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Comparison of Human Body Sizing Measurement Data by Using Manual and 3D Scanning Measuring Techniques

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Abstract

In this paper, we analyzed the data of the 17 body sizing measurement parameters of 300 adult male participants who were Shaanxi adult male aged 20∼50, which were collected by using the 3D automatic measurement, 3D interactive measurement and manual measurement. We compared the data of the 3D automatic measurement with those of the 3D interactive measurement and the manual measurement. From the results of the analysis, we can draw the following conclusions: (1) Deviation between the manual measurement and the 3D scanning measurement existed obviously, which cannot be ignored; (2) In the 3D automatic measurement, as the result of the deviation of the identification to the bone location, the measurement data must be checked and modified interactively; (3) The posture of the participant has a significant effect on the measurement data, and the specified basic stance will affect the measurements of shoulder, breast and waist. Therefore, the scanning posture should be standardized based on the need of the study. For example the stance with feet together can make the height measurement more accurate; (4) Many factors would interfere with the accuracy of the manual measure and result the difference with 3D measurement, such as the breathing and posture of the participants, and the measurement skill, experience, position mark etc. (5) There is a linear relation between the manual measurement and the 3D scanning measurement. By establishing the linear regression model the measurement data can be forecasted and calculated.

Keywords: Correlation and Regression Analysis, Manual Measurement, 3D Automatic Measurement, 3D Interactive Measurement

1 Introduction

It is indicated in ISO/DIS 20685 that when using the 3D scanner to measure the human body measurement and to build the human body database, it is needed to compare the accuracy between the 3D scanning measurement and the traditional human body measurement [1].

Many domestic and overseas researchers have studied the comparison of manual measurement and 3D human body scanning measurement.

Two groups of data are acquired by 3D body scanners and manual measurements. To ana1yze and research the relationship between the two groups of data, a curve fitting method based on

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the least-square principle is used. The mapping relationship is acquired between the two groups of data of the body parts which is common1y used in pattern design. By checking the curve goodness of fit, the precision rates of the body parts are discerned and they are above 97.25% [2].

First is comparing the traditional manual body measuring method with the three-dimensional body measuring method. Then an analysis of the repeatability of the data between two measuring methods with statistical methods is conducted. Afterwards it is necessary to probe into the reasons that causes the errors. Finally the key points need to be summarized to avoid errors in the three-dimensional body measuring method [3].

In the former research, the human body measurement experiment was organized [4]. 300 participants were chosen, who were Shaanxi adult male aged 20∼50 years old. To measure the 3D images by automatic measuring and interactive measuring, three sets of data for one subject of the 3D automatic measurements, the 3D interactive measurements, and the manual measurements were collected. By comparing and analyzing the difference of the three sets of the measurement data, the reason of the differences was detected and the relational model was established for the mutual forecast and conversion between the manual measurement and 3D scanning measurement.

2 Data Preparation

2.1 Sample Condition

300 participants were selected, and the average age of the participants was 31.

2.2 Measurement Items

Based on the height, length, girth, width and angle items, 17 typical measurement items were chosen, including Body Height, Cervical Height, Chest Height, Waist Height, Hip Height, Back Length, Arm Length, Neck Base Girth, Chest Girth, Waist Girth, Hip Girth, Whole shoulder Width, Breast Width, Back Width, Chest Depth, Hip Depth, and Shoulder Slope.

2.3 Data Reduction

ScanWorX was the mating measurement software of the Vitus Smart 3D human body scanner. The ScanWorX4.0.1 software can identify the human body gauge point and measure 85 human body parts automatically, and use the tools of line, curve, section, angle, etc to accomplish the interactive measurement.

1. The tool of automatic measuring of ScanWorX4.0.1 software was used to measure the 3D image, and the measurement data was shown as Group 1 (hereinafter as G1).

2. The tool of interactive measuring of ScanWorX4.0.1 software (line, curve, section, angle, ect.) was used to measure the 3D image, and the measurement data was shown as Group 2 (hereinafter as G2).

3. The manual measurements were input into the computer, which was shown as Group 3 (hereinafter as G3).