Learning-Based Animation of Clothing for Virtual Try-On

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Motivation

- Lack of realiable ways of shopping clothing online
- Physical try-on is time-consuming and tedious

Image from annasthoughtbubbles.wordpress.com   Image from tinaban88.wordpress.com
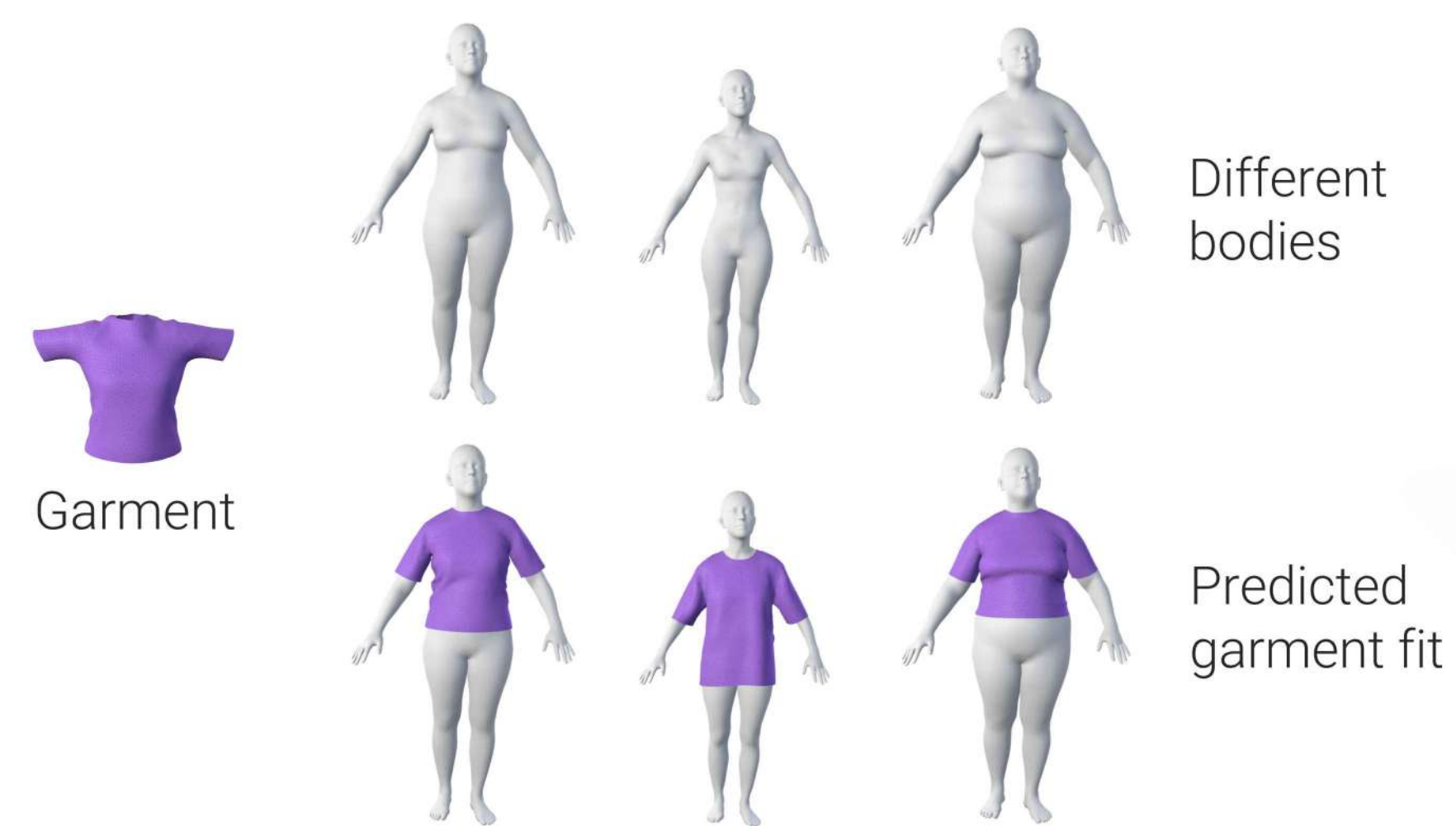
Contributions

A novel data-driven method that:

Generalizes to different body shapes:

Garment

Different bodies

Predicted garment fit

Achieves very high frame rates:

