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Automatic facial spots and acnes detection and removal

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Abstract. Taking self-portraits using a mobile phone is popular today. Since everybody wants to look good in picture, photo editing application becomes essential even in mobile phones. The applications, using simple image processing techniques, can reduce the noise, wrinkles and adjust the brightness of the photo. However, it is hard to remove large spots or acnes using the current simple photo editing applications. If it is possible, it requires a lot of human interaction. In this paper, we propose a system that can remove large spots and acnes in the portrait pictures automatically. The proposed system consists of three steps: face detection, acne marking and acne removal. Experiments show that the proposed system works well for the pictures in which the face colors are quite different.

Keywords: face feature, facial spots, acne removal, image inpainting

1 Introduction

There is a soft skin function in recent digital cameras, which is useful to human picture. It can adjust human skin brightness and color much better than real one. Especially most women like to use this function when they take photo. In medical field, to detect acne and spot from the picture is necessary for the cure of skin disease. Especially in Korea, plastic surgery is very popular. Many hospitals provide a service which clients could anticipate how their face will be change if they get a plastic surgery as virtually. For example, one client who is interested about double eye line surgery sent a picture to hospital, after that hospital operates a plastic surgery on her face on the picture. But this virtual picture surgery is not reasonable and reliable.

In commonly, there are many picture edit tools as a program. If we use this program to remove acne on the face in a picture, this just made a picture blurring. As a result, some acne or spot can be removed but all picture resolution will be diminished. Of course it's not what we want. It can be done by removing acne on picture as manually by photo edit tool. It needs an experience and knowledge how to use tool and original face could be change to other face totally.

For the removing of acne or spot, we need a special algorithm to find out where acne is, and remove only that specific region. This is not about adjusting skin color or brightness as a cosmetic but to remove an acne and spot on the face of picture automatically. In general, man does not like to edit their self-photo because it's

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inconvenient. If it doesn't take time and does not need to control photo edit tool manually, then anybody would edit their self-photo. If they have a skin disease include acne, they need this badly.

2 Proposed System

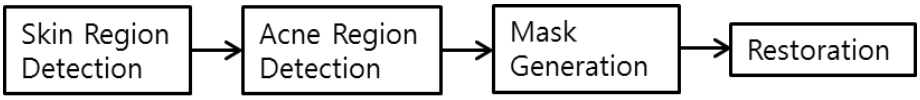


Fig. 1. Block diagram of the proposed system

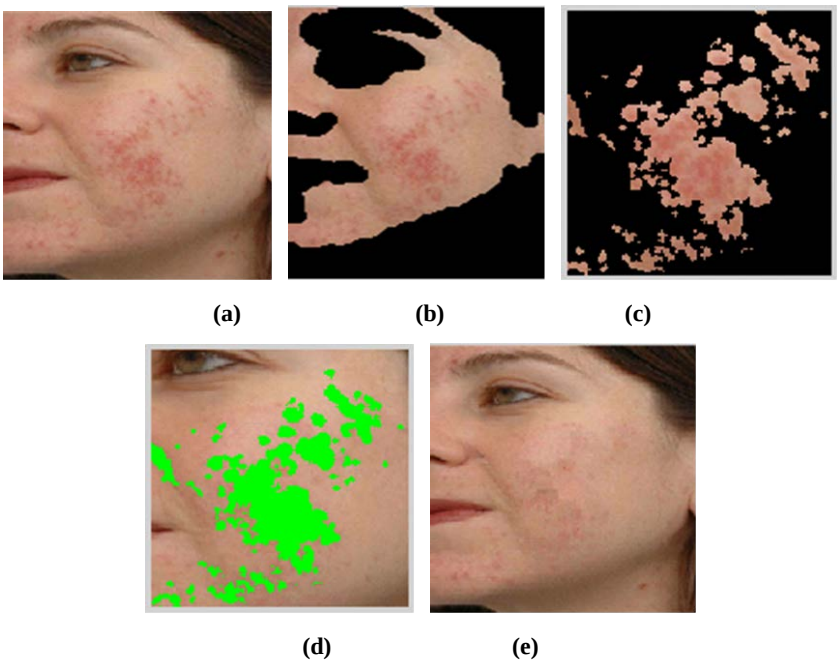


Fig. 2. (a) input image, (b) result of skin region detection, (c) Acne Region Detection, (d) Generated Mask on the input image, and (d) result of Restoration

The proposed system is divided into four stages, as shown in Figure 1. The first stage is skin region detection. After detecting face, leave only the skin region exclude eyes, mouth and hair. For this work, it needs color information about face and edge of face feature. Skin color has its own area in YCbCr color space. Especially skin color always has a lot of red color, because there is a blood under the skin. This fact is always true to any human race. Basic idea is that

