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Diabetic Retinopathy (DR) Detection in Fundus Images using Fusion Algorithm

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ABSTRACT: This paper proposes an automatic image processing algorithm that detects if a person has Diabetic Retinopathy using the 'Fusion' technique which shows better results than red and bright lesion detection. This model creates a large set of visual words, which increases with the number of lesions that are identified. Therefore, lesion detectors need to be combined to optimize classification. This paper describes an effective methodology to study any image captured by the fundus camera which can be utilized as a tool for diagnosis and detection of diabetes. The results that are experimentally obtained by applying this algorithm by applying it on the dataset 'KAGGLE' and obtained an accuracy of 96.73%on the respective dataset. The results have been highly satisfactory as well as having very low computational time.

KEYWORDS:Diabetic Retinopathy, Fusion.

I. INTRODUCTION

The advancement in computer technologies and specifically in Artificial Intelligence and Machine Learning has become one of the most important factors in development of medical field and its resources.India is home to 77 million diabetics, second highest in the world. Diabetes mellitus (DM), commonly known as diabetes, is a group of metabolic disorders characterized by a high blood sugar level over a prolonged period of time.Diabetic Retinopathy is complication which causes damages to the blood vessels of the light sensitive tissue of the back of the eye also known as retina. DR has fatal consequences if it is not dealt with for a long period of time, one of them is permanent blindness. One of the early symptoms of DR is microaneurysmsand haemorrhageswhich come underred lesions and cotton wool spots and hard exudates comes under bright lesions. The paper proposes an algorithm to detect Red Lesions for prediction of Diabetic Retinopathy. The automated system for detection of Diabetic Retinopathy uses color fundus images obtained by fundus camera as its input.

II. RELATED WORK

A lot of work has been done in this field and there are various ways for detecting DR. For its detection researchers have worked on various techniques as detecting blood vessels, various lesions such as microaneurysms, exudates, haemorrhages etc. A change in shape and size of blood vessels is a good indicator of detecting DR. In the same way presence of various lesions helps in detecting diabetic retinopathy. Thus various researches have been bifurcated in two ways as of automating blood vessels segmentation and of identifying the lesions. Thus the two most common ways are:

Segmentation of retinal blood vessels, it means to separate the blood vasculature of retina in fundus images from its background. It plays an important role not only in assessing DR which is our primary aim but also other cardiovascular and ophthalmic diseases. Also every person retina blood vasculature is different it can also be used in biometric identification. But this is a difficult task because of low contrast in fundus imaging, variable size vessels, presence of various pathologies as microaneurysms, hard exudates, haemorrhages etc. In terms of machine learning every image pixel is either a part of vessel or non-vessel decision class. And the other types of method are unsupervised and supervised methods. The unsupervised method proposes fuzzy based segmentation by using the red and green channels of the same image so that irregular illumination in fundus image can be corrected. To enhance the contrast between blood vessels and back ground matching filter is used. In final steps vascular tree structure is found with the helpmof fuzzy c-means clustering. In supervised methods make use of training set which is developed by opthalmologists . These are known as ground truths used to guide whole training process.various supervised classifiers are used for this

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purpose like Artificial Neural Networks(ANN), Principal Component Analysis(PCA) for feature selection followed by ANN, K-Nearest Neighbor (K-NN) classifier, Gaussian mixture model, Multiscale Gabor filters along with PCA, Feature-based Ad boost classifier

III. PROPOSED ALGORITHM

A. *Algorithm methodology:*

- Preprocessing step
- Red lesions detection and its features
- Bright lesion detection and its features
- Combining all the features to give fused features
- Extracting fused features for all 2415 images
- Classification using svm classifier
- Dr Severity grading.

B. *Description of the Proposed Algorithm:*

Aim of the proposed algorithm is to detect the diabetic retinopathy from fundus image using proposed algorithm

Step 1: Pre-processing step:

The first step is to convert rgb to ycbcr plane. Extracting the intensity plane and performing adaptive histogram equalization to improve contrast and then followed by median filtering to remove noise in improved contrast image and finally remapping the intensity plane to ycbcr plane.

