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An Efficient and Robust Iris Segmentation Algorithm Using Deep Learning

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Abstract
The iris segmentation algorithm is very essential in an absolute iris recognition system and has a direct influence on the verification and recognition results of the iris. However, traditional iris segmentation algorithms have poor adaptability and are not robust enough when used in noisy iris databases captured under infinite conditions. Under non-ideal conditions, existing segmentation based on local operations cannot see the true iris boundary, and iris recognition result come in failure. In addition, paper discuss on the iris distribution algorithm that shows the benefits from the convolution neural network (CNN).

INTRODUCTION

A biometric system provides automatic recognition of an individual based on some sort of unique feature or characteristic possessed by the individual. Biometric systems have been developed based on fingerprints, facial features, voice, hand geometry, handwriting, the retina [1], and the one presented in this thesis, the iris. Biometric systems work by first capturing a sample of the feature, such as recording a digital sound signal for voice recognition, or taking a digital colour image for face recognition. The sample is then transformed using some sort of mathematical function into a biometric template. The biometric template will provide a normalised, efficient and highly discriminating representation of the feature, which can then be objectively compared with other templates in order to determine identity. Most biometric systems allow two modes of operation. An enrolment mode for adding templates to a database, and an identification mode, where a template is created for an individual and then a match is searched for in the database of pre-enrolled templates. A good biometric is characterized by use of a feature that is; highly unique – so that the chance of any two people having the same characteristic will be minimal, stable – so that the feature does not change over time, and be easily captured – in order to provide convenience to the user, and prevent misrepresentation of the feature.

THE HUMAN IRIS

The iris is a thin circular diaphragm, which lies between the cornea and the lens of the human eye. A front-on view of the iris is shown in Figure 1.. The iris is perforated close to its centre by a circular aperture known as the pupil. The function of the iris is to control the amount of light entering through the pupil, and this is done by the sphincter and the dilator muscles, which adjust the size of the pupil. The average diameter of the iris is 12 mm, and the pupil size can vary from 10% to 80% of the iris diameter [2]. The iris consists of a number of layers, the lowest is the epithelium layer, which Contains dense pigmentation cells. The stromal layer lies above the epithelium layer, and contains blood vessels, pigment cells and the two iris muscles. The density of stromal pigmentation determines the colour of the iris. The externally visible surface of the multi-layered iris contains two zones, which often differ in colour [3]. An outer ciliary zone and an inner pupillary zone, and these two zones are divided by the collarette – which appears as a zigzag pattern.

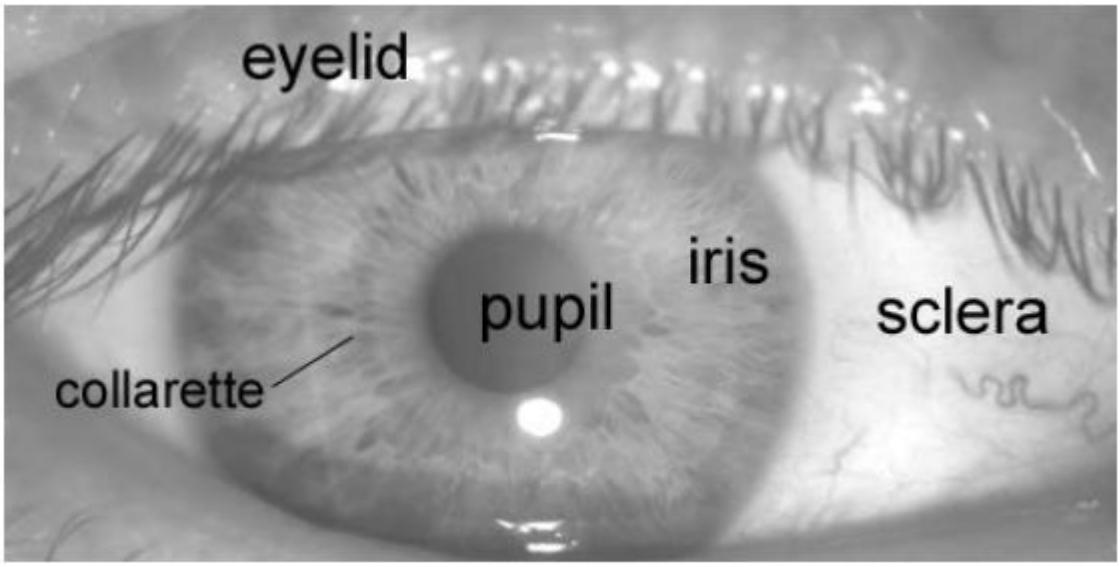


Figure 1 – A front-on view of the human eye.

