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PERFORMANCE ANALYSIS BETWEEN KEYPOINT OF SURF AND SKIN COLOUR YCBCR BASED TECHNIQUE FOR FACE DETECTION AMONG FINAL YEAR UTEM MALE STUDENT

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Abstract

This project presents an analysis of development out-of-plane of face detection using Speeded-Up Robust Feature (SURF) and skin colour of YCbCr colour-based technique. The technique of SURF method and skin colour of YCbCr was explored in order to compare the performances in terms of time response. The significant difference can be seen with an extraction of feature point followed by matching it using SURF technique whereas skin colour of YCbCr colour extract the skin region. It is discovered that the skin colour of the respondent does not give any impact on the result. The outcome is presented using MATLAB 2013a software. To determine the response of both technique in detecting the face area, out-of-plane captured images is varied and chosen randomly from 0°, 45° and 90°. The outcome shows that SURF technique can detect the SURF feature point in different angles, but the matching point cannot discover if the images in 45° and 90°. In contrast, the skin colour of YCbCr can spot the present of face despite its angle. Through the project analysis, the respondents' tone of skin colour does not affect the result of both techniques. Overall, SURF technique gives an impact in face detection if the angle of the images is being varied. Different angles are applied in this technique in order to vary the result of out-of-plane. The number of key feature for image 2 is the highest due to variation of angles from 90°, 45° and 0° in corresponding.

Keywords: SURF, YCbCr, angle, skin colour, face detection

1.0 INTRODUCTION

Face detection is a universal and complex with a diversity of techniques. It is tough in the main due to a large part of non-rigid and textual difference between the faces [1,2].The challenging part to detect the face are due to some limitation exists like uncontrolled lighting, complex background, and gender. There are many methods that have been discovered to overcome the problem such as EigenFace, 2D-PCA, Scale-Invariant Feature Transform (SIFT) until Speeded-Up Robust Features (SURF) is proposed in 2006 by Herbert Bay *et al*. SURF (Speeded Up Robust Features) is a robust image detector and descriptor that can apply and used in computer vision task like 3D version [3,4,5]. SURF is based on multi-scale space theory, but determinant of the approximate Hessian Matrix is only based on feature detector. Blob-like structure is detected first at the location where the maximum determinant before the interest point is located. SURF is developed because of the problem in real time. So to reduce time drastically, the integral image is used the Hessian Matrix approximation. Hessian Matrix also has high accuracy and a good performance.

In present days, face detection in colour images has gained popularity in image processing research field. Colour is the leading factor of face detection for individual person as compared to other features. Colour is an effective cue to extract skin regions, and it only can be attain in colour images [6]. The YCbCr is commonly used in the area of digital video, representation, transmission and processing. It was originally developed for the colour representation of digital television [6]. YCbCr is developed as other technique to work with digital television format. Basically, luminance information is stored as a single component (Y channels) and chrominance information is stored as two colour-difference components (Cb and Cr channels). Cb is represents the difference between blue and luma component while Cr represents the difference between red and luma components [6]. However, it is contrast to RGB, YCbCr colour based technique achieves better performance because it is luminance independent [7]. H. C. Vijay Lakshmi and S. PatilKulakarni stated that HSV and YCbCr colour space help to a greater extent in handling intensity variations [8]. Moreover, this method also had been applied in various applications such as traffic sign [9, 10].

In this research, it proposed SURF and skin colour YCbCr colour-based techniques to explore the performances of face detection for both methods. The results are been compared based on time response of out-of-plane images. Images are captured from 0°, 45° and 90° to vary an out-of-plane images to see the time response for image detection.

2.0 METHODOLOGY

2.1 Speeded Up Robust Feature

SURF is robust to common image such as image rotation, scale changes and illumination changes. This technique spot a SURF feature and matching the feature point in the images [11, 12]. As in Figure 1, it will read the input image before extract SURF features and two images are used to detect the cross point matching in the images. The first matching is display as outliers and the matching is detect matching point of feature outside the desired image (image 1). Then, the second matching is display as inliers which all the outliers is removed.