Step 2: Red lesions detection and its features:

Binirazing the preprocessed image with foreground polarity of sensitivity >0.15 followed by performing closing operation using a disc shape of radius 4. Now the edges of the image are enhanced by using imclearborder() function with 8 connectivity(default) . Now we use bwareafilt() method to identify the connected objects in the edge enhanced image with required area specification .The area considered is >=200. The features of total red lesions are extracted by using regionprops() function. We consider only the red lesions with aspect ratio >=0.15 and Extent >=0.15. The aspect ratio is defined as ratio of major/minor axis .The features included are number, mean area, max area, mean perimeter, solidity

Step 3: Bright lesion detection and its features:

The processed image is Binirized with foreground polarity of sensitivity>0.85 greater than red lesions .Followed by Performing logical “and” operation between binirized image and scaled gray image of pre-processed image.Now closing operation of prior output result is done by using a disc of radius 20 .Now we use bwareafilt() method to identify the connected objects in the edge enhanced image with required area specification .The area considered is >=200. Now the features of bright lesions are extracted. The features included are number, mean area, max area, mean perimeter, solidity

Step 4: Combining all the features to give fused features

The red and bright features are combined to give 10 features for an image which are called fused features. These fused features are given to training model.

Step 5: Classification using Svm classifier:

Multiclass Separate Vector Machine (SVM) has been used for DR detection. SVM is a supervised learning model which use associated learning algorithms to analyze the data for classification and regression. Multiclass SVM assigns labels to instances, which are drawn from a finite set of several elements. A template of SVM classifier is created with kernel function with Gaussian type and standardizes the model with a parameter of 1by using the function

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"templateSVM .The model then takes each image and performs the pre-processing and feature are extracted and addedto the array that is to be used for classification. Like this we extracted features of 2415 fundus images .Now we create 3 trained models using red, bright and fused features respectively by using fitcecoc() method . The accuracy of the respectively models is defined form loss function by default in SVM the loss is hinge loss we can achieve this in matlab by resubloss () method.

Step 6:DR severity grading:

Now we test the trained multiclass models using the testing dataset. For testing we first extract the all 10 features of the test images and these features are given to three trained models respectively by using predict () method.

predict (trained model , features of testing image). DR validation is done in terms of 0-4 grading

IV. PSEUDO CODE

Step 1: Preprocessing of image.
Step 2: Calculate red faetures.
Step 3: calculate bright features.
Step 4: Now calculate the fused features
Step 5: train the model using bright , red , fused features
Step 6: if(trained model!= original ground truth)
Loss = trained model
Step 7: calculate the accuracy from loss factor
Step 8: End.

V. SIMULATION RESULTS

The simulation studies involve the working of the original code and its accuracy. The proposed algorithm is implemented with MATLAB. And the confusionmatrix of the algorithm is observed