Formation of the iris begins during the third month of embryonic life [3]. The unique pattern on the surface of the iris is formed during the first year of life, and pigmentation of the stroma takes place for the first few years. Formation of the unique patterns of the iris is random and not related to any genetic factors [4]. The only characteristic that is dependent on genetics is the pigmentation of the iris, which determines its colour. Due to the epigenetic nature of iris patterns, the two eyes of an individual contain completely independent iris patterns, and identical twins possess uncorrelated iris patterns.

SECURE IRIS PATTERN RECOGNITION

The authentication of a human identity is a serious assignment in the present enormously unified civilization. The significance of the consistent human verification method has enlarged in view of high concerns regarding security and quick development. Biometrics is the knowledge of recognizing a individual on the basis of physiological or behavioral character. Applications such as customer control in airports, admittance control in forbidden areas, border control, database access and banking services are some of the instances where the biometric technology has been employed for more reliable identification and verification[5].. Iris based recognition is the most hopeful for serioussecurity environment among various biometric patterns including facial features, finger prints, palm veins, signature, palm prints, retina, gait etc, because of its uniqueness, stability and non-invasive property.

Iris Recognition Process

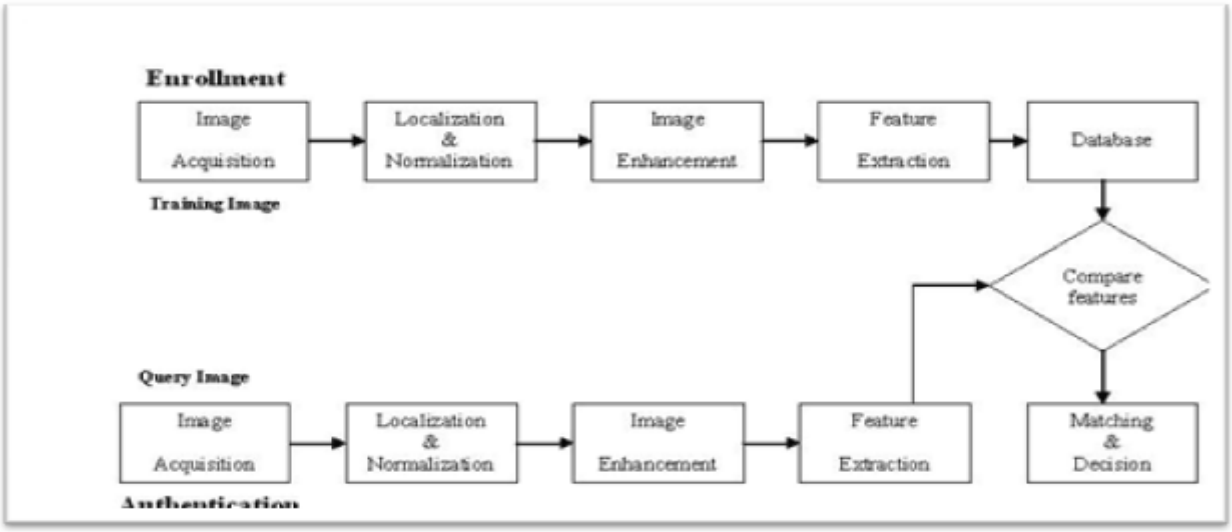


Figure 2 – An Efficient Algorithm for Iris Recognition Process

METHODOLOGY

This paper concerns to the iris segmentation stage, which, as in any other image processing task, plays a crucial role in the overall recognition success. Moreover, the noise regions resultant of the image capturing increases the demands of segmentation robustness and adaptability. The proposed methodology is based on Statistical Approaches, alpha trimming operation and checking the gray level transition. Image segmentation can be defined as the partitioning of an image into several components[6].. It is an important stage of any automated image processing system, essentially because it is the basis for any further operations, such as description or recognition. In the pattern recognition domain, segmentation is the assignment of each pixel to an image region, which can be regarded as a typical classification problem.