250 fps

Captures nonlinear clothing deformations:
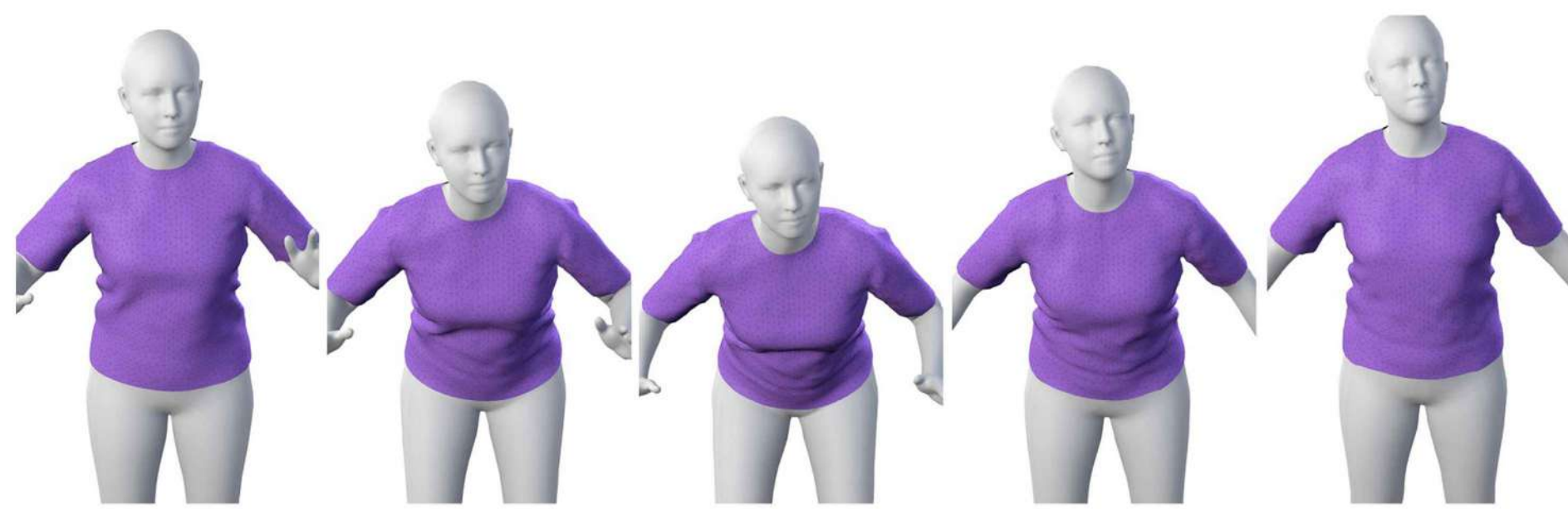
Acknowledgments

Our method

Preprocesing pipeline

Animation sequences $\{\theta_1, \theta_2, ..., \theta_t\}$ Body shapes $\{\beta_1, \beta_2, ..., \beta_s\}$

Cloth simulation [NSO12]