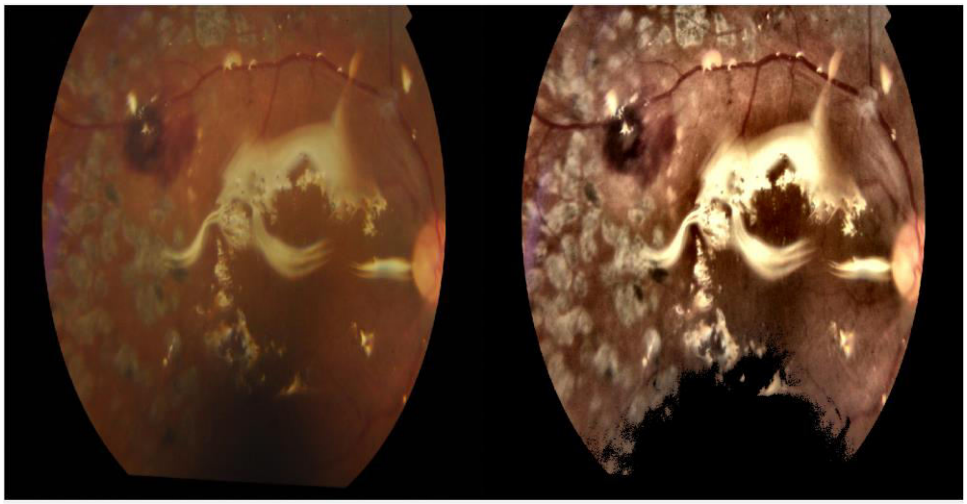

Fig.1.Fundus, pre-processed image

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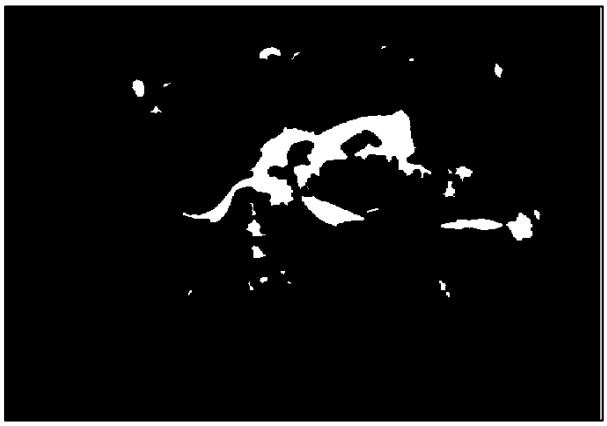

