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3D Garment Segmentation Based on Semi-supervised Learning Method ⋆

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Abstract

In this paper, we propose a semi-supervised learning method to simultaneous segmentation and labeling of parts in 3D garments. The key idea in this work is to analyze 3D garments using semi-supervised learning method which can label parts in various 3D garments. We first develop an objective function based on Conditional Random Field (CRF) model to learn the prior knowledge of garment components from a set of training examples. Then, we exploit an effective training method that utilizes JointBoost classifiers based on the co-analysis for garments. And we modify the JointBoost to automatically cluster the segmented components without requiring manual parameter tuning. The purpose of our method is to relieve the manual segmentation and labeling of components in 3D garment collections. Finally, the experimental results show the performance of our proposed method is effective.

Keywords: Semi-supervised; Segmentation; Co-analysis; Conditional Random Field; 3D Garments

1 Introduction

With the requirements of various garments in computer graphics modeling and garment customization, how to rapidly create types of 3D garments is a challenging problem. Compared with other complicated 3D models, 3D garments can be regarded as the composition of some prototype components, the changing and blending to some components can directly create a new garment. The prior knowledge learned from contextual component analogies in 3D garments can partition an existing garment model into meaningful components automatically.

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Recently, data-driven supervised segmentation approaches and unsupervised methods are proposed to segment and label components in various 3D models. But supervised approach [1] needs a substantial number of manually labeled training shapes. The performance drops dramatically when the number of training shapes decreases. Without prior knowledge of label information, the unsupervised segmentation [2, 3] results are inferior to the supervised one, especially when the meshes are complicated. Based on these observation, we present a semi-supervised learning method that can generate better garment segmentation results than both labeled and unlabeled methods. And the method overcomes the difficulties of requiring a large amount of labeled meshes and the inability to use unlabeled meshes. Different from these methods which were just designed for man-made objects [4], an important observation is that many garments share prototyping parts in spite of various fashions. Thus, we propose a simple but effective garment segmentation method that utilizes semi-supervised learning method. Fig. 1. illustrates the overview of our method. The contributions of our work are as follows:

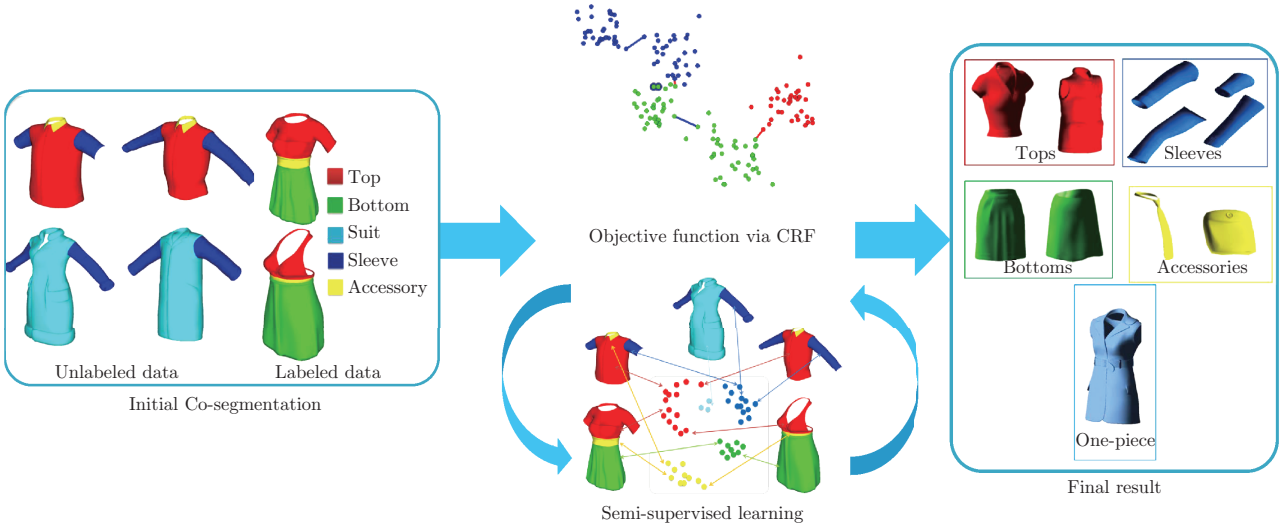

Fig. 1: The pipeline of our semi-supervised learning method consists three main parts: initial co-segmentation, objective function via CRF, and semi-supervised learning

1. Propose a semi-supervised learning method to simultaneous segmentation of components in 3D garments and exploit an effective training method that utilizes JointBoost classifiers.
2. Develop a semi-supervised garment segmentation approach using Conditional Random Field (CRF) model to learn the prior knowledge of garment parts from a set of training examples.
3. Demonstrate the advantages of our 3D garment segmentation method and illustrate the applications for 3D garments, which outperforms robust to mislabeling of training data.

2 Related Work

As an important research topic, shape segmentation has attracted much attention in years, which a comprehensive survey can be referred to [5]. In this section, we briefly review the related work in this area. Mesh segmentation is an optimization problem, including geometric based and semantic based approaches. Earlier approaches focused on finding low-level geometric features