ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 9, Issue 6, June 2022

Disease Prediction Based on Retinal Images using Deep Neural Networks

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ABSTRACT

Image processing and analysis methods are increasing importance in all fields of medical science because it is helpful to learn visual signs on Retinal vessels, There are several maladies in humanlike vascular diseases like diabetes, and hypertension. Blood vessels in the retina reflect the changes in the blood vessels of other parts of body like heart, brain, kidney etc. Veins of retina are partitioned into two kinds they are supply arteries and veins. For finding of different illnesses, it is more essential to initially recognize the vessels into arteries and veins. it is more important to first distinguish the vessels into arteries & veins. The largest arteries &veins are measured using CRAE &CRVE which is correlated with stroke& heart disease. Thus, wrong identification of vessels leads to wrong diagnosis of the diseases. However, automation of retinal segmentation that is difficult as a result of that the retinal pictures are noisy, distinction low, and therefore the vessel breadth often varies from very large to very tiny Hence pre processing steps are introduced to vessel segmentation using median filter algorithm. In this paper, our focus is calculation of Arteriolar-to-Venular diameter ratio (AVR) for the diagnosis of various diseases.

Keywords: CRAE, CRVE, artery, median filter, neural network, AVR.

1.INTRODUCTION

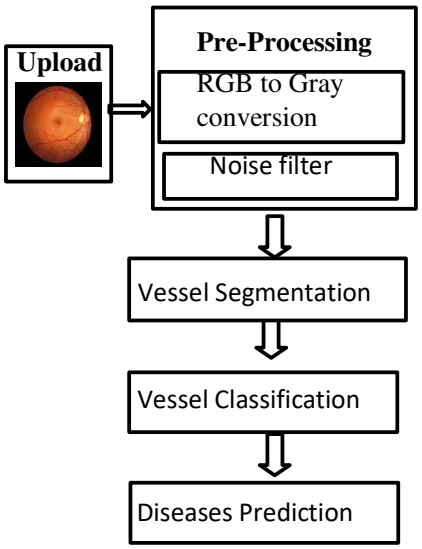
Currently the diseases associated with the eye are redoubled and lots of individuals suffered to visual impairment. Image process is that the area, that analysis the image and which involves within the vessel extraction, classification, and segmentation. By recognizing the vessel patterns within the retina of the human eye that were to research the vessels of the retinal image. Within the maladies like retinopathy principally leads to the result of the overall vision defect of the eye.

A design concept to medicine and biology for health care purpose is the Bio Medical Engineering (BME)Application The field seeks to close the gap between engineering and medicine field. Retinal images of the humans play the most important role in the detection and diagnosis of many human eye diseases for ophthalmologist. Some disease such as diabetic retinopathy and vascular degeneration and glaucoma are very dangerous diseases that they can lead to blindness of the human eye if they are not detected in early time correctly. Therefore, the detection of the human retinal images is very necessary and among them the detection of the blood vessels is most important. The alterations about the human eye blood vessels such as length, width and the branching patterns are very helpful to grade disease severity or automatically diagnose the diseases Arteriolar-to-venular diameter ratio can be comprised of two elements they are Central Retinal Arteriolar Equivalent (CRAE) and Central Retinal Venular Equivalent (CRVE).

These values which are beneficial in finding the disease such like hypertension and other vascular diseases. These kinds of diseases even change the vessel branching patterns, so that there is need to overcome the problems which occur due to the bifurcation, cut of vessel etc. however manual detection of blood vessels is much more difficult since the blood vessels in a retinal image are complex and with low contrast.

Also, there are number of retinal images to detect a disease. As a result, reliable and automatic methods for extracting and measuring the vessels in retinal images are needed. The main goal of this paper is estimation of the average diameter ratio of arteries with respect to veins which is the strong parameter in the diagnosis of the various vascular diseases.

2.SYSTEM ARCHITECTURE



3. MODULES

- Image acquisition
- Pre processing
- Vessel Segmentation
- Vessel Classification
- Disease diagnosis

3.1 Image Acquisition

Retinal image is the microscopic image of human eye. User can upload the retinal images. Image can be any size and any resolution. Based on retinal images, predict the diseases using blood vessels.

3.2 Pre processing

Convert RGB image into gray scale image.

Gray-scale image = (0.3 * R) + (0.59 * G) + (0.11 * B).

Using median filter algorithm to eliminate the noises in images. Such noise reduction is a typical pre-processing step to improve the results of later processing.

