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Fundus Images Based on Hybrid Neighbourhood Estimator Before Filling with Fuzzy Based Filtering

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Abstract - Segmentation means allocating tag to every pixel of image so that pixels having same label share definite visual traits. Automatic segmentation of fundus image plays an important role in detection of eye diseases. Accurate vessel segmentation in retinal images is an important and difficult task. Detection is made more challenging in pathological images with the presence of exudates and other abnormalities. Several methods of retinal vessel segmentation are proposed which can detect the exudates in fundus images in more promising manner. In this paper proposed a hybrid Neighborhood estimator before filling with fuzzy based filtering segmentation which enables us to segment vessels even in low intensity of images.

Keywords - Vessel segmentation, Neighborhood Estimator before Filling (NEBF), Fuzzy based Filtering

I. INTRODUCTION

A. Segmentation

In Image Processing, segmentation is a significant part. The whole image is segmented into many segments so that it becomes more significant for more processing. These segments are done on unique part of interest in this report the region of fascination is retinal vessel within the area. The outcome of image segmentation could be the number of segments that give the whole image.

Application area of Image Segmentation

1) In medical research to discover tumors, for the examination of various disorders in a person's eye by Automatic segmentation of retina images, for the diagnosis of diabetic retinopathy etc.

2) For recognition such as fingerprint detection, face detection and iris detection.

3) To locate objects in various satellite images like roads, crops, forests etc.

Different ways of image segmentation can be found but as compared to different images segmentation of retinal blood vessel is a complex method as there are divisions and complicated topologies in fundus image. Correct segmentation of the divisions is quite necessary. Artifacts are also there in images due to difference in illumination. Also there are vessels of different diameters that must be properly segmented. Noisy background of the picture also harms the precision of the image. So segmentation of fundus image to obtain the vessel portion is no easy task. To attain great results different segmentation techniques are used.

B. Retinal Vessel Segmentation in Fundus Images

Now a day there is a great increase in number of people which are suffering from eye related disorders. Many common eye related diseases are glaucoma, diabetic retinopathy, and age-related macular degeneration. Because of diseases the chances of loss of perspective and blindness are very high [1]. But early diagnosis of these problems can decrease the chances of blindness and vision loss. With the innovation of new methods and advancement of technology different strategies are available to get shade medical images. Images are taken of different parts of human body such as for instance bones, brain, heart, kidney, retina etc. [2]

Then different processing techniques are used for the evaluation of the images. These medical images are very helpful in analysis and treatment of numerous diseases. Fundus image represents a significant position in verification of eye as fundus has high sensitivity to vascular diseases. From the image of fundus analysis of the disorders is quite easy. Retina is an important part of a human eye and is an indicator of eye disorders. Retinal vessels have essential information regarding the situation of patient. From the fundus images retinal body vessels are segmented by using image segmentation techniques [3]. So our issue is always to segment image of retina in this way so that vessel part and non-vessel portions are divided from each other. Then from these segmented vessels automatic diagnosis of various diseases become easy. So our issue is to create an accurate approach to retinal vessel segmentation [4].

C. Automatic Segmentation

Automatic segmentation strategy has been predicated on artificial intelligence (AI) centered techniques. This involves supervised and unsupervised segmentation. Supervised

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segmentation involves a training data for manually segmented the image and requires the ground truth data. In this paper we use automated supervised segmentation. Supervised method uses the ground truth data for classifying each image pixel.

D. Fuzzy Based Filtering

The idea driving this filtering is usually to normal your pixel using additional pixel ideals by reviewing the neighborhood, however simultaneously to address critical image structures just like edges. The main priority from the recommended filtering is usually to distinguish between regional variations as a result of noises in addition to as a result of image structure. Your order to accomplish this, each pixel all of us derive a price in which communicates their education where the mixture within a particular path is usually small. This kind of a price is usually derived each path equivalent on the nearby pixels from the refined pixel by way of fluffy rule. The further engineering from the filtering is then in line with the watching with interest which a modest fluffy mixture almost certainly is usually the result of noises, whilst a sizable fluffy mixture almost certainly is usually the result of a footing while in the image. Therefore, each path it will use not one but two fluffy regulations in which carry this specific watching with interest note, understanding that decide this contribution from the nearby pixel values. The consequence of these regulations is usually de fuzzified plus a "a static correction term" is usually purchased for any refined pixel importance.