Runtime pipeline

Δ^{GT}

Regression (MLP) — Garment Fit

Regression (GRU) — Garment Wrinkles

Skinning + postprocessing

β β, θ_t $t-1$
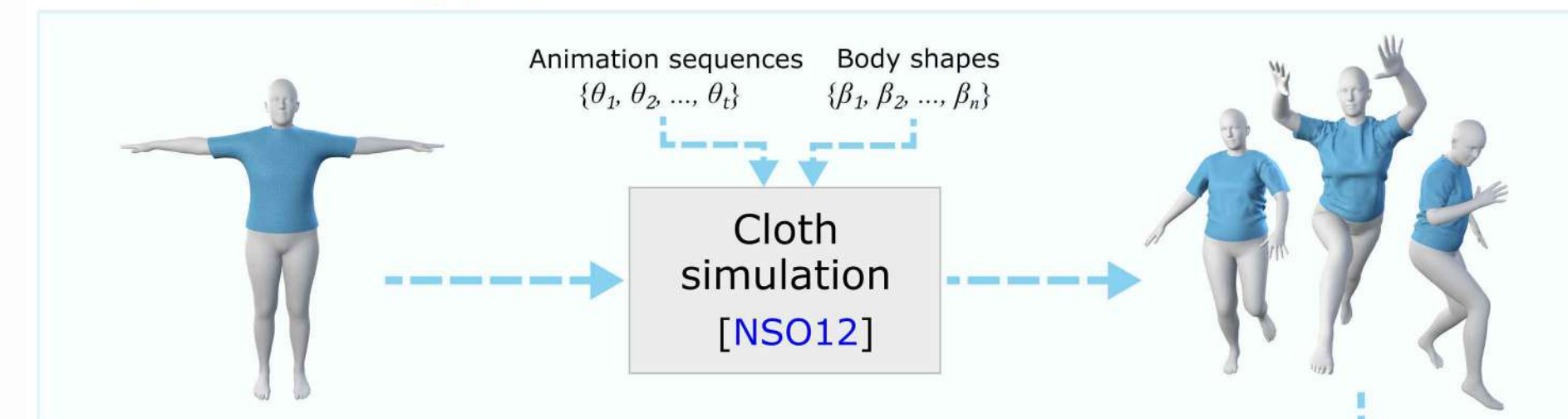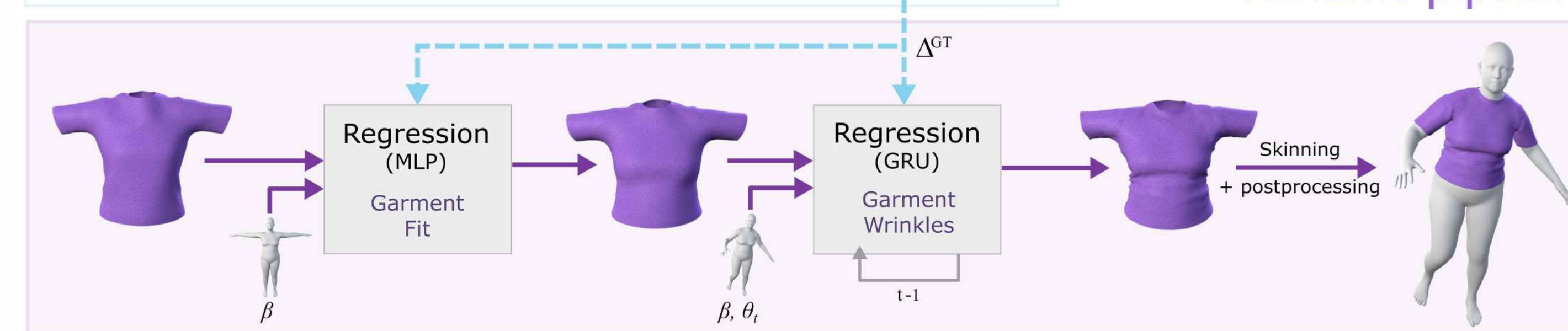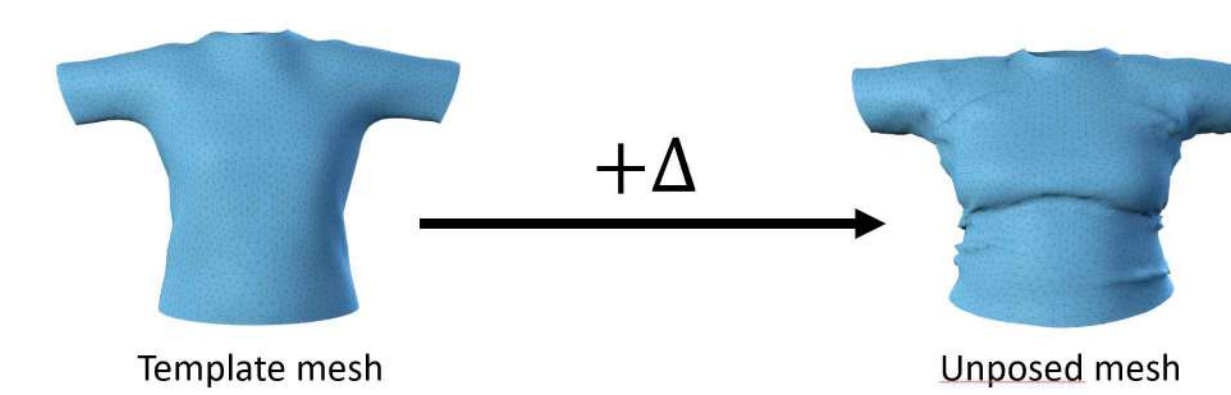
Data acquisition
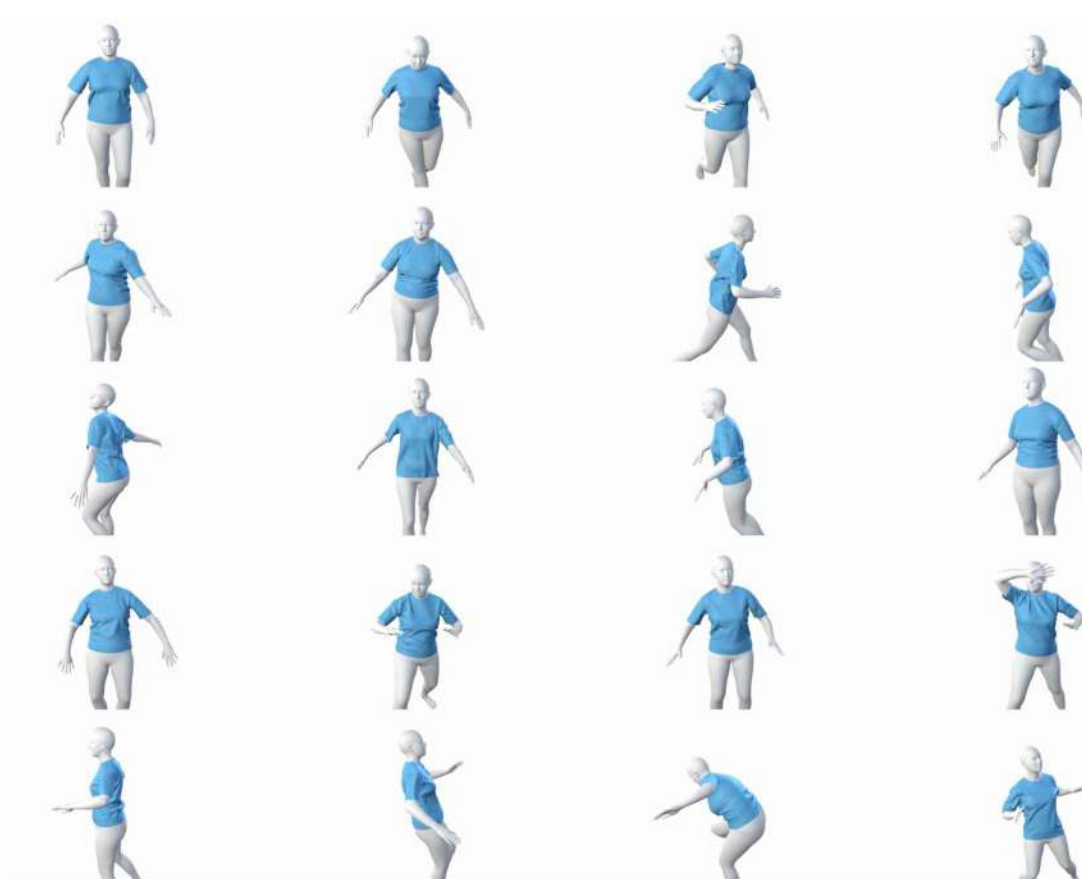
- Cloth simulation
  ARCSim [NSO12]