3.3 Segmentation of Blood Vessels

From this module, we implement neural network mechanism of image processing. At first vessel values are tracked and pointed the vessel features. Based on feature values, Back propagation algorithm is used.

3.4 Classification of Blood Vessels

Track the vessels and calculate the width of each blood vessel. Based on width values, categorize artery and vein vessels. And differentiate the vessels such as red represent as artery and blue represent as vein.

3.5 Disease Diagnosis

Calculate CRAE and CRVE measurements. Based on these above measurements, predict various diseases such as hyper tension, stroke, and blood pressure and so on.

4. MEDIAN FILTER

A grayscale is used in retinal image for determining the value of each pixel of a single image, in simple; it carries the information about intensity. In retinal imaging, it's known as "black-white" which is composed of exclusive shades of gray varying from black at weakest intensity to white at the strongest. Grayscale images(b) have many shades of gray in between.

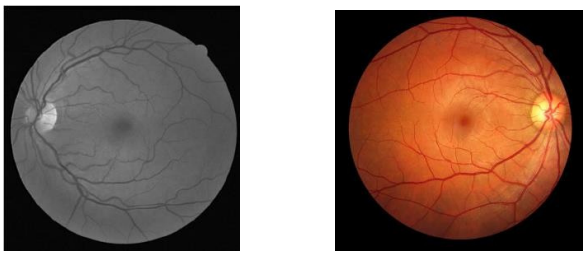


Fig IV(a) Fig IV(b)

In medical imaging, it is used for some kind of noise reduction on retinal image(b). It provides enhanced image. This type of noise reduction is typical a pre processing step. In median filter, majority of the computational effort and time is taken for calculating

Fig IV(C)

median of each window. Since the filter must process every entry of the vessels and for large vessels such as

images the median calculation efficiency is a critical factor to determine the speed of the algorithm and its run time capacity. Since in a given list of numbers only the middle value is required.

Median filtering is a nonlinear method used to remove noise from images. It is widely used as it is very effective removing noise while preserving edges. It is particularly effective at removing „salt and pepper" type noise. The median filter works by moving through the image pixel by pixel replacing each value with the median value of neighboring pixels.

5.TECHNIQUES AND ALGORITHMS:

The segmented vessels are classified into arteries and veins. Correct classification of vessels is vital, because heart diseases affect arteries and veins differently. The alterations in veins and arteries cannot be analyzed without distinguishing them. Segmented vessels are classified by the supervised method Support Vector Machine. After extraction of blood vessels, feature vector is formed based on properties of artery and veins. The features get extracted on the basis of centerline extracted image and a label is assigned to each centerline, indicating the artery and vein pixel. Based on these labeling phase, the final goal is now to assign one of the labels with the artery class (A), and the other with vein class (V). In order to allow the final classification between A/V classes along with vessel intensity information the structural information and are also used. This can be done using SVM classification.

The trained classifier is used for assigning the A/V classes to each one of the sub graph labels. First, each centerline pixel is classified into A or V classes, then for each label (Ci j , j = 1, 2) in sub graph i, he probability of its being an artery is calculated based on the number of associated centerline pixels classified by LDA to be an artery or a vein. The probability of label Ci j to be an artery is Pa(Ci j)= naCi j /(naCi j + nvCi) Where naCi j is the number of centerline pixels of a label classified as an artery and nvCi j is the number of centerline pixels classified as a vein. For each pair of labels in each sub graph, the label with higher artery probability will be assigned as an artery class, and the other as a vein class. Finally, to prevent a wrong classification as a result of a wrong graph analysis, we calculate the probability of being an artery or a vein for each link individually.

6.NEURAL NETWORKS

It is a system of hardware and software patterned after the operation of neurons in the human brain, it is also called artificial neural network. Image processing techniques use vessel segmentation method which is used to generate vascular tree in clinical imaging. It is widely demonstrated in ophthalmology. It enables external inspection of the condition and structure of blood vessels. The detection of arteries in ophthalmology is a basic procedure for the diagnosis of retinal pathologies, which are commonly seen and indicated in patients with diabetes and hypertension. Vision loss is an accurate identification for prevention of further deterioration. Pathologic progression is characterized by abnormal vascular arrangement in the eye. Segmentation of vascular tree forms the first step towards construction of an algorithmic basis for pathological detection. A DNN approach has been constructed of pixels for given image. It is a natural approach, for which heterogeneity in the roles of processing layer in the network required for recognizing different geometrical and spatial features of vessels. Neural networks (also referred to as connectionist systems) are a computational approach, which is based on a large collection of neural units. Each neural unit is connected with many others, and links can be enforcing or inhibitory in their effect on the activation state of connected neural units.

