Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 8, No.3, August : 2024

SEMANTIC SEGMENTATION OF RETINAL BLOOD VESSELS FROM FUNDUS USING RANDOM FOREST ALGORITHM

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Abstract— Diabetic retinopathy is a complication of diabetes that is caused by changes in the blood vessel of the retina and it is one of the leading cause of blindness in the developed world. Diabetic Retinopathy is a sickness in which the retinal veins swell and it might even break. This harms the retina of the eye and may prompt vision misfortune if the level of diabetes is high. Early determination of Diabetic Retinopathy can counteract vision misfortune in patients. This project is developed on automatic detection of diabetic retinopathy using Support vector machine algorithm. The input of this these sorts can be utilizing fundus images of diabetic patients and it is given to the preprocessing stage for detecting abnormalities associated with fundus image, the images have to be pre-processed in order to correct the uneven illumination, not sufficient contrast between exudates and image background pixels and the presence of noise in the input fundus image. The preprocessed image is applied to the feature extraction process. The technique proposed in this project for discovery of Diabetic Retinopathy infection level accentuates on assurance of two imperative sorts of Diabetic Retinopathy; Haemorrhages and Exudates. Both Hemorrhages and Exudates appear as bright lesions in retinopathies images and have sharp edges and high contrast with the back- ground. We perform detection for exudates using thresholding and processing .In the process of feature extraction features are to be extracted from the given fundus image. The extracted image is given to the random forest algorithm

INTRODUCTION

Diabetic Retinopathy (DR) is an eye illness which happens because of diabetes. It harms the little veins in the retina bringing about loss of vision. The danger of the illness increments with age and along these lines moderately aged and more established diabetics are inclined to Diabetic Retinopathy. The National Eye Institute assesses that 40 to 45 percent of persons having diabetes are influenced by diabetic retinopathy because of which around 24,000 individuals wind up noticeably daze each year. Side effects of diabetes retinopathy don't surface until the point when visual harm to the retina has happened, ordinarily by fractional vision. Hence standard eye screening is important to give early finding and treatment before critical harm is caused to the retina as it possibly decrease the danger of visual deficiency in these patients by half. The increasing number of diabetic retinopathy cases worldwide requires to intensify efforts in developing tools to assist in the diagnosis of diabetic retinopathy. Automatic detection of diabetic retinopathy will lead to a large amount of savings of time and effort. Thus, we proposed a method for automatic detection of microaneurysms in retinal fundus images. In fact, support vector machines were used by in the automated diagnosis of non-proliferative diabetic retinopathy. Several image pre-processing techniques have also been proposed in order to detect diabetic retinopathy. However, despite all these previous works, automated detection of diabetic retinopathy still remains a field for improvement.

LITERATURE SURVEY

[1] Sheikh Muhammad Saiful Islam, Md Mahedi Hasan, and Sohaib Abdullah, “Deep Learning

based Early Detection and Grading of Diabetic Retinopathy Using Retinal Fundus Images"
Currently, a novel DCNN, which plays out the beginning time identification by recognizing all microaneurysms (MAs), the first indication of DR, alongside accurately allotting names to retinal fundus pictures which had five classes. The architecture was tested on Kaggle dataset and got the output of 0.851QWK score and 0.844 AUC score.

[2] S. H. Kassani, P. H. Kassani, M. J. Wesolowski, K. A. Schneider, and R. Deters, "Breast cancer diagnosis with transfer learning and global pooling,"
In recent projects and researches, AI models, and in AI specially "Deep Learning" gives the most accurate outputs in finding hidden layers in various AI tasks, particularly in the field of medical image analysis Based on the deep learning models which are classify diseases and support medical decision making and can improve the persistent consideration (extra care) .

[3] Yuchen Wu , Ze Hu "Recognition of Diabetic Retinopathy Based on Transfer Learning"
Pretrained models such as VGG19, Resnet50, InceptionV3, etc are put to use in this paper. The pretraining of the aforementioned neural networks has been done on the ImageNet dataset already. The accuracy of the experiment is stated as 0.60.

[4] Hoover, V. Kouznetsova and M. Goldbaum, "Locating blood vessels in retinal images by piecewise threshold probing of a matched filter response**"**
This paper investigates and proposes a set of optimally adjusted morphological operators to be used for exudate detection on diabetic retinopathy patients non-dilated pupil and low-contrast images.

