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Detection of Retinal Diseases Based on SVM Classifier

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ABSTRACT: Support Vector Machine (SVM) can be used to detection of retinal diseases. The advantage of using SVM is to give wide field of view, which can image a large part of the retina for better diagnosis of the retinal diseases. In this paper, we propose a novel methodology to naturally extricate out genuine retinal range from a SVM as a machine learning approaches . The Simple Linear Iterative Clustering (SLIC) is the algorithm used in the paper. To decrease the unpredictability of picture preparing errands and give an advantageous primitive picture design, we have gathered pixels into distinctive districts taking into account the provincial size and minimization, called superpixels. The structure then ascertains picture based elements reflecting textural and basic data and characterizes between retinal region and ancient rarities. To reduce the time and provide accuracy for the retinal images.

KEYWORDS: Feature selection, retinal artefacts extraction, support vector machine(SVM), simple linear iterative clustering(SLIC)

I. INTRODUCTION

EARLY detection and treatment of retinal eye diseases is critical to avoid preventable vision loss. Conventionally, retinal disease identification techniques are based on manual observations. Optometrists and ophthalmologists often rely on image operations such as change of contrast and zooming to interpret these images and diagnose results based on their own experience and domain knowledge. These diagnostic techniques are time consuming. Automated analysis of retinal images has the potential to reduce the time, which clinicians need to look at the images, which can expect more patients to be screened and more consistent diagnoses can be given in a time efficient manner.

SLIC is a Simple Linear Iterative Clustering Algorithm in which it is used for superpixel segmentation. The function is that it takes the center point of the image to that of the adjacent point and from that the average value is taken and produces the best result from it.

Compared to that of the (GS04, NC05, TP09,Q309) SLIC gives the equal segmentation so that there is no wastage of pixel quality. The step by step process is included in the process hence there is clarity of pixel quality. In combination with the SLIC Algorithm SVM (support vector machine) is used. It is basically a dataset or machine which performs input and output operation.

Properties of SVM are flexibility in choosing a similarity function. Sparseness of solution when dealing with large data sets - only support vectors are used to specify the separating hyper plane . Ability to handle large feature spaces - complexity does not depend on the dimensionality of the feature space. Over fitting can be controlled by soft margin approach. A simple convex optimization problem which is guaranteed to converge to a single global solution

We are using an basic RBG colors for the identification of the brightest image and hence so SVM create an boundary between three layers to classify between eyelashes and the eyelids before that ANN classifier is used which identifies the eylelashes and eyelids by neuron network which is not that much efficient than SVM. Hence SVM is only used for the classification purpose that separates the eye between eyelashes and eyelids and with the combination of SLIC algorithm it compares with the data set and produces the best result.

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In this study, we have constructed a novel framework for the extraction of retinal area in SLO images. The three main steps for constructing our framework include:
1) Determination of features that can be used to distinguish
Between the retinal area and the artefacts;
2) Selection of features which are most relevant to the classification;
3) Construction of the classifier which can classify out the Retinal area from SLO images.
For differentiating between the retinal area and the artefacts, we have determined different image-based features which reflect gray scale, textural, and structural information at multiple resolutions. Then, we have selected the features among the large feature set, which are relevant to the classification. The feature selection process improves the classifier performance in terms of computational time.

II. SYSTEM ANALYSIS

Existing System

The 2-D retinal scans obtained from imaging instruments [e.g., fundus camera, scanning laser ophthalmoscope (SLO) may contain structures other than the retinal area; collectively regarded as artefacts. Exclusion of artefacts is important as a preprocessing step before automated detection of features of retinal diseases. In a retinal scan, extraneous objects such as the eyelashes, eyelids, and dust on optical surfaces may appear bright and in focus. Therefore, automatic segmentation of these artefacts from an imaged retina is not a trivial task. The purpose of performing this study is to develop a method that can exclude artefacts from retinal scans so as to improve automatic detection of disease features from the retinal scans. In the existing system, the watershed based ANN classifier is used

Disadvantages:

- Therefore, automatic segmentation of these artefacts from an imaged retina is not a trivial task.
- The purpose of performing this study is to develop a method that can exclude artefacts from retinal scans so as to improve automatic detection of disease features from the retinal scan.