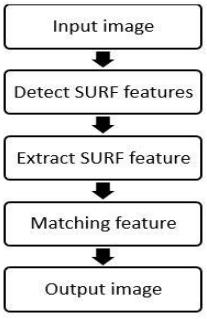

Figure 1 Flow Chart of face detection using SURF technique

2.2 Skin Colour YCbCr Based Technique

Skin colour detection is vital part in face detection. Skin color segmentation is a technique to distinguish between skin and non-skin pixels of an image [13]. Color provides importance information for humans to recognize objects which can be illuminated under a very wide range of conditions [14]. Through this research YCbCr colour-based technique flow in Figure 2 is used to detect the skin portion of an image. Nine respondents (sample) of male UTeM final year students was chosen randomly with distinct angle of the image is used as an input image. The face detection using YCbCr colour-based technique process is broadly categorized into six parts. The progression is shown below:

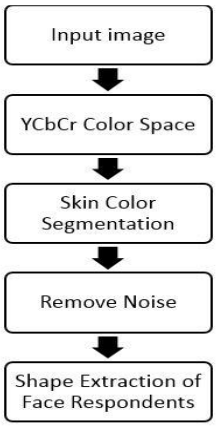

Figure 2 Flow of face detection using Skin Colour YCbCr Based technique

3.0 RESULTS AND DISCUSSION

This section expounds the implementation of both techniques. The analysis is based on the angle of an image captured and the time response. Images are captured from three varied angles which are 0°, 45° and 90° as shown in Figure 3.

Figure 3 Three Different Angles of Face Detection,- (a) 0°, (b) 45°and (c) 90°

3.1 SURF and Matching Point of SURF Technique

Figure 4 shows the steps to detect SURF feature point and matching point. Based on Figure 5, Figure 6 and

Figure 7 it shows the number of key feature and matching point by using the SURF technique. The graph has four line which are key feature of image 1 and image 2 together with matching point of outliers and inliers. All the data are shown in figure below:

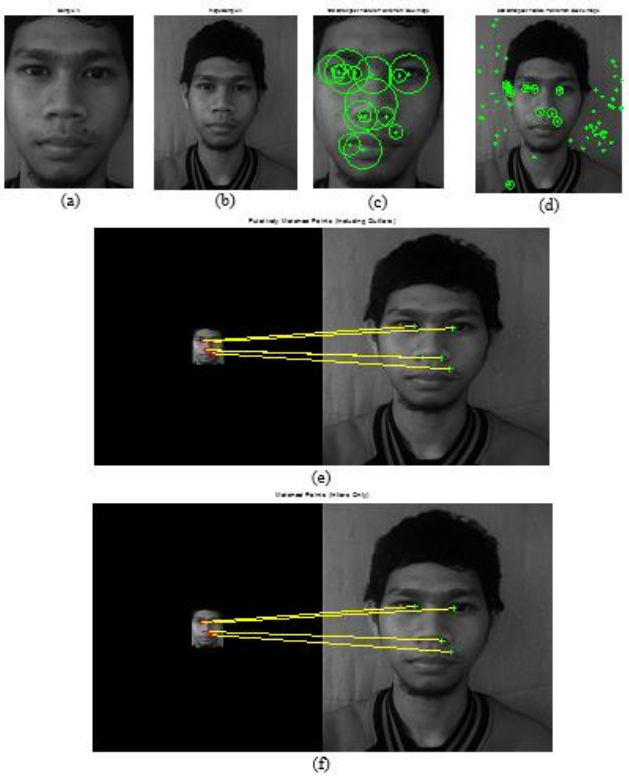

Figure 4 SURF Feature Point and Matching Point,- (a) image 1, (b) image 2, (c) detect SURF feature at image 1, (d) detect SURF feature at image 2, (e) matching point of outliers, (f) matching point of inliers

