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TSCom-Net: Coarse-to-Fine 3D Textured Shape Completion Network

Ahmet Serdar Karadeniz, Sk Aziz Ali, Anis Kacem, Elona Dupont, and Djamila Aouada

SnT, University of Luxembourg

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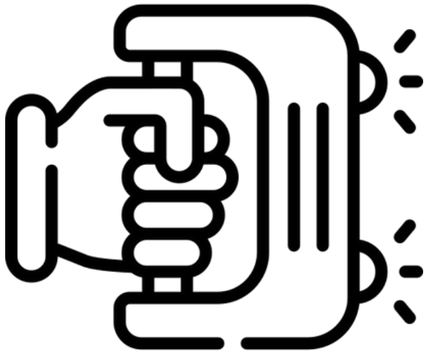
3D Scanning and Challenges



3D Scanner

- Occlusions
- Movement
- Optical properties

3D Object

Partial Scan Result

Retrieving the **textured** 3D object from its partial scan

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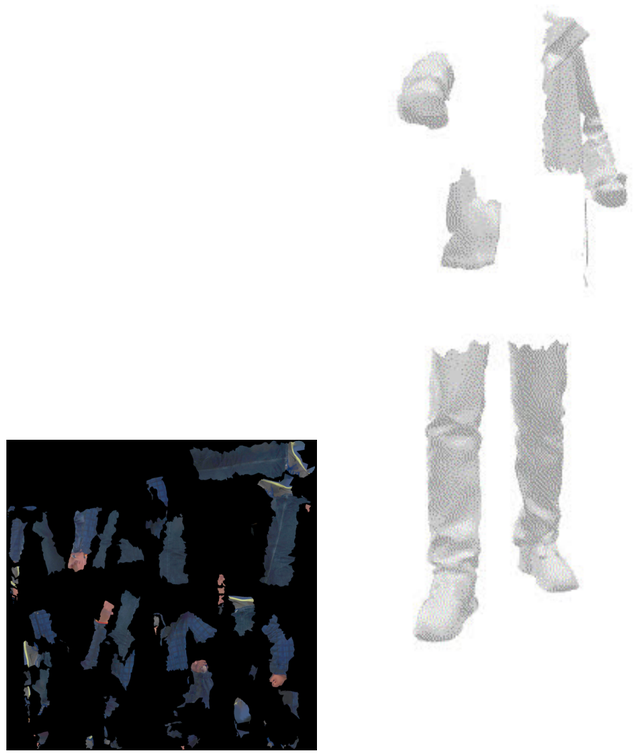
3D Textured Shape Completion



Partial 3D Mesh

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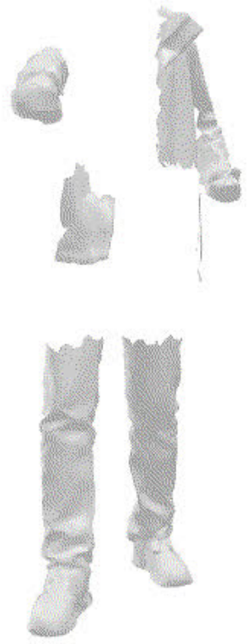
3D Textured Shape Completion