Neural networks (also referred to as connectionist systems) are divided into three layers

1. Input layer is defined as the various input such as image, in which vessel width are given.
2. Hidden layer is responsible for actual processing.
3. Output layer includes the processing of code in hidden layer we get a desired output.

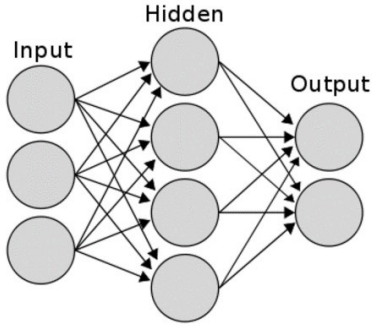


Fig V(a)

Retinal arteriole to venular ratio	Adjusted RR (95% CI) *	
	Women	**Men**
1st quintile (range: 0.57-0.78)	2.2 (1.0-4.6)	1.1 (0.7-1.8)
2nd quintile (range: 0.59-0.82)	2.3 (1.1-4.8)	1.0 (0.6-1.7)
3rd quintile (range: 0.83-0.86)	1.6 (0.8-3.4)	1.2 (0.7-1.9)
4th quintile (range: 0.87-0.91)	1.3 (0.6-2.8)	1.2 (0.7-2.1)
5th quintile (range: 0.91-1.22)	1.0	1.0

7. DISEASE PREDICTION

Recognizable proof the sicknesses exploitation AVR quantitative connection upheld CRAE and CRVE estimations. Vessel movement CRAE, CRVE discovered correlative with the dangers elements of cardiovascular ailments and are sure genuine numbers. The significant general determinant for littler CRAE is higher pulse though more extensive CRVE is important in view of everyday cigarette smoking, higher circulatory strain or cardiovascular sickness, fundamental irritation infection (SID) and avoirdupois. A more up to date think about found that the strong circuitous connection between neural works and retinal parameters (CRAE and CRVE) in a very accomplice of eighty the sound individuals, that recommends a run of the mill determinant in pre-clinical organ damage. [5] discussed that Liver tumor division in restorative pictures has been generally considered as of late, of which the Level set models show an uncommon potential with the advantage of overall optima and functional effectiveness. The Gaussian mixture model (GMM) and Expected Maximization for liver tumor division are introduced. [8] discussed about diabetic retinopathy from retinal pictures utilizing cooperation and information on state of the art sign dealing with and picture preparing. The Pre-Processing stage remedies the lopsided lighting in fundus pictures and furthermore kills the fight in the picture. [10] discussed about detection of leukaemia using a small picture handling method that distinguishes between red blood cells and young white cells. Visual examination of minuscule photos by looking at alterations such as surface, calculation, shading, and measurable research of photographs is now the only recognisable proof of blood trouble.

This is in help of prior examinations looking at the relationship between retinal vascular signs and episode cardiovascular sickness giving verification To retinal picture were utilized for trademark impacts of ailments like cardiovascular maladies therefore that a decline in CRAE is in this manner a predecessor to clinical beginning of cardiovascular infection and occurs before entirely unexpected indications of organ damage Beside the value of CRAE inside the recognizing and foreseeing HTN (hypertension), it conjointly demonstrates decent potential in various pathologies together with stroke and polygenic issue.

TABLE IV(a)Retinal Arteriolar Narrowing and 3-Year
Risk of Coronary Heart Disease

8. BACK PROPAGATION

It is a common method of training a neural network in which the initial system output is compared to the desired output, and the system is adjusted until the difference between the two is minimized. Back propagation neural networks employ one of the most popular neural network learning algorithms, the Back-propagation algorithm. It has been used successfully for wide variety of applications, such as image pattern and medical diagnosis. Back propagation is a common method of training artificial neural networks and used in conjunction with an optimization method such as gradient descent. [2] discussed that In surgical planning and cancer treatment, it is crucial to segment and measure a liver tumor's volume accurately. Because it would involve automation, standardisation, and the incorporation of complete volumetric information, accurate automatic liver tumor segmentation would substantially affect the processes for therapy planning and follow-up reporting.

