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Review on : DIABETIC RATINOPATHY ANALYSIS USING SVM AND LDA

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Abstract: *There are several ways for analysing the diabetic ratinopathy. In this research the diabetic ratinopathy analysis using techniques using SVM & LDA and result are quality based. This thesis proposed a work where take an input image and make pre-processing then applying image segmentation. After the image segmentation extracts the features where use the techniques SVM and LDA for analysis of diabetic retinopathy then post processing of an image provides final result.*

Keywords: *Diabetic Ratinopathy Analysis, Feature Extraction, Segmentation, Fundus Images, Retina, SVM and LDA.*

I. INTRODUCTION

The human eyes allow sensation of vision including color distinction and perception of depth due to presence of rods and cones in the retina which known as sensor tunic and neural layer present in retina which plays direct role in vision and also in visual processing. Importantly, parts of retina are optic disc, macula, fovea and blood vessels. Optic disc is brightest region having elliptical shape that appears bright orange pink with pale center. Optic disc is called blind spot where it lacks photoreceptors and blood vessels are emit out from the optic disc where lateral to the blind spot of the eye a hazy dark region having oval shape with a diameter of nearly 0.4mm is present where it is also called macula lutea that is yellow spot. The center of the macula is called fovea which having size of a pin head that contains only the cones and helps in acuity vision. Most of the time macula contains cones and its density declines gradually from the edge of macula to retinal fringe. Neural retina is sustained by blood circulation in the central artery and central vein which allowance the eye through center of the optic disc. Where these vessels provide rise to rich vascular network which clearly visible to non-invasively by help of ophthalmoscope.

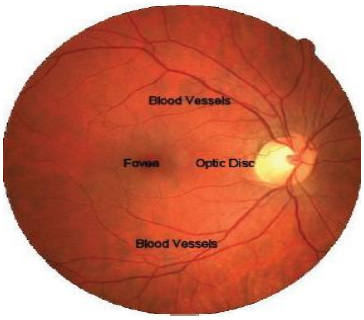

Figure1: Normal Eye

Blood Vessel

The retinal blood vessels are usually referred to arteries and veins where the artery and central vein normally appear near to each other in nasal side of the optical disc center. Clearly blood vessels are in the green component where the information about the structure of the blood vessels can help to classify the severity of the disease and may also serve as reference during operation. These two strategies used for detection of blood vessels in image where one is the detection of edges and other is monitoring that require a priori knowledge of the position from the image. About the blood vessels information is used in grading disease severity or part of process of automated diagnosis of diseases with ocular manifestations. Blood vessels can act as landmarks for localizing the optic nerve, fovea, and lesions. Result of systematic or local ocular disease the blood vessels have measurable abnormalities in

diameter and color. Example is central retinal artery occlusion usually causes generalized constriction of retinal arteries, hypertension may result in focal constriction of retinal arteries, central retinal vein produces dilated tortuous veins can cause the arteries to acquire a copper or silver color, and diabetes can create new blood vessels where reliable method of vessel detection is needed which preserves various vessel measurements.

Optic Disc

Optic disc (OD) location is of critical importance in retinal image analysis where in normal images the optical disc is brighter than any part of the retina and normally circular in shape. Also the entry and exit point for nerves entering and leaving the retina to and from the brain. Optical disc detection helps the ophthalmologists for finding that patient is affected by diabetic retinopathy or not.

Diabetic retinopathy (DR)

Diabetic retinopathy (DR) having a condition where retina is damaged due to fluid leaking from the blood vessels into retina where in the extreme cases patient will become blind therefore early detection of diabetic retinopathy is crucial to prevent blindness. Diabetic retinopathy main stages are nonproliferation diabetes retinopathy (NPDR) and proliferate diabetes retinopathy (PDR).

