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GAN-based Garment Generation Using Sewing Pattern Images

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https://gamma.umd.edu/researchdirections/virtualtryon/garmentgeneration/

Motivations

Garment Generation

- Problem: generate 3D garment mesh from 2D design patterns
- Important for garment-manufacturing, 3D virtual try-on system, etc.

Yang et al. "Detailed garment recovery from a single-view image." *ACM TOG* (2016).

Key Contributions

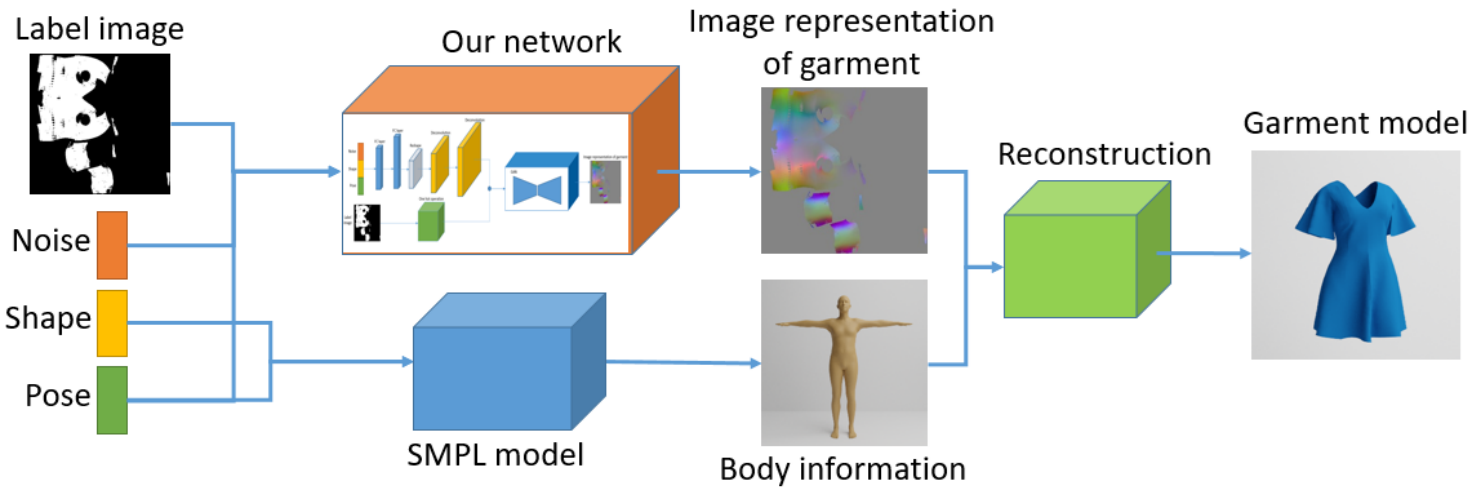
- The first image-based garment generative model that can support most garment topology, sewing patterns, human body shapes and sizes, and fabric materials.

- A novel image representation of garment that can transfer to/from general 3D garment models with little information loss, and enable garment retargeting.

- A large garment appearance dataset for unsupervised learning.

System Overview: Pipeline

- The upper sub-pipeline generates *image representation of garment* with our network, while the bottom one generates the *body* information. We recover the garment model with the image rep. of both the garment and the body info