Partial 3D Mesh

Completed 3D Mesh

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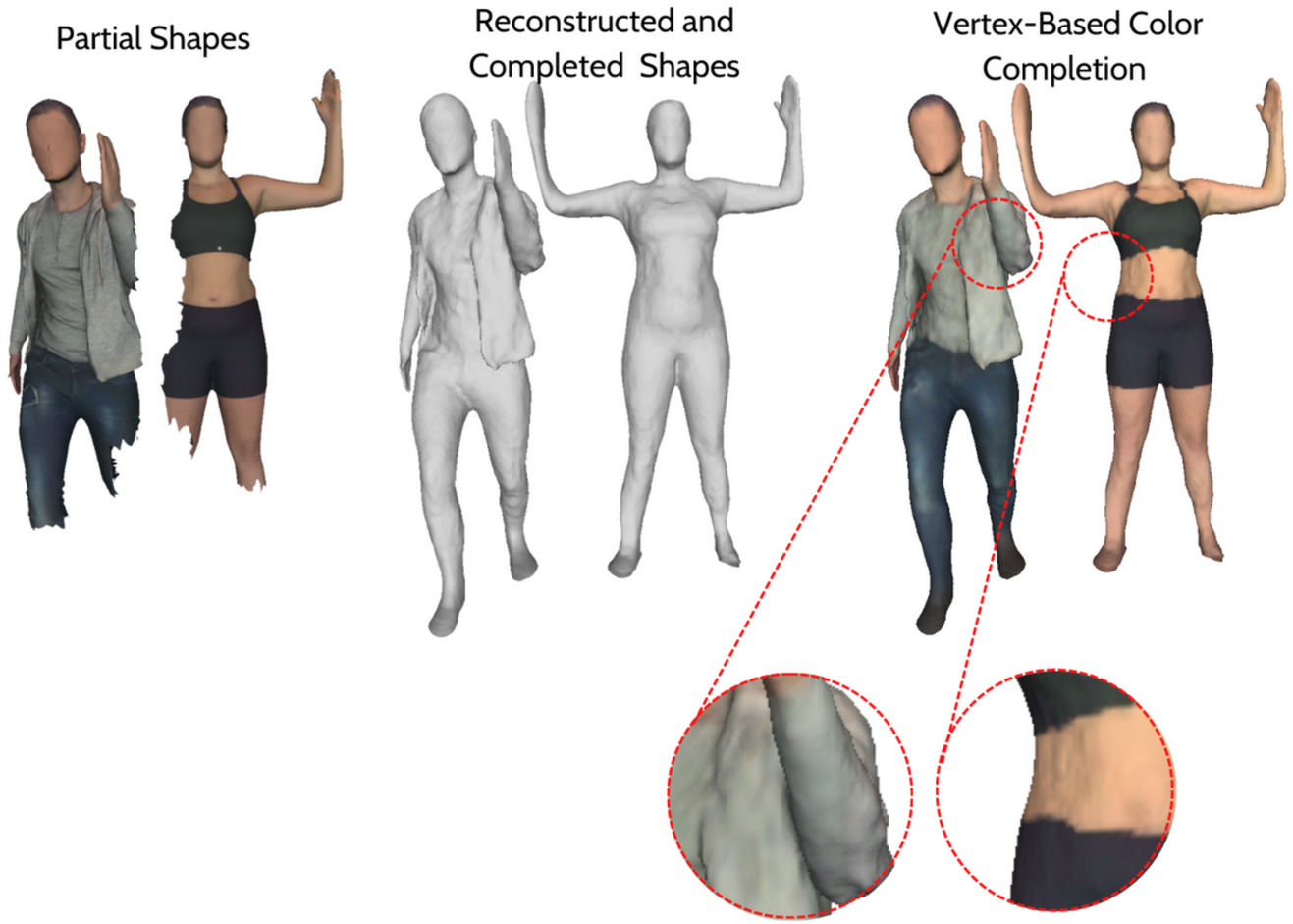
3D Textured Shape Completion



