Journal of Fiber Bioengineering and Informatics 8:3 (2015) 501–511
doi:10.3993/jfbim00148

Study on Human Body Contour Extraction from Images Based on HSV Color Model

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Abstract

Color is one of the most powerful and important types of visual information. Color information of images plays an important role in human body contour extraction process. In most of the current human body contour extraction systems, color images are converted into gray images first and then human body contours are extracted from these gray images. In this process, a large mount of color information is lost and the extraction results are inaccurate. Besides, strict requirements are put forward about objective conditions when taking pictures in these systems, such as background, dress, pixel of cameras, light and so on. In order to solve these problems, HSV color model in line with human visual habits was adopted to extract human body contours in this paper. Human body contours were directly extracted from color images by analyzing and changing H, S and V values. MATLAB software was used to write a human body contour extraction program. Results of experiments show that the accuracy of extraction is improved. The requirements about the background, dress, pixel, light and other factors are reduced through adopting HSV color space. Automatic human body contour extraction under complex conditions is realized in this paper, which can lay a foundation for the development of remote automatic human body measurement systems. Research results of this paper provide a reliable basis for the development of apparel electronic-commerce and personalized customization.

Keywords: Color Information; Human Body Contour Extraction; Color Images; HSV Color Model; Requirements about Conditions

1 Introduction

With the rapid development of computer network and information technology, traditional garment industry stepped into a process of informatization, digitization and automation, which promoted the development of the e-commerce and online shopping of apparel [1]. At the same time, people's requirements about clothing also transformed from practicality and popularity to personalization and fitness [2]. Fitness is an integral part of clothing quality inspection and it also has the most significant impact on consumers' satisfaction [3]. However, the traditional mass production model

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of clothing can not meet the need for fitness of each consumer, so the personalized customization of garments has become the development trend of clothing industry. Higher requirements about size measurements of human bodies has been put forward to satisfy consumer's requirements about personalization and to promote the development of apparel e-commerce. So it is critical to research and develop practical and portable measurement systems [4].

Human body contour extraction, working as the first step in the non-contact body measurement process, plays a significant role on the accurate extraction of characteristic body size. Some achievements have been obtained on the non-contact body measurement systems in China, though many problems still exist in the body contour extraction process. In previous body contour extraction systems, color images were converted into gray images and be retouched in detail by using some graphic software. Then, human contours are extracted from these digitally-altered gray images. Calculation and analysis of gray images are relatively simple, so it can accelerate the speed of image processing [5]. However, much information about images is lost in this process and the accuracy of the image is decreased, which will lead to inaccurate extraction results of human body contours. At the same time, subjects are required to stay in the same laboratory with experimenters in special clothes and stand in standard posture in front of the configured background board. Besides, all pictures should be taken in bright light. Otherwise these pictures will be in uneven gray, which causes the bad result that body contours can not be extracted completely and accurately. In addition, Single Lens Reflex cameras with high resolution must be used to take pictures of human bodies. These SLR cameras are very expensive and the operation of them is complex [6].

In order to reduce the requirements for background, dress, pixel, light and other objective conditions in body contour extraction systems, a method to extract human body contours based on HSV model was developed. A computer program code was written by MATLAB software in this paper. In the code, HSV color space was adopted and RGB images were transformed into HSV images first. Human body contours were directly extracted from color images by analyzing and changing H, S and V values, which could improve the accuracy of extraction results and realize the automation of human body contour extraction. Pictures of human bodies can be taken by anybody using mobile phones or cameras and subjects are allowed to wear their own daily clothes. Besides, all pictures can be taken under fluorescent lights or natural light. Results of experiments show that human body contour can be extracted accurately from complex background without artificial retouching based on HSV color model. Objective conditions, such as background, dress, pixel and light are not strictly required when taking photos. Research results of this study, as an important link of a practical remote non-contact human body measurement system, lay a foundation for personalized customization of garments. Besides, they provide a reliable theoretical basis for the development of e-commerce and online shopping of garments.

2 Theoretical Background

2.1 HSV Color Model

Color is an essential element of images, so it is very important to select a color model in line with human visual habits to extract contours from images. Pixel information of color images displayed on the computer is generally indicated and stored by RGB color model. RGB model is good for the indication of colors. However, color information represented in the widely-used RGB