

# Localization of Optic Disc using HRF database

Deepali D. Rathod Dept of CS and IT, Dr. B. A. M. University, Aurangabad MS (India) <a href="mailto:rathoddeepali2@gmail.com">rathoddeepali2@gmail.com</a>	Ramesh R. Manza Dept of CS and IT, Dr. B. A. M. University, Aurangabad MS (India) <a href="mailto:manzaramesh@gmail.com">manzaramesh@gmail.com</a>	Yogesh M. Rajput Dept of CS and IT, Dr. B. A. M. University, Aurangabad MS (India) <a href="mailto:yogesh.rajput128@gmail.com">yogesh.rajput128@gmail.com</a>	Manjiri B. Patwari Institute of Management Studies & Information Technology, Vivekana nd College Campus, Aurangabad MS (India) <a href="mailto:Manjiri.patwari@gmail.com">Manjiri.patwari@gmail.com</a>	Manoj Saswade Director, Saswade Eye Clinic” Aurangabad MS (India) <a href="mailto:nehad35@gmail.com">nehad35@gmail.com</a>	Neha Deshpande Director, Guruprasad Netra Rugnalaya pvt. Ltd, Aurangabad MS (India) <a href="mailto:prachims@yahoo.com">prachims@yahoo.com</a>
--	---	---	---	---	--

**Abstract-** Optic disc is the raised part on the retina at the entry part of optic nerve. It is yellow in color and it sends the signal towards brain. Optic disc is the center point of retina. It is origin where blood vessels are grown. For optic disc localization two steps have been performed, firstly in preprocessing steps we have convert RGB image in to Green channel image then histogram equalization for enhancing the image quality. Then applied speed up robust feature for the localization of optic disc. All the operations are done on the green channel of the fundus image, because green channel shows higher intensity as compare to red and blue respectively. For this work we have used High Resolution Fundus image database (HRF Database). The database is provided by the Pattern Recognition Lab (CS5), the Department of Ophthalmology, Friedrich-Alexander University Erlangen-Nuremberg (Germany), and the Brno University of Technology, Faculty of Electrical Engineering and Communication, Department of Biomedical Engineering, Brno (Czech Republic). There are total 45 images we have tested 15 images are of Healthy patients, 15 images are of glaucomatous patients, and 15 are of Diabetic retinopathy patients. For the evaluation of result we have used Receiver Operating Characteristic curve (ROC). This algorithm achieves 97 % accuracy.

**Keywords:** Optic Disc, Speed up robust feature, ROC

## I. INTRODUCTION

Optic disc is the raised part on the retina at the entry part of optic nerve. Optic Disc is yellow in color and it sends the signal towards brain. It is the center point of retina. Optic disc is origin where blood vessels are grown. We have use two steps for the localization of

optic disc. Firstly we have converted RGB image to green channel. Only green channel of RGB image is utilized because green channel has higher intensity as compared to red and blue channel respectively. Then Histogram equalization is used for enhancing the image quality. After the preprocessing is done we have used speed up robust feature for localization of optic disc. For this work we have used High Resolution Fundus image database (HRF Database). The database is provided by the Pattern Recognition Lab (CS5), the Department of Ophthalmology, Friedrich-Alexander University Erlangen-Nuremberg (Germany), and the Brno University of Technology, Faculty of Electrical Engineering and Communication, Department of Biomedical Engineering, Brno (Czech Republic). There are total 45 images we have tested 15 images are of Healthy patients, 15 images are of glaucomatous patients, and 15 are of Diabetic retinopathy patients. For the evaluation of result we have used Receiver Operating Characteristic curve (ROC).

## II. METHOD

Overview of the proposed method is that, we have use two steps for the localization of optic disc. In preprocessing step we have converted RGB image to green channel. Only green channel of RGB image is utilized because green channel has higher intensity as compared to red and blue channel respectively. Then Histogram equalization is used for enhancing the image quality. After the preprocessing is done we have used speed up robust feature for localization of optic disc. Firstly we have done the process of taking green

channel from RGB image; the formula for green channel is as follows:

$$g = \frac{G}{(R + G + B)} \quad (1)$$

Here g is a Green channel and R, G and B are Red, Green and Blue respectively.

After the Green channel we have applied histogram equalization for image enhancement.

$$h(v) = \text{round} \left( \frac{\text{cdf}(v) - \text{cdf}_{\min}}{(M \times N) - \text{cdf}_{\min}} \times (L - 1) \right)$$

Where,  $\text{cdf}_{\min}$  is the minimum value of the cumulative distribution function,  $M * N$  gives the image's number of pixels  $L$  is the number of grey levels. With the help of this histogram equalization we can enhance the image.