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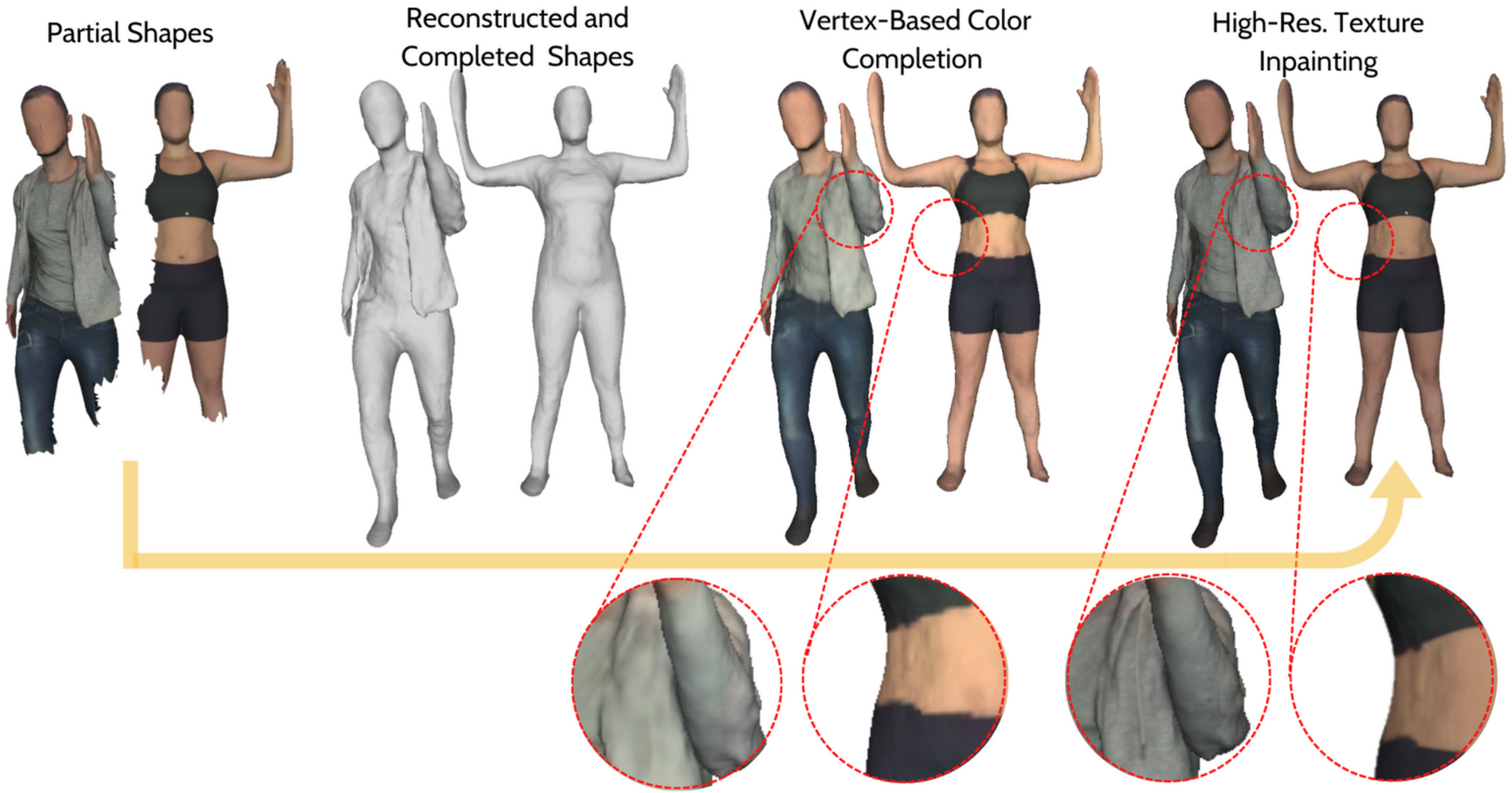
3D Textured Shape Completion



