Yeshwantrao Chavan College Of Engineering

Mini Project

On

'Skin Segmentation'

Language Used: MATLAB

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Abstract

A lot of computer vision applications benefit from robust skin color classification. This is due to the various image conditions like camera settings, illumination, light source, shadows and many more. Furthermore people's tans and ethnic groups also extend those conditions. In this context, a parametric skin color classifier that can be adapted to the conditions of each image or image sequence. This is done by evaluating some previously know skin color pixels which are acquired by applying a face detector.
This approach can distinguish skin color from very similar color like lip color or eye brow color. Its high speed and high accuracy makes it appropriate for real time applications such as face tracking and mimic recognition.

Introduction

There is a widespread benefit of skin color detection in computer vision applications as face detection, mimic recognition, person identification, and gesture detection etc. Skin color occupies a larger subspace within the color space and the various cameras types and settings, illumination conditions etc make that subspace even larger.

The need to distinguish between skin and objects colored in a similar way such as lips makes that challenge even harder. Most detectors classify lips as skin because the difference between skin color and lip color is small. In other words, the subspace of skin color intersects with that of lip color.

Knowing the image conditions in advance a more specific skin color model can be used. This will shrink the subspace of all possible skin colors and improve the classification result. Those image conditions can easily be figured out if we know some pixels to be skin color pixels.

Original Image

Skin Segmented Image

Skin segmentation or skin color classifier

Skin color classifiers often specify some bounds that narrow down the color space (e.g. RGB) to the subspace of skin color. In order to gain resistance towards various illumination conditions such as the color of the light source and shadows a different color space is used. The chromatic color space (also known as "normalized RGB") uses the proportional part of each color:

$$BASE = R+G+B$$
$$R_c = R/BASE$$
$$B_c = B/BASE$$

$$R_c + G_c + B_c = 1$$

This color space provides a commonly known way to quickly detect skin color pixels via the following classifier:

Skin_color= ($R_c > 0.35$) ^ ($R_c < 0.5$) ^ ($Gc > 0.2$) ^ ($G_c < 0.7$) ^ ($BASE > 200$)

Using this skin classifier skin color can be detected for illuminations conditions of each image which are determined by camera settings, light source, shadows and many more parameters.

Program

```
clear all;
%str= input('Enter the image file with extension ' , 's' );
%str='JapaneseGirl';
%str='AFReuropean.jpg';
%str='SwimmingChild.jpg';
str=input('Enter the file name','s');
a=imread(str);
[Height Width z]=size(a);

a=double(a);
s_c=255*ones(Height,Width,3);

for i=1:Height
    for j=1:Width
        s=double(0);
        s=sum(a(i,j,:));
        rc=a(i,j,1)/s;
        gc=a(i,j,2)/s;
        bc=a(i,j,3)/s;
        if((rc>0.35)&(rc<0.5)&(bc>0.2)&(bc<0.7)&(s>200))
            s_c(i,j,1)=rc*s;
            s_c(i,j,2)=gc*s;
            s_c(i,j,3)=bc*s;
        end
    end
end

figure;
subplot(1,2,1);imshow(uint8(a));title('Original Image');
subplot(1,2,2);imshow(uint8(s_c));title('Skin Segmented Image');
str=input('Want to save the image (y/n)','s');
if(str=='y'|str=='Y')
    str=input('Enter the new file name','s');
    imwrite(s_c,str,b.Format);
end
```

Note: Above code is written using MATLAB 7.0.4.

Code specification

MATLAB (MATrix LABoratory) is a special-purpose computer program optimized to perform engineering and scientific calculations. The fundamental unit of data in any MATLAb program is the array. Array with one dimension is referred as 'vectors' and more than one dimension are referred as 'matrix'.

Variable	Type	Use
Str	Char	To store the file name
a	Array(hxwx3)	To store the pixels
[Height, Width, z]	Matrix	To store the size of image
Rc, Bc, Gc	Double	For Skin color
S_c	Matrix	Skin color segmented image

Functions Used

Imread : This function read the image and return its pixels to an array.

Figure *: Open a new figure window*

Subplot(x,y,z) : Plot 'z' figures in a single figure window

Imshow(a) : Plot the image in the figure window

Imwrite(a,f,fmt) : Write the image 'a' (saves) as file name 'f' in format 'fmt'.

Conclusion And Future Work

Skin color classification is difficult due to many issues. We created a parametric classifier that can be adapted to the image conditions and the ethnic group of the person on the image. Above technique's result increases dramatically compared to a non-adaptive classifier, especially in the case of poor lightning conditions and colored people. As a special benefit facial parts such as eye brows, lips and teeth are detected correctly as non-skin color objects.

This technique can be further used for real time i.e. it can be implied over a frame of video recorded earlier by some camera or in real time mode. In real time mode, execution time for the segmentation must be fast.

Bibliography

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