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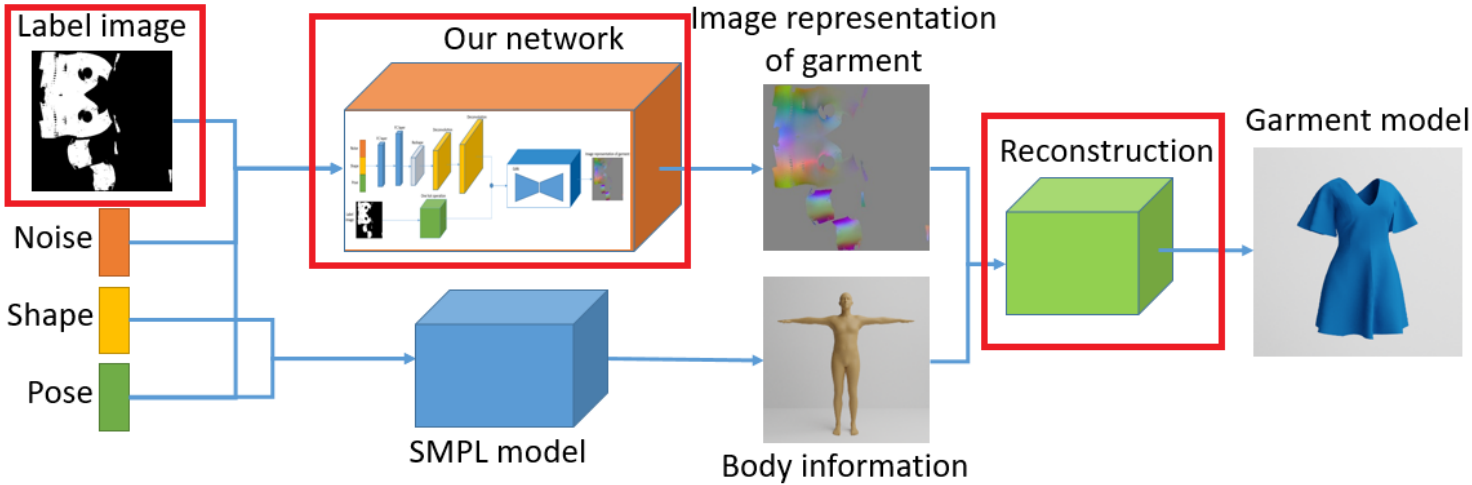
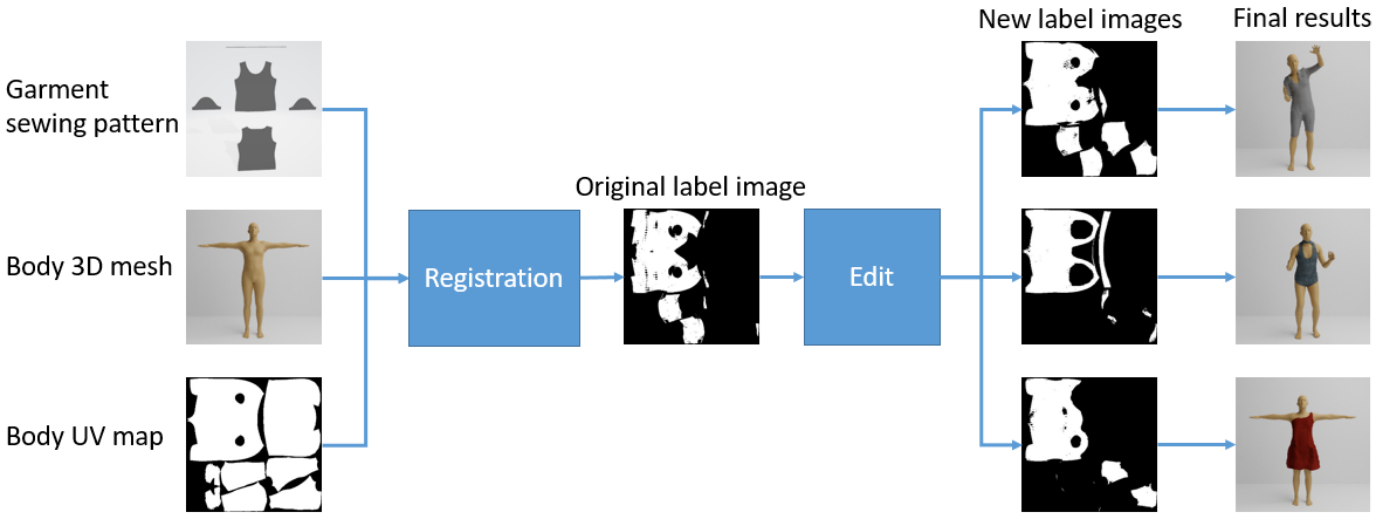