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Outline

- Related Work
- Proposed Approach
- Experimental Evaluation
- Conclusion

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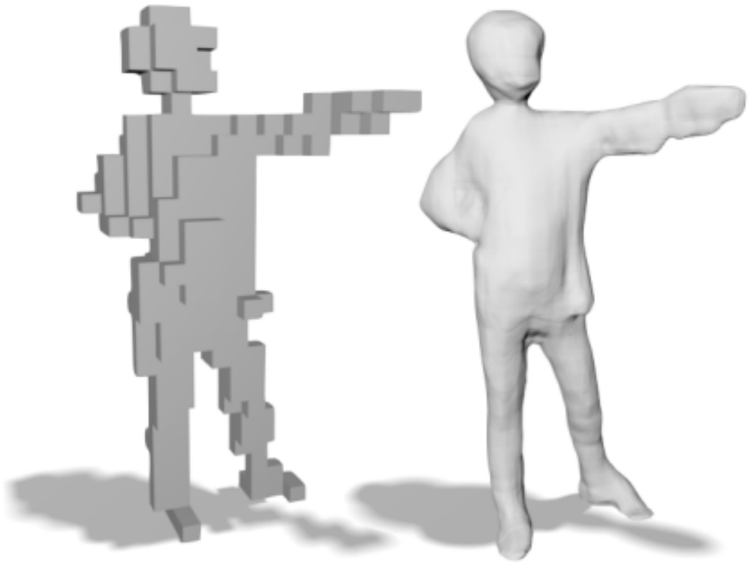
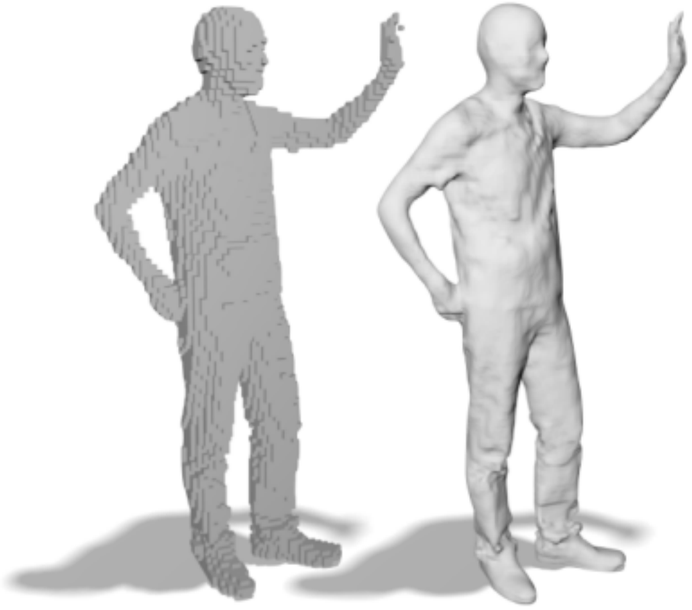
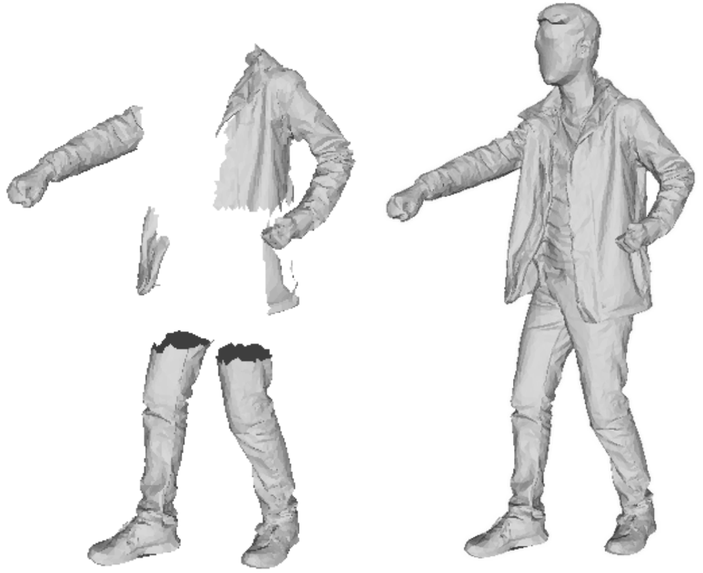
Related Work - Implicit Feature Networks



Sparse Voxel Reconstruction



Dense Voxel Reconstruction



Shape Completion

"Implicit functions in feature space for 3d shape reconstruction and completion." *CVPR* 2020.

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Related Work - IFNet

Input

Overview of IFNet

"Implicit functions in feature space for 3d shape reconstruction and completion." *CVPR* 2020.

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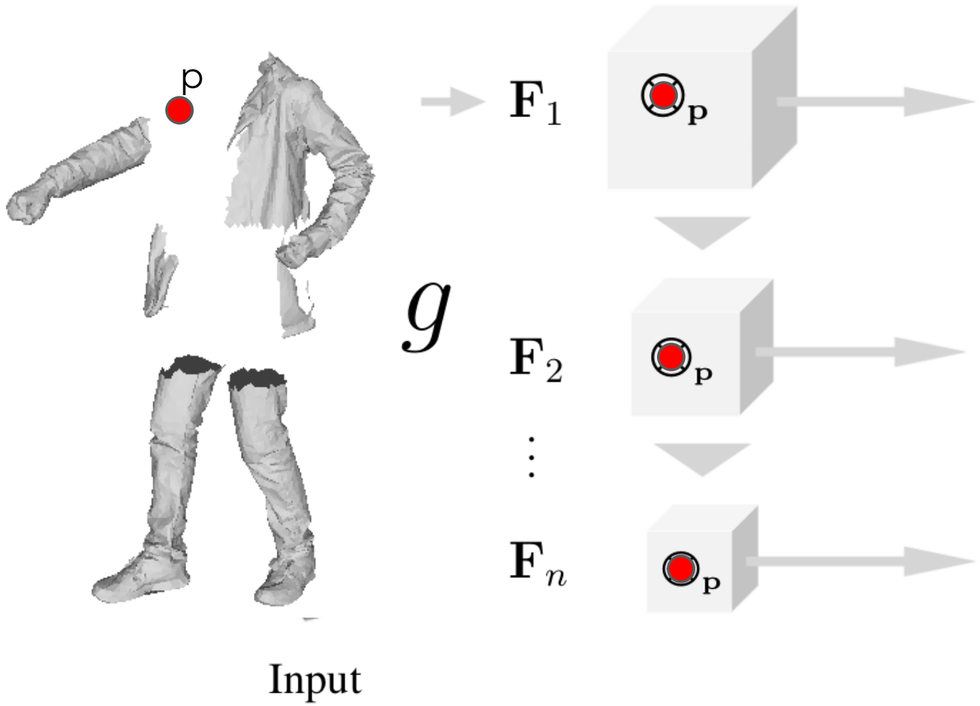
Related Work - IFNet



Overview of IFNet

"Implicit functions in feature space for 3d shape reconstruction and completion." *CVPR* 2020.

