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A Comparative Study to Evaluate Retinal abnormality Squint Eye on Human Face Images

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***Abstract* - This paper presents a comparative study for detection of abnormalities in images of the human eye acquired from a camera. This is due to defective binocular vision which causes Vision loss in the turned eye. The eyes need to be straight for the brain to combine the images seen by the two eyes into a single picture. This gives us 3-D vision, which allows us to judge depth. Any turn of the eye can interrupt 3-D vision, if an eye turns in, it can reduce the total field of vision. Over the years, many methodologies have been developed to detect squint eye. In this paper we compare an efficient algorithm to detect drusen in eye images by extracting the useful information without being affected by the presence of other structures. We present a fast method for locating eye features in frontal face images based on the Hough transform and determine the Vision loss in the turned eye. It consists of an initial detection and a tracking which uses eye features from initialization for speeding up computation. The algorithm was applied to images of subjects taken under normal room lighting conditions.**

***Index Terms* - Hough transforms, image processing, co-variance filter.**

1. MOTIVATION

We decided to explore the capabilities of an approach which is mostly based on the Hough transform although current methods for eye feature extraction use deformable templates [3].The advantage of the Hough transform over using templates is that the final result is computed from a number of independent partial solutions. The Hough transform is therefore well-suited for the fusion of partial results with predictions from a model. The algorithm has been applied to test images of faces which were taken under different lighting conditions. The two irises and their features are detected during initialization. Given the features the localization information will be fine-tuned by evaluating a small neighborhood of each iris.

II.INTRODUCTION

Squint is the term used when the eyes are not pointing in the same direction or eyes are not aligned with respect to each other they point towards different direction. Most commonly one eye either turns in or out. Occasionally one eye may be higher than the other. Some common ways to detect vision loss relate to symptoms that words on a page look blurred, a dark or empty area appears in the center of vision, or straight lines are distorted, it has been identified that age is the greatest risk factor and there is also a hereditary nature associated with the disease. Depth vision cameras have been developed to capture the eye images for accurate on-line analysis. The goal of our research is the on-line processing of eye images, so as to detect the presence of drusen and help the examiner meet the right decision.

If the eyes are not looking in the same direction then they are sending different signals to the brain and this can cause double vision. In this condition eyes are not straight. In most cases one eye appears to look straight ahead while the other eye turns inwards, outwards, upwards or downward and stop working with other eye. The medical name for Squint (or crossed-eye or lazy eye) is Strabismus which means misalignment of eyes.

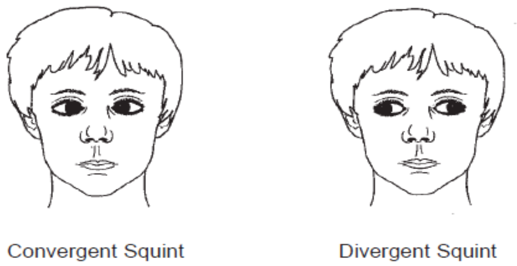

Fig.1

A squint can occur for a number of different reasons these include Damage to the muscles controlling the eye, poor development or damage to the eye muscle control centers in the brain and poor vision in the eye can stop the brain being able to keep the eyes together. This occurs in adults who have had a squint as a child.

III.METHOD

While the patient is looking on front of camera or object, his eyes are photographed simultaneously by using CCD or standard camera and point flashlights mounted at the center of iris. Based on the position of the reflexes point visible on the iris squint eye, percentage amount of squint and the angle of squint can be determined [3][5].Multiple biometric traits simultaneously. By asking the user to present a random subset of biometric traits, the system ensures that a live user is indeed present at the point of acquisition. However, an integration scheme is required to fuse the information presented by the individual modalities.

3.1 Digital image processing

Detection of squint eye may be achieve by measuring the landmark points (eye corners, iris center points), from which the approximate eyelid contours are estimated and thus the exact determination of the squint angle is achieved and by processing and extracting the information from the digital image captured by the camera amount of squint may be calculated. At a first step, the position of the iris is defined as a region of interest [3].

3.2 Using Projection Function

Due to its indifference against disturbances of the contour of an object Mean and variance projection functions are utilized in each eye pair window to validate the presence of the eye for locating the corner and center point of the eye., So in this technique possible eye areas are localized using a simple thresholding in colour space followed by a connected component analysis to quantify spatially connected regions and further reduce the search space to determine the contending eye pair windows.

3.3 Automatic detection by Modelling

This is the simplest yet efficient method for squint eye detection. Modelling the eye by means of its light-refracting layers - cornea, aqueous humour, crystalline lens and vitreous body. is calculated. We modelled the human eye as a circle circumscribed in an ellipse, where circle represents the iris of human eye and the ellipse represents the eye lashes. This is not the only model for an eye, there are infinite models possible and they can be applied as per requirement From the analytical description of the diffraction figures, a rotatory symmetrical model function Due to the low resolution of signals, a simple matched filter is not sufficient for the detection of the squint eye since the digitization only yields a few pixels. Thus, the Cross-Covariance- Function is calculated.