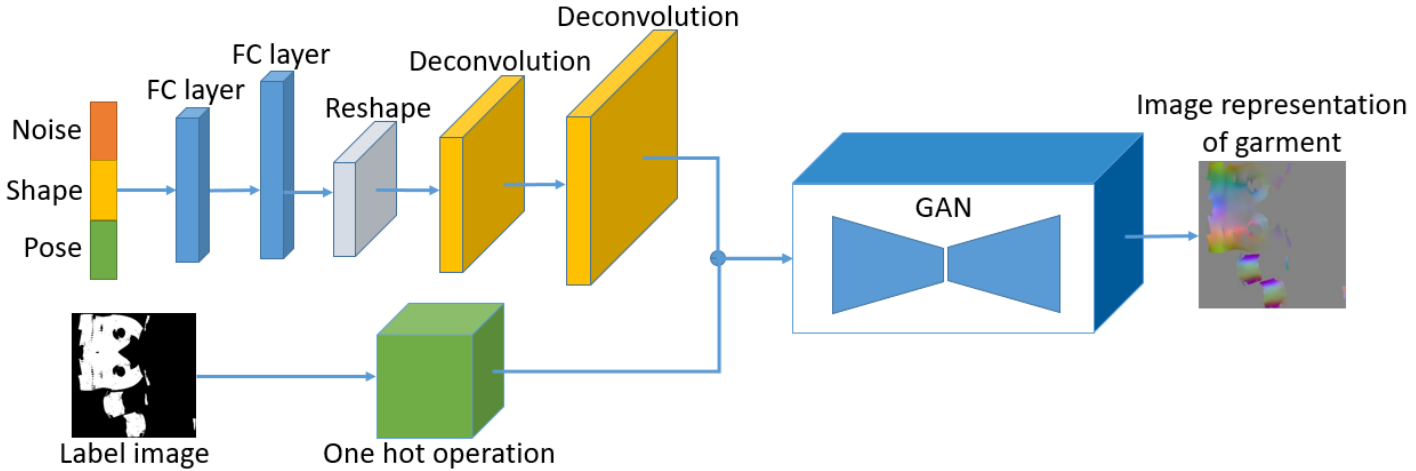
System Overview: Label image generation

- Original label image can be generated with garment sewing patterns, body mesh and body UV map. We can edit the original label image to different new label images, leading to different garment topology in the final results.