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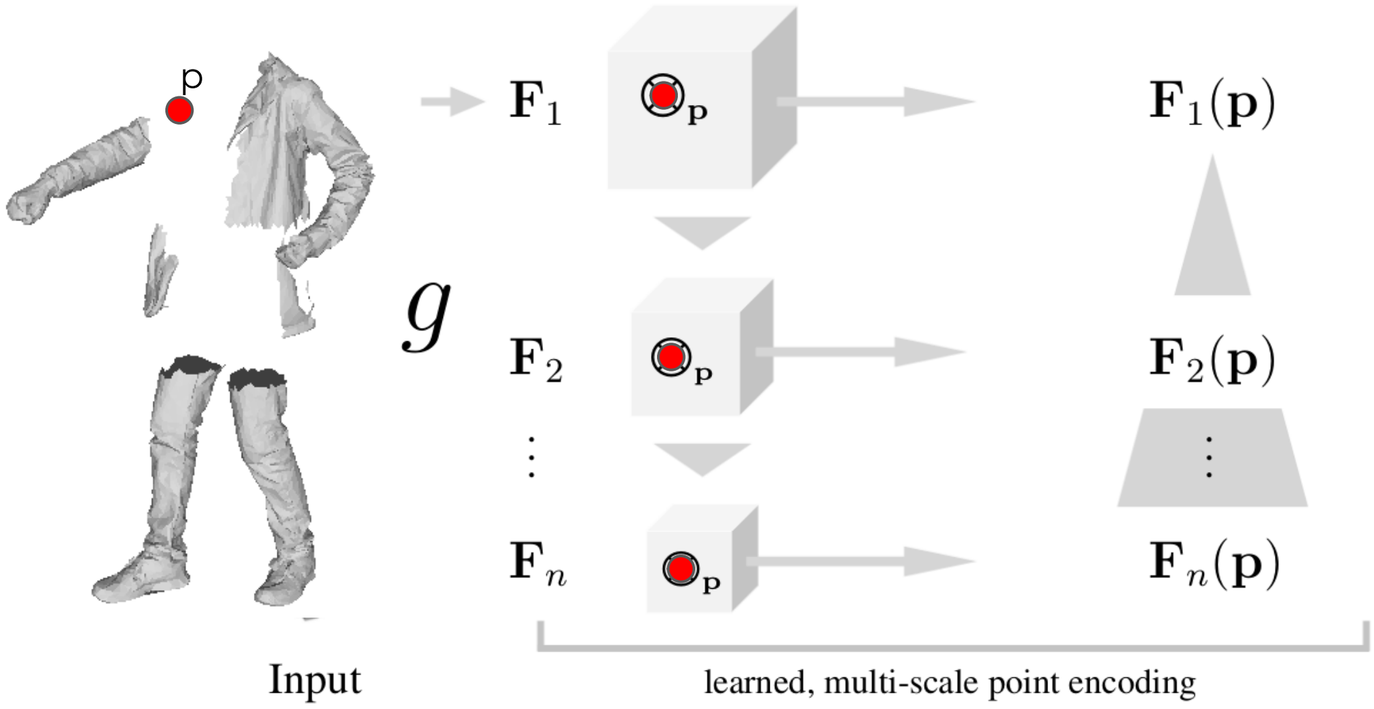
Related Work - IFNet



Overview of IFNet

"Implicit functions in feature space for 3d shape reconstruction and completion." *CVPR* 2020.