Fig.2 Bright lesions

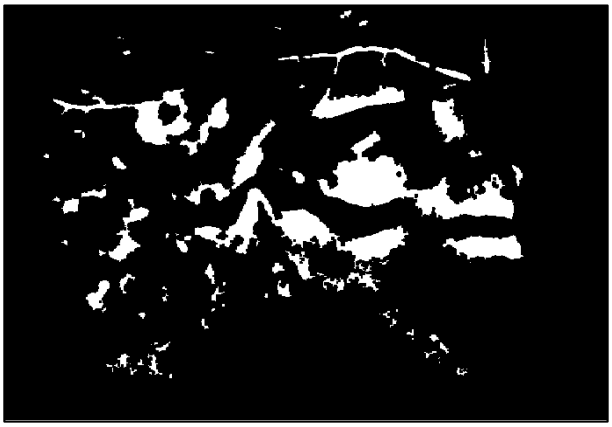

Fig. 3. Red lesions

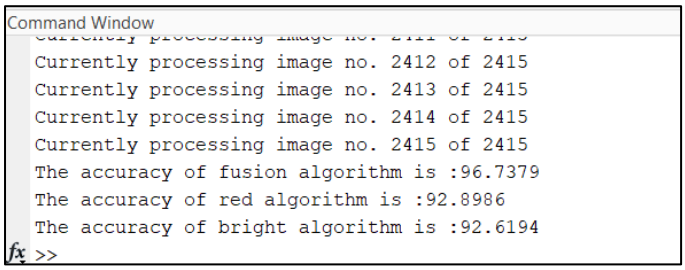

Fig 4. Accuracy of fusion algorithm

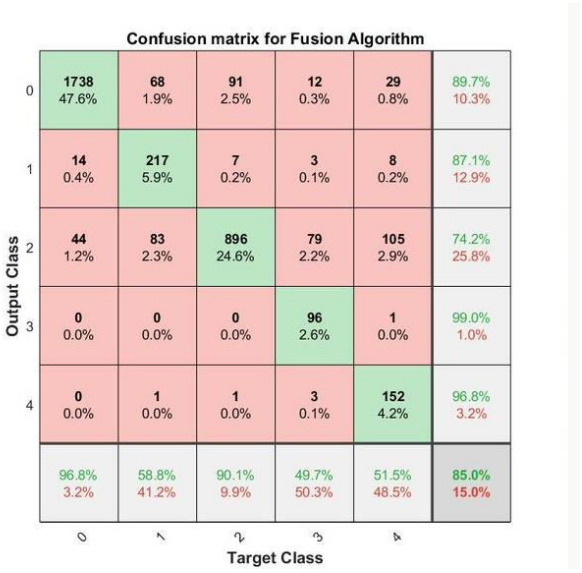

Fig 5Confusion Matrix of fusion algorithm

VI. CONCLUSION AND FUTURE WORK

Detection of DR helps in prevention of blindness. Ophthalmologists judge the stage of DR by visualizing various features like vessels, microaneurysms etc. with the assistance of an ophthalmoscope. Now a day's digital imaging helps tons in automating the method of DR. Regular screening of patients are very necessary for detection of DR stage in order that they will be cured on time. this is often highly required as treatment in some cases is even impossible at the

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later stages of DR However grading of the retinal images by ophthalmologists cost high so automated systems for an equivalent are highly required.

Distinct lesion detection combined with data fusion for distinct lesion performs exceptional. All lesions are identified with accuracy greater than 80%. the simplest result was obtained with SVM using data fusion suggesting that the utilization of outputs of individual detectors during a new classification level are often defined as a strong framework to spot the presence of DR. Fusion method proves to be the simplest out of all the techniques used for predicting the diabetic retinopathy using fundus images

Artificial Neural Networks have already been applied widely in medical imaging, but special kind of neural networks known as Deep Networks especially CNN (Convolution Neural Networks) are producing outstanding results in automatic features extraction and classification. So the above proposed algorithm can be directly implememnted using

REFERENCES

1. K. Zuiderveld, “Contrast limited adaptive histogram equalization,” in *Graphics Gems*, pp. 474–485,1994.
2. J. Alex Stark, "Adaptive Image Contrast Enhancement Using Generalizations of Histogram Equalization", IEEE Transactions On Image Processing, VOL. 9, NO. 5, MAY 2000.
3. Aliaa A AYoussif, Atef Z. Ghalwash, and Amr S. Ghoneim, "A Comparative Evaluation of Preprocessing Methods for Automatic Detection of Retinal Anatomy", Proceedings of the Fifth International Conference on Informatics and Systems (INFOS07), Cairo-Egypt, March 24-26,2007.
4. Yong Yang, Yuan Zhou, Shuying Huang, NiniRao, Zhijun Fang and Jucheng Yang, "Effective Combined Algorithms for Retinal Blood Vessels Extraction", Advances in information Sciences and Service Sciences(AISS) Volume4, Number3, February 2012 doi: 10.4156 AISS.VOL. 4. Issue3.32.
5. R. Pajak, "Use of Two-Dimensional Matched Filters for Estimating a Length of Blood Vessels Newly Created in Angiogenesis Process", OptoElectronics Review 11(3), 237241 (2003).
6. ThitipornChanwimaluang and Guoliang Fan, "An Efficient Blood Vessel Detection Algorithm for Retinal Images Using Local Entropy Thresholding", EEE Trans. Medical imaging, VOL. 17, no. 4, August1998.
7. Ramish B. Kawadiwale and Vijay M. Mane, "Evaluation of Algorithm for Segmentation of Retinal Blood Vessels," International Conference on Pervasive Computing, January 2015, inpress.
8. FangyanNie, Chao Gao, YongcaiGuo and Min Gan, 'TwoDimensional Minimum Local Cross-Entropy Thresholding Based on Co-occurrence Matrix", Computers and Electrical Engineering 37 (2011) 757767.
9. Ahmed S Abutaleb, "Automatic Thresholding of Gray-Level Pictures using Two- Dimensional Entropy", Computer Vision, Graphics, And Image Processing 47, 22-32 (1989).
10. Soju George and BhailalLimbasiya, "A Review Paper on Detection and Extraction of Blood Vessels", Microaneurysms and Exudates from Fundus Images, International Journal of ScientificAndTechnologyResearchVOL.2,IssueII,November2013Issn22778616.
11. R.J. Winder, PJ. Morrow, LN. McRitchie, J.R. Bailie and P.M. Hart, "Algorithms for Digital Image Processing in Diabetic Retinopathy", Computerized Medical Imaging and Graphics 33 (2009) 608622.

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