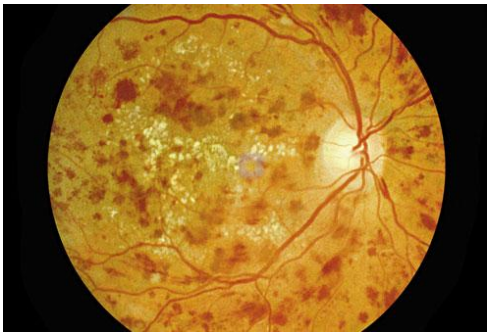

Figure2: Diabetic Effected Retina

Non-proliferative diabetic retinopathy (NPDR)

The earliest stage of diabetic retinopathy is non-proliferative diabetic retinopathy (NPDR) with this condition damaged blood vessels in retina begin to leak extra fluid and small amounts of blood into the eye. The deposits of cholesterol or other fats from the blood may leak into the retina where NPDR can cause changes in the eye as it including:

Micro aneurysms: Small bulges in blood vessels of the retina that often leak fluid.

Retinal hemorrhages: Tiny spots of blood which leak into retina.

Hard exudates: Deposits of cholesterol or other fats from blood which leaked into the retina.

Macular edema: Swelling of the macula caused by fluid leaking from the retina blood vessels and macula does not function properly when it swollen where macular edema is the most common cause of vision loss in diabetes.

Macular ischemia: Small blood vessels which also called as capillaries close where your vision blurs because of macula no longer receives enough blood to work properly. Many diabetes people have mild NPDR which usually not affect their vision however if their vision is affected and it is the result of macular edema and macular ischemia.

Proliferative Diabetic Retinopathy (PDR)

Mainly proliferative diabetic retinopathy occurs when many of the blood vessels in the retina close and preventing enough blood flow where in attempt to supply blood to the area as the original vessels closed and retina responds as growing new blood vessels which is called neovascularization. These new blood vessels are abnormal they do not supply the retina with proper blood flow and new vessels are also accompanied as scar tissue that may cause the retina to wrinkle or detach.

II. LITERATURE REVIEW

Banumathi et al, 2003 Proposed the performance of three different template matching algorithms in respect of detection of blood vessels in the retinal images for both gray level and color images where blood vessels detection using the proposed 2D Gaussian matched filtering provide complete and continuous vessel map of the blood vessels.

Bevilacqua et al, 2005 Proposed a computational model to extract from eye fundus images and retinal vasculature then to detect its features where as bifurcations and crossover points of retinal vessels.

Herbert F. Jelinek et al , 2007 where proposed fluoresce in labeled retinal blood vessels of 27 digital images automatically segmented using Gabor wavelet transform and classified using traditional features like area, perimeter and additional five morphological features which based on derivatives of Gaussian wavelet derived data.

Mohammed AlRawi et al,2006 Proposed matched filter which response to the detection of blood vessels is increased by proposing better filter parameters where (Huiqi Li et al, 2004) proposed a technique for extraction of exudates using edge detection techniques and the principal component analysis is used to detect the optic disc and shape of the optic disc is detected by a modified active shape model.

Sinthanayothin Cet al.2002 Introduce the use of Recursive Region Growing diabetic Segmentation algorithm (RRGS) of window size of 10x10 for the detection of the diabetic retinopathy on digital fundus images where (Sanchez et al 2004) introduce the use of color and fine edge features for the detection of

exudates. Where first the yellowish objects are detected then objects which have fine edges in the image are detected by using Kirsch's mask and results of yellowish objects with fine edges are used to detect the exudates.

LiliXu et al.2010 Proposed the uses segmentation method to differentiate the contrast in larger and thin blood vessels where adaptive local thresholding is used to provide normalized image and to extract larger vessels and thin vessel segments are classified by using support vector machine.

Niemeijer et al.2007 Proposed a method to differentiate bright lesions like exudates, cotton wool spots and drusen from color retinal images where OpasChutatape presented a method to detect exudates using region growing and edge detection techniques and also detect the optic disk using principal component analysis where using a modified active shape model the shape of optic disk was detected.

III. DIFFERENT TECHNIQUES

Following techniques are used in the diabetic retinopathy analysis:

Linear Discriminant Analysis (LDA) Linear Discriminant Analysis (LDA) is scheme for feature extraction and dimension reduction. It has been used widely in many applications involving highly dimensional data as face recognition and image recognition. Linear Discriminant Analysis easily handles the case where the within-class frequencies are unequal and their performances have been examined on randomly generated test data. This method maximizes the ratio of between-class variance to the within-class variance in any particular data set thereby guaranteeing maximal separability. Linear Discriminant Analysis (LDA) is a techniques used for data classification and dimensionality reduction.

