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Dream-Diabetic Retinopathy Detection System Using Machine Learning

Shubham Singh, Mohit Bhambri and Krishna Pandey

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DREAM: Diabetic Retinopathy Analysis using Machine Learning

Abstract: The Diabetic Retinopathy(D.R) is an eye disease which occurs due to changes in blood vessels of retina because the patient is suffering from diabetes. It is the most common cause of blindness in the world. To avoid blindness caused by diabetes,the detection of diabetic retinopathy as quicly and early as possible is the only option as number of persons becoming blind because of this disease are huge and can't be done much if it is detected at a later stage. In this review paper we have focused on automatic detection of diabetic retinopathy through detecting retinal condition and also classify the stage of the (D.R). We studied various methods available to detect the (D.R). Detecting D.R early so that treatment on diabetic retinopathy can be done and blindness caused by it can be avoided. Decision making for the severity level of disease was performed by collaborating KNN and LBP algorithm which gives accuracy and reduces time of diagnosis of diabetic retinopathy (D.R).
This paper presents review on various technique used for detection and diagnosis of diabetic retinopathy.

Keyword: Retinopathy, LBP, Feature extraction, KNN.

INTRODUCTION

Diabetic Retinopathy eye disease is a primary cause of poor vision and blindness. Approximately 10% of all the patients diagnosed with the diabetes have vision problems. According to clinical tested results, early detection and treatment may prevent more than 95% of the vision problems that are observed in diabetic patients. For the patients suffering from diabetes, regular eye exams will be needed to obtain proper theraputics before it is too late to get any positive results. In biomedical applications, automated retinal image analysis has made the detection of retinal pathologies much more easier for ophthalmologists, whereas conventional methods, such as dilating the eye pupil, takes time and makes the patients suffer for a while. Diabetic Retinopathy (DR) is caused by the damage to blood vessels of the retina. It occurs when high blood glucose, the characteristic of diabetes, has caused massive damage to the the small vessels that provide oxygen and nutrients to the retina. The proteins and lipids getting leaked from the bloodstream into the retina through damaged blood vessels is among the chief causes of this problem. The screening process for diabetic retinopathy involves excessive dilation of pupil which affects the patients' eye. So, automated methods are presented in this paper for detection of retinal damage from the non-dilated colour fundus retinal images using morphological process. Degeneration in macula is caused by the drooping the central portion of the retina, innermost layer of the eye which archives images and also directsthem via the optic nerve from the eye to the brain. Glitches in macula may occur at higher age but they were perceived at the second part of people life (40 – 60 years old). Diseases in macula have so many variations of shapes and textures and sometimes they are very large number of variations present that hard to identify and recognize even by skilled doctors. For such situation,this

algorithm becomes very useful tool not only for doctors but also for researchers. That's why we are trying to build up and optimize such a algorithm which is based on brainy image classification. The image of the retina is acquired using a retinal investigation camera . An image processing module can be used for quality improvements or geometrical transformations. A certain features of image is then habitually extracted, the obtained values being applied to the inputs of the K Nearest Neighbour (KNN) used for imageClassification/recognition.

PROPOSED SYSTEM

In the first stage we tried to gather the dataset of the images. We got the database from the kaggle website.In the dataset we have the collection of images starting from stage 0 to stage 4 .On the basis of the feature of the image the stage of Diabetes Retinopathy is predicted.Then the dataset is used for training and testing purpose where most of the database is used for training purpose and the rest is used for testing purpose.KNN classifier is being used for the training purpose .Then when the training part is done and the machine has learnt to predict the output on giving the specific input. And it predicts it on the basis of the knowledge which the model gets from the dataset and display the specific result. And in the final stage we get the accuracy of our model whether our model is good enough to predict the accurate result.

METHOD& MATERIALS

KNN

In pattern recognition, the k-nearest neighbours algorithm (k-NN) is a non-parametric method used for classification and regression.[1] In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether k-NN is used for classification or regression.The training examples are vectors in a multidimensional feature space, each with a class label. The training phase of the algorithm consists only of storing the feature vectors and class labels of the training samples.

In the classification phase, k is a user-defined constant, and an unlabeled vector (a query or test point) is classified by assigning the label which is most frequent among the k training samples nearest to that query point.

LBP

Local binary patterns (LBP) is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990.[1][2] LBP was first described in 1994.[3][4] It has since been found to be a powerful feature for texture classification; it has further been determined that when LBP is combined with the Histogram of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.[5] A comparison of several improvements of the original LBP in the field of background subtraction was made in 2015 by Silva.