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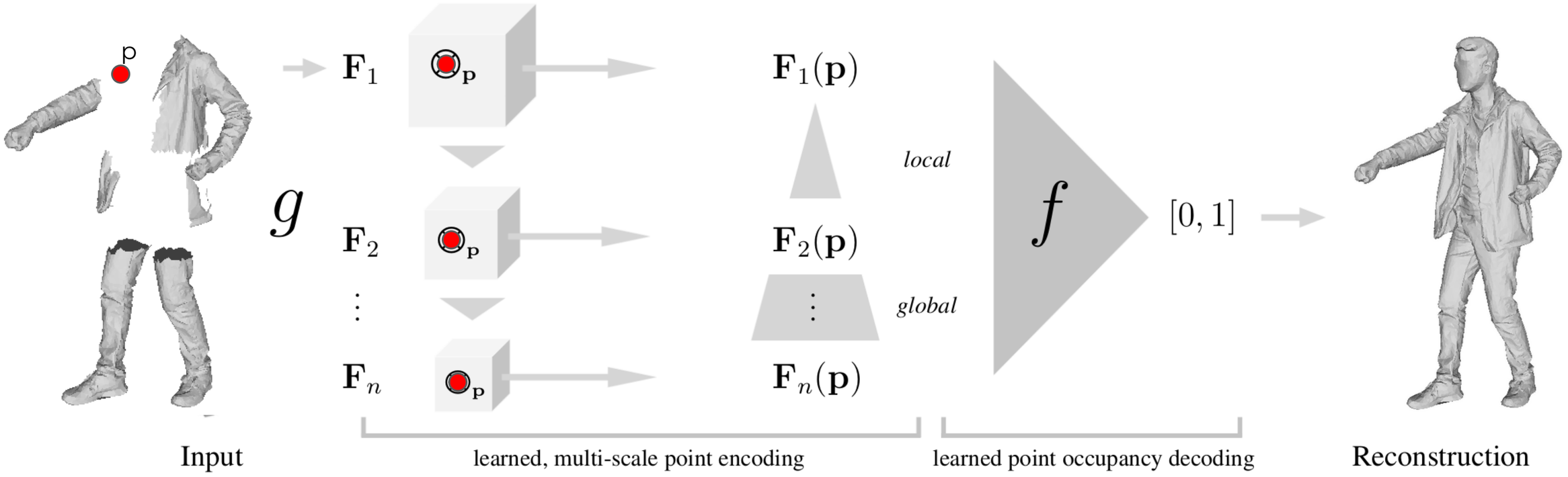
Related Work - IFNet



Overview of IFNet

"Implicit functions in feature space for 3d shape reconstruction and completion." *CVPR* 2020.

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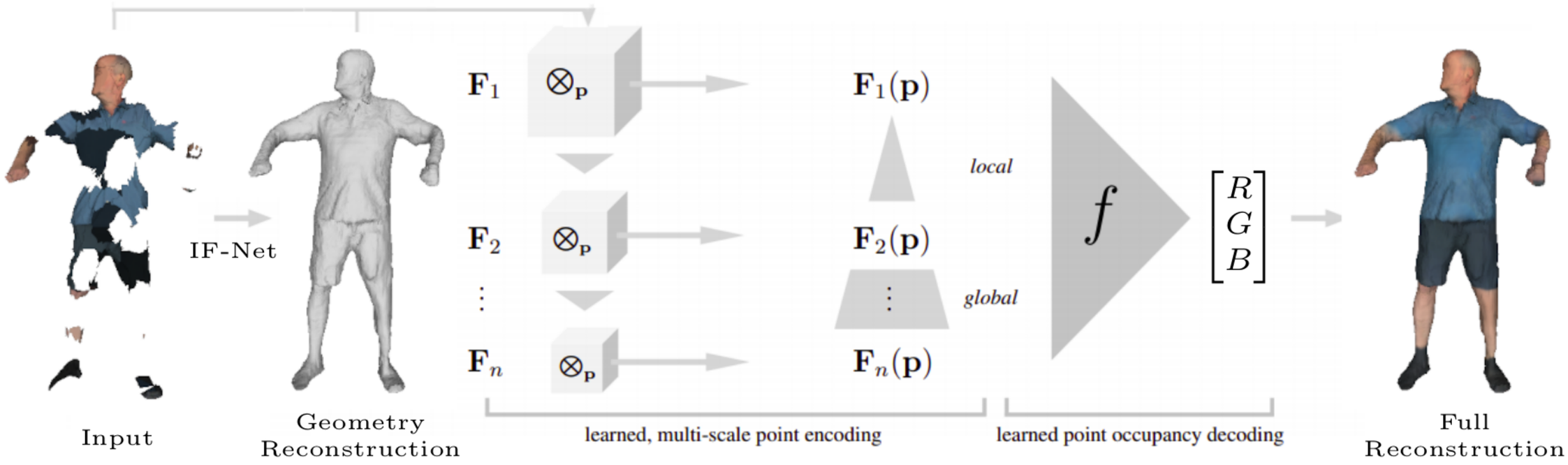
Related Work - IFNet-Texture



Overview of IFNet-Texture

"Implicit feature networks for texture completion from partial 3d data." ECCV, 2020.