$S_w = \sum_{i=1}^{k} \sum_{x \in \prod i} (x - m_i)(x - m_i)^T$ and $S_b = \sum_{i=1}^{K} n_i$ (m_i -m) (m_i-m)^T,where

$m_i = \frac{1}{n_i} \sum_{x \in \prod i} x$ is the mean of the ith class and m = $\frac{1}{n}$ $\sum_{i=1}^{k} \sum_{x \in \prod i}$ x is the global mean in discriminant analysis, two scatter matrices, called within-class (Sw) and between-class (Sb) matrices are defined to quantify the quality.

SVM has been found to be successful when used for pattern classification problems. Applying the Support Vector approach to a particular practical problem involves resolving a number of questions based on the problem definition and the design involved with it. One of the major challenges is that of choosing an appropriate kernel for the given application. There are standard choices such as a Gaussian or polynomial kernel that are the default options, but if these prove ineffective or if the inputs are discrete structures more elaborate kernels will be needed. By implicitly defining a feature space where the kernel provides the description language used by the machine for viewing the data. Once the choice of kernel and optimization criterion has been made the key components of the system are in place.

IV. PARAMETERS USED

There are many parameters given which are used in previous research papers.

MSE: Mean Squared Error is essentially an image fidelity measure where compare two images which provide a quantitative score that describes the degree of difference and errors between them and MSE between two images is given by the following formula:

$$MSE = (1/N)\Sigma i|x(i)- e(i)|^2$$

Where x and e are the input and compressed image respectively and N is the size of image.

PSNR: Embedding this extra data must not degrade human perception about the object. Evaluation of imperceptibility is usually based on an objective measure of quality, called peak signal to noise ratio and PSNR between input and compressed image can be obtained by using following formula:

$$PSNR=20\log10(PIXEL\_VALUE/MSE)$$

Block Diagram of Proposed system: The following depicts the steps of proposed work.

STEP1: Take input image and pre-processed it.
STEP2: Then do segmentation.
STEP3: After above step extract the features.
STEP4: For diabetic analysis used LDA and SVM.
STEP5: Make post processing it finally provides results.

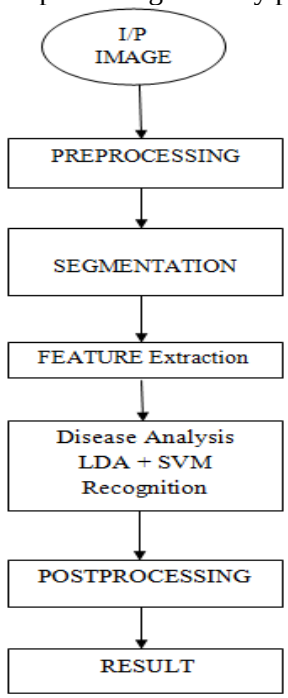

Figure3: Block Diagram of Proposed System

V. CONCLUSION

In this paper using feature based Linear Discriminant Analysis (LDA) technique with combination of SVM techniques and preprocessing is to improve robustness of blood vessel and optic disk detection. LDA used for detecting blood vessels in eye images by grouping the blood vessels into one category as on pixels and remaining part of the eye where another category like off pixels. The detection accuracy calculated with comparison to expert ophthalmologist hand drawn ground truths and results are comparatively analyzed where the implementation of this proposed work use the Image Processing Toolbox under Matlab Software.

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REFERENCES

[1] Banumathi A, Karthika, R., Kumar.A , (2003), "Performance analysis of matched filter techniques for automated detection of blood vessels in retinal images", Conference on Convergent Technologies for Asia Pacific Region, 2, pp 543–546.

[2] Bevilacqua V., Cambò, S.Cariello, L.Mastronardi ,G ., (2005), "A combined method to detect Retinal Fundus Features", Conference on EACDA, Italy.

[3] Edgardo FelipeRiveron1 and Noel Garcia Guimeras, (2006) , "Extraction of Blood Vessels in Ophthalmic Color Images of Human Retinas",CIARP 2006, LNCS 4225, pp. 118 – 126, Springer Verlag Berlin Heidelberg.