E. Neighbourhood Estimator Before Filling (NEBF)

Feature Extraction is the 'point of interest' for image. When the input data is too large to proceed and it is suspected to be repetitive it could be converted into reduced pair of features. This process is called feature extraction. In image processing a certain feature extraction algorithm are accustomed to detect and isolate different ideal portion or shapes (feature) of an image.

Vessels, optic disk and fovea are used in many applications. From retinal images the extraction of exudates may be difficult and the two factors concerned would be the unequal background illumination and improper retinal image contrast. Improper contrast is due to various vessels have various contrasts. Therefore, our intention is to proposed an algorithm for the removal of exudates in blood vessels from the retinal image. So we propose an algorithm called NEBF is definitely an impainting filtration which is used to impaint the exudates.

The residue of the paper contains some sections which are as follows. Section II described the related work. Section III organized the Proposed Methodology. Section IV explained the Experimental Evaluation Material Used. Section V represents Performance Measures.

II. RELATED WORK

Akram et al. (2013) [9] proposed a technique of retinal blood vessels segmentation that utilize the pixel intensity information of both green and red channels of image. That intensity explanation is applied to adjust for non-uniform illumination. To boost the contrast of vessels when compared with background matched filter is used. Then vessel segmentation is obtained by using spatially measured fuzzy c indicates clustering based thresholding.

Pereira et al. (2015) [10] features the utilization of Possibilistic fuzzy c-means Clustering for segmentation of retinal blood vessels from fundus image. Possibilistic fuzzy c-means (PFCM) clustering optimised by way cuckoo search technique can be used to get rid of the constraints of the prior fuzzy c-means method. This method is extremely correct and effective against the noise.

Shradha Mirajkar (2013) [11] new algorithm to find out the body vessels successfully has been proposed. The original advancement of the image is carried out using Adaptive Histogram Equalization. This increased image is useful for the extraction of the body vessels. The vessel extraction is completed predicated on thresholding strategy and the Kirsch's templates. It involves spatial filter of the image utilizing the themes in eight various orientations.

Roychowdhury et al. (2014) [12] proposed a method for segmenting the retinal vessel from the fundus images using line operators. A line detector is used on green channel of the fundus image. Then according to average grey level along lines that have 15 pixels and pass at 12 orientations from target pixel, linear features are calculated. Two different segmentation methods are used. Firstly basic line detector is employed and threshold is applied to its response to acquire unsupervised pixel classification. Secondly for the supervised classification a support vector machine is used for constructing feature vector. For this purpose, two orthogonal line detector is used. So retinal vessel segmentation is achieved by using two different methods.

Saleh et al. (2014) [13] proposed a method of retinal blood vessel segmentation from fundus image. Pixel classification is done using seven dimensional feature vectors that is extracted from the fundus image. Neural Network scheme is used for classification that will determine whether a pixel belongs to vessel or non-vessel class. Then in post processing stage, gaps in pixels that are detected in retinal vessels are filled and false pixel vessels are removed.