- 56 sequences
  CMU Motion Capture Database
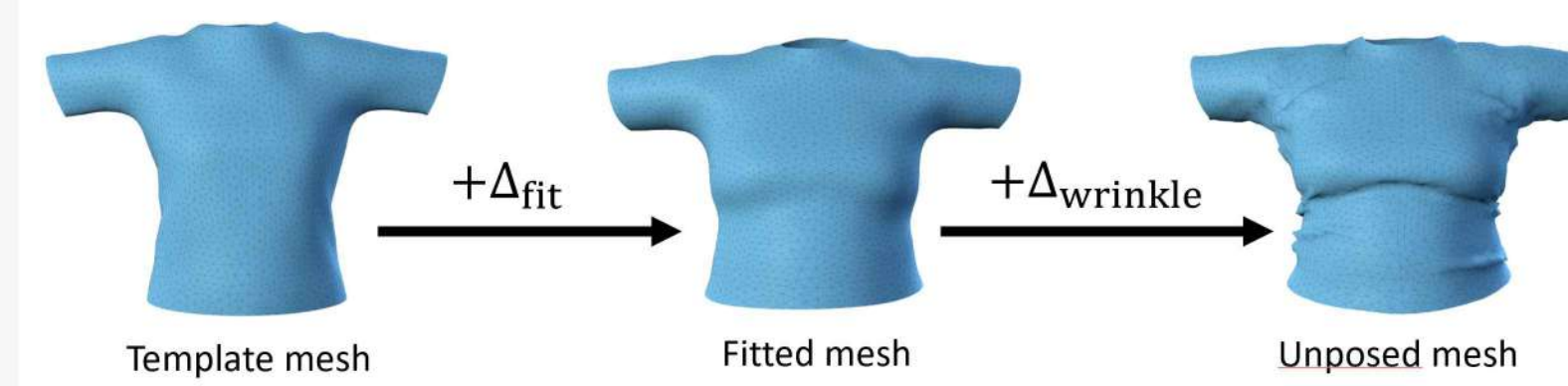
- 17 body shapes
  SMPL [LMR*2015]

Data preprocesing

Deformations in pose-space

$$LBS^{-1}\left(\text{<image>}\right) = \text{Unposed mesh}$$

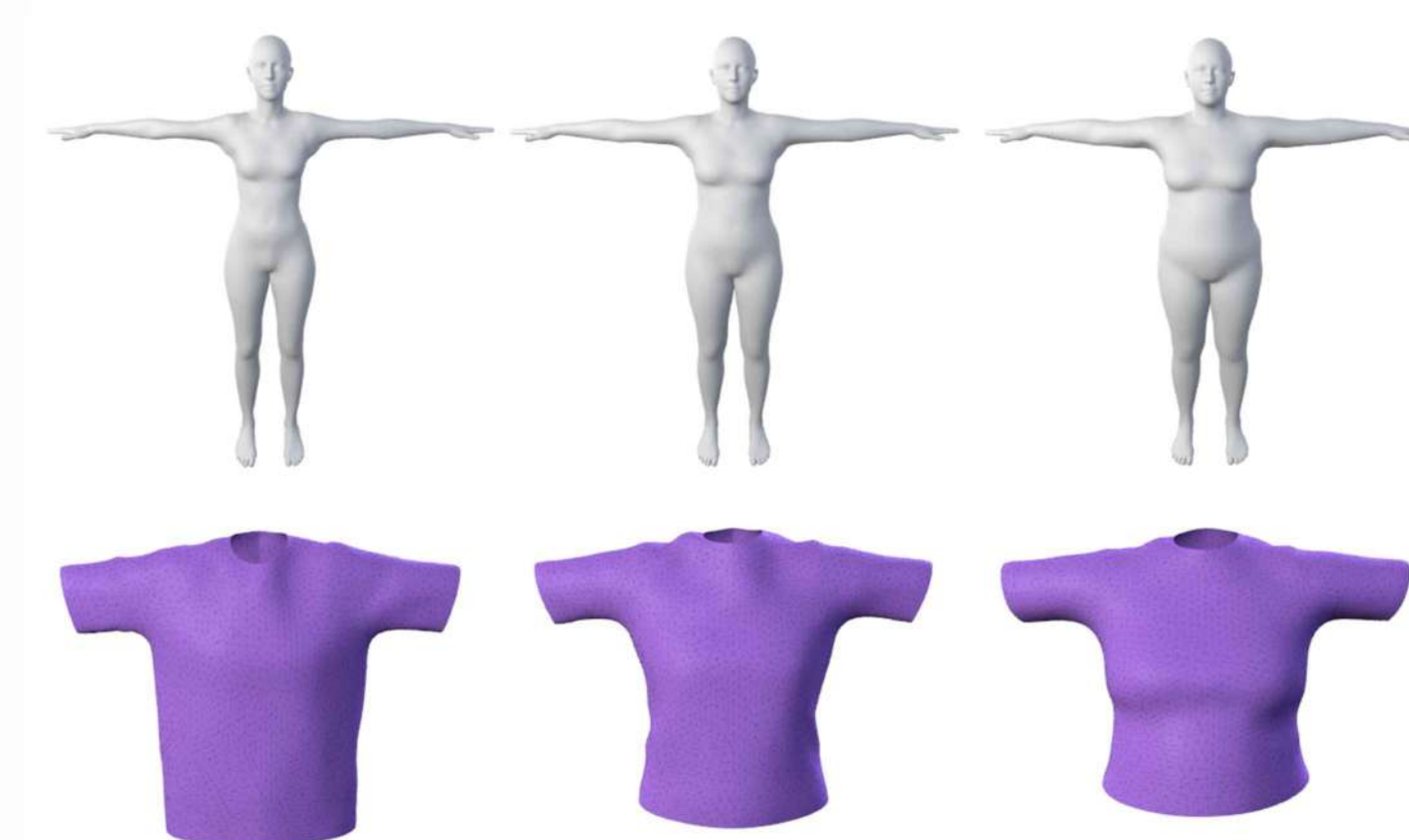Naïve approach (single step)

