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Automatic body landmark identification for various body figures

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ABSTRACT

In this paper, we presented automatic body landmark identification algorithms that deals flexibly with the difference in body shapes and reduces the inconsistency resulting from the differences in body shapes. First, the landmark search range was defined using the statistical analysis. Next, body scan direction was identified and it was segmented. Next, automatic landmark identification algorithms were developed for each of the six landmarks and the accuracy was examined for each body shape. The scans were extracted from 5th Size Korea database. This algorithms were successfully tested on various body shapes and improved the robustness.

Relevance to industry: In automatic body measurement systems, the landmark location error occurring at nonstandard body shapes nullifies the advantage of saving time. It also makes the 3D scan measurements unreliable. The improvement of reliability and accuracy of the automatic 3D body measurement algorithm for various human body shapes will reduce the time for performing measurements and be practical for use in human-size-related production processes.

1. Introduction/purpose

Body measurements constitute the basic information necessary for the fabrication of industrial products. An accurate body measurement system is important in the apparel industry because it is applied to the size of apparel products and is directly associated with the fit of consumers (Zheng et al., 2007). The most common method used to acquire body measurements are physical measurements. Automatic body measurement systems that use 3D body scan data have recently been developed; these systems include ANTHROSCAN (Human Solutions GmbH), DigiSize (Cyberware Inc.), Body Line Manager (Hamamatsu Photonics KK), and BMS (Textile Clothing Technology Corporation, [TC]^2).

The consistency of automatically extracted landmarks and automatically extracted measurements from 3D body scans (scan measurements) have not been validated for various body shapes. Most automatic body measurement systems exhibit landmark location errors when dealing with nonstandard body shapes (Priya and Istook, 2004), and the user must manually adjust the landmark positions after the system has automatically extracted the landmarks (Ashdown and Dunne, 2006). The systemic landmark location error nullifies the time saving advantages of the system. This location error makes scan measurements unreliable and renders them useless in apparel production, for which accurate size is imperative. The improvement of automatic scan measurement algorithms (in the reliability and accuracy for various human body shapes) will reduce the time needed for acquiring measurements and will be practical for use in human size–related production processes.

The automatic body measurement process can be broadly divided into two steps: (1) landmark identification and (2) size measurement achieved by generating a measuring path (line) based on the landmarks. In 3D automatic body measurements, the landmark identification step is more difficult to automate than is the size measurement. Numerous research studies have been conducted on automatic landmark extraction, but comparatively few studies have been done on automatic size measuring (Zhong and Xu, 2006).

Landmarks known as "feature points" are base points in measuring body sizes; they indicate the major features on the body. The term feature point is used mainly for computer graphics involving body modeling from scanned data. The accuracy of feature points used for body modeling is less important when compared to the accuracy of landmarks used for body measurements. This study focuses on automatic landmark identification for body size measurement along with the consistency and accuracy of landmark verification.

The difficulties in automatic landmark identification on a 3D human body are threefold: (1) There are parts omitted during the 3D scanning process, making landmark identification difficult. (2)

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