Volume : 3 | Issue : 4 | April 2014 • ISSN No 2277 - 8179

Research Paper

Biotechnology

KEYWORDS : Iris recognition, biometrics, iris segmentation, integrodifferential operator, active contour

Survey on Segmentation to Iris Recognition System

Meenakshi BK — 4thsem, Mtech, Dept. CS&E, East west of Technology, Bangalore

Mrs. Prasad M R — Asst. Professor, Dept. CS&E, East west of Technology

ABSTRACT *– Iris recognition is regarded as the most reliable and accurate biometric identification system available. Iris recognition systems capture an image of an individual's eye; the iris in the image is then segmented and normalized for feature extraction process. A review of various segmentation approaches used in iris recognition is done here.*

Introduction

Iris recognition is automated method of biometric applications it uses that uses mathematical pattern-recognition techniques on video images of the irides of an individual's eyes, whose complex random patterns are unique and can be seen from some distance. Need to find accurate irides part for security considerations. Different steps to be followed to get accurate irides part are segmentation, normalization, feature extraction and matching.

Iris segmentation is a critical step in an iris recognition system. It is very important for the further processing. Main goal of segmentation is to localize the iris fom surrounding noises, including pupil, sclera, eyelids, eyelashes, eyebrows and reflections. Pupil places the most important part of segmentation. Iris regions are closer to pupil provide the most useful information for recognition. Accuracy of location of pupil has important impact on overall system performance. The Integrodifferential operator [1], which acts as a circle edge detector is employed for determining the inner outer boundaries of iris.

Wildes applied hough transform [2] based method to segmenting the iris, and the upper and lower boundaries of eyelid are approximated using parabolic curves. All above methods consider iris contour as circles or ellipse, recent active contour [4] has been proposed which has been utilized to improve the performance for arbitrarily shapes but it not varying according to the different gradients. So new effective method proposed by considering the arbitrary shapes and gradients factors.

1. Integrodifferential operator

This approach [1] is regarded as one of the most first and foremost approach in the survey of iris recognition. Daugman uses an integrodifferential operator for segmenting the iris. This operator search over dimensional image domain for maximum partial derivatives, with respect to radius of the normalized contour integrals image domain along, circular arc and center co-ordinates convolute with smoothing function such as a Gaussian function for the maximum and minimum radius to finds both inner and the outer boundaries of the iris region. The outer as well as the inner boundaries are referred to as limbic and pupil boundaries. The parameters such as the center and radius of the circular boundaries are being searched in the three dimensional parametric space in order to maximize the evaluation functions involved in the model. This algorithm achieves high performance in iris recognition. It is having a drawback that, it suffers from heavy computation.

2. Hough Transform

The Hough transform [2] 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 by Wildes. Firstly, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then threshold 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 and radius, which are able to define any circle according to the equation.

A maximum point in the Hough space will correspond to the radius and centre coordinates of the circle best defined by the edge points. Wildes et al. and Kong and Zhang also make use of the parabolic Hough transform to detect the eyelids, approximating the upper and lower eyelids with parabolic arcs, which are represented as to performing the preceding edge detection step, Wildes et al. 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. Taking only the vertical gradients for locating the iris boundary will reduce influence of the eyelids when performing Hough transform, and not all of the edge pixels defining the circle are required for successful localization. Not only does this make circle localization more accurate, it also makes it more efficient, since there are less edge points to cast votes in the Hough space. There are a number of problems with the Hough transform method. First of all, it requires threshold values to be chosen for edge detection, and this may result in critical edge points being removed, resulting in failure to detect circles/arcs. Secondly, the Hough transform is computationally intensive due to its "brute-force" approach, and thus May not be suitable for real time applications.

3. Unified framework approach

A new iris segmentation framework has been developed[3], which can robustly segment the iris images attained using NIR or else the visible illumination. This approach exploits multiple higher order local pixel dependencies using Zernike moments (ZM), in order to strongly (robustly) classify the eye region pixels into iris or else the non iris regions using trained neural network/ support vector machine (NN/SVM) classifiers. Image enhancement using single scale retinex (SSR) algorithm has been employed for illumination variation problem. Face as well as the eye detection modules has been integrated in the unified framework to automatically provide the localized eye region from facial image for segmenting the iris. A robust post processing operations algorithm has been developed in order to effectively alleviate the noisy pixels which has been caused due to misclassification. It requires lots of computational time .

4. Traditional active contour Model

Algorithms based on active contours, or snakes, iteratively adapt the segmented shape to the edges of the image. This class of algorithms is commonly adopted in many computer vision applications. Ritter [4] proposed the first active contour model to localize the iris in an image. The model detects pupil and limbus by activating and controlling the active contour using two defined forces: internal and external forces. The internal forces are responsible to expand the contour into a perfect polygon with a radius larger than the contour average radius. The internal force is defined as each vertex and position of vertex, position is obtained with respect to current contour.

Volume : 3 | Issue : 4 | April 2014 • ISSN No 2277 - 8179

Contour is defined as average radius of current contour and contour center is average distance of all the vertices from the defined center point. The internal forces are designed to expand the contour and keep it circular. The force model assumes that pupil and limbus are globally circular, rather than locally, to minimize the undesired deformations due to specular reflections and dark patches near the pupil boundary. The contour detection process of the model is based on the equilibrium of the defined internal forces with the external forces. The external forces are obtained from the grey level intensity values of the image and are designed to push the vertices inward. The magnitude of the external forces is defined as is the grey level value of the nearest neighbor its direction of the external force for each vertex. The movement of the contour is based on the composition of the internal and external forces over the contour vertices. Drawback of this model is that, this is not works if gradient factor of image more.

5. New Active Contour Approach

All previous segmentation techniques model iris boundaries simple geometric models, pupil and limbus are often modeled also low gradient factor as circles. Effective technique for segmentation has been proposed [5] new active contours scheme based on active contours without edges method to localize the pupil accurately which is more efficient than different segmentation. GVF (Gradient Vector Flow) snakes combined with multiscale wavelet maxima edge detection to localize inner and outer boundary. Multiscale wavelet is used to get an accurate edge map for iris outer boundary, the left and right side of iris edge are weak, and then maxima wavelet vertical components have been used for iris edge enhancement. GVF is similar to the traditional snake but here they define a new external force field this is effective than traditional Active contour model. It is defined as a contour coordinates which is vector field substitutes of external field with reference to the outer boundary.

Conclusions

This work presents a literature survey on the various segmentation techniques involved in iris recognition. There are various techniques that can be used for this purpose. Overall segmentation accuracy of all these techniques has been analyzed. Higher the segmentation rate, thus higher is its performance. The New active contour Approach [5] has the highest segmentation rate and highest performance.

REFERENCE

[1] J.G. Daugman, High confidence visual recognition of persons by a test of statistical independence, IEEE Transactions on Pattern Analysis and Machine Intelligence, 15, p.1148, Nov 1993. | [2] R.P. Wildes, Iris recognition: An emerging biometric technology, Proceedings of the IEEE, 85 p.1348, sep. 1997. | [3] Ritter, N. and J. Cooper. Locating the iris: A first step to registration and identification. in Proceedings of 9th IASTED International Conference on Signal and Image Processing. 2003. | | [4] Tan, C. and Kumar, A., Unified framework for automated iris segmentation using distantly acquired face images. IEEE Transactions on Image Processing, 21(9):4068–4079, Sep 2012. | | [5] M.Nabti and A. Bouridane, New Active Approach and phase Wavelet Maxima to Improve iris Recognition System. Visual information Processing (EUVIP), 4th European Workshop on Image Processing, 238-244, 2013 |