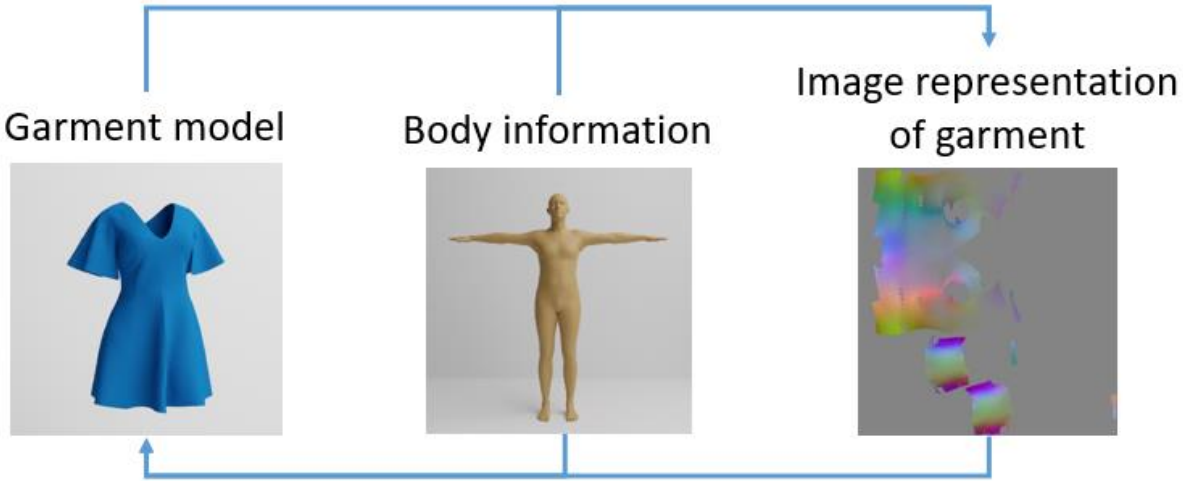
System Overview: Network Architecture

- Given one dimensional information, assuming sizes are the same as the image (upper pipeline), then concatenate with one hot labelled image (bottom pipeline), feed them into the GAN network, to obtain the image representation of the garment (right)



System Overview: Data Format Transformation

- The garment model and the image representation of garment can transfer to each other using body information.



Dataset

Sample meshes from our garment dataset. The dataset includes several common garment topology and materials, as well as varying human poses.

Dataset

Animations: different garment topology, patterns, and human poses.

Dataset

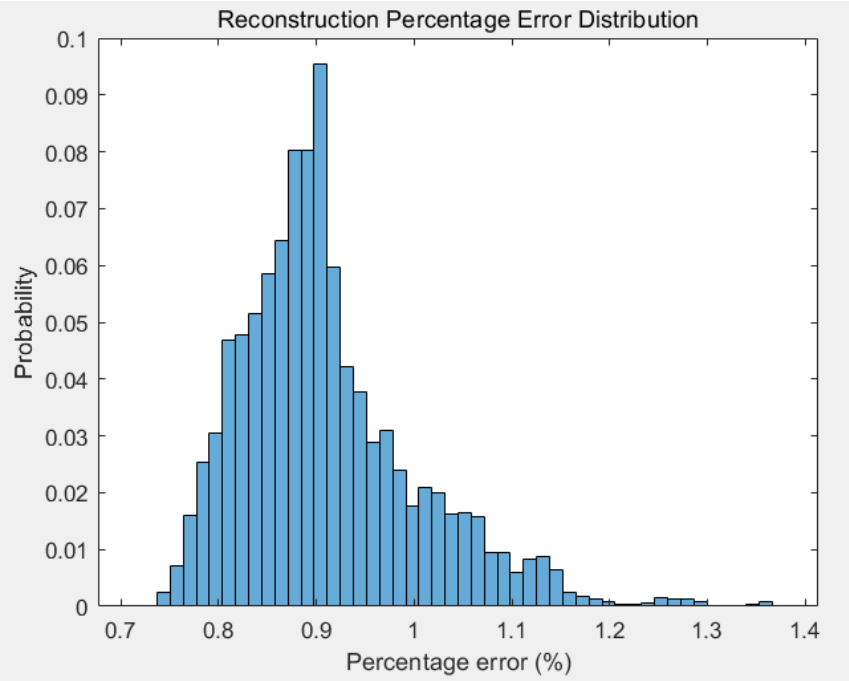
Animations: different garment materials.

Garment Reconstruction

Our data transfer method is able to map 3D garment mesh with different topology, materials and poses to its 2D image representation with little information loss.