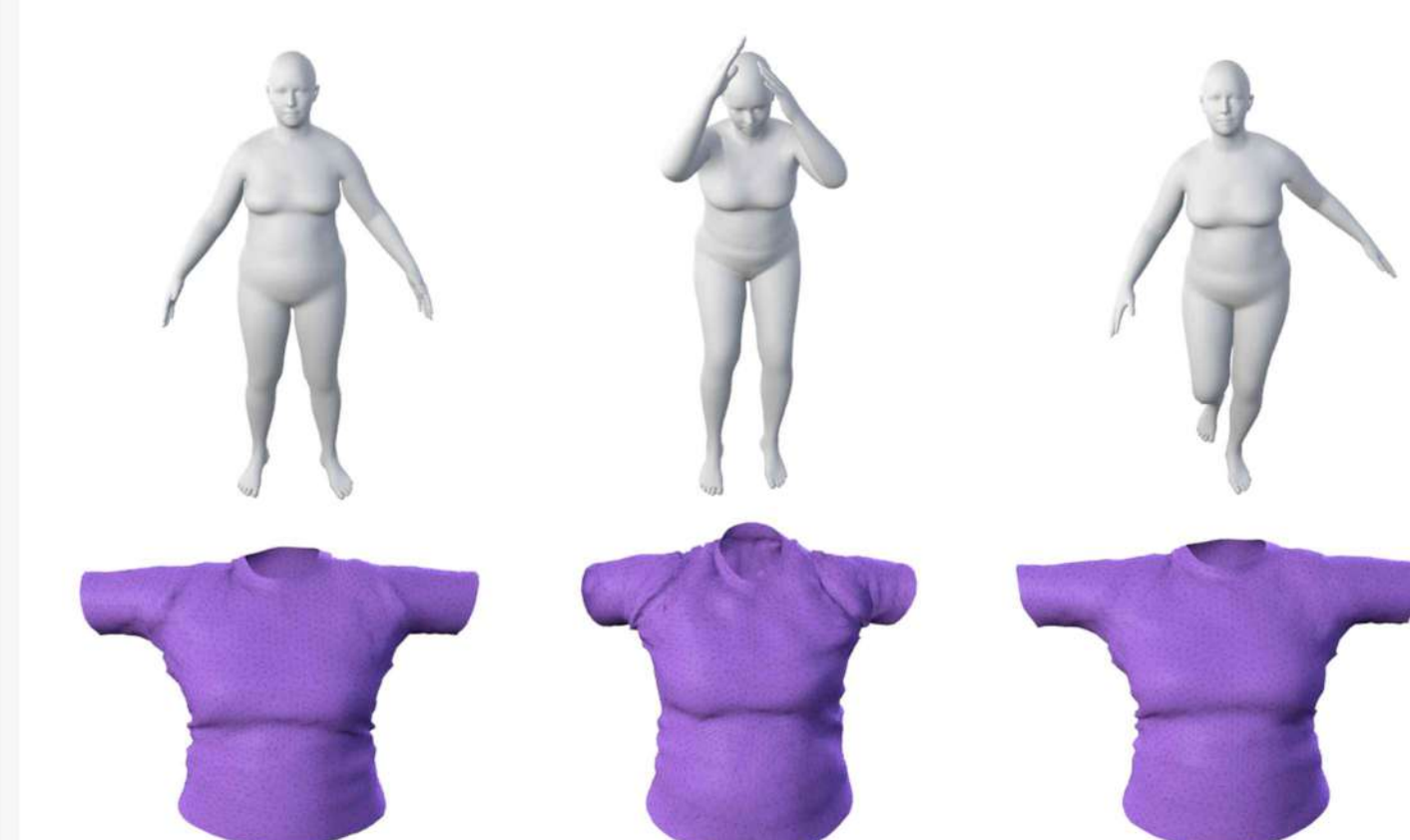Template mesh $\xrightarrow{+\Delta}$ Unposed mesh

