Texture Preserving Garment Transfer

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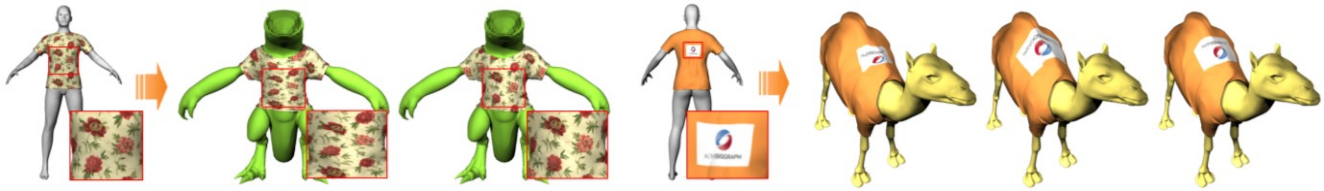

Figure 1: *Result and Comparison: (a)(b) Our method successfully preserves texture uniformly on clothing, (c)(d)(e) preserves an applique in the back part of the clothing of the camel by user specifying weight.*

1. Introduction

Dressing virtual characters is necessary for many applications, while modeling clothing is a significant bottleneck. Therefore, it has been proposed that the idea of Garment Transfer for transferring clothing model from one character to another character [Brouet et al. 2012]. In recent years, this idea has been extended to be applicable between characters in various poses and shapes [Narita et al. 2014]. However, texture design of clothing is not preserved in their method since they deform the source clothing model to fit the target body (see Figure 1(a)(c)).

We propose a novel method to transfer garment while preserving its texture design. First, we cut the transferred clothing mesh model along the seam. Second, we follow the similar method to "as-rigid-as-possible" deformation, we deform the texture space to reflect the shape of transferred clothing mesh model. Our method keeps consistency of the texture as clothing by cutting them along a seam. In order not to generate the inversion, we modify the expression of "as-rigid-as-possible". Our method allows users not only to preserve texture uniformly on transferred clothing (see Figure 1(b)), but also in particular location the user specified, such as the location with an appliqué (see Figure 1(e)). Our method is the pioneer of Texture Preserving Garment Transfer.

2. Our Approach

In order to preserve the texture of the clothing, we deform the texture space to reflect the shape of transferred clothing mesh model. We used the method proposed in [Narita et al. 2014] to deform the source clothing model to fit the target body. Our method consists of two parts.

First, in order to correspond the texture coordinates of source clothing and the vertices of transferred clothing model in one-to-one, we cut the transferred clothing model into the required number of the parts. We consider the part which two texture coordinates are assigned to for one vertex of the clothing model to be a seam and cut the clothing model along it. Adjustment of the scaling is performed since the scale of the clothing model and texture space differs. We define the model obtained in this process as "reference mesh model".

Second, we perform the optimization so as to deform the shape of a transferred clothing mesh to make it similar to the shape of texture space mesh. While various methods have been proposed for the flattening of the mesh, we refer to Implementing As-Rigid-As-Possible Shape Manipulation and Surface Flattering [Igarashi et al. 2009] since scale consistency is important in our method. However, there is a possibility that the inversion caused by distortion occurs since we cut the clothing model to keep the consistency of texture as a clothing in the previous step. Therefore we modify their equation and we solve the minimization problem as,

$$\arg\min_{v' \in V}\{\sum_{\{i,j\}\in E} w_{ij}\left\|(v_j' - v_i') - T_{ij}(v_j - v_i)\right\|^2 + \lambda_1 \sum_i ||v_{i,y}'||^2 + \lambda_2 \sum_i ||v_i' - v_i||^2\}$$

where w_{ij} , λ_1, λ_2 is a weight factor, v_i is the vertex coordinate of the current shape, v_i' is the vertex coordinate of the deformed shape, E is a set of edges, $v_{i,y}'$ is the vertex y-coordinate of the deformed shape, T_{ij} is scaling matrix which stored the ratio of the length of the edge consisting of vertices v_i and $v_j$and that of the corresponding edge of the reference mesh model. The first term will be minimized when the length of the edge of mesh in texture space and that of correspondent edge of reference mesh model is close to each other. The second term is fluttering. The third term is dumping. Initial shape of the optimization starts with the mesh in texture space of source garment. By deforming the mesh in texture space with the damping, we prevent the inversion of the mesh around the seam of the clothing. In general, it is often difficult to preserve the texture of the whole clothing model, since developable surfaces are preferred to flatten on to the plane without distortion. Therefore, by adjusting the value w_{ij}, users are allowed to specify texture is preserved preferentially.

3. Results

The result of our method is shown in Figure 1. Our method successfully preserves texture uniformly on clothing (see Figure 1 (b)) and preserves an applique in the part such as the back part of the clothes of the camel by user specifying weight (see Figure 1 (d) (e)).

References

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SIGGRAPH 2015 Posters, August 09 – 13, 2015, Los Angeles, CA.
ACM 978-1-4503-3632-1/15/08.
http://dx.doi.org/10.1145/2787626.2792622