YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING, NAGPUR.
(An autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

"Development of an algorithm for detection of Hemorrhages in retinal images"

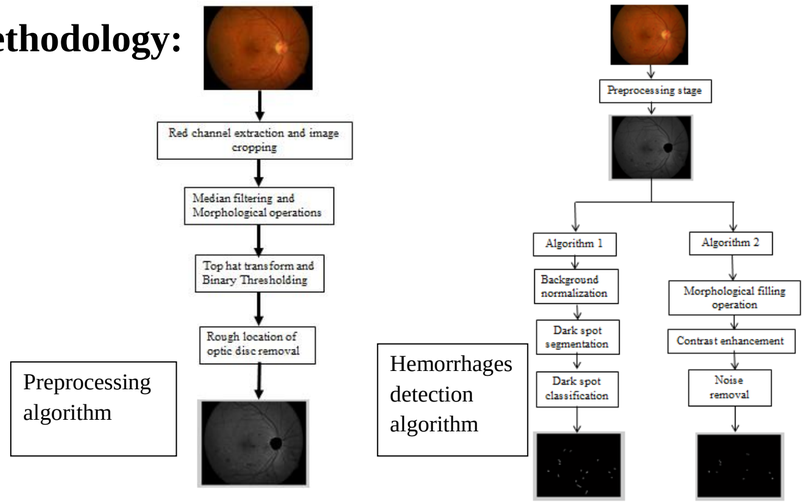
By- N. D. Rehpade

Abstract: Diabetic retinopathy is a common complication of diabetes. The system extracts retinal feature i.e. optic disc for easier segmentation of dark spot lesions in the fundus images. Hemorrhage candidate are detected with two algorithms. In the first algorithm Background normalization, H maxima Transform, multilevel thresholding and Feature extraction are proposed for detection Hemorrhages in retinal images. The second algorithm proposed for dark lesion i.e. Hemorrhages detection using morphological filling operation, binary thresholding and noise removal. With the evaluation result, it is concluded that algorithm 2 is better than algorithm 1 for successful detection of Hemorrhages.

Introduction:

Diabetic retinopathy (DR) is one of the well-known and commonest eye diseases, affecting patients with diabetes mellitus. Signs of diabetic retinopathy include red lesions such as Microaneurysms (MA), intraretinal hemorrhages, and bright lesions such as exudates. Red lesions are the first clinically observable lesions indicating diabetic retinopathy. Therefore, their detection is critical for a prescreening system.Hemorrhages are larger irregular 'dot' configuration therefore usually they have the same color as blood vessels. Due to non-uniform illumination and contrast across retinal image, it becomes difficult to detect Hemorrhages precisely. The objective is to develop MATLAB based image processing algorithms for detection of hemorrhages in retinal images. Thus, the performance of this algorithm shows that it has an appreciable amount of potential in helping ophthalmologists.

Methodology:



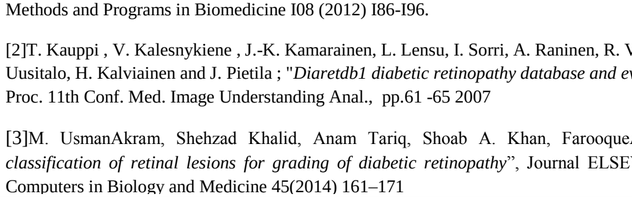
Evaluation Results

Evaluation result for algorithm1

	FPR	FNR	WER	
Hemorrhages	1	0	0.0909	R=0.1
	0.1837	0.5000	0.3418	R=1
	0	0.9500	0.0864	R=10

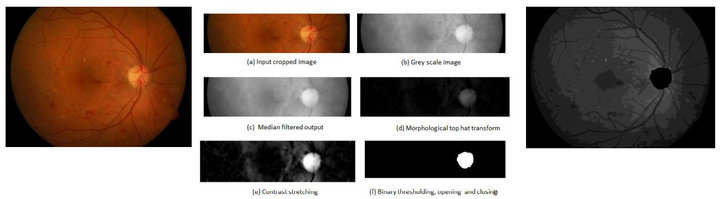
Evaluation result for algorithm2

	FPR	FNR	WER	
Hemorrhages	0.6327	0.05	0.1030	R=0.1
	0.1429	0.3500	0.2464	R=1
	0	0.9500	0.0864	R=10



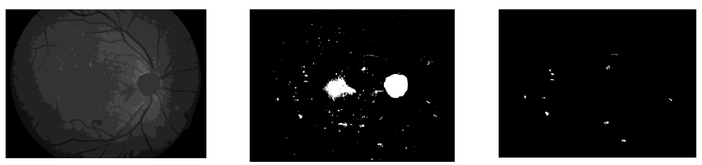
ROC (TPR vs. FNR)

Preprocessing results:



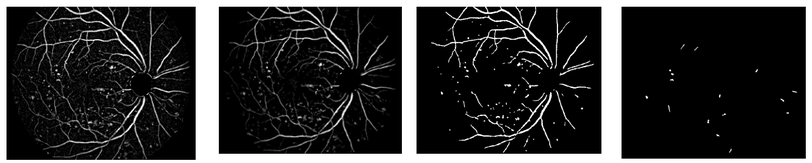
(a) Input image from DIARETDB1[2] (b) Preprocessing steps (c) Optic Disc removal

Hemorrhages detection using Algorithm 2:



(a) Morphologically filled image of preprocessed image (b) Contrast enhanced image (c) Hemorrhage detection after noise removal

Hemorrhages detection using Algorithm 1:



(a)Background normalization to preprocessed image (b) H maxima Transform (c) Multilevel thresholding (d) Hemorrhage detection using Feature extraction

Algorithm applied on clinical database:

(a) Input image from clinical database (b) Hemorrhage detected using algorithm 1 (c) Hemorrhage detected using algorithm 2

Conclusion and Future scope:

Conclusion:

In this study, a new algorithm for automatically detecting hemorrhages in the retinal images is presented. We applied our algorithm to 69 fundus images from DIARETDB1 database and images from clinical database. With the evaluation tools it is demonstrated that the algorithm 2 detected dark lesion with higher accuracy and reliability than algorithm 1. Therefore our system will help in improving diagnostic accuracy as well as in reducing the workload of ophthalmologists in the future.

Future scope:

The severity level grading of DR (Diabetic Retinopathy) may be given by analyzing the other dark lesion in retinal images.Several other retinal complications are also to be incorporated into this work in order to complete the whole DR diagnosis.

References:

[1]Marwan D. Saleh, C. Eswaran, "*An automated decision-support system for non-proliferative diabetic retinopathy disease based on MAs and HAs detection*", Journal ELSEVIER (Science Direct), Computer Methods and Programs in Biomedicine I08 (2012) I86-I96.

[2]T. Kauppi , V. Kalesnykiene , J.-K. Kamarainen, L. Lensu, I. Sorri, A. Raninen, R. Voutilainen, H. Uusitalo, H. Kalviainen and J. Pietila ; "*Diaretdb1 diabetic retinopathy database and evaluation protocol*", Proc. 11th Conf. Med. Image Understanding Anal., pp.61 -65 2007

[3]M. UsmanAkram, Shehzad Khalid, Anam Tariq, Shoab A. Khan, FarooqueAzam, "*Detection and classification of retinal lesions for grading of diabetic retinopathy*", Journal ELSEVIER (Science Direct), Computers in Biology and Medicine 45(2014) 161–171