After the preprocessing we have use speed up robust feature

$$I_{\Sigma}(x, y) = \sum_{i=0}^{x} \sum_{j=0}^{y} I(x, y)$$

$I$  is the input image and a point  $(x; y)$  the integral image is calculated by the sum of the values between the point and the origin. This function is used for localizing the Optic Disc.

### III.RESULT

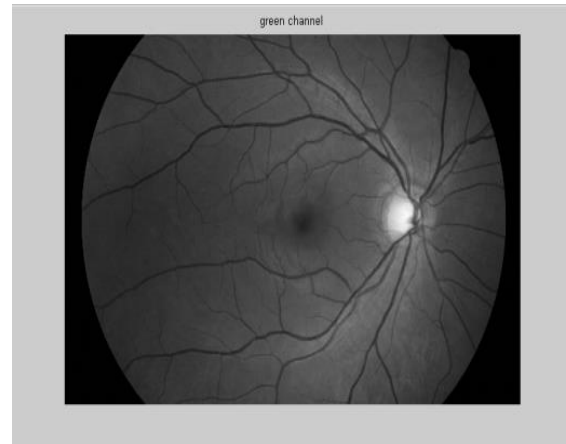
We have done all the work in MATLAB 2013a. For the evaluation of result we have used Receiver Operating Characteristic (ROC) curve, and we have got the 97% result. Evaluation method is done on the HRF database. Total images we have used for evaluation are 45 images. 15 images are of Healthy patients, 15 images are of glaucomatous patients, and 15 are of Diabetic retinopathy patients. The evaluation method is done by the following terms

- 1) Sensitivity= True Positive/(True Positive + False Negative)
- 2) Specificity= True Negative/(True Negative + False Positive)
- 3) Accuracy = True Positive + True Negative/(True Positive + False Negative + True Negative + False Positive)

### IV.EXPERIMENTAL WORK



**Figure 1: Original image**



**Figure 2: Green Channel**



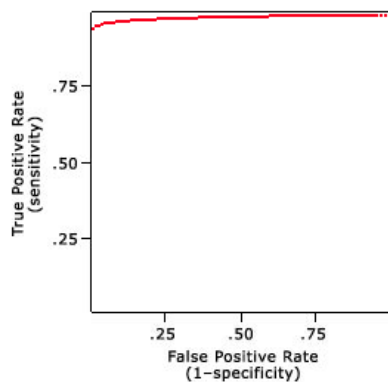
**Figure 3: Enhanced Image**



**Figure 4: Optic Disc localization**

The result of the ROC curve is as follows

ROC Curve for  $y = 0.01\ln(x) + 1$   
Area under curve = 0.9902



**Figure 5: ROC Curve**

This algorithm achieve 97 % Sensitivity, Specificity is 0% and accuracy is 97%.

## V.DISCUSSION

We have done the localization of optic disc in MATLAB 2013a. We have use two steps for the localization of optic disc. In preprocessing step we have converted RGB image to green channel. Only green channel of RGB image is utilized because green channel has higher intensity as compared to red and blue channel respectively. Then Histogram equalization is used for enhancing the image quality, and then speed up robust feature is used for localization of optic disc. For this work we have used

High Resolution Fundus image database (HRF Database) .The database is provided by the Pattern Recognition Lab (CS5), the Department of Ophthalmology, Friedrich-Alexander University Erlangen-Nuremberg (Germany), and the Brno University of Technology, Faculty of Electrical Engineering and Communication, Department of Biomedical Engineering, Brno (Czech Republic).For Evaluation ROC curve is used and we got 97 % accuracy in result.

## VI.CONCLUSION

In this work we have done optic disc localization on various images. For enhancement of optic disc we have applied histogram equalization function on the green channel of fundus image. For localization of optic disc we have used Speeded-Up Robust Features function and we have got 97 % accuracy.97% sensitivity and 0% specificity.

## VII.ACKNOWLEDGEMENT

We have used the database which is provided by the Pattern Recognition Lab (CS5), the Department of Ophthalmology, Friedrich-Alexander University Erlangen-Nuremberg (Germany), and the Brno University of Technology, Faculty of Electrical Engineering and Communication, Department of Biomedical Engineering, Brno (Czech Republic). And we are thankful to University Grant Commission (UGC) for providing us a financial support for the Major Research Project entitled “Development of Color Image Segmentation and Filtering Techniques for Early Detection of Diabetic Retinopathy” F. No.: 41 – 651/2012 (SR) also we are thankful to DST for providing us a financial support for the major research project entitled “Development of multi resolution analysis techniques for early detection of non-proliferative diabetic retinopathy without using angiography” F.No. SERB/F/2294/2013-14.