III. PROPOSED METHODOLOGY

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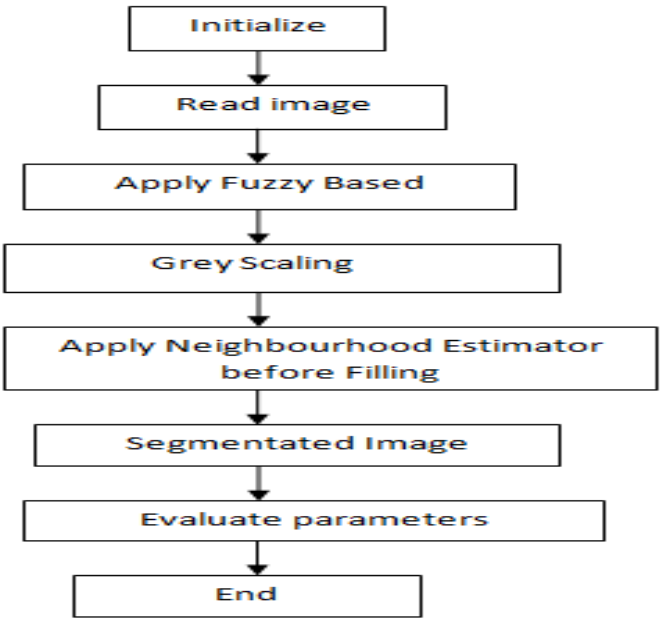
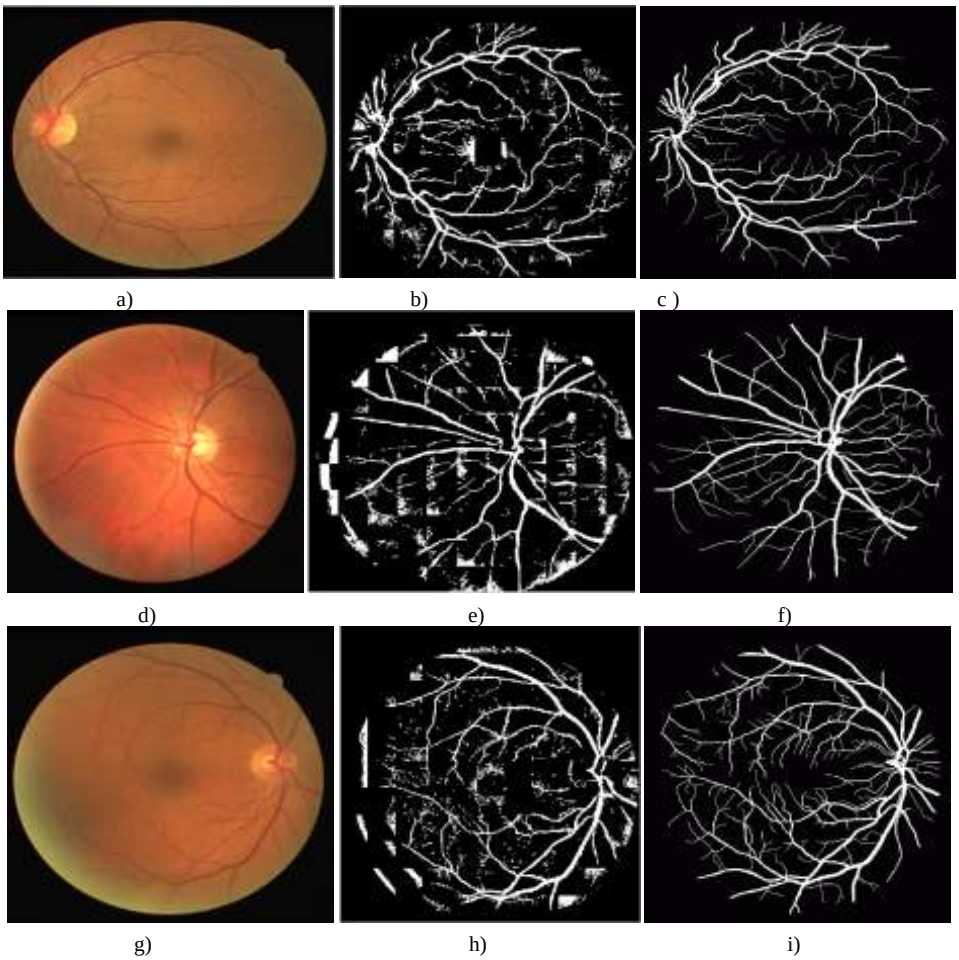


IV. EXPERIMENTAL EVALUATION MATERIAL USED

To find the efficiency of the vessel segmentation method described next part, openly accessible DRIVE dataset is used: The DRIVE (Digital Retinal Images for Vessel Extraction) database includes 40 color fundus images and also their ground truth images. All images in DRIVE database are digitized employing a Cannon CR5 non-mydriatic 3CCD camera with a 45 level field of view. Every image is grabbed using 24-bits per pixel at the image measurement of 565×584 [8].



a) b) c)

d) e) f)

g) h) i)