[5] Decenciere, X. Zhang, G. Cazuguel, B. Lay, B. Cochener, C. Trone, `P. Gain, R. Ordonez, P. Massin, A. Erginay, B. Charton, and J.-C. Klein, "Feedback on a publicly distributed database: the Messidor database, "Image Analysis & Stereology".Thus, this paper proposes a new computer assisted diagnosis based on the digital processing of retinal images in order to help people detecting diabetic retinopathy in advance. The main goal is to automatically classify the non-proliferative diabetic retinopathy grade of any retinal image. For that, an initial image processing stage isolates blood vessel, microaneurysms and hard exudates in order to extract features that can be used by a support vector machine (SVM) to figure out the retinopathy grade of each retinal image. The image database used in this study is the Messidor database.

EXISTING METHOD

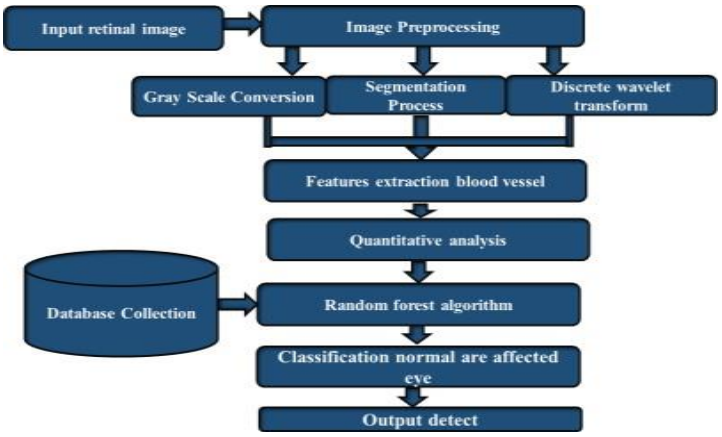
In this existing method, have done work to increase the accuracy of this automated diagnosis. For this purpose, we have used technique that detect diabetic retinopathy in patients using their retina fundus photographs. Cascading multiple layers of nonlinear processing units which compute successively to give one output. Artificial neural networks have different instances, one of which is Convolutional neural networks (CNN) which we will be using for our project. The fundamental problem statement of our task is Image Classification. There are several layers as Convolution, Nonlinear, Pooling and Fully Connected through which the image is passed which leads to the output. In this existing system achieved an accuracy of 73% which is much morethat that of previous work done

PROPOSED SYSTEM

The proposed method has a new computer assisted diagnosis based on the digital processing of retinal images in order to help people detecting diabetic retinopathy in advance. Initially the process starts with taking out of retinal fundus images as input after loaded the image it will go for preprocessing steps. There features can be extracted from retinal part of eye.The input fundus image is given from the database to the preprocess stage. In that phase RGB image is converted into gray scale image .The gray scale image contain the clear view of the eye so it converted. In that image noise removal is one of the processes. In that process eliminate the unwanted noise and apply the de noising method . The preprocessed image is applied to the feature extraction process. The technique proposed in this project for discovery of Diabetic Retinopathy infection level accentuates on assurance of two imperative sorts of Diabetic Retinopathy, Haemorrhages and Exudates. Both Hemorrhages and

Exudates appear as bright lesions in retinopathies images and have sharp edges and high contrast with the back- ground.After the feature extraction, the random forest algorithm will classify the normal eye and the diabetic retinopathy eye by comparing the trained fundus image in the training data

SYSTEM FUNCTION



RESULTS

The automated system successfully detects diabetic retinopathy levels in patients using fundus images. By employing preprocessing techniques to address illumination and contrast issues, as well as noise reduction, the system ensures accurate feature extraction. Leveraging thresholding and processing methods, it effectively identifies hemorrhages and exudates, crucial indicators of diabetic retinopathy. The Random Forest classifier then assesses the severity of the condition based on the presence and quantity of these lesions, enabling timely intervention to prevent vision loss in diabetic individuals.