Our approach (two steps)

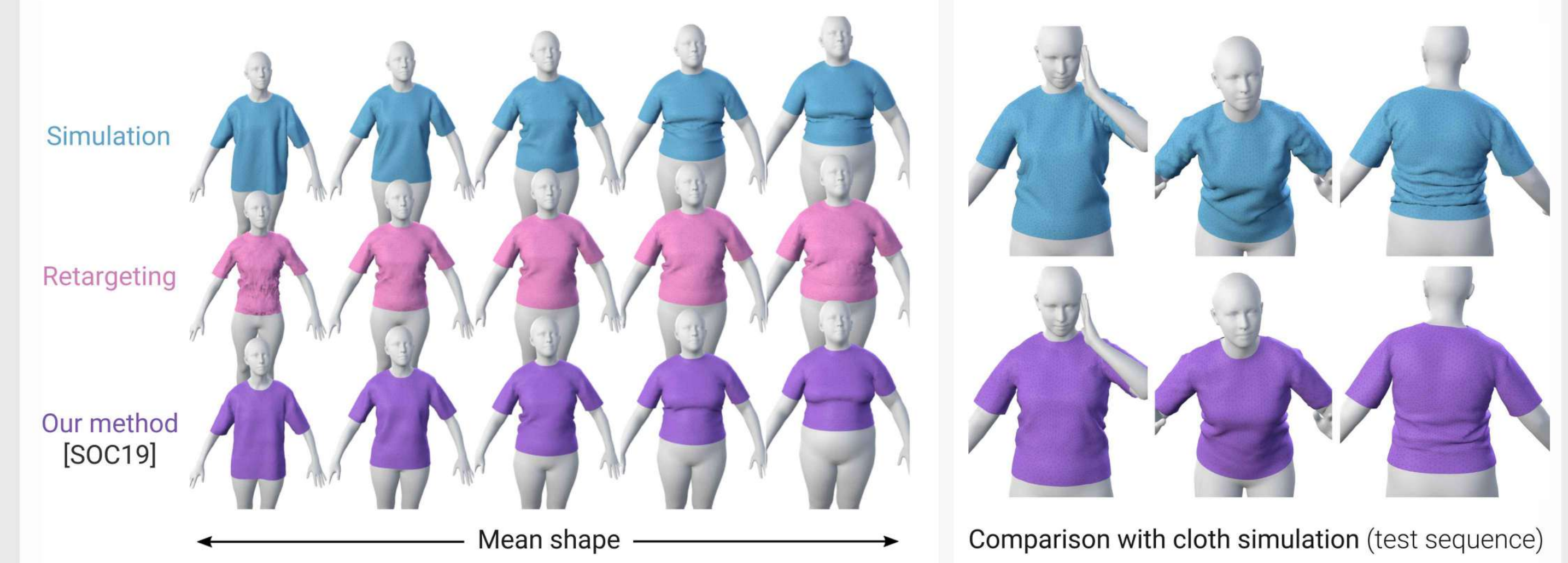Template mesh $\xrightarrow{+\Delta_{fit}}$ Fitted mesh $\xrightarrow{+\Delta_{wrinkle}}$ Unposed mesh

Fit regresion (Δ_{fit})

Wrinkle regression ($\Delta_{wrinkle}$)

Qualitative evaluation

Simulation   Retargeting   Our method [SOC19]

Mean shape   Comparison with cloth simulation (test sequence)

Quantitative evaluation

- Generalization to new shapes

Per-vertex mean error
Animation sequence: walking_and_varying_shape (testing)

