Draft-Space Warping for Smart Grading

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Abstract

We present fast and automatic method for garment grading. Grading is a hard task without an exclusive knowledge. Nowadays, there are in need of the grading techniques in the animation and game productions, since costume design takes an important component in the process. For grading technique, we introduced retargeting technique which is widely used in the computer graphics field. To use retargeting technique, we need the mediator and the correspondence function. For the mediator of our method, we got the insight from the process of drawing the pattern-making draft. We call this mediator Parameterized draft. Local coordinates systems are good methods for making correspondence. Among others, the mean value coordinates system would be an excellent choice. We call this approach smart grading. Smart grading is less time-consuming and easy to implement. Therefore, our approach can minimize designer's specialized know-how and save performing time for the grading of real garment and virtual garment.

Keyword : Garment grading, Mean value coordinates, Clothing design retargeting

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1. Introduction

In the clothing production, a garment is usually designed for the standard body, and then the result is modified to fit specific body. The latter part referred to as grading. Grading is a tedious process which calls for a large amount of user's intervention. In order to approach the problem from a different angle, grading is treated as retargeting problem. We call the approach draft-space warping. For the development of a grading technique, we obtained the insight from the process of drawing the patternmaking draft. We note that, when the drafting is developed as a computer procedure (parametrized draft), a draft can be constructed instantly. With the parametrized draft, we develop a grading method based on the draft-space warping. The proposed grading method can be performed instantly for any given body without calling for the user's intervention. With experimental results, we show that the new grading framework can bring an improvement to garment grading.

2. Related Works

In the clothing field, computer cad system [1] which have been used for garment design and grading in order to dispose tedious process. In the computer graphics field, Wang et al. [2] proposed a novel retargeting method which created spatial relationship between the target body and the source body. Meng et al. [3] presented an automatic resizing method which solves the distortion problem of [2] by introducing a local geometry encoding method. Recently, Brouet et al. [4] presented another method which can do retargeting a given garment while preserving the original design. These methods have to go through the pattern extraction process [5], because the retargeted outputs are a 3D meshes.

3. Draft-Space Warping

The draft-space warping (DSW) takes three steps: (i) draft-space encoding, (ii) target draft construction, then (iii) draft-space decoding. Input to the DSW is the source panels $\Phi(\mathrm{A}) = [p_1, p_2, \dots p_N]$ positioned in reference to the source draft D(A). The essence of DSW is to keep the D(A) relative positions invariant during the D(A) to D(B) space warp. Let $P_{k,j}$(j=1,…,L) be the vertices of the panel p_k. Let v_i (i=1,…,M) be the vertices in the source draft D(A).

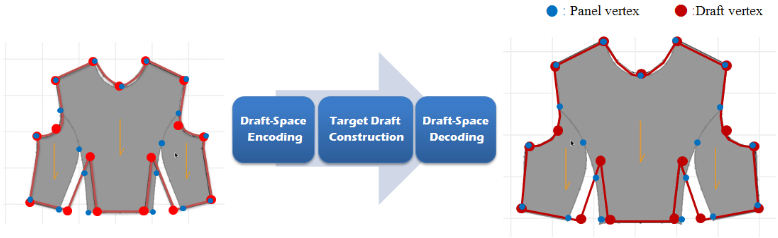

Fig. 2. Outline of the Draft Space Warping

Draft-space encoding: This step encodes the position of each panel vertex $P_{k,j}$ with respect to D(A). In this work, we encode $P_{k,j}$ by expressing it as a linear combination of the draft vertices.

$$P_{k,j} = \sum_{i=1}^{M} \lambda_i v_i$$

More specifically, this step finds out the weight vector λ_i for each panel vertex $p_{k,j}$. Floater [6] introduced a weighting scheme, so-called the MVC.

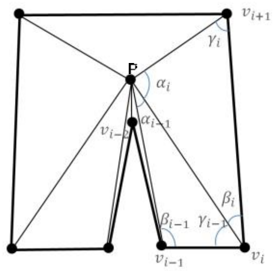

Fig. 3. Calculating the mean value coordinates

Target draft construction: In this step, we generate the target draft D(B) of the source body B, which is a trivial task when the parametrized draft is available. Let $\hat{v}_i$ (i=1,…,M) be the vertices of the target draft D(B). The target draft contains the scaling information to cover the target body.

Draft-space decoding: This step finds out the new vertex position $\hat{P}_{k,j}$ of the graded panel $\hat{P}_k$. With the assumption that the relative position (i.e., encoding) of each panel vertex $P_{k,j}$ is invariant during the D(A)-to-D(B) space warp, we compute $\hat{P}_{k,j}$ with

$$\hat{P}_{k,j} = \sum_{i=1}^{M} \lambda_i \hat{v}_i$$

4. Results

We implemented the method presented in this paper on an Intel Core i7 CPU at 3.20GHz and a NVIDIA Geforce GTX560 GPU. We used a physically-based simulator which is built based on [7] [8] for the analyses. Fig. 4 shows the source body and three target bodies used for the experiment.