9.CONCLUSION

Retinal vascular structure measurements provide good diagnostic capabilities for the risk of cardiovascular disease. The wrong identification of vessels will lead to incorrect diagnosis. In the existing system Graph Tracer Algorithm is used to segment vessels. Graph tracer algorithm is not a perfect approach because there are bifurcations & cut-off of vessels. The proposed algorithm will focus on the use of a new gray image as input obtained from IR sensor scanner with the three RGB components. The median filter algorithm overcomes the drawbacks of graph tracer algorithm. The proposed work will be extended to detect the age of the patient with the CRAE& CRVE measures using optic disk.

REFERENCE

[1] Abdallah, Mariem Ben, et al. "Automatic extraction of blood vessels in the retinal vascular tree using multiscale medialness." Journal of Biomedical Imaging 2015 (2015),

[2] Christo Ananth, S. Amutha, K. Niha, Djabbarov Botirjon Begimovich, “Enhancing Segmentation Approaches from Super Pixel Division Algorithm to Hidden Markov Random Fields with Expectation Maximization (HMRF-EM)”, International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022,pp. 2400-2410.

[3] Joes Staal, Michael D Abramoff, Meindert Niemeijer, Max A ` Viergever, and Bram Van Ginneken. Ridge-based vessel segmentation in color images of the retina. TMI, 23(4):501–509, 2004.

[4] K.V.Kauppi T, Lensu L, Sorri I, Raninen A, "Diaretdb1: Diabetic M. Fraz, P. Remagnino, A. Hoppe, B. Uyyanonvara, A. Rudnicka, C. Owen, and S. Barman, “Blood vessel segmentation methodologies in retinal images - a survey,” Comput. Methods Prog. Biomed. vol. 108, no. 1, pp. 407–433, Oct. 2012.

[5] Christo Ananth, M Kameswari, Densy John Vadakkan, Dr. Niha.K., “Enhancing Segmentation Approaches from Fuzzy-MPSO Based Liver Tumor Segmentation to Gaussian Mixture Model and Expected Maximization”, Journal Of Algebraic Statistics, Volume 13, Issue 2, June 2022,pp. 788-797.

[6] Meindert Niemeijer, Bram Van Ginneken, Michael J Cree, Atsushi Mizutani, Gwenol ´ e Quellec, Clara I S ´ anchez, Bob ´ Zhang, Roberto Hornero, Mathieu Lamard, Chisako Muramatsu, et al. Retinopathy online challenge: automatic detection of microaneurysms in digital color fundus photographs. IEEE transactions on medical imaging, 29(1):185– 195, 2010.

[7] N. Srivastava, G. Hinton, A. Krizhevsky, I. Sutskever, and R. Salakhutdinov, “Dropout: A simple way to prevent neural networks from overfitting,” The Journal of Machine Learning Research, vol. 15, no. 1, pp. 1929–1958, 2014.

[8] Christo Ananth, D.R. Denslin Brabin, Jenifer Darling Rosita, “A Deep Learning Approach To Evaluation Of Augmented Evidence Of Diabetic Retinopathy”, Turkish Journal of Physiotherapy and Rehabilitation, Volume 32,Issue 3, December 2021,pp. 11813-11817.

[9] Ramprasaath R Selvaraju, Michael Cogswell, Abhishek Das, Ramakrishna Vedantam, Devi Parikh, and Dhruv Batra. Grad-cam: Visual explanations from deep networks via gradient-based localization. In ICCV, pages 618–626, 2017.

[10] Christo Ananth, P. Thenmozhi, Stalin Jacob, Dr.A. Anitha, “Leukemia Blood Cancer Detection Using MATLAB”, Turkish Journal of Physiotherapy and Rehabilitation, Volume 32,Issue 3, December 2021,pp. 10257-10261.

[11]V.Kumari And N.Suriyanarayanan, "Feature Extraction For Early Detection Of Diabetic Retinopathy," In International Conference On Recent Trends In Information,

Telecommunication And Computing, 2010, Pp. 359-361.
[12]S.Ravishankar, "Automated Feature Extraction For Early Detection Of Diabetic Retinopathy In Fundus Images" In Computer Vision And Pattern Recognition, 2009. CVPR 2009. IEEE Conference On 2009, Pp. 210-217.
[13] Gonzalez, R.C., R.E. Woods And S.L. Eddins, 2004. Digital Image Processing 2nd Edn., Pearson Education India.
[14] Sinthanayothin C, Boyce Jf, Williamson Th, Cook Hl, Mensah.