SCALE: Modeling Clothed Humans with a Surface Codec of Articulated Local Elements

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qianlim.github.io/SCALE

Goal

A model of pose-dependent clothed human shapes that have expressive geometry, are flexible to topological change, easy to render, and fast at inference.

Problem

Existing 3D representations cannot satisfy these requirements for modeling 3D humans in clothing.

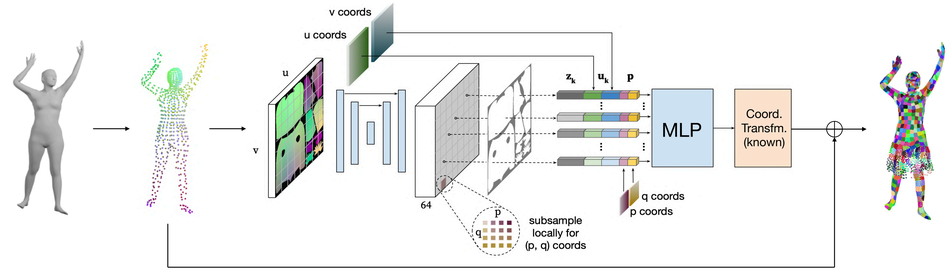
	Articulation Support	Topology Flexibility	Fast Inference
Meshes	✓	✗	✓
Implicit Surfaces	✓ / ✗	✓	✗
Surface Patches	✗	✓	✓
Point Clouds	✗	✓	✓
SCALE (ours)	✓	✓	✓

References

[1] Groueix et al. 3D-CODED: 3D Correspondences by Deep Deformation. ECCV 2018.
[2] Yuan et al. PCN: Point Completion Network. 3DV 2018.
[3] Prokudin et al. SMPLpix: Neural Avatars from 3D Human Models. WACV 2021.
[4] Ma et al. Learning to Dress 3D People in Generative Clothing. CVPR 2020.
[5] Deng et al. Neural Articulated Shape Approximation. ECCV 2020.

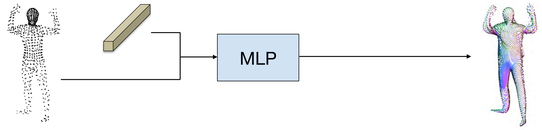
Our Approach

- Represent 3D clothed humans as dense point clouds.
- Structure the points into hundreds of *articulated*, *local* patches, decoded from *local* features.

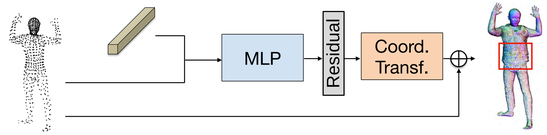


Articulated Local Patches

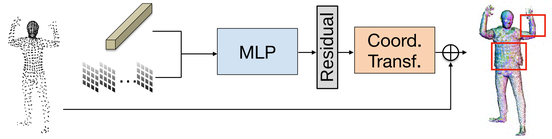
Global patch [1] + global feature — over-smooth



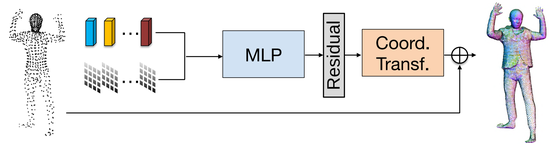
Global patch + global feature + articulation — lacks local detail



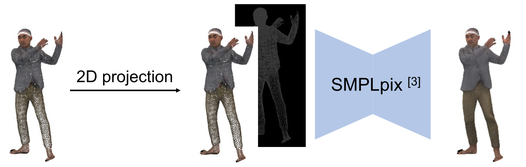
Local patches [2] + global feature + articulation — noisy, lacks detail



Local patches + local features + articulation — coherent global shape, expressive local details



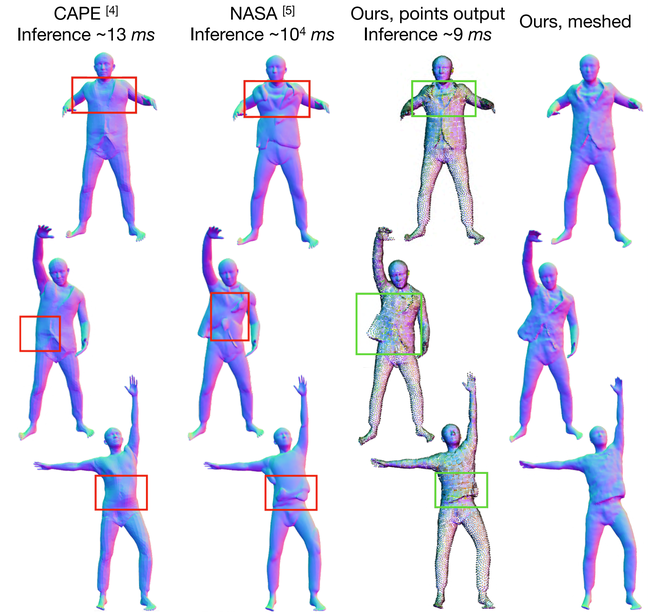
Rendering SCALE



Results

Quantitative and qualitative evaluation on CAPE [4] dataset:

	Chamfer-*L2* ($\times 10^{-4} m^2$) ↓			Normal Diff ($\times 10^{-1}$) ↓		
	Blazer	T-shirt	Skirt	Blazer	T-shirt	Skirt
CAPE [4] (mesh)	1.96	1.37	*N.A.*	1.28	1.15	*N.A*
NASA [5] (implicit surface)	1.37	1.05	*N.A.*	1.29	1.17	*N.A.*
Ours (local patches)	**1.07**	**0.89**	**2.69**	**1.22**	**1.12**	**0.94**



Code & Animated Results: https://qianlim.github.io/SCALE

CVPR VIRTUAL JUNE 19-25