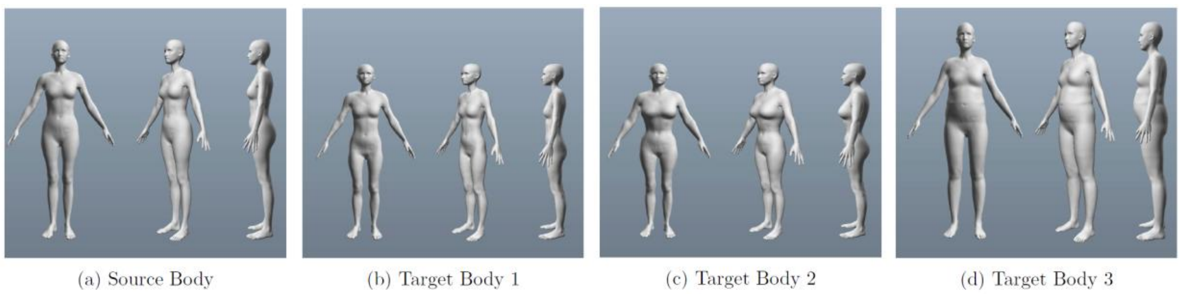

Fig. 4. Source and target bodies

In our method, the input was source garment panels which was designed to fit source body. Fig. 5(a) shows the source garment panels that well fit to the source body. Fig 5(b), Fig 5(c), Fig 5(d) show the each result of smart grading. Every panel was modified for fitting each target body, but our method preserved the panels shape such as arm hole, diamond space and neckline.

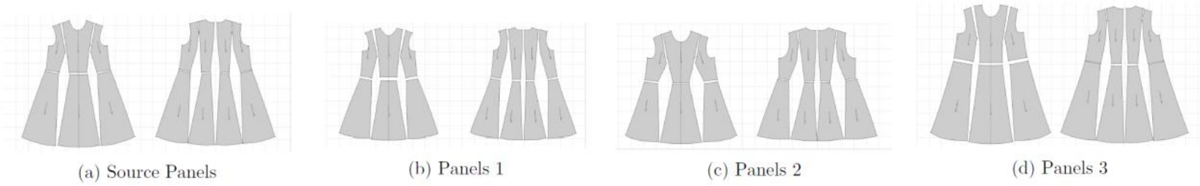

Fig. 5. Source and graded panels

For the silhouette analysis, we draped the source dress (Fig 5(a)) to the source body (Fig 4(a)), also we draped the graded dresses(Fig 5(b), Fig 5(c), Fig 5(d)) to each target body. The source dress well fitted to the source body as shown in Fig 6. We observed that the graded dress properly fitted to the target bodies.

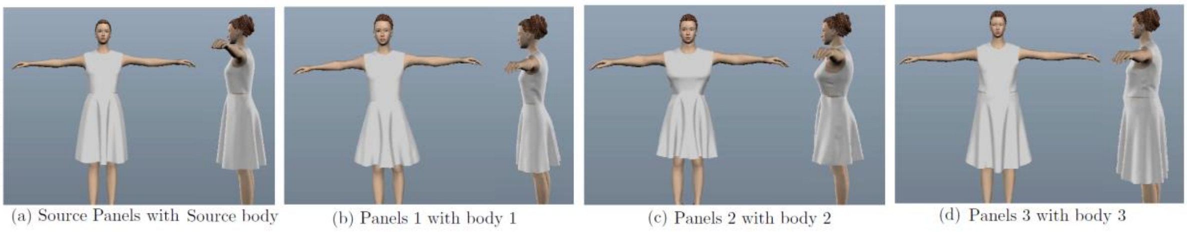

Fig. 6. Draping dresses

5. Conclusion

The goal of our research was to propose fast and accurate grading method. We considered that the 2D based grading is an appropriate approach. We introduced parameterized draft for the approach. Because, parameterized draft can be a good mediator on 2D based method. This draft always fit to the given body, also we can make easily by using draft constructor. Each point of garment panel is represented by linear combination of that draft, and the weight function was calculated according to MVC. We would easily perform grading through the new approach, even if we are not professional designers. We can do grading for arbitrary body, not only linear grading, since the draft can be generated according to arbitrary PBSs. Since smart grading perform on the 2D, we do not go through conversing dimension steps such as physically-based simulation and pattern extraction. Therefore our approach is able to improve producing speed. Consequently, smart grading lead to minimizing knowledge intensive work and saving performing time for garment grading.

Reference

[1] Y.-J. Liu, D.-L. Zhang, M. M.-F. Yuen, “A survey on CAD methods in 3D garment design”, Computers in Industry, vol. 61, Issues 6, pp. 576 - 593 , August 2010.

[2] C. C. L. Wang, K. C. Hui, K. M. Tong , “Volume Parameterization for Design Automa- tion of Customized Free-Form Products”, IEEE TRANSACTIONS ON AUTOMA- TION SCIENCE AND ENGINEERING., vol. 4, Issues 1, No. 1, January 2007.

[3] Y. Meng, C. C. L. Wang, X. Jin , “Flexible shape control for automatic resizing of apparel products”, Computer-Aided Design., vol. 44, Issues 1, pp. 68 - 76 , January 2012.

[4] R. Brouet, A. Sheffer, L. Boissieux and M. P. Cani, “Design preserving garment transfer”, ACM Transactions on Graphics., vol. 31, Issues 4, Article No. 36, July 2012.

[5] A. Sheffer, E. Praun, K. Rose , “Mesh parameterization methods and their applica- tions”, Foundations and Trends in Computer Graphics and Vision, vol. 2, Issues 2, pp. 105 - 171 , January 2006.

[6] M. S. Floater, “Mean value coordinates”, Computer Aided Geometric Design., vol.20, Issues 1, pp. 19-27, March 2003.

[7] K.-J. Choi, H.-S. Ko, “Stable but responsive cloth”, in Proceedings of SIGGRAPH 2002, Computer Graphics Proceedings, ACM, pp. 604-611.

[8] D. Baraff, A. Witkin, “Large steps in cloth simulation”, in Proceedings of SIGGRAPH 1998, Computer Graphics Proceedings, ACM, pp. 43-54.