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AUTOMATED GENERATION OF 3D GARMENTS IN DIFFERENT SIZES FROM A SINGLE SCAN

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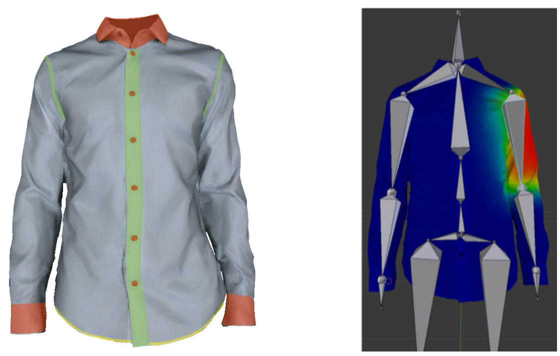
Figure 1: Results of the method.



(a) (b)

Figure 2: Sizing the mesh. a) semantic classification map. Red parts do not scale with size, green parts scale along a single dimension. b) sizing an upper arm. The color coding shows the body part association.

Abstract. *We describe a method to generate additional sizes of a garment from a single scanned size and grading tables. The method helps retailers and manufacturers to efficiently capture their entire product range, which in turn enables advanced AR applications such as virtual fashion try-on.*

1. Introduction

Online fashion retailers need 3D models of their entire product range to enable advanced e-commerce applications, such as 3D viewing and virtual try-on. These retailers usually have a high number of items and the product range changes frequently. Therefore, to obtain 3D models for their entire product catalog, manual modeling is not a feasible approach.

3D reconstruction through photogrammetry is more efficient and photo-realistic. However, retailers want to avoid the overhead of scanning multiple sizes of a single garment. This document describes a different approach which algorithmically generates the different sizes from a single 3D reconstructed model and the garment's grading tables, and thereby increases the scalability of photogrammetry. Figure 1 shows results.

2. Related Work

Previous work in garment modeling generates sizes by adapting a garment to a target body, as opposed to sizing tables [1]. Other machine-learning-based approaches enable decomposition and assembly of new garments but do not allow resizing [2] or rely on templates [4], which inherently limits these approaches to known shapes.

3. Method

The challenge of size synthesis is that garments do not scale uniformly. For example, going from size "Medium" to size "Large", the scale factor for the length of the sleeves is different from the factor for the circumference of the sleeve. The way a garment's parts scale is described by a grading table. We use this information to adjust the geometry of the model for the distinct sizes.

Furthermore, the fabric of the garment is not

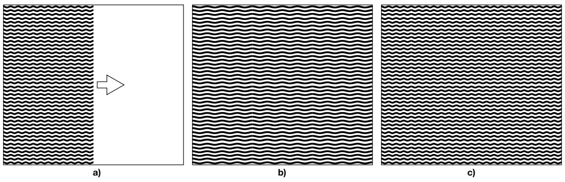


Figure 3: Increasing the size of a texture patch (a) by scaling (b) or repetition (c).

scaled uniformly but repeated. Knowledge of the used materials is needed to simulate this behavior. Elements like buttons or pockets also do not scale, or only under certain constraints (e.g., seams or zippers scale in one direction). Prints on a garment usually also scale independently from the pattern of the fabric. The behavior usually cannot be described by a set of global rules. Therefore, the proposed system provides a way to adjust the scaling behavior for each element independently.

3.1. Input

The method takes a 3D garment model created through photogrammetry and a size chart as its input. The garment model consists of a mesh and a mapped texture. A parametric body model consisting of a pose and a shape description is registered to the 3D garment model. The measurements of the grading table are associated with the parametric body model in the form of edge paths.

3.2. Semantic Region Segmentation

First, the garment mesh and its texture are input to a machine learning algorithm which assigns a semantic meaning to each texel (e.g. collar, seam, button, etc.). Moreover, the same algorithm labels background and mannequin texels for removal. The map's semantic meaning can be transferred to the mesh's faces and vertices through texture mapping.

3.3. Sizing the Mesh

The grading table describes how different elements like sleeves, collars, legs, etc. scale between the sizes. Each measurement is associated with an edge path in the parametric body model. These paths are projected onto the garment's mesh. The actual scaling transformation is performed through Laplacian Mesh Processing [3]. Parts which should not scale obtain high regularization weights. The edge path lengths act as the data terms of the desired transformation. See Figure 2.

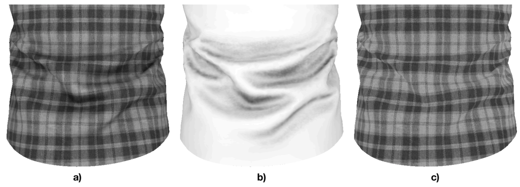


Figure 4: Texture decomposition of (a) into illumination (b) and material (c).

3.4. Sizing the Texture

Simply scaling a garment's mesh and texture based on the grading table and the parametric body model is not enough because fabrics are not stretched but rather more of the fabric is used (Figure 3). This is achieved by repeating the texture instead of scaling. The pattern repetition is aligned with the sewing/cutting lines of the garment, which are derived from the parametric body like measurement paths. Finally, the texture needs to be preprocessed to separate the material's diffuse color from large scale lighting effects, such as wrinkles which should not be repeated. Figure 4 shows the decomposition.

4. Conclusion

We have shown a method to generate additional sizes of a garment from a single scanned size and grading tables. The method helps retailers and manufacturers to efficiently capture their entire product range, e.g. for virtual fashion try-on. Moreover, this work demonstrates how to overcome a major limitation of photogrammetry: the ability to create 3D models of items which are not available for scanning.

References

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