SYSTEM SOFTWARE PYTHON PROGRAMMING LANGUAGE

THRESHOLDING IMAGE

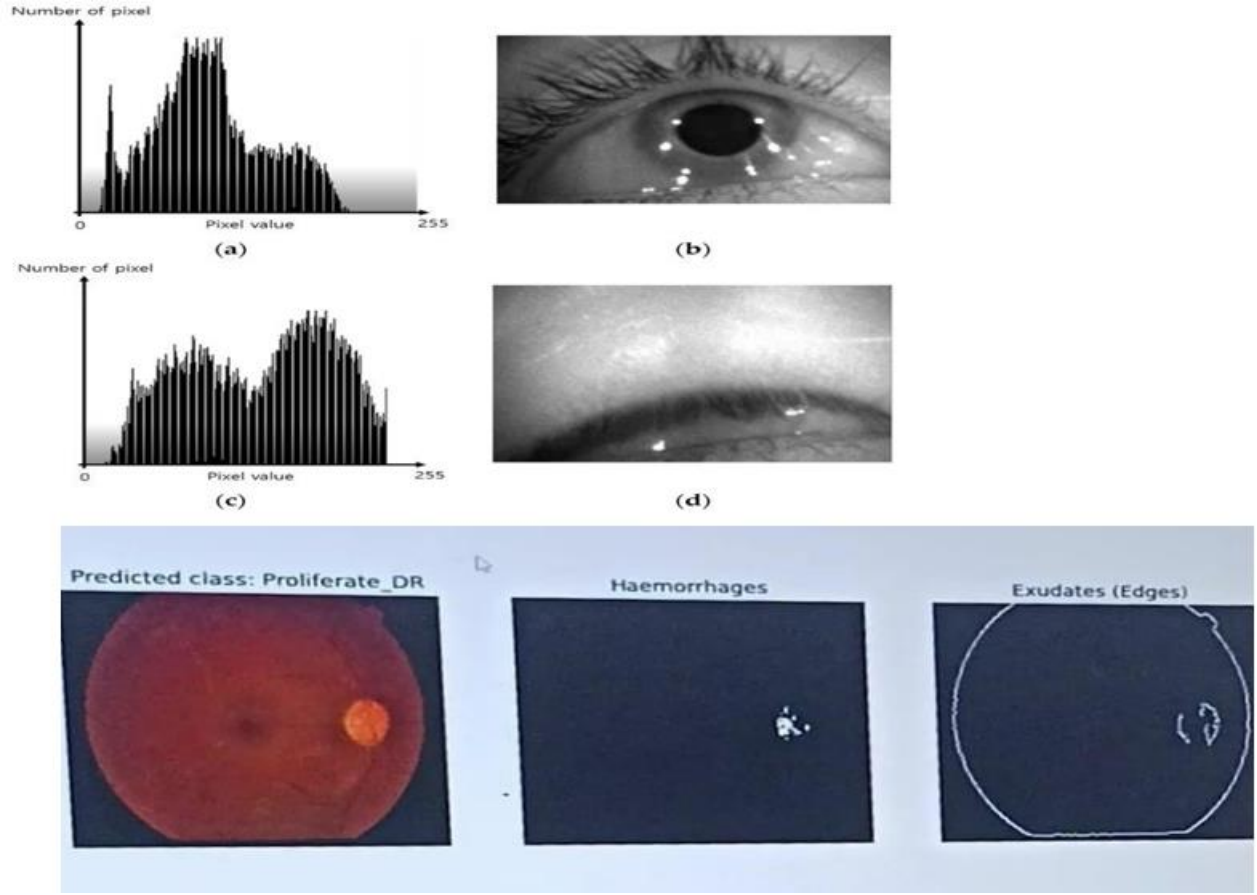


Fig no:4.16 Output of Retinal Blood Vessels

CONCLUSION

Detection of diabetic retinopathy in retinal image is a challenging one. So, we predict the method for detection in three stages. One is to remove the impurities from the image. Another one is to extract the features from the image. Features would be really helpful to identify the disease. In retina the abnormal tissue has to be grown in enormous manner than normal tissue which are categorized under an abnormal image. Identifying the location of disease can be done using random forest algorithm. The experimental results have shown that this technique is robust in detecting and bounding the abnormal cells in retinal images despite in homogeneity intensity or the complicate shape of the diabetic retinopathy. The random forest algorithm has an accuracy of 95.38%. However, we can improve the efficiency of the correct classification by extracting better features and by increasing the number of data in each class and also by combining with other pattern classification models.

REFERENCES

[1] Xiaomin Zhou, Chen Li, Md MamunurRahaman, Yudong Yao et al. "A Comprehensive Review for Breast Histopathology Image Analysis Using Classical and Deep Neural Networks", IEEE Access, 2020

[2] Varun Gulshan, Subhashini Venugopalan, Rajiv Raman, “Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs,” JAMA. 2021;316(22):24022410.doi:10.1001/jama.2018.17216.

[3] Kele Xu, Dawei Feng, and Haibo Mi, “Deep Convolutional Neural Network-Based Early Automated Detection of Diabetic Retinopathy Using Fundus Image,” Received: 10 November 2020; Accepted: 22 November 2017; Published: 23 November 2020.

