

****Supplementary Material****

STAR: Sparse Trained Articulated Human Body Regressor

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1 Model Training

Annealing Schedule. STAR is trained for 4 iterations, in each training iteration we anneal the regularization parameters (see Section 3 of the main paper) as outlined in Table 1.

Table 1: Annealing schedule of the regularization parameters for each training iteration.

Iteration	λ_b	λ_c	λ_p	λ_s
1	1	1e-3	50	8×10^2
2	1e-1	1e-4	50	8×10^2
3	1e-2	1e-4	50	8×10^2
4	1e-5	1e-5	50	8×10^2

Pose and shape Dependent correctives. The SMPL pose corrective formulation is independent of the subject shape as discussed in Section 1 and Figure 2b in the main paper. STAR pose correctives are conditioned on subject pose θ and shape encoded by the second principal component β_2 . We choose β_2 as a feature as it correlates with the Body Mass Index (BMI). We estimate the BMI for the i^{th} subject, \mathcal{B}^i using the subject’s personalized template mesh volume V_i and subject height H_i :

$$\mathcal{B}^i = \frac{V_i}{H_i^2} \quad (1)$$

Figure 1 shows the SMPL male and female BMIs for subject in the training set as a function of the second principal component β_2 .

2 Training Data

The shape space of STAR is trained on both CAESAR and SizeUSA. Figure 2 shows a samples of the SizeUSA scans.

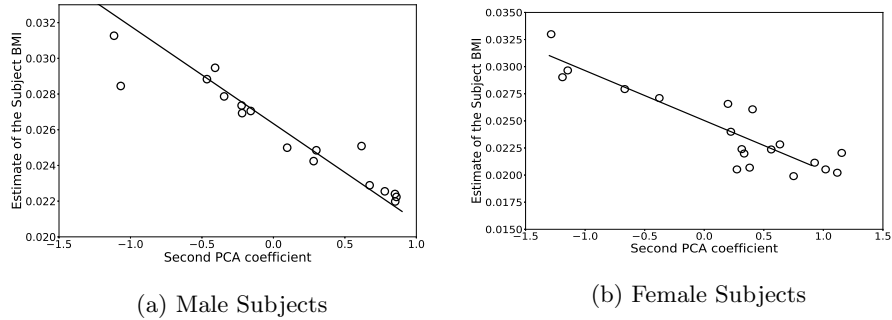


Fig. 1: **BMI and PCA.** There is a strong linear relationship between the BMI of SMPL training subjects and the second shape principal component, β_2 , for both the male and female subjects.

Explained Variance. Section 4.3 in the main paper shows that a shape space trained on either SizeUSA or CAESAR subjects is insufficient to explain the variance in the other dataset. Figure 3 shows the percentage of explained variance for male and female subjects, for shape spaces trained on CAESAR subjects only, on SizeUSA subjects only, or jointly on SizeUSA and CAESAR subjects. Figure 3 highlights that a shape space trained on a single dataset is insufficient to explain the variance in body shape for the other data set subjects. This emphasizes that the data is not redundant. Only a shape space trained on both data sets is sufficient to explain the variance in body shapes across both datasets. This observation is consistent for both male and female subjects.

Figure 4 highlights the most poorly reconstructed body shapes from both CAESAR and SizeUSA when reconstructed using a shape space trained on the other dataset. The SizeUSA dataset contains extremely obese male subjects, which are poorly reconstructed under a CAESAR shape space, as shown in Figure 4c. The CAESAR female shape space is biased to a sport’s bra chest shape, hence fails to accurately reconstructs the SizeUSA females chest shapes as shown in Figure 4d.

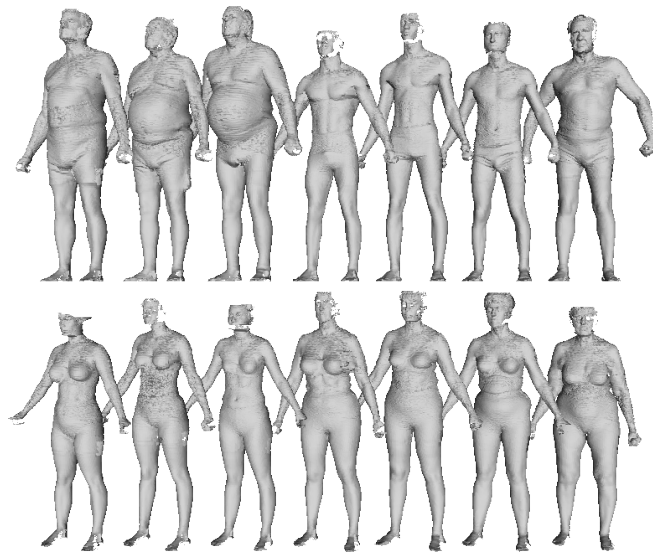


Fig. 2: **SizeUSA Example Scans.** Note the noise and missing data.