3.4 Detection by Nonlinear Enhancement and Segmentation

This algorithm based on histogram-techniques for the problem of squint eye evaluation. The detection of anomalies in human eye's retina is a biomedical problem, appropriate for image processing and automated segmentation, whose solution is intended to help the doctors in their decision making process. Use of the proposed detector may reduce false negatives and give reliable detection accuracy in both position and mass size. Histogram- based enhancement technique uses histogram equalization as its core operator and a histogram- based segmentation technique to segment areas that differ slightly from their background regions. This method is able to detect actual drusen in all cases. Even in hard-to-diagnose cases, where many small and vague drusen exist.

3.5 Detection using Hough Transform

The Hough-Transformation is suited for the detection of the squint eye. It is based on the idea of transforming all contour points belonging to the structure into one point of transformation space (accumulator array). This point is identified as the global maximum of the AA. It becomes more prominent the greater the number of contour points belonging to the transformed object. The Hough Transform can be calculated for any curve described by parameters, which turn into the axes of the Accumulator Array. Centre, corner and radius of the circular iris in space can thus be read as coordinates of the global maximum of the Accumulator Array which in this case is three-dimensional. The binary edge image is produced by calculating the modulus of the gradient of the original image.

The Hough transform is a standard computer vision algorithm that can be used to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions. An automatic segmentation algorithm based on the circular Hough transform is employed. Firstly, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then thresholding the result. From the edge map, votes are cast in Hough space for the parameters of circles passing through each edge point. These parameters are the centre coordinates X_c and Y_c, and the radius R, which are able to define any circle according to the equation

$$X_c^{\ 2} + Y_c^{\ 2} = R^2$$

A maximum point in the Hough space will correspond to the radius and centre coordinates of the circle best defined by the edge points. Hough transform to detect the eyelids, approximating the upper and lower eyelids with parabolic arcs, which are represented as

$$(- (x - h_j) \sin \theta_j + (y - k_j) \cos \theta_j)^2 = a_j ((x - h_j) \cos \theta_j + (y - k_j) \sin \theta_j)$$

Where a_j controls the curvature, (h_j ,k_j is the peak of the parabola and θ_j angle of rotation relative to the x-axis. In performing the preceding edge detection step, bias the derivatives in the horizontal direction for detecting the eyelids, and in the vertical direction for detecting the outer circular boundary of the iris. The motivation for this is that the eyelids are usually horizontally aligned, and also the eyelid edge map will corrupt the circular iris boundary edge map if using all gradient data. Vertical gradients for locating the iris boundary will reduce influence of the eyelids when performing circular Hough transform, and not all of the edge pixels defining the circle are required for successful localization.

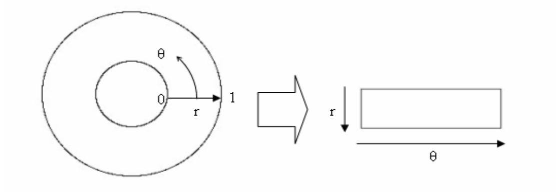

Fig.2

The remapping of the iris region from (x, y) Cartesian coordinates to the normalized non-concentric polar representation is modeled as:

$$I\,(x(r,\theta), y(r,\theta)) \rightarrow I\,(r,\theta)$$

with

$$x(r,\theta) = (1 - r)\,x_p(\theta) + r\,x_1(\theta)$$
$$y(r,\theta) = (1 - r)\,y_p(\theta) + r\,y_1(\theta)$$

where I(x, y) is the iris region image, (x, y) are the original Cartesian coordinates, (r, θ) are the corresponding normalized polar coordinates, and are the x_p , y_p x_l , y_l coordinates of the pupil and iris boundaries along the direction.

IV. DRAWBACKS

Detection of the iris becomes indifferent to disturbances which can be created by spectacle lenses. Glass reflexes appear as bright spots on dark background and lead to wrong detections even though they may have a radius corresponding to that of the iris. Problems are created by reflexes on spectacle frames which act as the amplitude of the gradient is taken into account may falsify the HT to such an extent that the iris is not detected. If the image is blurred and the model function for the Cross-Covariance-filter no longer matches and is discarded. Through the automatic analysis of images, strabometry becomes suitable for screening. The high sensitivity of the system leads to an early recognition of symptoms, and thus to the desired treatment of the illness at an early stage of its development.

V. CONCLUSION

In this paper we have focused the different squint aye detection technique. So the detection of abnormalities in human eye's retina is a biomedical problem, appropriate for image processing and automated segmentation, whose solution is intended to help the doctors in their decision making process. Hough Transform can be used for the detection of circle and ellipse then final eye is detected with amount of squint by neglecting the wrong detections and ruling out a pair of eyes based on geometrical considerations. This method is also applied for online eye detection purpose. It cannot be supposed that the contour of the iris is closed and free of distortions .Due to the indifference to interruptions of the contour of an object the Hough-transformation is especially selected for squint eye detection. A significant factor that affects the overall performance of other approaches is the presence of noise, which makes surfaces look rough and renders the segmentation process difficult. Although, it is not a common case, since the presence of noise is rare in such images and provides adequate results even in the case of noise contamination.

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