An Effective Approach to Shadow Removal and Skin Segmentation using Deep Neural Networks

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Abstract

One of the greatest challenge of traditional skin segmentation is false positive rate increases when skin tones are under shadow conditions and overlapping of skin pixels and non-skin pixels. This paper presents an effective approach to shadow removal and skin segmentation in both RGB and HSV color space and it is a deep neural networks to learn high-level representations of skin tones. Firstly, shadow from the input images or frames of video is detected by using hybrid shadow detection algorithm and then removed using correlation based neighbourhood matching algorithm. After the image enhancement, the skin segmentation is done by using triclass thresholding. Skin region recognition can be done by using VGGNet and has learned rich feature representation for a wide range of images. Instead of predicting each pixels individually, we utilize block of pixels for skin segmentation to avoid overlapping of skin pixels and non-skin pixels.

Keywords: Pixels, Vggnet, Skin Segmentation, Correlation, Images

I. INTRODUCTION

A good skin detector is designed to capture skin tones under different conditions and is important to human-machine interaction application such as face detection, human motion recognition, hand gesture recognition etc. But traditional skin segmentation is based on skin probability maps and guassian mixture models and classify each pixels individually. As a result it is more probable to overlap skin pixels and non-skin pixels. In our design, blocks of pixels can be treated as input and it also overcome false positive rate by using shadow detection and removal algorithm. Shadow from the input is first detected by using hybrid shadow detection and removed by using correlation based neighbourhood matching. The result is given to skin segmentation algorithm and skin region recognition algorithm after the image enhancement to provide accurate skin segmentation results. Traditional skin segmentation based on Stacked Auto Encoders (SAEs)[1] is the good technique but the greatest challenge is that it cannot provide accurate result when skin tones are under shadow. This paper introduces an effective approach to shadow removal and skin segmentation in both RGB and HSV color space.

Skin region recognition can be done by using deep neural network such as VGGNet. It is a Convolutional Neural Network(CNN) with weight layers and very accurate in large scale skin region recognition. This model has learned rich feature representation for a wide range of images. Triclass thresholding is based on otsu's method and it can select one threshold which can be determined by the mean of all pixel values. Based on these threshold, image can be classified into skin pixels and non-skin pixels and the process continued into all pixels. This can be done for accurate edge and boundary segmentation.

II. PROPOSED METHOD

The greatest challenge of the traditional skin segmentation is that it cannot provide good result when the skin tones are under shadow. This proposed system first detect and remove shadow and provide accurate skin segmentation results. Shadow detection and removal can be done by using hybrid shadow detection and correlation based neighbourhood matching respectively. Skin segmentation can be done by using VGGNet which is a deep neural network.

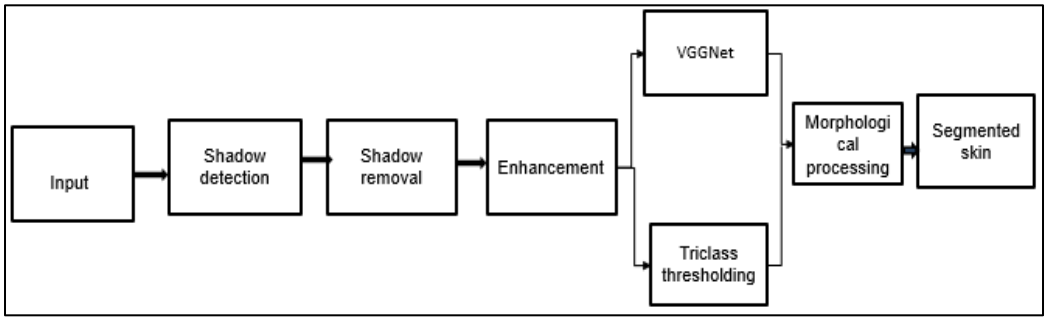

Fig. 1: Block diagram of proposed system

III. SHADOW DETECTION AND REMOVAL

Shadow detection and removal can be done by using hybrid shadow detection and correlation based neighbourhood matching respectively. Hybrid shadow detection comprises optimal adaptive thresholding and Laplacian of Guassian (LoG) filter. In adaptive thresholding, a threshold value can be determine for a small regions of image. It is very effective to get different threshold for different regions of the same image and it gives better results for image with varying illumination. Laplacian of Guassian (LoG) filter is basically an edge detection method. The original image is input in the first stage of filter as guassian blur to blur the image inorder to make laplacian filter less sensitive to noise and then applies to laplacian filter and final check zero crossings. The result of the filter highlights the edge.

Correlation based neighbourhood matching involves rotation and scale invariant normalised cross correlation and used as similarity measure to estimate difference between the interest points. Both size and orientation are considered in correlation based neighbourhood matching technique and epipolar geometry can be used to reject false matches.

IV. IMAGE ENHANCEMENT

Image enhancement can be done by using CLAHE(Contrast Limit Adaptive Histogrm Equilisation) is a variant of adaptive histogram equalisation in which the contrast amplification is limited, as to reduce the problem of noise amplification. It can be done by clipping the histogram at predetermined value before computing the CDF. Enhancement function is applied over all neighbourhood pixel and transformation function is derived and is used to improve the visibility level of foggy images or videos.

V. VGGNET

VGGNet is a deep neural network. It is convolutional neural network with 16 or 19 layers. According to these weight layers, VGGNet is divided into VGG-16or VGG-19. It has very accuracy in large scale image recognition. This model can trained more than million images and can classify images in to 1000 object recognition and has learned rich feature representation for a wide range of images.

VI. RESULT

Shadow from the input images or frames of video is detected by using hybrid shadow detection algorithm and then removed using correlation based neighbourhood matching algorithm. After the image enhancement, the skin segmentation is done by using triclass thresholding. Skin region recognition can be done by using VGGNet and has learned rich feature representation for a wide range of images. This algorithm can be run in MATLAB 2017b version and the simulation result can be showed below.

(a) (b)

(c) (d)

(e) (f)

Fig. 2: (a) input image, (b) gray scale image, (c) shadow detected image, (d) shadow removed image, (e) segmented image, (f) segmented color image

VII. CONCLUSION

In this paper, we propose a novel skin feature algorithm for shadow detection and removal and skin segmentation in both RGB and HSV color space. Shadow detection and removal can be done by using hybrid shadow detection and correlation based neighbourhood matching respectively. Hybrid shadow detection comprises optimal adaptive thresholding and Laplacian of Guassian (LoG) filter. CLAHE is a variant of adaptive histogram equalisation in which the contrast amplification is limited, as to reduce the problem of noise amplification. Triclass thresholding can determine a threshold that minimizes the intraclass variance of segmented image and based on this threshold images is divided into skin regions and non-skin regions. VGGNet can trained more than million images and can classify images in to 1000 object recognition.

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