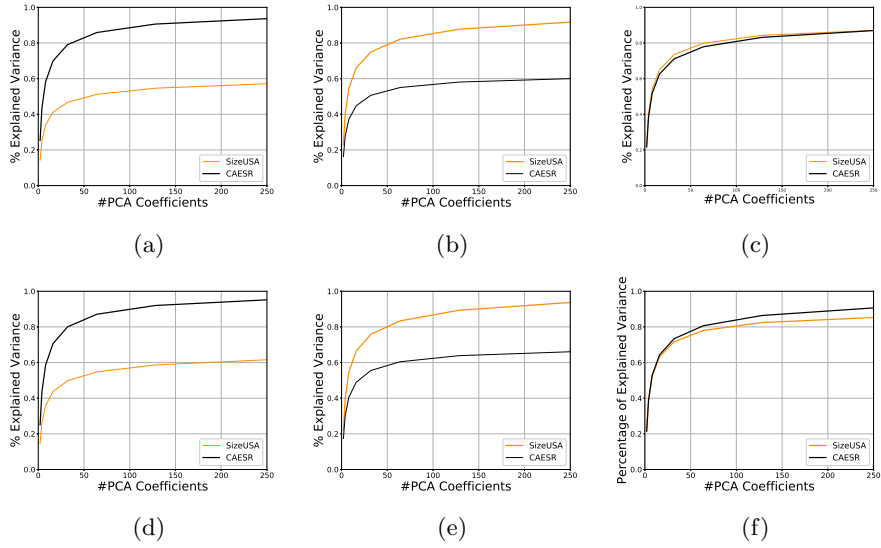


Fig. 3: Percentage of explained variance: Figure highlighting the percentage of explained variance of SizeUSA and CAESAR subjects when reconstructed by a shape space trained on CAESAR subjects (left column), SizeUSA subjects (middle column) and both SizeUSA and CAESAR subjects (right column). Top row is for male subjects and bottom row is female subjects. A shape space trained on either dataset was insufficient to explain the variance in the other dataset; this is consistent for both male and female subjects. Only a shape space trained on the combined male and female subjects was able to adequately explain the variance for both populations.

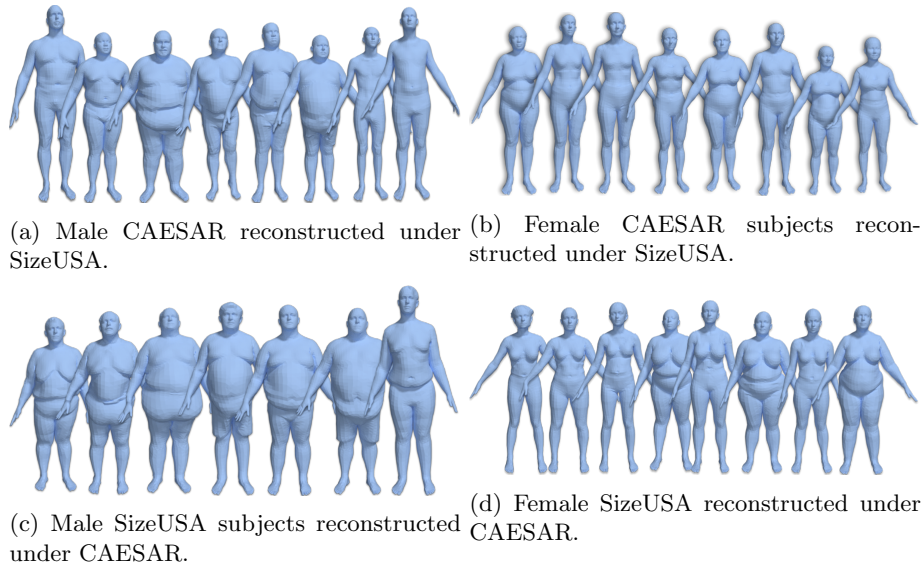


Fig. 4: **Reconstruction Error:** Subjects with the high reconstruction error. Top row are the most poorly reconstructed subjects in the CAESAR dataset, with a shape space trained on SizeUSA. Bottom row are the most poorly reconstructed SizeUSA subjects under a shape space trained on CAESAR subjects. A CAESAR shape space is biased towards sport bras and fails to capture the female chest shape in SizeUSA. SizeUSA includes more obese subjects that are poorly reconstructed under a CAESAR shape space.