Retargeting — Ours
Error (cm) / Time (seconds)
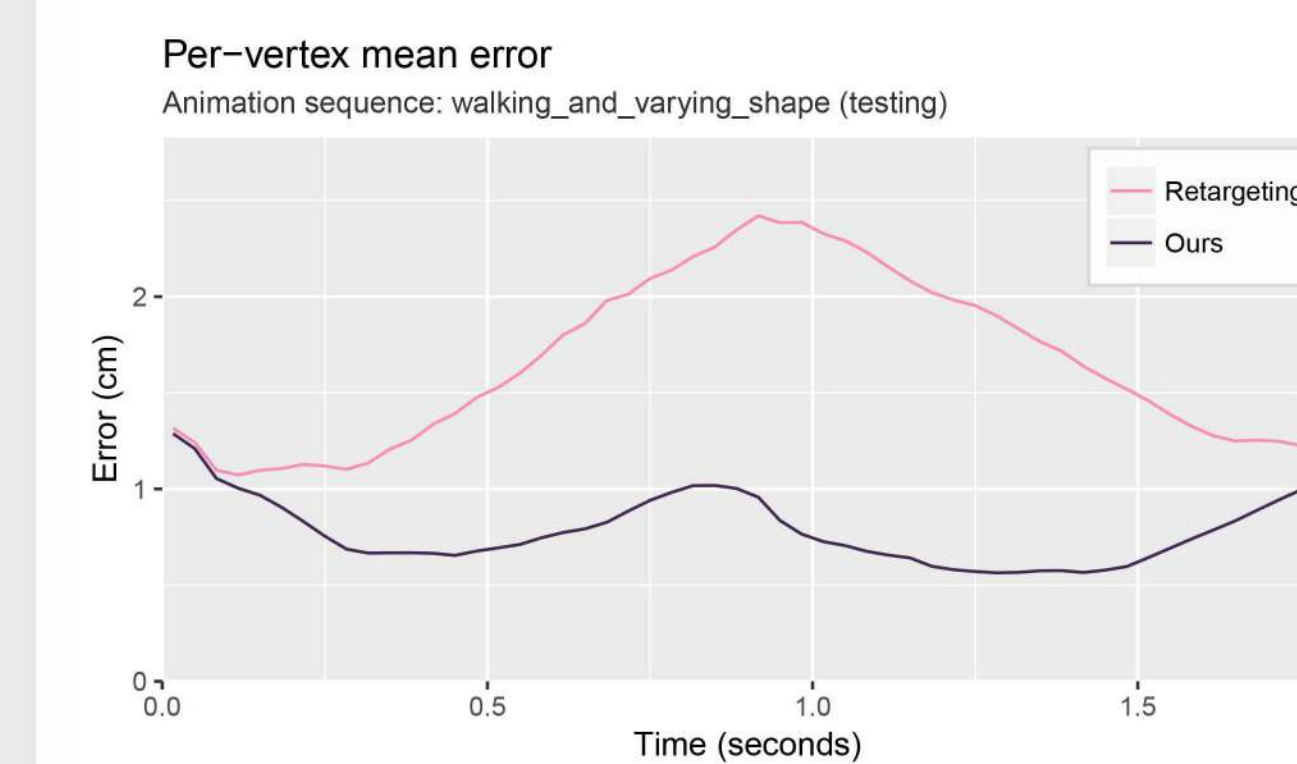
- Generalization to new motions

Per-vertex mean error
Animation sequence: 55_27 (testing)

LBS — LR — Ours
Error (cm) / Time (seconds)
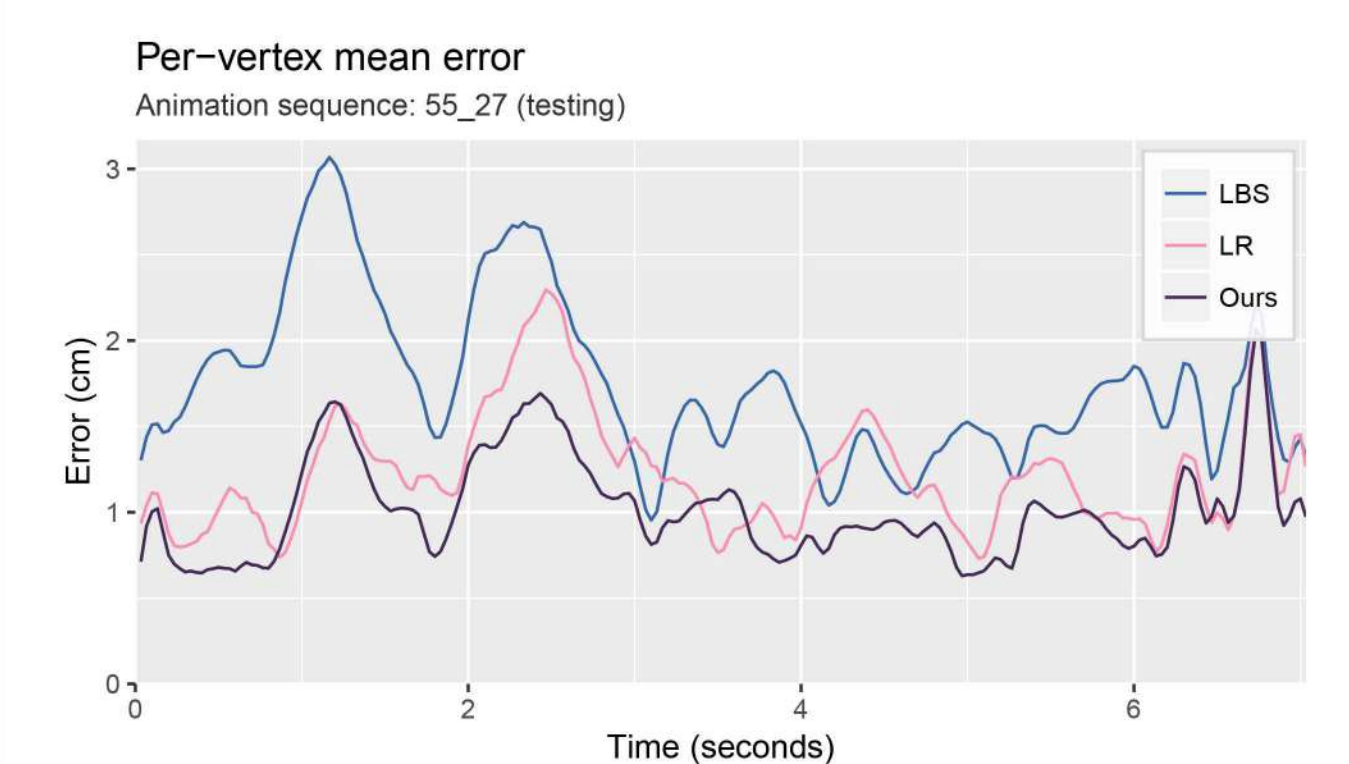
Comparison with other methods