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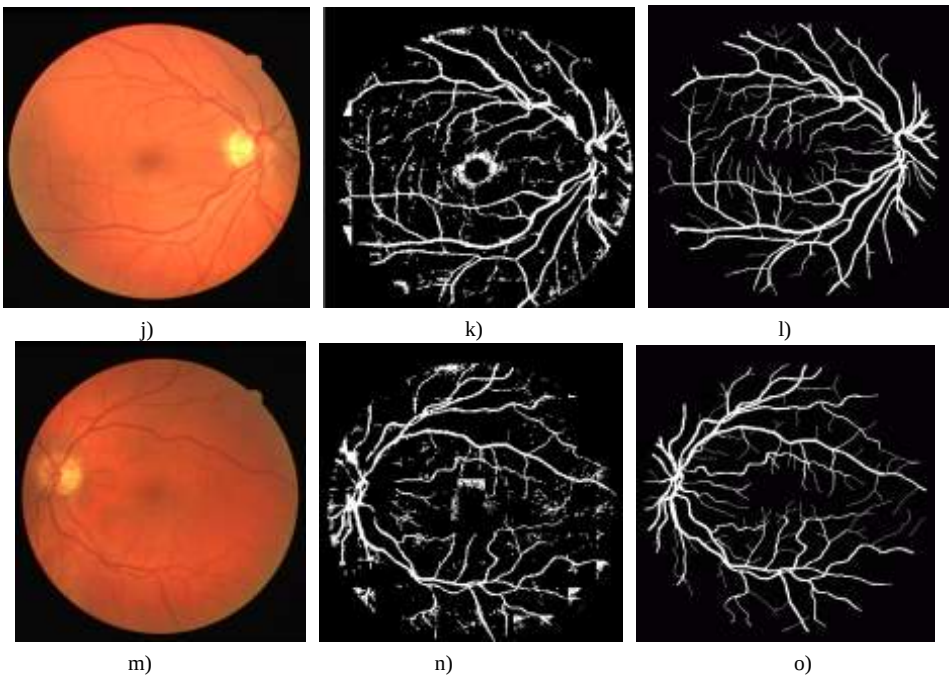

Figure 1. a), d), g), j), m) shows Original Fundus image; (b), (e), (h), (k), (n) image after applying Morphological operation; (c), (f), (i), (l), (o) segmented image after applying fuzzy based filtering with NEBF

V. PERFORMANCE MEASURES

In order to evaluate the proposed method, a drive dataset is used with parameters Sensitivity (Se), F-measure, Positive Predictive Value (PPV).

Sensitivity is also known as the correct positive rate or likelihood of detection. Sensitivity measures the amount of positives that are properly identified. Sensitivity need to be maximized; so the main objective is to increase the Sensitivity as much as possible. The proposed algorithm is showing the better results than the available methods as Sensitivity is giving higher amount of positives in every case.

$$\text{Se} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

Table 1. Sensitivity

Image Number	Existing(NEBF)	Proposed(NEBF+ fuzzy filtering)
1	0.9175	0.9574
2	0.9073	0.9575
3	0.9170	0.9627
4	0.9188	0.9609
5	0.9217	0.9644
6	0.9108	0.9511
7	0.9314	0.9675
8	0.9364	0.9652
9	0.9216	0.9552
10	0.9309	0.9631

PPV is also called True Positive or Precision. PPV measures the ratio of correctly classified vessel pixels. PPV need to be maximized; so the main objective is to increase the PPV as much as possible. The proposed algorithm is showing the better results than the available methods as PPV is giving higher amount of positives in every case.

$$\text{PPV} = \frac{\text{TP}}{\text{TP} + \text{FP}}$$

Table 2. PPV

Image Number	Existing(NEBF)	Proposed(NEBF+ fuzzy filtering)
1	0.9175	0.9574
2	0.9073	0.9575
3	0.9170	0.9627
4	0.9188	0.9609
5	0.9217	0.9644
6	0.9108	0.9511
7	0.9314	0.9675
8	0.9364	0.9652
9	0.9216	0.9552
10	0.9309	0.9631

F-measure views equally the precision p and the remember r. p is how many appropriate excellent results separated by how many all excellent results, and r is how

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many appropriate excellent results separated by how many excellent results which should have now been returned.

$$\text{F\_measure} = 2.\frac{\text{precision.recall}}{\text{presision} + \text{recall}}$$