QT DESIGNER

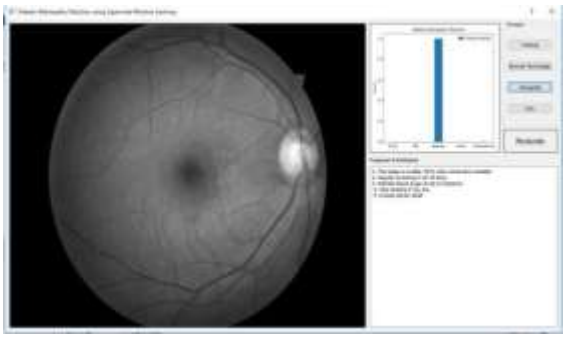
Qt Creator is a cross-platform C++, JavaScript and QML integrated development environment which is part of the SDK for the Qt GUI application development framework.[3] It includes a visual debugger and an integrated GUI layout and forms designer. The editor's features include syntax highlighting and autocompletion. Qt Creator uses the C++ compiler from the GNU Compiler Collection on Linux and FreeBSD. On Windows it can use MinGW or MSVC with the default install and can also use Microsoft Console Debugger when compiled from source code.

OPEN CV

OpenCV (Open Source Computer Vision Library: http://opencv.org) is an open-source BSD-licensed library that includes several hundreds of computer vision algorithms. The document describes the so-called OpenCV 2.x API, which is essentially a C++ API, as opposed to the C-based OpenCV 1.x API (C API is deprecated and not tested with "C" compiler since OpenCV 2.4 releases)

SYSTEM WORKING

[1] We trained the dataset of the images and after few hours when the dataset is trained [2] We can provide Input or we can upload the image of the scanned eye [3]. Then the system will resize the input image in 1000* 1000 resolution so that it can predict only when the dimension are same.[4] After extracting the feature then it will calculate the local binary pattern (lbp) value of the uploaded image and compare it with the known value of Lbp
[5] Using KNN it classify the images and give the result whether it has normal eye ,mild DR , Moderate DR, Severe DR, Proliferative DR respectively.[6] at last on the basis of the stage it even provide the prognosis and medication with a proper bar graph.



ADVANTAGES AND DISADVANTAGES

ADVANTAGES

[1] Detects Diabetic Retinopathy better than humans.
[2] Best for detecting low DR stages.
[3]User friendly interface for the ease of use.
[4]Does not require much resources.

LIMITATION

[1] Not work properly with unproper and poor quality images

FUTURE SCOPE

For any research, there is always room for improvement. Ours is not an exception of that.
We have found some areas where this system can be improvised.

WORK ON MORE CATEGORIES

This can be improvised with a lot more categorized such as according to ages, genders, background studies, working facilities and so on. As an example, A matured man from the IT background has different eye condition that a matured women from Teaching background.

WORK ON MORE CLASSES

As we working on only two classes whether it is good or bad. In future we are going to add more classes like low, medium, severe condition. In this way patients can know about their condition more accurately.

DIFFERENT ALOGORITHM

CRF (Conditional Random Field), maximum entropy and other probabilistic graphical model can also be used to train our dataset in order to improve the algorithm.

MORE ANALYSIS

To achieve more accuracy we could use more dataset. If we use huge amount of dataset, machine will train more and it would give us more accurate prediction and accuracy.

HARDWARE IMPLEMENTATION

A hardware product can be the best solution for patient. So, we are looking forward to build a hardware system where we can use our model to implement results on diabetic patients easily. We can then input the data of the patient and wait for the machine to create a new prescription integrated with Doctor's suggestion.

SOFTWARE IMPLEMENTATION

We can build a website or an android app for this purpose. In this way patient will be able to upload their data into our server and our machine learning software will let them know about their disease through our website whether it is in a good or bad condition.

RESULT

In the proposed method features are extracted from the images by using LBP function which are local binary pattern values and all the these features were given as an input to the KNN classifier. 4000 images were given as an input classifier to train the features. In these 4000 images some of them belongs to 0 category while others belong to 1,2,3, or 4^{th} category.

CONCLUSION

We have tried to construct an ensemble to predict if a patient has diabetic retinopathy using features from retinal photos. For both sets KNN is providing higher accuracy rate for predicting DR. Despite the shortcomings in reaching good performance results, this work provided a means to make use and test machine learning algorithms and try to arrive to ensemble models that would outperform individual learners. It also allowed exploring a little feature selection, feature extraction and ensemble selection problems and experiences the constraints in computation time when looking for possible candidate models in high combinatorial spaces, even for a small dataset as the one used. The structure of our project has been built in such a way that with proper dataset and minor alternation it can work to classify the disease in any number of categories. KNN provides an easy and cheap way to classify diabetic retinopathy stages on scale 0-4 without requirements for high graphic card and high RAM and CPU.The accuracy we achieved from the model is 66.74%. Some of the features which were considered during the design of this system were cost-effective and easy to install when compared to existing systems. The design is flexible, can be modified according to user specifications.

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