

A Sketch-based 3D Garment Model Retrieval Algorithm

Yanxing Ou^a, Ruomei Wang^{a,b,*}, Fan Zhou^{a,b,*}, Li Liu^{a,b,c}

^a*National Engineering Research Center of Digital Life, State-Province Joint Laboratory of Digital Home Interactive Applications, School of Information Science & Technology, Sun Yat-sen University
Guangzhou 510006, China*

^b*Shenzhen Digital Home Key Technology Engineering Laboratory, Research Institute of Sun Yat-sen University in Shenzhen, Shenzhen 518057, China*

^c*Faculty of Information Engineering and Automation, Kunming University of Science and Technology
Kunming 650500, China*

Abstract

With the rapid increase in the number of available 3D garment models, the ability to accurately and effectively search for 3D garment model is crucial for many applications such as industrial design and engineering, and in areas such as manufacturing. In this paper, a sketch-based 3D garment model retrieval algorithm is reported. Users can draw their sketch images according to their interest sensations. Then they can retrieve the 3D garment from the 3D garment database. Each garment in database is used to render an associated image to represent it. Then local features are extracted based on Gabor filtering for each image and the input sketch. The *bag of features* model is used for vectorizing each image and the sketch. Then the cosine similarities of each garment with the sketch are computed. Evaluations are performed to show the retrieval performance of the proposed algorithm.

Keywords: Model Retrieval; Sketch-Based Retrieval; 3D Garment Retrieval

1 Introduction

Virtual 3D garment plays an important role in computer aided garment design, character-based games environment and virtual reality. With the fast development of the advanced modeling [1-3] and visualization [4, 5] techniques of virtual garment, 3D garments have been a more and more popular type of digital media. The number of available 3D garment models in different types increases steadily. The ability to accurately and effectively search for 3D model is crucial for many applications such as industrial design, engineering, and manufacturing area.

The research to retrieve 3D models based on their content has led to the development of several approaches to compute the similarity between two 3D models in recent years [6]. Several algorithms like shape histogram [7], shape distribution [8], moment [9], light field [10], spherical

*Corresponding author.

Email addresses: isswrm@mail.sysu.edu.cn (Ruomei Wang), isszf@mail.sysu.edu.cn (Fan Zhou).

harmonics [11] have been reported. Following these approaches, users can search for 3D models by supplying an example query object. Depending on the task, 3D model retrieval using query-by-example is not the most intuitive approach. It assumes that users already have a well defined 3D query model, which is similar to what they are searching for. Another approach to search 3D models is based on two dimensional, user-drawn sketches. Among numerous interaction methodologies, humans can sketch important features of objects they are interested in very quickly [12]. Although a sketch is composed of only a few lines, it is a coarse but detailed picture including key features. In order to compute the similarity between a 3D model and a user sketch image, the main method is to project and render the model from several viewpoints and the best-matching similarity between the sketch image and the projected images are computed.

In this paper, a novel approach for sketch based garment model retrieval by computing view-based descriptors using suggestive contours is proposed. In real life, garment designers use design drawings to illustrate the effect of garments. Following this habit, user sketch is used as input to find similar garment model. The goal of this paper is to score the 3D garment models in the database, and then recommend the highest ones to the user. It is particularly suited for 3D garment model retrieval, as the human visual system perceives 3D models as two dimensional projections.

2 Related Work

Sketch-based model retrieval systems [10, 12-15] use user sketches as inputs or part of inputs to search 3D models. The general approach of sketch-based retrieval is extracting several views from models and computing the similarity between user sketch and model views. To get a better result and to speed up the process, different feature descriptors are used for encoding the view images, such as light field descriptor [10] and Gabor local line-based feature (GALIF) [16]. The descriptors encode the features of view images and represent the images by a small scale vector. Since local descriptors discard the lowest value data of image, the computation of similarity between images can also benefit. Sketch-based model synthesis researches focus on composing 3D scene with user sketching interaction. Shin and Igarashi [17] composes 3D scenes using model retrieving interaction. Their retrieving algorithm is generating 16 reference views of models and encoding these views with Centroid Fourier Descriptor. Then models with highest matching scores are defined as candidates for user selection to get to the final scene. Lee and Funkhouser [18] proposed a system for composing new models from parts of source models based on user sketching interaction. Eitz et al. [16] provided a benchmark for sketch-based model retrieval and a novel algorithm for sketch-based shape retrieval. They extract *best view* from models and use *GALIF* features for similarity comparison.

3 Sketch-based 3D Garment Model Retrieval

The processing of sketch-based modeling retrieval is shown in Fig. 1. First, 3D garment models were collected and saved into the database. The models are used to render the front view images with their suggestive contours and vectorizing the images with their features. Second, when user inputs a sketch, similar feature extracting and vectorizing work will be performed on it. At last, the retrieval algorithm computes the similarity between the user sketch vector and the vectors of