**CS3330 REPORT**

1. Background

Eyes detection:

Eyes detection in human face images plays an important part in facial recognition. Accurately extracting the eyes region help us performing normalisation of the human face (i.e., facial features alignment), which is a crucial pre-processing step of various face recognition systems.

There are several existing approaches for extracting the location of the eyes.

Most of modern face detection algorithms are developed based Viola-Jones object detection framework [1], which based on series of Haar like features. Haar cascades are the combination of multiple weak classifiers. The downside of this algorithm is the slow learning process and large number of features.

Rajpathak [2] was able to detect the face's skin region by performing six-sigma operation on mixture of NTSC, HSV and RGB spaces. When an eye is well illuminated, it has a very sharp reflection point .Because of this fact; morphological operations had been used to detect the spot between the two eyes. Having to use three color space models, a high complexity is the main limitation of this algorithm.

The third algorithm that I have looked into was proposed by Kawaguchi and Rizon [3] which use edge detection, region growing and circular Hough transformation to. Slow and expensive computationally was the major disadvantage of this algorithm.

2. Algorithm

Motivate why it would be suitable for solving your chosen problem, making reference to the literature.

Kawaguchi and Rizon proposed an algorithm in which eyes were extracted by the intensity valley from the face region using edge detections, morphology, region growing algorithm, circular Hough transformation and feature template approaches [7]. The limitation of this algorithm was computationally slow.

The illumination spot between eyes had been detected by morphological operations and this was based on the fact that an eye had a sharp point of reflection whenever it was being well illuminated [11]. The major drawback of this algorithm was increased complexity due to many color space models.

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The location of the eyes is the most commonly used features to perform face normalisation (i.e., alignment of facial features), which is an essential pre-processing stage of many face recognition systems.

slow learning method and large number of features were major drawback of this algorithm.

Viola and Jones used integrated image, Adaboost learning algorithm with Haar like features, and combining the classifier in a cascade for face detection [8]. Weak classifier, slow learning method and large number of features were major drawback of this algorithm.

Various researchers have been working on face detection and eyes extraction in human face image for two decades due to its numerous applications in various fields. The extraction of eyes from face region was achieved by many researchers while certain researchers extract face region with the help of eyes points. The related work of different face detection and eyes extraction methods are discussed here.

in computer vision applications such as face recognition, face verification, gaze estimation and human computer interaction. The position of the eyes can be extracted from an image using different eye features such as colour, illumination, edge, shape and geometrical information. Most colour variations occur in eye regions in facial images due to colour difference between eyelids and skin, skin and sclera, sclera and iris, and iris and pupil (see figure 1). The colours of the rest of the face are more uniform when compared to the eyes. Therefore, if edge detection was applied to facial images then the eye regions would have maximum edge densities. The proposed method uses this edge density information to extract the eyes from facial images

Find shape:

<https://uk.mathworks.com/matlabcentral/answers/10721-how-to-detect-an-circular-ellipse-object-in-an-image>  
  
RGB to YcBcR

<https://uk.mathworks.com/help/images/ref/rgb2ycbcr.html>

connected component

<https://uk.mathworks.com/help/images/ref/bwconncomp.html>

blob detection:

<https://uk.mathworks.com/matlabcentral/answers/357682-extraction-of-rectangular-blob-from-binary-image>

https://uk.mathworks.com/help/images/ref/bwconncomp.html#inputarg\_conn

https://uk.mathworks.com/help/images/ref/regionprops.html#Tips

angle line:

https://stackoverflow.com/questions/22944984/matlab-angle-between-two-points

proposed : delete small component one more time before apply rules. (Area>100). Reduce the chances of mistaken small are to eyes. (nose strills..)

RULES:

Proposed: distance between two eyes shouldn't be too large or too small compare to their bounding box size.

Increase eyes orientation to 90.0

eyes slope decrease to 30.0

eyes size ratio to 3.0

[1] P. Viola, and M. J. Jones, “Robust real-time face detection”, International Journal of Computer Vision, vol. 57(2), pp. 137-154, 2004.

[2] T. Rajpathak, R. Kumar, and E. Schwartz, “Eye detection using morphological and color image processing”, Proceeding of Florida Conference on Recent Advances in Robotics, pp. 1-6, 2009.

[3] T. Kawaguchi, and M. Rizon, “Iris detection using intensity and edge information”, Pattern Recognition, vol. 36(2), pp. 549-562, 2003.