Extraction of Facial Parts and Facial Expression Recognition

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1.Introduction

Recently, the facial emotion recognition is widely studied. The study of the facial expression recognition has many applications such as teleconference, telenursing, and so on.

In this paper, we will give a preview of a system of nursing patients without language for which the information of patients' expression recognition is utilized. In this system, the camera is installed to take the image sequences of the patients. And then, the faces which appear the expression change are extracted from the taken images with the background and displayed. The time of the patient's expression change is also displayed together. Next, these facial expression is recognized and the result is given. Because in the case of nursing patients without language, what the doctor is concerned with are the emotions of patients' uneasiness, suffering and happiness, we only select these expressions as the patterns to recognize. Some experimental results of facial extraction and facial expression recognition are also represented in this paper.

2.Extraction of facial parts with expression change

It is necessary and useful for the system of nursing patients without language to obtain the information of patient's expression change. For example, the nurse will go to a sickroom to nurse the patient when she know the patient's uneasiness and suffering by the computer terminal.

Most people in East Asia have almost same skin color. Skin regions might be extracted by converting RGB color images to YIQ representation and using the I component, which includes color components from orange to cyan.

As is well known, a conversion formula from RGB to YIQ is given as:

$$\begin{pmatrix} Y \\ I \\ Q \end{pmatrix} = \begin{pmatrix} 0.30 & 0.59 & 0.11 \\ 0.60 & -0.27 & -0.32 \\ 0.21 & -0.52 & 0.31 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix} \quad (1)$$

The smaller the value of the I component, the more it contains the component of orange hues and the less it contains that of cyan hues. Accordingly, only the orange hues which include the skin color in the images are kept, if the values of I component in a interval are adopted and those outside the interval are set as 0. In the following, we term the images the gray level of which is expressed by the value of the I component filtered as above, as I component images.

An example of a color image's I components which in the interval of [15,45] is shown in Fig.1(the original image is not presented because of the privacy). On the other hand, the difference of the images, one of which was mentioned above, the other of which is one taken on the next time, is shown in Fig. 2. The AND image of the Fig. 1 and Fig. 2 is shown in Fig. 3. Compared with Fig. 2 and Fig. 3, it is clear that in Fig. 3, the noise of background is reduced and the facial parts which moved ever has extracted perfectly.

図 1:　I components in a interval of $[15, 45]$

The other extraction results of the facial parts for other images are shown in Fig. 4. From these images, we can see that the extraction of facial parts with a movement presented above is effective.

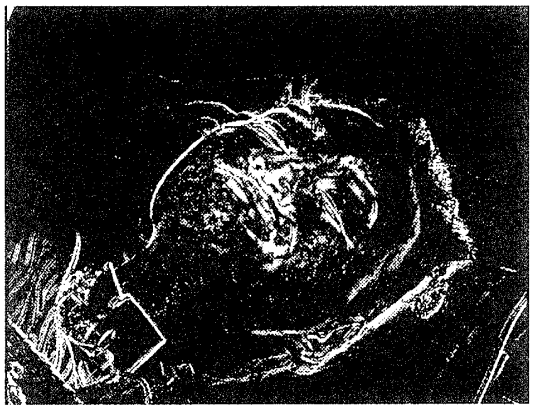

図 2: Difference of images mentioned above

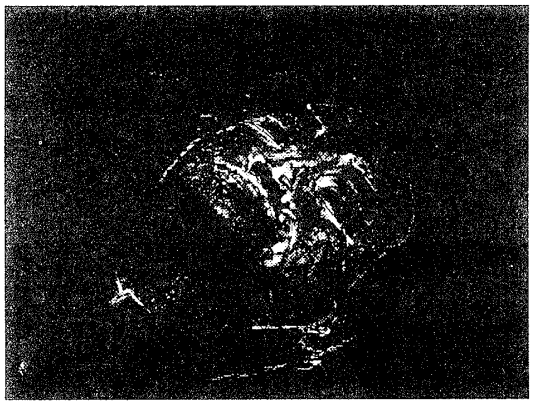

図 3: AND image of Fig. 2 and Fig. 1

3.Location of facial position and facial expression recognition

In the above section, some extraction images of facial parts with the movement were obtained. From these images, we noted that in some cases, there is the expression change evidently on the face, for example, Fig. 3. But, in some cases, there is a little expression change on the face, for example, Fig. 4 (b), where only eyes had a movement. It is necessary for us to display and save the time of expression change and the facial image on this time, and recognize the facial expression in the both cases. For in the case such as Fig. 3, it is easy to locate the facial position by using the histogram of gray-level and XY coordinates. For in the case such as Fig. 4 (b), it is necessary to combine the histogram of gray-level and xy cooddinates with the pre-knowledge to locate the facial position. That is, according to the particular situation, the approximate size of the face is given in advance. If the size determined by the histogram is much smaller than the given one, the result will be revised. Combining the position information of facial parts with the given size of face, the facial position is determined finally.

As mentioned before, in the system of nursing patients without language, we only consider the expression of patients' uneasiness, suffering and happiness. For the recognition of these expressions, the approach presented in [1] is considered to use. The experimental results will be presented in our future paper.

Reference

[1] Y. Dai et al. "Recognition of facial expressions based on the Hopfield memory model", Proceedings of ICMCS'99 (1999).

(a)

(b)

図 4: Other extraction results