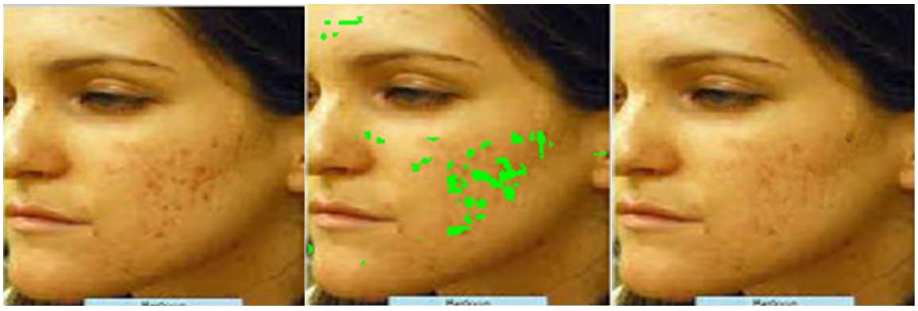
eyes and nose, lips are always have a big edge on a face. This allows dividing the component from cheek and forehead. Acne and spot exist only on a skin region. The skin region detected is shown in Figure 2-(b).

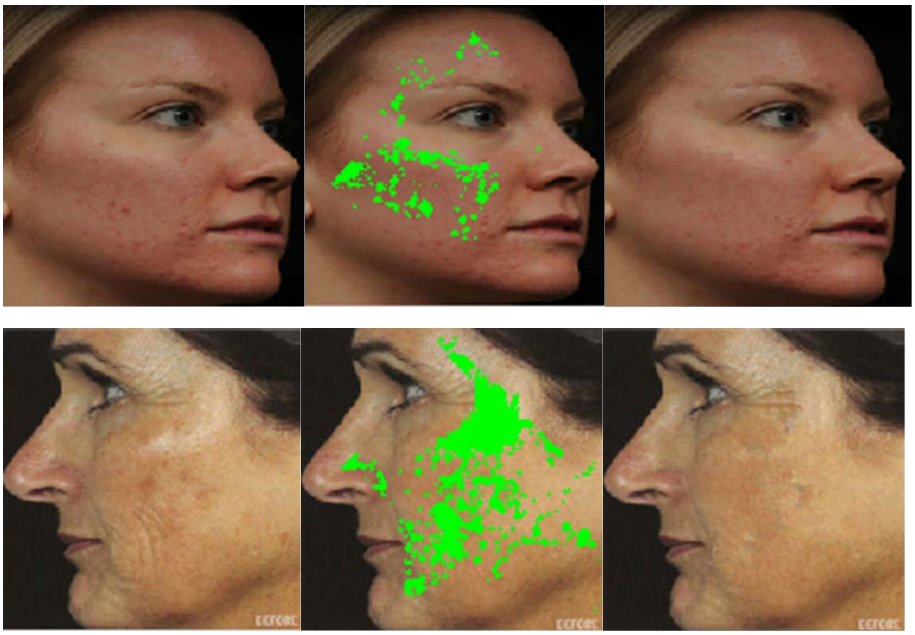
Next, acne region detection stage follows. Acne is differentiated from the skin region. Acne color is different and the gradient is larger than the other regions. The acne region is shown in Figure 2-(c). The mask generated in the acne region detection stage is overlaid onto the original image as shown in Figure 2-(d). Finally, cover acne skin region by clear skin sample on the other region in the same face which needs similar color and shape. To cover skin is not done by one time. It consists of repetition process like a paint touch on drawing. This method is called inpainting. The removed acne size is called a patch. If the patch size became bigger, then covering time will become shorter than the smaller patch. But it doesn't mean that we only select big size patch. For a good result of covering image, structure consist of image is the most important factor. The image recovered by inpainting is shown in Figure 2-(e).

Human sight is more sensitive to the structure and edge than texture of image. This is why image inpainting needs to start from the structure element like edge and gradient from image. There is a various order to restore, and it is a main factor to determine inpainting output's quality to make good quality, inpainting takes a lot of arithmetic operation and it takes time. If the picture is bigger, then it takes more time. To minimize this shortcoming, this paper uses a bounding, spiral search, distance weight algorithm. This method can reduce running time dramatically.

3 Result

Experimental results are shown in Figure 3. Most of acnes are detected and removed. As shown in the second row, the system works well even if face color is different. For the image in the third row, the acne region is over determined. But these regions are recovered during restoration stage, and the wrinkles on her chick are removed.





(a) (b) (c)

Fig. 3. (a) Original images, (b) Masks overlaid on original images, and (c) Recovered images

3 Conclusion

Removing acne and large spots on picture without help of manual control is a challenging work. This paper presents a system for that purpose. The system detects acne area first, and then recovers it with the pixels in the other skin area. During recovering, the exemplar-based inpainting method has been used. Experiments show that the result is satisfactory in most cases, but when face image is small or skewed too much, it failed to detect the face. The inpainting is a time consuming process, and thus a fast method should be developed for this system to be useful practically.

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