Proposed work:

Our methodology is based on analyzing the SVM image-based features, which are calculated for a small region in the retinal image called superpixels. The determination for each superpixel is computationally efficient as compared to determination for each pixel. The superpixels from the images in the training set are assigned by the class either retinal area. The algorithm called SLIC based super pixel segmentation with SVM classifier is used to detect the retinal diseases.

Advantages:

- Feature selection enables the most significant features to be selected
- Reduces computing cost too.
- Computational time
- High Accuracy

III. LITERATURE SURVEY

[1] M. S. Haleem, L. Han, J. van Hemert, and B. Li, “Automatic extraction of retinal features from colour retinal images for glaucoma diagnosis: A review,”Comput. Med. Imag. Graph., vol. 37, pp. 581–596, 2013.

Glaucoma is a group of eye diseases that have common traits such as, high eye pressure, damage to the Optic Nerve Head and gradual vision loss. It affects peripheral vision and eventually leads to blindness if left untreated. The current common methods of pre-diagnosis of Glaucoma include measurement of Intra-Ocular Pressure (IOP) using Tonometer, Pachymetry,Gonioscopy; which are performed manually by the clinicians. These tests are usually followed by Optic Nerve Head (ONH) Appearance examination for the confirmed diagnosis of Glaucoma. The diagnoses require

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regular monitoring, which is costly and time consuming. The accuracy and reliability of diagnosis is limited by the domain knowledge of different ophthalmologists. Therefore automatic diagnosis of Glaucoma attracts a lot of attention. This paper surveys the state-of-the-art of automatic extraction of anatomical features from retinal images to assist early diagnosis of the Glaucoma. We have conducted critical evaluation of the existing automatic extraction methods based on features including Optic Cup to Disc Ratio (CDR), Retinal Nerve Fibre Layer (RNFL), Peripapillary Atrophy (PPA), Neuroretinal Rim Notching, Vasculature Shift, etc., which adds value on efficient feature extraction related to Glaucoma diagnosis.

Demerits:

The diagnoses require regular monitoring, which is costly and time consuming. The accuracy and reliability of diagnosis is limited by the domain knowledge of different ophthalmologists. Therefore automatic diagnosis of Glaucoma attracts a lot of attention.

[2] M. J. Aligholizadeh, S. Javadi, R. S. Nadooshan, and K. Kangarloo, "Eyelid and eyelash segmentation based on wavelet transform for iris recognition," inProc.4th Int. Congr. Image Signal Process., 2011, pp. 1231–1235.

Noise removal is a very important step in an iris segmentation process. Iris regions are usually occluded by Eyelid and eyelashes. For overcome this problem, we present a robust method for eyelid and eyelashes segmentation based on wavelet transform. Our approach follows two main stages. First, eyelashes are removed using wavelet transform. Then eyelids boundary are modeled with a parabolic curve. Second, Eyelashes are modeled by Hough transform. Afterwards eyelashes are segmented using neural network. Experimental results on a set of 756 images show that the accuracy of proposed method leading to accurate eyelid and eyelash segmentation.

Demerits:

Iris images could be taken from humans eyes free from such limitations as frontal image acquisition and special illumination circumstances images could be taken from humans eyes free from such limitations as frontal image acquisition and special illumination circumstances.

[3] D. Zhang, D. Monro, and S. Rakshit, "Eyelash removal method for human iris recognition," inProc. IEEE Int. Conf. Image Process., 2006,pp. 285

Iris segmentation is an essential module in iris recognition because it defines the effective region used for feature extraction, and therefore is directly related to the recognition accuracy. Eyelids, eyelashes and shadows are three major challenges for effective iris segmentation. In this paper, we discuss various novel methods to localize each of them. In first method, a novel coarse-line to fine- parabola eyelid fitting scheme is developed for accurate and fast eyelid localization. A smart prediction model is established to determine an appropriate threshold for eyelash and shadow detection. In second method includes two parts mainly. In the first part, eight eyelids or eyelash models are presented and the second part is iris enhancement .In third method, a new noise- removing approach based on the fusion of edge and region information. The whole procedure includes three steps: 1) rough localization and normalization, 2) edge information extraction based on phase congruency, and 3) the infusion of edge and region information and fourth method discuses a novel eyelash removal method for preprocessing of human iris images in a human iris recognition system is presented.

