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Rapid 3D Human Body Modeling and Skinning Animation Based on Single Kinect ⋆

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Abstract

Dynamic geometries acquisition of human is one of the most popular topics in the fields of computer vision and computer graphics. This paper presents the related techniques on rapidly generation of human model sequences and makes skinning animation using single Kinect. In specified applied conditions, it has good animation effects and interaction functions. As the comparatively low request on resolution by animation, using the Kinect can greatly save human body animation production time and reduce production cost.

Keywords: Human Body; Rapid Modeling; Single Kinect; Skinning Animation

1 Introduction

With the development of the technology of Virtual Reality and the network technology, the research and application of realistic 3D human body model have been more and more important in the virtual reality system. At present, there are mainly two methods to obtain high quality 3D human body models [1]: 1) draw 3D human body models by using some 3D modeling software, such as Rhinoceros 3D, Poser, Maya, 3D Max; 2) obtain geometric data from the human body surface by using the 3D scanner. It is beautiful to draw models by using software. But it is complex and difficult to operate for the common users in a short time. The human body model obtained by using 3D scanning equipment has more comprehensive data and rich texture. But it needs the specialized equipment to scan, and also the equipment not only is expensive but also has slower scanning speed.

The appearance of the Kinect accelerates the process of the rapidly established 3D human body model and also increases the popularity of the application of 3D human body model. The Kinect

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reduces the price of producing high quality model and greatly shortens the development cycle of the products. So it can be quickly applied to the real-time virtual reality systems. Human animation is one of the most important parts of the computer animation and interactive design [2, 3]. The capturing technology can produce the real-time animation, which solves the complex adjustment process of software on human body animation of 3D human animation. However, most of the capturing equipments have quite expensive price [4].

In this paper, our work is based on the completion of the rapid modeling use one single Kinect to capture data of human bones, using mature skin technology to drive human model and human body output skin animation. The framework consists of four phases: Firstly, human geometries are extracted from the given color, depth and skeleton data captured by the Kinect; Secondly, borderline removing, noise smoothing, point cloud matching and merging are performed on the human geometries and a mesh model is reconstructed based on RBF fitting; Again, the human mesh is further refined; Finally, double quaternion skinning is employed to interactively generate sequences.

2 Related Work

In computer graphics, there are already some researches on Kinect to obtain the human body model. Tong et al. [5] used 3 Kinects to obtain the data of human body model and propose a human body reconstruction method based on Kinect. Zheng et al. [6] proposed a method that uses the Kinect to obtain the 3D human posture to be fitted to get the human body model. Zhou et al. [7] used the iterative closest point algorithm and variable model to match by using 2 Kinects and fit the point cloud data scanned to generate 3D human body model. This method has some defects when it is used for noise processing so that the quality of 3D human body model will be affected. Song et al. [8] used Kinect to scan the human body data and aimed at gaining the human depth data so that they can further construct the point cloud data on the surface of human body.

Recently, KinectFusion which is an open source project developed by Richard [9] and Microsoft is being very popular for using Kinect to construct model rapidly. It uses mobile scanning mode to scan the objects by using the handheld camera equipment (such as Kinect). At present, the KinectFusion project can derive .stl and .obj format data by human body modeling. However, these two kinds of human body model is relatively rough and has noise, moreover, the generated human body model has many non-endemic area composed of discontinuous small grids. Cui et al. [10] used the data scanned by single Kinect to make the reconstruction of human body model. Since this method needs relatively long time to post process the model, Wang et al. [11] adopted Kinect to scan the whole human body and aligned the scanning point cloud data to decompose into the corresponding region. They matched the human body database by using the posture to generate 3D human body model. Zwicker et al. [12] also used the method of global alignment to solve the larger deformation problems of scanning data, but only had a better effect on the jagged registration. Alexander et al. [13] developed SCAPE model library [14], capturing the contour of the human body by using Kinect to estimate the parameter of the human body model. The disadvantage of this method is that the scanned human needs to wear tight clothes.

These methods by using Kinect to build human body model still needs to be mature. Presently, the algorithms of human body modeling by using Kinect are still required to rotate. The efficiency of generating the model is relatively slow which leads to the applications in real-time virtual