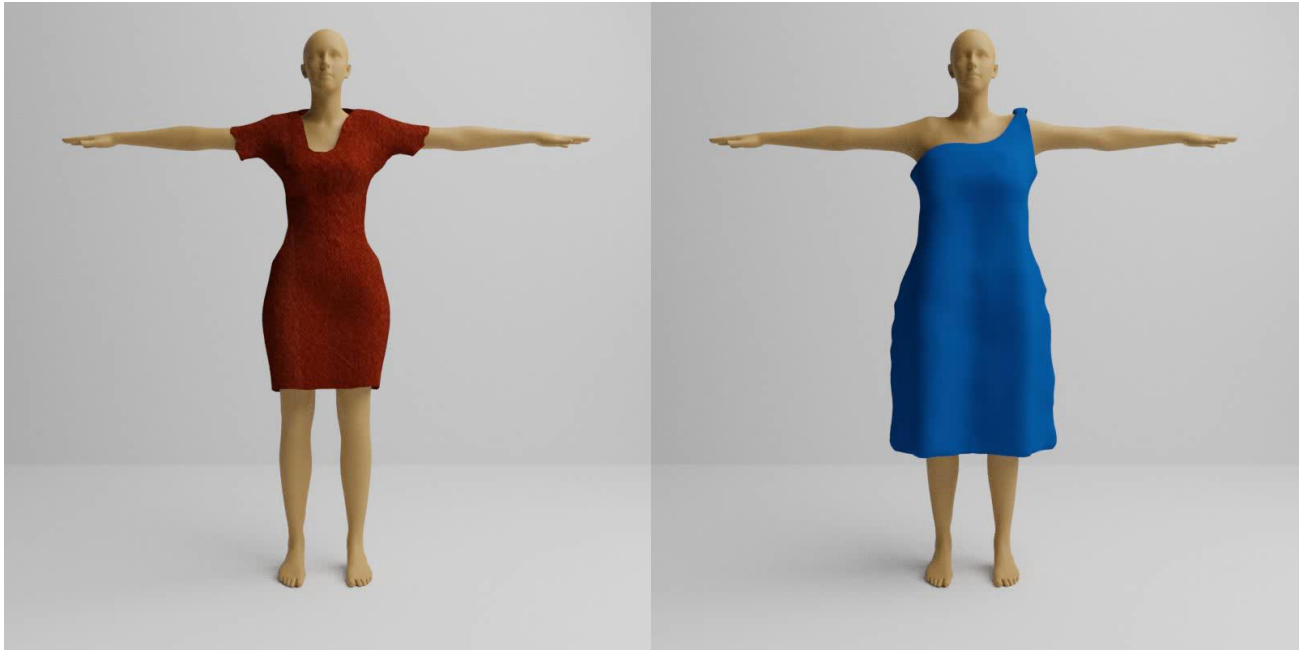
Garment Reconstruction

Reconstruction percentage error distribution:



Garment Generation

Animations of our generated garments, with different topology and materials.

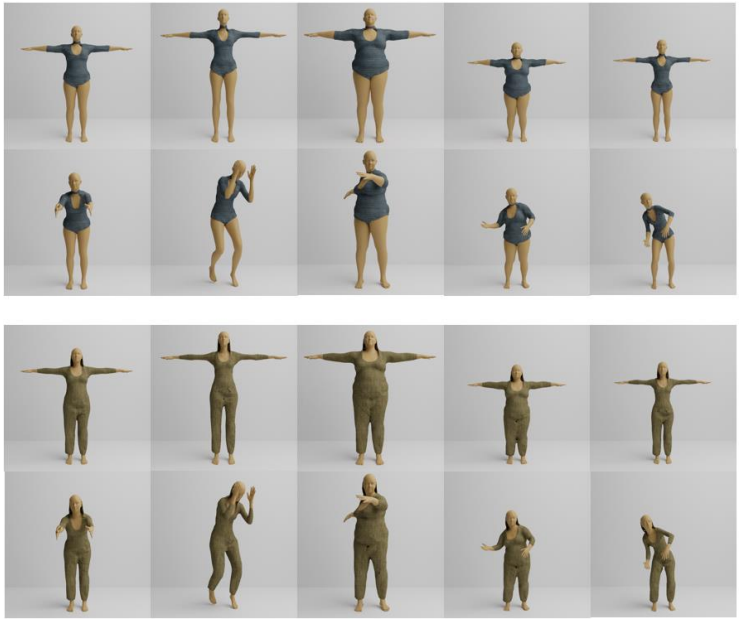


Interpolation

The garment changes from leftmost style to rightmost style smoothly, showing that our learned latent space is smooth and compact.

