Landmarks for Dressing Avatars at Scale

Ye FAN [1,2], Seung Heon SHEEN [1], Clarissa MARTINS [1], Dinesh K. PAI [1,2]

[1] Vital Mechanics Research Inc., Vancouver BC, Canada;
[2] University of British Columbia, Vancouver BC, Canada

Keywords: Clothing, Landmarks, Avatars, Fitting, Simulation

Abstract

Dressing avatars in realistic clothing is a key requirement in many settings, including digital fashion, feature films, video games, and the metaverse. Achieving a good initial placement is extremely important, both to capture the intended use of the garment and for physics-based simulation. For example, the waistline of a pair of jeans can be placed at different heights depending on the style and preference. Mainstream tools such as Clo3D and VStitcher provide interactive tools for artists to place a garment on an avatar to achieve the desired look and fit for a single avatar. This is a time-consuming process of manual tweaking, especially for complex, multilayered garments. Moreover, this process is not scalable for dressing multiple avatars, as the manual tweaking process must be repeated for each avatar.

A key reason is that the semantics of how a garment is intended to be worn are not captured explicitly by existing tools. We propose the use of {\bf garment landmarks} to capture the intended semantics. Garment landmarks, like body landmarks, locate meaningful points, such as the top of the waistline. Garment landmarks only need to placed once, during the design, and paired with corresponding body landmarks. Body landmarks are widely used in anthropometry, and may be built into an avatar, or predicted using machine learning models. The garment's placement is then automatically adjusted to achieve placement intent by solving an optimization problem that minimizes the distance between the garment landmarks and the body landmarks, subject to other requirements described below. This simple yet powerful idea allows a garment to be easily placed on multiple avatars according to the desired intent, with minimal manual effort.

We will demonstrate how this new tool has been successfully implemented in our VitalFit virtual fit testing system, and can achieve complex placements of multilayered garments. It handles multiple garment layers, fixes existing mesh tangling, and scales naturally once a good garment placement is available on one avatar.

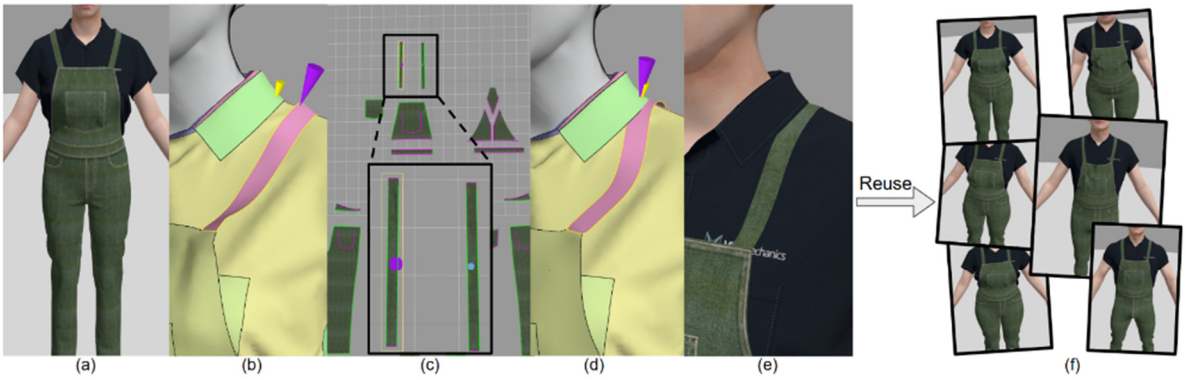

Figure 1: Avatar wearing an overall on top of a collared shirt. This simple example captures many of the complexities of dressing. (a,b) The initial placement produced by a garment CAD system. At first glance it looks reasonable, but the shoulder straps are placed too low, and should ideally be nearly vertical. A naïve adjustment of the strap would put the strap op top of the collar, which is undesirable. (b,c) In our system we place landmarks on the straps (purple cone indicators), one on each side, to indicate where the top of the strap should be. The landmarks are included in the garment pattern. We pair the two landmarks to the standard body landmarks (known as "High Point Shoulder"), shown with yellow cone indicators. (d) After the placement solve, the straps are moved to the desired height, followed by a physics-based simulation (e) for final fit. Notice that the strap now sits nicely between the collar and the shirt. This also shows that our method is effective at adjusting intermediate layers smoothly. (f) The outfit transferred to a range of different avatars, including two males and four females with different body shapes, with no manual tweaking. Avatars shown at the same scale for comparison.