Demerits:

Poor overall performance of the iris recognition system.

[4] A. V. Mire and B. L. Dhote, "Iris recognition system with accurate eyelash Segmentation and improved FAR, FRR using textural and topological features,"Int. J. Comput. Appl., vol. 7, pp. 0975–8887, 2010.

This paper represents novel iris recognition technique which uses textural and topological features. Converting circular iris pattern into rectangular pattern makes it rotation invariant. Most of the research in iris recognition is on encoding and recognition of iris pattern but segmenting exact iris pattern is itself very tedious task in this paper we are trying to emphasize on better iris segmentation technique . In other systems performance of the system is always dependent on threshold. There is always conflict between FAR & FRR, if tied to improve one quantity

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degrades other one. This paper describes an alternate means to identify individuals using images of their iris with low false acceptance rate and low false rejection rate. For encoding topological feature Euler vector can be utilized while for encoding textural feature histogram is used. Histogram is matched by using Du measure whose origin belong in Hyper spectral Image Analysis while for matching euler vector Difference Matching algorithm is developed .

Demerits:

Most of the research in iris recognition is on encoding and recognition of iris pattern but segmenting exact iris pattern is itself very tedious task in this paper.

[5] B. J. Kang and K. R. Park, "A robust eyelash detection based on iris focus assessment,"PatternRecog. Lett., vol. 28, pp. 1630–1639, 2007

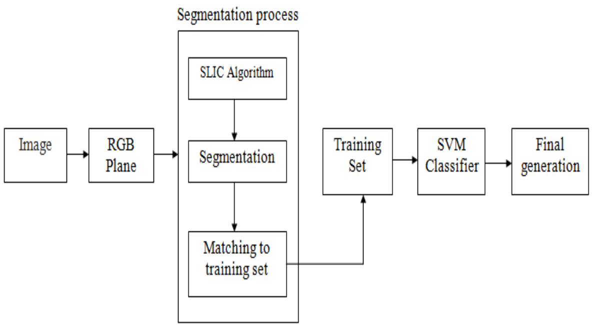
For accurate iris recognition, it is essential to detect eyelash regions and remove them for iris code generation, since eyelashes act as noise factors in the iris recognition. In addition, eyelash positions can be changed for enrollment and recognition and this may cause FR (false rejection). To overcome these problems, we propose a new method for detecting eyelashes in this paper. This work shows three advantages over previous works. First, because eyelash detection was performed based on focus assessment, its performance was not affected by image blurring. Second, the new focus assessment method is appropriate for iris images. Third, the detected eyelash regions were not used for iris code generation and therefore iris recognition accuracy was greatly enhanced. Experimental results showed that the eyelash detection error was about 0.96% when using the CASIA DB and iris recognition accuracy with eyelash detection was enhanced more than 0.86% of EER when compared to the EER obtained without eyelash detection.

Demerits:

Cannot use the CASIA DB and iris recognition system.

IV. METHODOLOGY

The subtasks for training, testing, and deployment stages are briefly described as follows:



1) Image Data Integration: It involves the integration of image data with their manual annotations around true retinal area.

2**) Image Preprocessing**: Images are then preprocessed in order to bring the intensity values of each image into a particular range.

3) **Generation of Superpixels:** The training images after preprocessing are represented by small regions called superpixels. The generation of the feature vector for each superpixel makes the process computationally efficient as compared to feature vector generation for each pixel.

4**) Feature Generation:** We generate image-based features which are used to distinguish between the retinal area and the artefacts. The image-based features reflect textural, grayscale, or regional information and they were calculated for

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each superpixel of the image present in the training set. In testing stage, only those features will be generated which are selected by feature selection process.

