Abstract

Image processing is the process of converting the data from image to digital for feature extraction or performing a new change in the image [1].

The one of image processing topics is skin detection that refers to detection of human skin within an image [2].

In the skin detection, there are many challenges related to color range, light, shadow, etc. In this report, I described how to detect the skin in photo of only human face using OpenCV c++, and I lists the results.

The result is the original image with cut non-skin areas from start to end pixel of the row.

Table of Contents

1. Introduction

In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images [1]. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing [1]. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing [1]. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems [1].

Color is an efficient feature for object detection as it has the advantage of being invariant to changes in scaling, rotation, and partial occlusion [3]. Skin color detection is an essential required step in various applications related to computer vision [3]. The rapidly-growing research in human skin detection is based on the premise that information about individuals, intent, mode, and image contents can be extracted from colored images, and computers can then respond in an appropriate manner [3]. Detecting human skin in complex images has proven to be a challenging problem because skin color can vary dramatically in its appearance due to many factors such as illumination, race, aging, imaging conditions, and complex background [3]. However, many methods have been developed to deal with skin detection problem in color images. The purpose of this study is to provide an up-to-date survey on skin color modeling and detection methods [3]. We also discuss relevant issues such as color spaces, cost and risks, databases, testing, and benchmarking. After investigating these methods and identifying their strengths and limitations, we conclude with several implications for future direction [3].

OpenCV (Open Source Computer Vision Library) is released under a BSD license and hence it's free for both academic and commercial use [4]. It has C++, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android [4]. OpenCV was designed for computational efficiency and with a strong focus on real-time applications [4]. Written in optimized C/C++, the library can take advantage of multi-core processing [4]. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform [4].

In this report, I provide an experiment performed by c++ using OpenCV to perform skin detection of some of human face photos to produce the same photos without non-detected skin areas.

About the references section, I used Chicago citation style.

2. Assumptions

When a user uses this project, he must enter images contains only human face.

3. Implementation

In this section, I described the process and technical details of the project.

3.1. Input and Output

There are 100 sample that will be entered to the program that produces 100 output. The output is the image whose non-skin areas cut from start to end pixel of the row.

3.2. Main Idea

The main unit of the most of image process problems is the color. The main idea is extraction of areas, within the image, whose color within the range of skin color range.

3.3. Algorithm

The program performs sequence of steps to reach the results. The steps are:

1- read input image
2- convert the image from RGB to HSV
3- declare the range of skin color in HSV system
4- binarize the HSV image according
5- loop on input image pixels
6- when the loop finds non-skin pixel, it counts it
7- after the loop, if the number of non-skin pixel is greater then the half of row pixel number, the program convert the whole row the white color (cut it).
8- write the result image

3.4. Skin Color Range

The skin color range is in HSV system.

The lower scale:

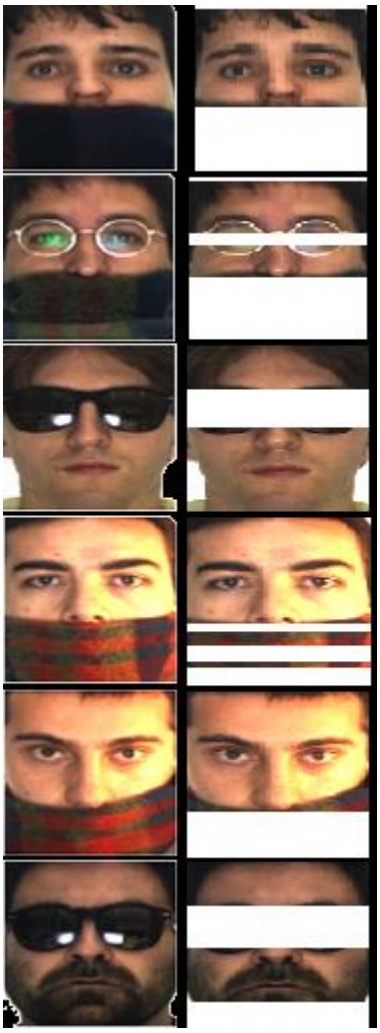
- Good: (0, 71.4, 0)
- Maybe better: (0, 45.9, 0)
- maybe too much: (0, 20.4, 0)

The upper scale:

- Good: (25, 173.4, 255)
- Good: (25, 198.9, 25)

4. Results

In this section, I present 9 samples of results that represent the whole data set.



5. Delimiters

The program that I used has some delimiters that are:

1- Cannot detect the skin with high light

2- Cannot detect the high-dark skin

3- Cannot detect the skin that overlayed by light reflection

4- Wrongly detect non-skin areas that have a color which in skin color range

6. Recommendations

1- Generation of multiple cases of skin color range

2- Systematically determination of an appropriate color range case according to read light, shadow and other photo conditions

3- Generation of skin color range in RGB system, it makes the detection is easier

References

[1] Wikipedia, s.v. “Digital image processing,” (accessed March 7, 2019), https://en.wikipedia.org/wiki/Digital_image_processing.

[2] Thao Nguyen, Trang, “A New Efficient Approach to Detect Skin in Color Image Using Bayesian Classifier and Connected Component Algorithm.” Mathematical Problems in Engineering Volume 2018 (2018): 10.

[3] Naji, S., Jalab, H.A. & Kareem, S.A. Artif Intell Rev (2018). https://doi.org/10.1007/s10462-018-9664-9.

[4] “About,” OpenCV. Accessed March 2017. https://opencv.org/about.html.