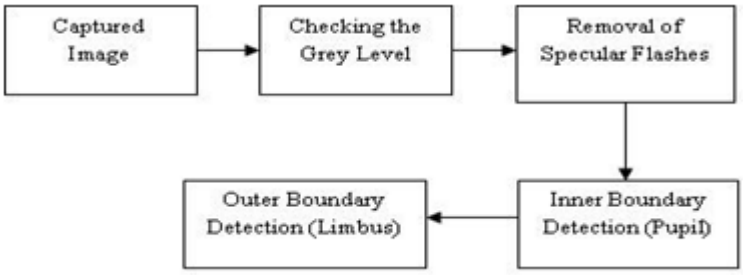
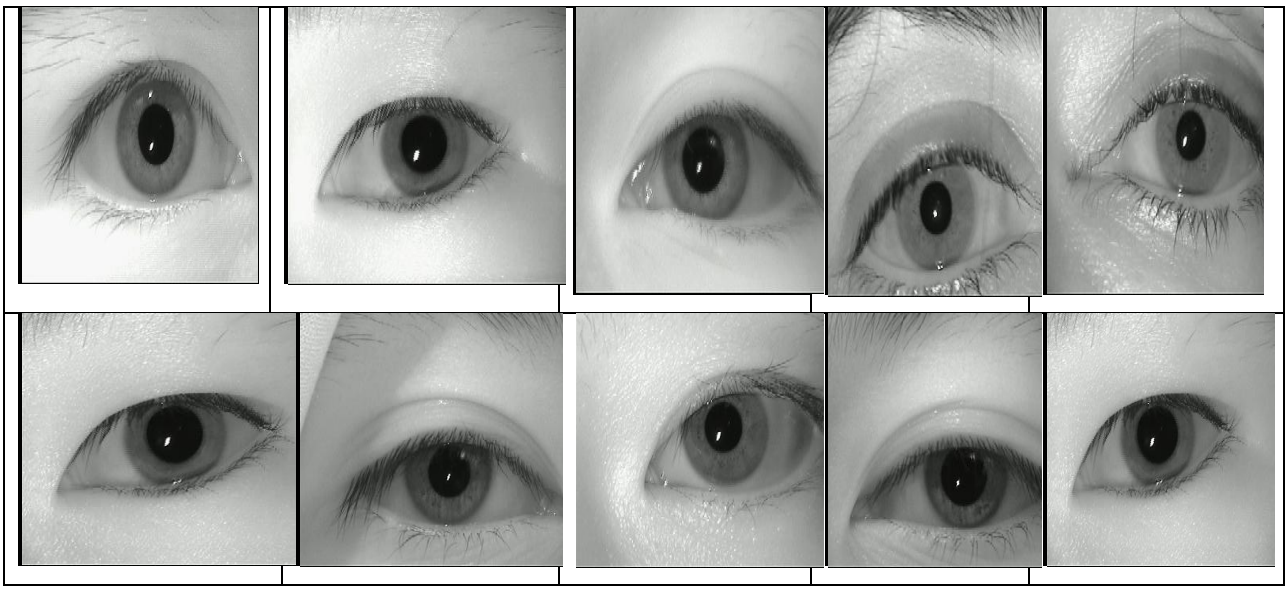


Figure 3 – Flowchart Showing The Localization Stage

PROPOSED SYSTEM

Iris images were trained by extracting the GLCM and Vgg16 feature from the texture feature of the images. The input Iris image is first preprocessed from the dataset images by using the RGB to gray. The Iris is detecting in the input image and then the features are extracted. Then GLCM and Vgg16 feature were extracted from the image. Then the feature vector is generated. These are considering as test feature. The extracted features were then classified using Support Vector Machine classifier and the Iris is matched. The performance of the process is measured. The process continues till the end. At each node level the generated values were saved as features. The obtained features were used for the classification of the Iris image [7].. The values of the texture were taken as features. The extracted features were then classified using VGG16 network and classifier and the race, liveliness was detected and the Iris is matched. The extracted feature values were then classified based on the label given by the user. The classifier gives the label to which the input image belongs. Three different labels were given in order to find the liveliness, Race and matching of iris. The input image is classified to any one of the two categories that we have specified (i.e.) fake or Real, Asian or Non-Asian[8].. The category of the Iris is also identified using Multi VGG16. It categorizes the images into more number of categories. The performance of our process is measured by calculating the accuracy, sensitivity and specificity of the classifier for the three processes[9,10].. The accuracy of the classifier represents to which extend the classifier classifies the images based on the given label. The sensitivity of the classifier represents how exactly the classifier correctly classifies the data to each category. The specificity of the classifier represents how exactly the classifier correctly rejects the data to each category.