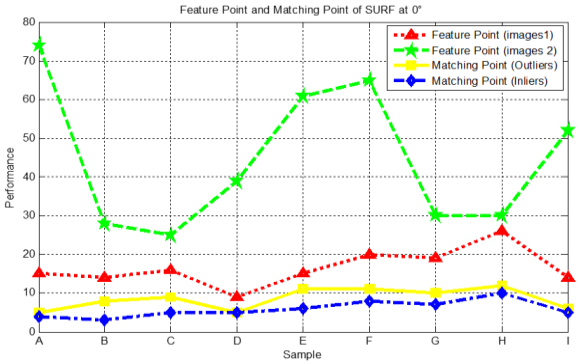

Figure 5 Graph of Performance Using the SURF Technique at 0°

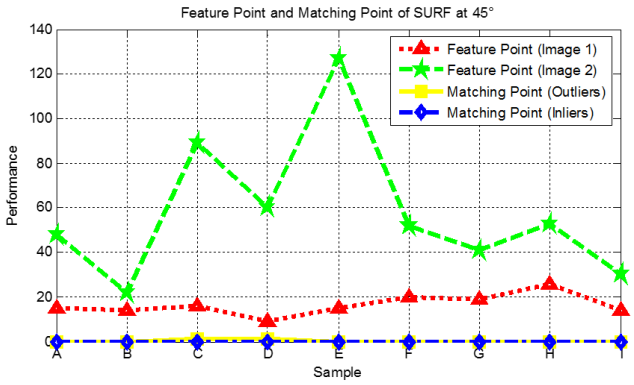

Figure 6 Graph of Performance Using the SURF Technique at 45°

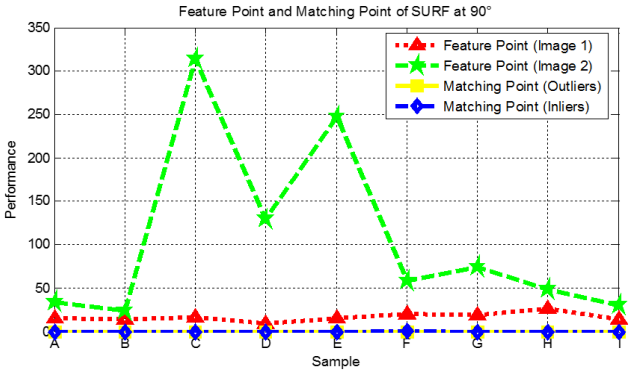

Figure 7 Graph of Performance Using the SURF Technique at 90°

Overall, SURF technique gives an impact in face detection if the angle of the images is being varied. Different angles are applied in this technique in order to vary the result of out-of-plane. The number of key feature for image 2 is the highest due to variation of angles from 90°, 45° and 0° in corresponding.

3.2 Skin Colour Detection of YCbCr Colour Based Technique

Figure 8 shows a skin region using YCbCr colour-based technique.

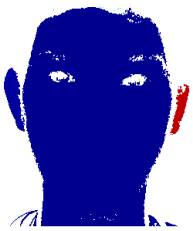

Figure 8 Skin regions at 0°

Figure 9, Figure 10 and Figure 11 shows the result of skin colour detection. The graph has five line which are face (I), colour (T), skin (S), skin with noise removal (SN), and face sample (L). All the data are shows in graph below:

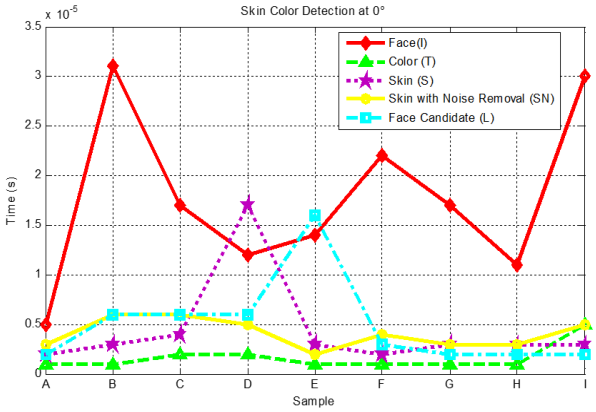

Figure 9 Graph of Skin Colour Using YCbCr Colour Based Technique at 0°

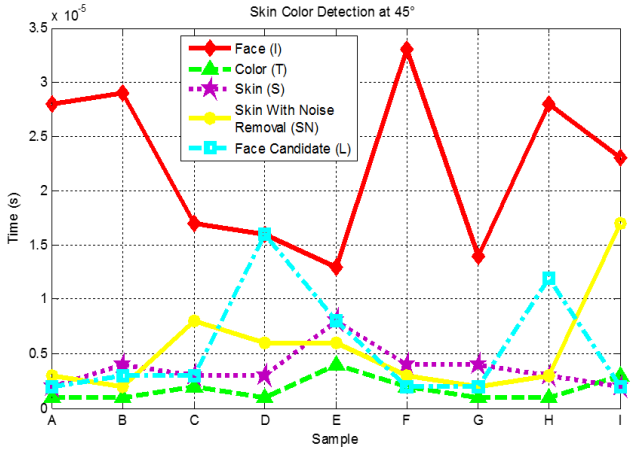

Figure 10 Graph of Skin Colour Using YCbCr Colour Based Technique at 45°

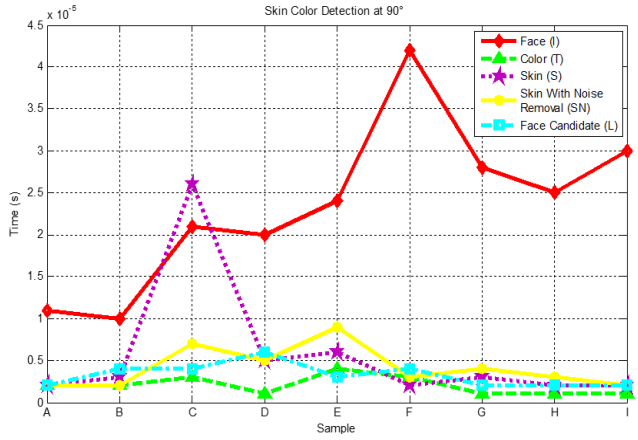

Figure 11 Graph of Skin Colour Using YCbCr Colour Based Technique at 90°

Overall, the angle of the images not affects the performance skin colour of YCbCr colour based technique. By varying the angle of out-of-plane image, the performance in term of time response can be determined in clarity. YCbCr colour-based technique is an invariant skin region detector as it keeps detecting the skin colour even though different angle are applied.

3.2 SURF and YCbCr Colour Based Technique

Figure 12 shows the results of SURF and the skin colour of YCbCr colour-based techniques. The total time taken for both techniques by varying to 3 different angles is used to determine the better performances in terms of time taken. The solid line and dotted lines are signifies SURF technique and skin colour of the YCbCr colour-based corresponding. The average times between the both methods are slightly differing. Colour can detect a region of face at different angles meanwhile by using the SURF technique only SURF feature points are detected. Noted that a lighter and darker skin colour take a longer time to detect the skin region of the face.

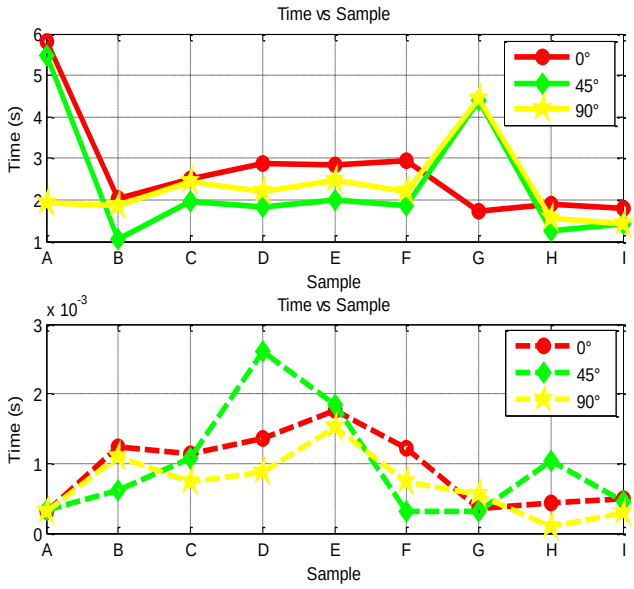

Figure 12 Graph of SURF and Skin Colour of YCbCr Colour Based Technique

4.0 CONCLUSION

As a conclusion, the skin colour of YCbCr colour based-technique is faster in time response of face detection. This method also not affected by the input image that is from different angles. SURF cannot detect the matching point of the image if different angle is used between image 1 (desired image) and image 2 while colour can detect the skin region in all angles. Through the research, it is discovered that the skin colour of the respondent does not give any

impact on the result. The outcome shows that SURF technique can detect the SURF feature point in different angles, but the matching point cannot discover if the images in 45° and 90°. In contrast, the skin colour of YCbCr can spot the present of face despite its angle. Through the project analysis, the respondents' tone of skin colour does not affect the result of both techniques. In future works, shape of face is varied and the number of database is increase [15]. The proper method must be chosen wisely to produce the accurate reliable and acceptable results [16].

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