Table 3. F_measure

Image Number	Existing(NEBF)	Proposed(NEBF+ fuzzy filtering)
1	0.5561	0.8242
2	0.5566	0.8411
3	0.5533	0.8430
4	0.5484	0.8357
5	0.5483	0.8380
6	0.5555	0.8143
7	0.5599	0.8342
8	0.5450	0.8197
9	0.55394	0.8087
10	0.55164	0.8198

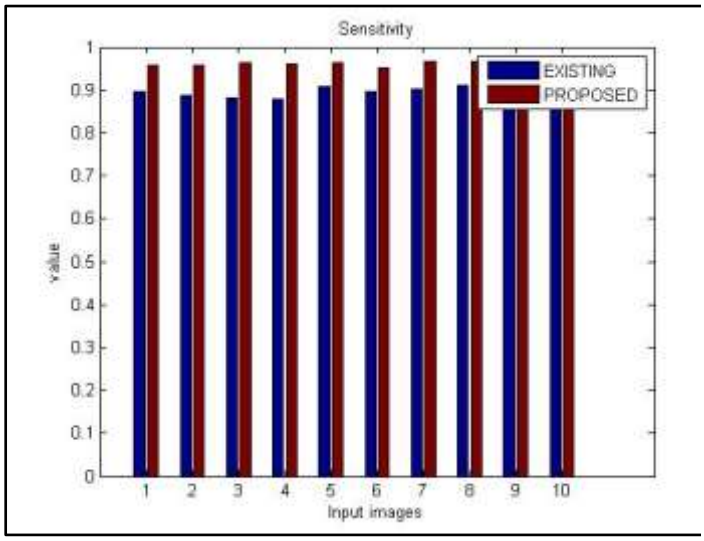

Figure 2. Sensitivity for all test images from DRIVE database

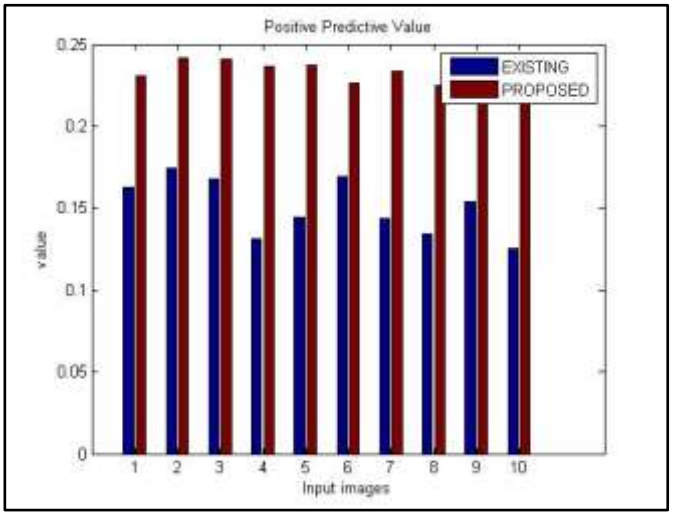

Figure 3.PPV for all test images from DRIVE database

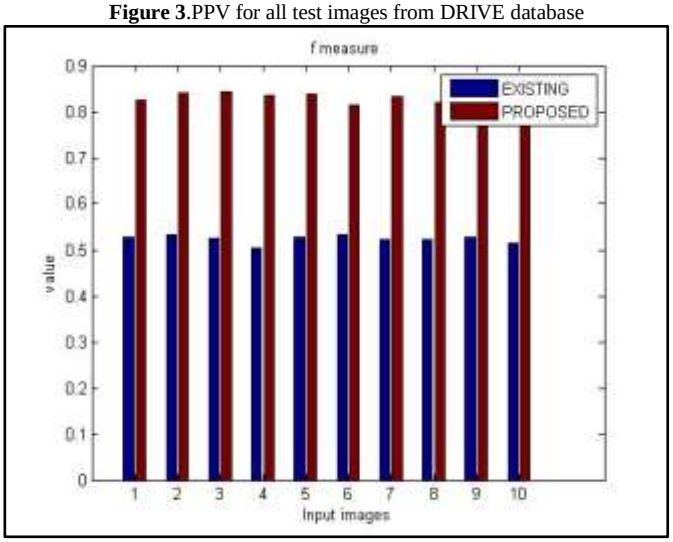

Figure 4. F_measure for all test images from DRIVE database

VI. CONCLUSION

This paper represents that segmentation means dividing image into multiple segments so as to find objects like circles, lines, blobs and boundaries from the image. Though manual segmentation provides with good results but automates analysis of retinal images is more promising as it reduces time and effort required by the experts. The existing technique has been done its work on Neighbourhood estimator before filling has shown significant results over available techniques, but it is poor in its speed. This paper has proposed the hybrid Neighbourhood estimator before filling with fuzzy based filtering segmentation which enables us to segment vessels even in low intensity of images. The evaluation of techniques has been done by using parameters like sensitivity, positive predictive value and F_measure. Therefore it improves the accuracy of vessel segmentation in terms of F_measure.