## VIII.REFERENCES

- [1] Jan Odstrcilik, Radim Kolar, Attila Budai, Joachim Hornegger, Jiri Jan, Jiri Gazarek, Tomas Kubena, Pavel Cernosek, Ondrej Svoboda, Elli Angelopoulou, „Retinal vessel segmentation by improved matched filtering: evaluation on a new high-resolution fundus image database,“ IET Image Processing, Volume 7, Issue 4, June 2013, pp.373-383.DOI: 10.1049/iet-ipr.2012.0455, Print ISSN 1751-9659, Online ISSN 1751-9667

- [2] Yogesh M. Rajput, Ramesh R. Manza, Manjiri B. Patwari, Neha Deshpande, "Retinal Optic Disc Detection Using Speed Up Robust Features", National Conference on Computer & Management Science [CMS-13], April 25-26, 2013, Radhai Mahavidyalaya, Auarnghabad-431003(MS India).
- [3] T. Walter and J. C. Klein, "Segmentation of color fundus images of the human retina: Detection of the optic disc and the vascular tree using morphological techniques," in *Medical Data Analysis*, J. Crespo, V. Maojo, and F. Martin, Eds. Berlin, Germany: Springer-Verlag, 2001, pp. 282–287. ser. Lecture Notes in Computer Science
- [4] Youssif AAHAR, Ghalwash AZ, Ghoneim AASAR "Optic disc detection from normalized digital fundus images by means of a vessels' direction matched filter", IEEE Trans Med Imag 27(1):11–18, 2008
- [5] <http://www.vassarstats.net/roc1.html>
- [6] Rangaraj M. Rangayyan, Xiaolu Zhu, Fábio J. Ayres, and Anna L. Ells "Detection of the Optic Nerve Head in Fundus Images of the Retina with Gabor Filters and Phase Portrait Analysis" Journal of Digital Imaging, Vol 23, No 4 (August), 2010: pp 438Y453
- [7] Manjiri B. Patwari, Dr. Ramesh R. Manza, Yogesh M. Rajput, Dr. Manoj Saswade, Dr. Neha K. Deshpande, Sangramsing N. Kayte, "Calculation of Retinal Blood vessels Tortuosity by using Image processing Techniques and Statistical Techniques", 2nd International Conference on System Modeling & Advancement in Research Trends (SMART) Department of Computer Applications, TMIMT ,Teerthanker Mahaveer University, published in Academic Journal online (AJO), International Journal of Trends in Computer Science, ISSN: 7462 – 8452, Volume 2, Issue 11, 2013.
- [8] Manjiri B. Patwari, Ramesh R. Manza, Yogesh M. Rajput, Manoj Saswade, Neha K. Deshpande, "Detection and Counting the Microaneurysms using Image Processing Techniques International Journal of Applied Information Systems (IJAIS) – 6(5):11-17, November 2013. Published by Foundation of Computer Science, New York, USA., ISSN : 2249-0868, Vol. 6 Number 5, October - 2013, Impact Factor 1.187
- [9] Fischer JG, Mewes H, Hopp HH, Schubert R. Analysis of pressurized resistance vessel diameter changes with a low cost digital image processing device. *Comput Meth Prog Bio.* 1996;50:23–30.
- [10] Manjiri B. Patwari, Dr. Ramesh R. Manza, Yogesh M. Rajput, Dr. Manoj Saswade, Dr. Neha K. Deshpande, "Automatic Detection of Retinal Venous Beading and Tortuosity by using Image Processing Techniques", International Journal in Computer Application(IJCA), February 2014, ISBN : 973-93-80880-06-7, Impact Factor 0.821
- [11] Manjiri B. Patwari, Dr. Ramesh R. Manza, Dr. Manoj Saswade and Dr. Neha Deshpande, "A Critical Review of Expert Systems for Detection and Diagnosis of Diabetic Retinopathy", Ciit International Journal of Fuzzy Systems, February 2012, DOI: FS022012001 ISSN 0974-9721, 0974-9608. (IF 0.441).
- [12] Yogesh M. Rajput, Ramesh R. Manza, Manjiri B. Patwari, Neha Deshpande, "Retinal Blood Vessels Extraction Using 2D Median Filter", Third National Conference on Advances in Computing(NCAC-2013), 5th to 6th March 2013, School of Computer Sciences, North Maharashtra University, Jalgaon-425001 (MS) India.
- [13] Manjiri B. Patwari, Ramesh R. Manza, Yogesh M. Rajput, Manoj Saswade, Neha K. Deshpande, "Review on Detection and Classification of Diabetic Retinopathy Lesions Using Image Processing Techniques", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 2 Issue 10, October - 2013, Impact Factor 1.76
- [14] Manjiri B. Patwari, Ramesh R. Manza, Yogesh M. Rajput, Neha K. Deshpande, Manoj Saswade, "Extraction of the Retinal Blood Vessels and Detection of the Bifurcation Points", International Journal in Computer Application(IJCA), September 18, 2013. ISBN : 973-93-80877-61-7, Impact Factor 0.821