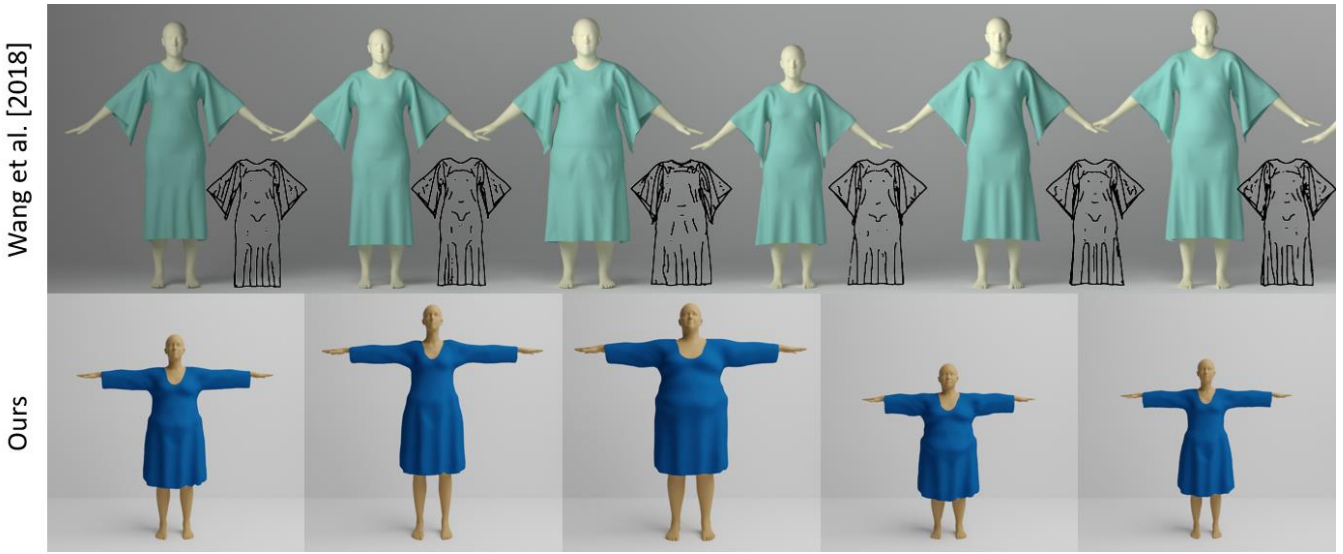
Garment Retargeting

Our method can retarget garments with different topology, patterns and materials to bodies with different shapes, sizes and poses properly.



Garment Retargeting -- Comparison

Our system is computationally more efficient, while have nearly the same retargeting effect.



Comparison

Huang et al. generate garment model with texture. Wang et al. generate garments with realistic wrinkles from the sketch. Tex2Shape generates combined body and garment models. Our method generates garments with *various topologies*.

Huang, et al.

Wang, et al.

Tex2Shape

Our method

Performance

The following table shows the performance of each stage in our method.

Stage	Network inference	Garment reconstruction	Post-processing	Total
Time (***sec***)	0.369	1.303	0.576	2.248
Percentages	16.4%	57.9%	25.7%	100%

Summary

- 3D garment-generation method supports most garment *topology, patterns* and *materials*, as well as human *body shapes, sizes* and *poses*.
- Generated garments can be retargeted to other bodies of different shapes, sizes, and poses easily and accurately with low cost.
- A large garment appearance dataset for unsupervised learning.

Future Work

- Support the multi-layer garments
- Use 3D loss to further improve the accuracy

Thank you!

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