provided that the stern destruction of retina has not been done, vision can be improved by the surgical elimination of vitreous gel (vasectomy). In proliferative diabetic retinopathy, at times, an anti-inflammatory medicine or anti-vascular endothelial growth factor medication injection can help in the new blood vessels contraction process. Since symptoms cannot build up until the disease turns into the stern, initial discovery via regular screening is essential. Non-proliferative diabetic retinopathy contains early indications of DR and it is extremely critical to recognize and analyze DR at its initial stages. If a person with diabetes gets legitimate eye mind consistently and treatment when fundamental, DR will once in a while cause all out blindness. Proposed MA detection achieved a good sensitivity and specificity on a per image basis. This is especially meaningful when this method is integrated into a reliable automated system for detecting abnormality in digital fundus images. The proposed candidate filtering process is able to significantly reduce the number of non-MA candidates and sufficiently extract more candidates located close to the vasculature. We take the advantage of a basic CNN method to filter MA candidates' profiles.

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