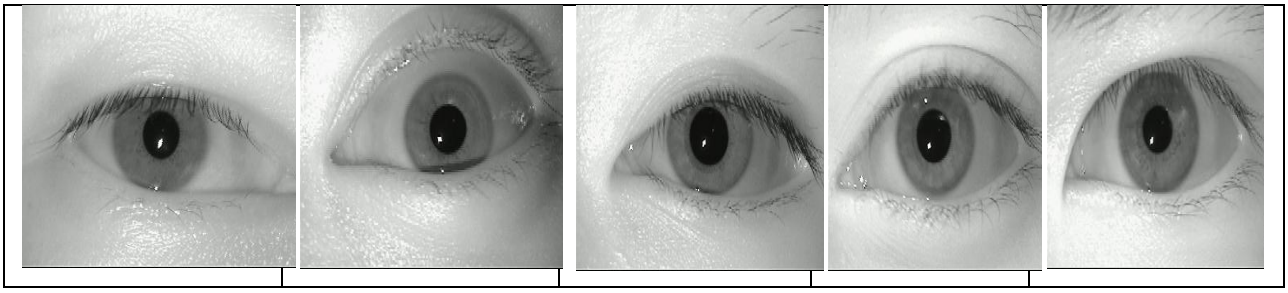


Fig 4 Input data set

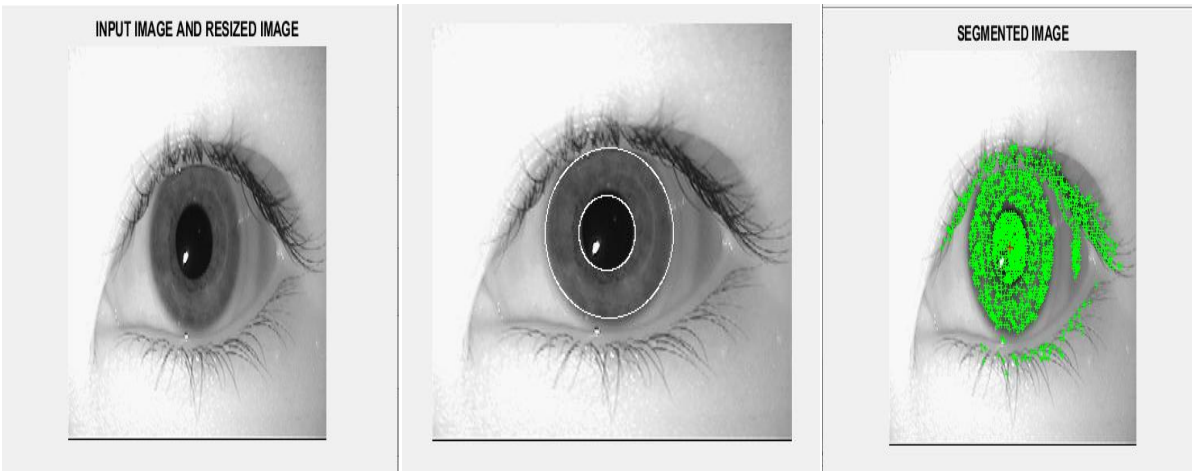


Fig.5 Accurate Detection of Iris and Pupil Boundaries

PERFORMANCE MEASURES

System performance is measured by calculating the accuracy, sensitivity and specificity of the classifier. The accuracy of the classifier indicates the area where the classifier ranks the image based on the specified label. Classification sensitivity indicates how the classifier correctly ranks the data in each category[11].. The classifier's specificity indicates how the classifier correctly rejects each data category

Performance parameters: We have used three parameters accuracy, precision, specificity.

TN- is total number of poorly classified prospects (true negative numbers).

FN- is total number of false rejections, which represents the number of false pixels of foreground pixels classified as background (false negatives).

FP- is total number of false positives, which means that pixels are mistakenly classified as foreground (false positives). Calculate presentation value for each frame of input video based on overhead indicators.

CONCLUSION

The proposed system recognizes the iris of the persons in the dataset based on the features extracted using GLCM and Vgg16. The extracted features are based on the GLCM and Vgg16 which is combined with many of the other texture generation process. The recognition of the iris is done using the kernel function of the VGG16 classifier. The proposed system gives accuracy of 90.91% which is higher than the existing algorithms. The Texture method used are thoroughly evaluated and shown to significantly outperform.

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