DRAPE [GRH*12]

Our method [SOC19]

ClothCap [PMPHB17]

Our method [SOC19]
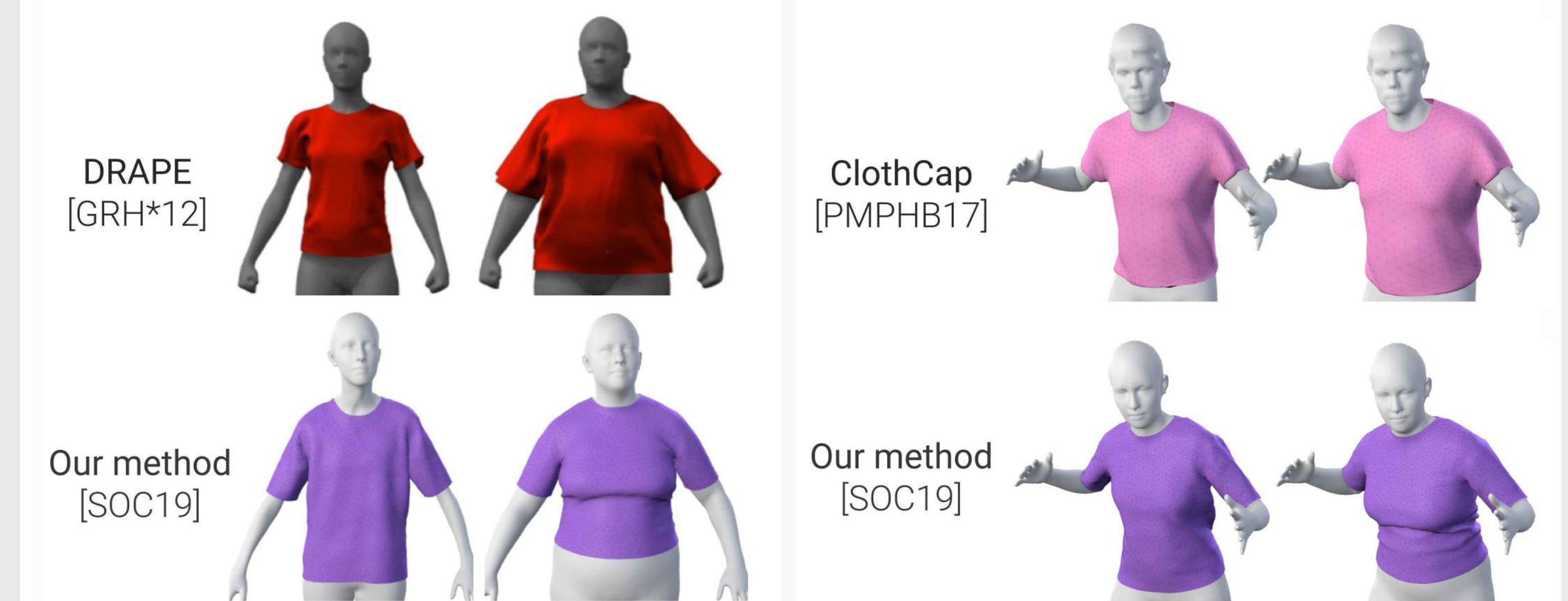
References

[GRH*12] Guan, P., Reiss, L., Hirshberg, D. A., Weiss, A., & Black, M. J. (2012). *DRAPE: DRessing Any PErson*. ACM transactions on graphics (TOG), 31(4), 35-1.

[LMR*15] Loper, M., Mahmood, N., Romero, J., Pons-Moll, G., & Black, M. J. (2015). *SMPL: A skinned multi-person linear model*. ACM transactions on graphics (TOG), 34(6), 248.

[NSO12] Narain, R., Samii, A., & O'Brien, J. F. (2012). *Adaptive anisotropic remeshing for cloth simulation*. ACM transactions on graphics (TOG), 31(6), 152.

[PMPHB17] Pons-Moll, G., Pujades, S., Hu, S., & Black, M. J. (2017). *ClothCap: Seamless 4D clothing capture and retargeting*. ACM Transactions on Graphics (TOG), 36(4), 73.

[SOC19] Santesteban, I., Otaduy, M. A., & Casas, D. (2019). *Learning-Based Animation of Clothing for Virtual Try-On*. Computer Graphics Forum (Proc. Eurographics)