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REFERENCES

[1] Lee, Noah, Andrew Laine, and R. Theodore Smith. "A hybrid segmentation approach for geographic atrophy in fundus auto-fluorescence images for diagnosis of age-related macular degeneration." In Engineering in Medicine and Biology Society, 2007. EMBS 2007. 29th Annual International Conference of the IEEE, pp. 4965-4968. IEEE, 2007.

[2] Kong, Lingwang, Qiong Li, and Shanhu Huang. "Color Image Segmentation Scheme for Retinopathic Fundus." In Computer Science and Software Engineering, 2008 International Conference on, vol. 6, pp. 237-240. IEEE, 2008.

[3] Fang, Guoliang, Nan Yang, Huchuan Lu, and Kaisong Li. "Automatic segmentation of hard exudates in fundus images based on boosted soft segmentation." In Intelligent Control and Information Processing (ICICIP), 2010 International Conference on, pp. 633-638. IEEE, 2010.

[4] Yin, Fengshou, Jiang Liu, SimHengOng, Ying Sun, Damon WK Wong, NganMeng Tan, Carol Cheung, Mani Baskaran, Tin Aung, and Tien Yin Wong. "Model-based optic nerve head segmentation on retinal fundus images." InEngineering in Medicine and Biology Society, EMBC, 2011 Annual International Conference of the IEEE, pp. 2626-2629. IEEE, 2011.

[5] Neha Gupta, Er. Aarti, "A Review on Segmentation Techniques for Extracting Blood Vessels from Retina Images", International Journal of Emerging Research in Management &Technology, ISSN: 2278-9359 (Volume-5, Issue-3), March 2016.

[6] Y. Tyagi1, T. A. Puntambekar1, Preeti Sexena2 and Sanjay Tanwani2, "A Hybrid Approach to Edge Detection using Ant Colony Optimization and Fuzzy Logic", International Journal of Hybrid Information Technology Vol. 5, No. 1, January, 2012.

[7] R. Annunziata, A. Garzelli, L. Ballerini, A. Mecocci and E. Trucco, "Leveraging Multiscale Hessian-Based Enhancement With a Novel Exudate Inpainting Technique for Retinal Vessel Segmentation," in *IEEE Journal of Biomedical and Health Informatics*, vol. 20, no. 4, pp. 1129-1138, July 2016.

[8] http://www.computervisiononline.com/dataset/1105138662.

[9] Akram, M. Usman, SundusMujtaba, and Anam Tariq. "Automated drusen segmentation in fundus images for diagnosing age related macular degeneration." In Electronics, Computer and Computation (ICECCO), 2013 International Conference on, pp. 17-20. IEEE, 2013.

[10] Pereira, Carla, LuísGonçalves, and Manuel Ferreira. "Exudate segmentation in fundus images using an ant colony optimization pproach." Information Sciences 296 (2015): 14-24.

[11] Shradha Mirajkar, M.M.Patil. "Feature Extraction of Diabetic Ratinopathy" International Journal of Computer Applications® (IJCA) (0975 – 8887) Proceedings on Emerging Trends in Electronics and Telecommunication Engineering (NCET 2013).

[12] Roychowdhury, S., D. D. Koozekanani, and K. K. Parhi. "Blood Vessel Segmentation of Fundus Images by Major Vessel Extraction and Sub-Image Classification." (2014).

[13] Saleh, Marwan D., N. D. Salih, C. Eswaran, and Junaidi Abdullah. "Automated segmentation of optic disc in fundus images." In Signal Processing & its Applications (CSPA), 2014 IEEE 10th International Colloquium on, pp. 145-150. IEEE, 2014.

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