5) **Feature Selection**: Due to a large number of features, the feature array needs to be reduced before classifier construction. This involves features selection of the most significant features for classification.

6) **Classifier Construction:** In conjunction with manual annotations, the selected features are then used to construct the binary classifier. The result of such a classifier is the superpixel representing either the "true retinal area" or the "artefacts."

7) **Image Postprocessing:** Image postprocessing is performed by morphological filtering so as to determine the retinal boundary using superpixels classified by the classification model.

AVERAGE CLASSIFICATION ACCURACY

Classifier	Filter Approach			Filter/SFS Approach			SFS Approach		
	DI	DR	DA	DI	DR	DA	DI	DR	DA
SVM	88.48%	88.48%	88.47%	88.41%	88.36%	88.46%	90.93%	90.89%	90.96%
ANN	89.36%	89.49%	89.22%	88.88%	89.00%	88.75%	90.48%	90.28%	90.68%
kNN	88.35%	88.53%	88.17%	88.09%	88.24%	87.94%	90.34%	90.17%	90.52%

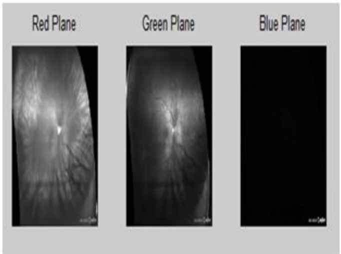
COMPARISON OF FRAMEWORK OUTPUT PERFORMANCE USING DIFFERENT CLASSIFIERS

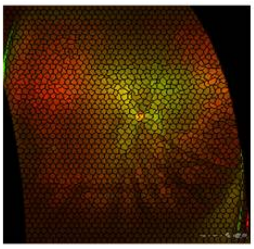
Classifier	Training Time	Testing Time	*DI*	*DR*
ANN	30 min	0.013 s	91.93%	91.87%
SVM	12.5 min	8.5 s	92.00%	91.94%
kNN	1.45 s	2.05 s	91.43%	91.31%

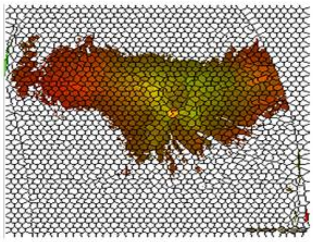
SELECTED FEATURES

Features	Equation	Values
Sum Average	$\mu_{sum} = \sum_{i=2}^{2\_Ng} i p_{x+y}(i)$	6.47
Autocorrelation(R)	$acorr = \sum_{i} \sum_{j} ij p(i,j)$	12.50
Sum of Squares(R)	$\sigma_{sum} = \sum_{i=2}^{2\_Ng} (i - Hsum) p_{x+y}(i)$	12.48
Sum of Variance	$\sigma_{sum} = \sum_{i=2}^{2\_Ng} (i - Hsum) p_{x+y}(i)$	9.72
Sum of Squares(G)	$\sigma_{sos} = \sum_{i} \sum_{j} (i - \mu)^2 p(i,j)$	4.75
Entropy(G)	$H = -\sum_{i} \sum_{j} p(i,j) \log(p(i,j))$	1.63
Difference Entropy	$Hdiff = -\sum_{i=0}^{Ng-1} p_{x-y} \log(p_{x-y}(i))$	0.33

V. DISCUSSION AND CONCLUSION







The existing work is based on the SLO(scanning laser Opthalmascope)with watershed based ANN classifier which produces result with high computational time. In the proposed system, SLIC algorithm with SVM classifier produces at low computational time and also the efficiency is maintained compared to that of the previous work . ANN classifier captures only 200 degree in which the clarity of the image is insignificant whereas SVM captures full image so that the image clarity is maintained perfectly. As compared in the table given above svm classifier is giving high accuracy. Future work is to reduce the computational time and using best algorithm.

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[3] A. V. Mire and B. L. Dhote, "Iris recognition system with accurate eyelash Segmentation and improved FAR, FRR using textural and topological features,"Int. J. Comput. Appl., vol. 7, pp. 0975–8887, 2010.
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