[4] Herbert F. Jelinek , Michael J. Cree , Jorge J. G. Leandro , João V. B. Soars and Roberto M. Cesar, Jr. A. Luckie , May (2007), "Automated segmentation of retinal blood vessels and identification of proliferative diabetic retinopathy ", Optical society of America, 24, pp 14481456.

[5] Mohammed AlRawi, Munib Qutaishat, Mohammed Arrar, (2006), "An improved matched filter for blood vessel detection of digital retinal images" , Computers in Biology and Medicine, pp 262 – 267.

[6] Sanchez, C.I. Hornero, R. Lopez, M.I. Poza, J. "Retinal Image Analysis to Detect and Quantify Lesions Associated with Diabetic Retinopathy" In International Conference on Engineering in Medicine and Biology Society (EMBC) , 2004, pp. 1624 – 1627.

[7] Huan Wang, Wynne Hsu, Kheng Guan Goh and Mong Li Lee. 2000. "An effective approach to detect lesions in retinal images". Proc. IEEE Conf. Comput. Vis. Pattern Recogn, Hilton Head Island, SC, Vol. 2, pp. 181–187.

[8] LiliXu, ShuqianLuo, 2010. "A novel method for blood vessel detection from retinal images", BioMedical Engineering OnLine , 9:14.

[9] Sinthanayothin C, Boyce JF, Williamson TH, Cook HL, Mensah E, Lal S, Usher D., 2002. "Automated detection of diabetic retinopathy on digital fundus images". Diabetic Medicine.19(2), 105-12.

[10] Huiqi Li, OpasChutatape, 2004. "Automated Feature Extraction in Color Retinal Images by a Model Based Approach", IEEE Transactions On Biomedical Engineering, Vol. 51, no. 2, pp. 246-254.

[11] Usher, D. Dumskyj, M Himaga, M. Williamson, T.H. Nussey, S. Boyce, "Automated detection of diabetic retinopathy in digital retinal images: a tool for diabetic retinopathy screening". 2004.

[12] Goh, K.G.; Hsu, W.; Li Lee; Wang, H. adris: "an Automatic Diabetic Retinal Image Screening system". In Medical data mining and knowledge discovery; Krzysztof, editor. Physica-Verlag: Heidelberg, Germany, 2001; pp. 181-210.

[13] Ege, B.M. Hejlese, O.K. Larsen, O.V. Moller, K. Jennings, B. Kerr, D. Cavan, D.A. "Screening for diabetic retinopathy using computer based image analysis and statistical classification". 2000.

[14] Walter, T. Klein, J.C. Massin, P. Erginay, A. "A Contribution of Image Processing to the Diagnosis of Diabetic Retinopathy-Detection of Exudates in Colour Fundus Images of the Human Retina". IEEE Transactions on Medical Imaging , 2002, 21 , 1236 - 1243.

[15] Niemeijer, M. Ginneken, B.V. Russell, S. R. Suttorp-Schulten, M.S.A. Abramoff, M.D. "Automated detection and differentiation of drusen, exudates, and cotton-wool spots in digital color fundus photographs for diabetic retinopathy diagnosis".2007

[16] Bezdek, J.C. "Pattern Recognition with Fuzzy Objective Function Algorithms". Plenum: New York, NY, USA, 1981.

[17] Sochini Roychowdhury, "(DREAM) Diabetic retinopathy analysis using machine learning SVM", 10.1109/jbhl2013.2294635 IEEE Journal of Biomedical and Health Informatics, 2013.

[18] Adarsh P and D. Jeyakumari , "Multiclass SVM- Based Automated Diagnosis of Diabetic Retinopathy", International conference on Communication and Signal Processing, April 3-5, 2013, India

[19] K.Narasimhan, V.C.Neha and K.vijayarekha,"An Efficient Automated System for Detection of Diabetic Retinopathy from Fundus Images Using Support Vector Machine and Bayesian Classifiers", 2012 International Conference on Computing, Electronics and Electrical Technologies [ICCEET].

[20] Jyoti D. patil and Anant.L.Chaudhari, "Tool for the Detection of Diabetic Retinopathy using Image Enhancement Method in DIP", International Journal of Applied Information Systems (IJAIS) – ISSN : 2249-0868 Foundation of Computer Science FCS, New York, USA Volume3, No3., July 2012 – www.ijais.org.