[4] Sheikh Muhammad Saiful Islam, Md Mahedi Hasan, and Sohaib Abdullah, “Deep Learning

based Early Detection and Grading of Diabetic Retinopathy Using Retinal Fundus Images," arXiv:1812.10595v1 [cs.CV] 27 Dec 2021.
[5] R BorysTymchenko, Philip Marchenko and Dmitry Spodarets, "Deep Learning Approach to Diabetic Retinopathy Detection", 2019.
[6] Weiguo Fan, Edward A. Chandan K. Reddy, "A Deep Learning Based Pipeline for Image Grading of Diabetic Retinopathy", 2021.
[7] Eswar Kumar Kilari, Swathi Putta. " Delayed progression of diabetic cataractogenesis and retinopathy by inSTZ-induced diabetic rats ", Cutaneous and Ocular Toxicology, 2019.
[8] Keith A. Goatman, Alan D. Fleming, Sam Philip, Graeme
J. Williams, John A. Olson and Peter F. Sharp, "Detection of New Vessels on the Optic Disc Using Retinal Photographs", IEEE Transactions on Medical Imaging, Vol. 30, No. 4, pp. 972 – 979, 2022.
[9] Le, D.; Alam, M.N.; Lim, J.I.; Chan, R.P.; Yao, X. Deep learning for objective OCTA detection of diabetic retinopathy. Ophthalmic Technol. 2020, 11218, 112181P.
[10]. Singh, A.; Sengupta, S.; Mohammed, A.R.; Faruq, I.; Jayakumar, V.; Zelek, J.; Lakshminarayanan, V. What is the Optimal Attribution Method for Springer: Cham, Switzerland, 2020; pp. 21–31.
[11]. Singh, A.; Mohammed, A.R.; Zelek, J.; Lakshminarayanan, V. Interpretation of deep learning usingattributions: Application to ophthalmic diagnosis. Appl. Mach. Learn. 2020, 11511, 115110A.
[12]. Shah, S.A.A.; Laude, A.; Faye, I.; Tang, T.B. Automated microaneurysm detection in diabetic retinopathyusing curvelet transform. J. Biomed. Opt. 2019, 21, 101404.
[13]. Huang, H.; Ma, H.; van Triest, H.J.W.; Wei, Y.; Qian, W. Automatic detection of neovascularization in retinal images using extreme learning machine. Neurocomputing 2022, 277, 218–227.
[14]Khan, Z.; Khan, F.G.; Khan, A.; Rehman, Z.U.; Shah, S.; Qummar, S.; Ali, F.; Pack, S. Diabetic Retinopathy Detection Using VGG-NIN a Deep Learning Architecture. IEEE Access 2021, 9, 61408–61416.
[15]. Saeed, F.; Hussain, M.; Aboalsamh, H.A. Automatic Diabetic Retinopathy Diagnosis Using Adaptive Fine-TunedConvolutional Neural Network. IEEE Access 2021, 9, 41344–44359.
[16]. Wang, Y.; Yu, M.; Hu, B.; Jin, X.; Li, Y.; Zhang, X.;
Zhang, Y.; Gong, D.; Wu, C.; Zhang, B.; et al. Deep learning-based detection and
stage grading for optimizing diagnosis of diabetic retinopathy. Diabetes/Metab. Res. Rev. 2021, 37, 3445.
[17]. Wang, S.; Wang, X.; Hu, Y.; Shen, Y.; Yang, Z.; Gen, M.; Lei, B. Diabetic Retinopathy Diagnosis Using Multichannel Generative Adversarial Network with Semisupervision. IEEE Trans. Atom. Sci. Eng. 2021, 18, 574–
585.
[18]. Datta, N.S.; Dutta, H.S.; Majumder, K. Brightness- preserving fuzzy contrast enhancement scheme for the detection and classification of diabetic retinopathy disease. J. Med. Imaging 2022, 3, 014502.
[19]. Lin, G.-M.; Chen, M.-J.; Yeh, C.-H.; Lin, Y.-Y.; Kuo, H.-Y.; Lin, M.-H.; Chen, M.-C.; Lin, S.D.; Gao, Y.;Ran, A.; et al. Transforming Retinal Photographs to Entropy Images in Deep Learning to Improve Automated Detection for Diabetic Retinopathy. J. Ophthalmol.2022, 1–6
[20]. Panigrahi, P.K.; Mukhopadhyay, S.; Pratiher, S.; Chhablani, J.; Mukherjee, S.; Barman, R.; Pasupuleti, G. Statistical classifiers on local binary patterns for optical diagnosis of diabetic retinopathy. Nanophotonics 2020,10685, 106852Y.