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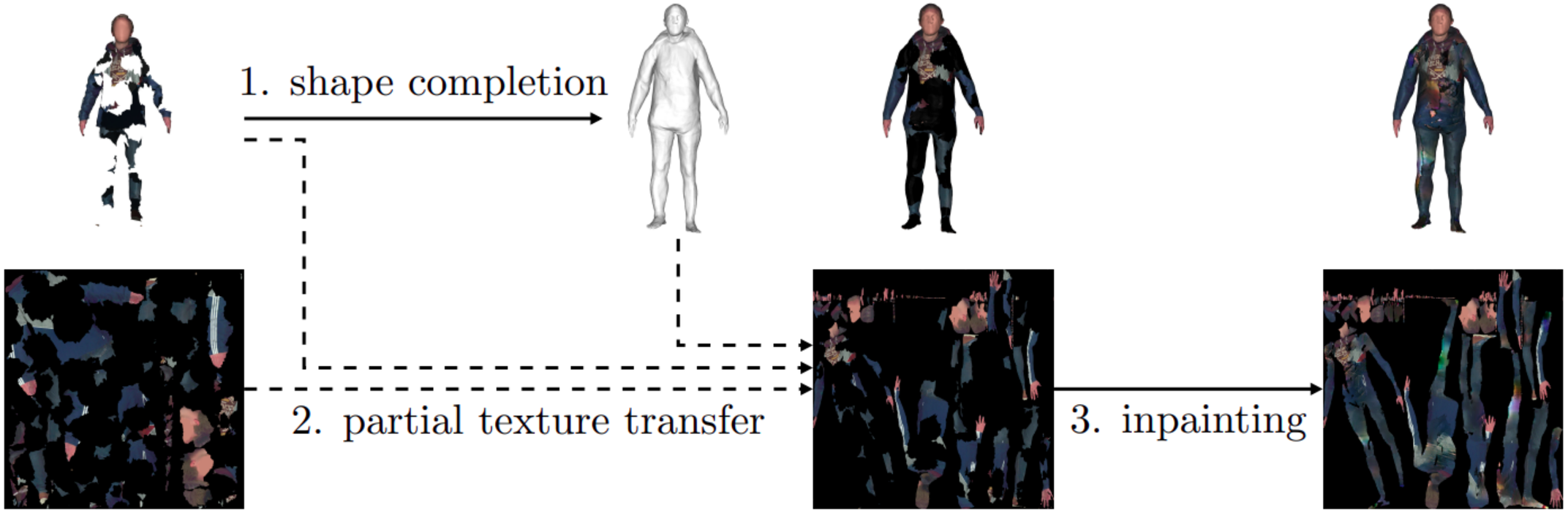
Related Work - 3DBooSTeR



Overview of 3DBooSTeR

"3dbooster: 3d body shape and texture recovery." ECCV 2020.

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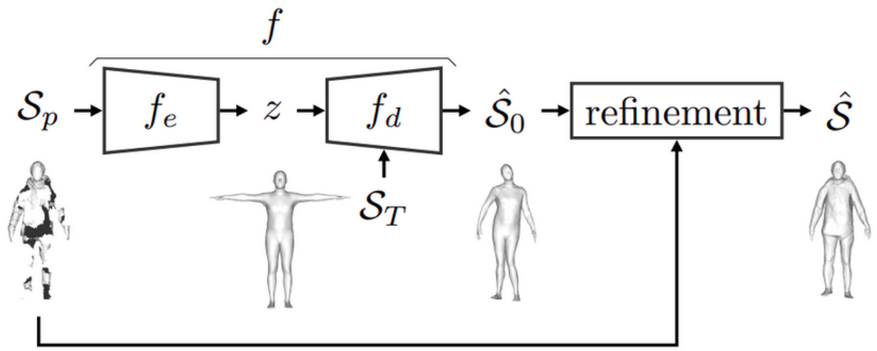
Related Work

Shape Completion

SMPL-based



- Limited in terms of poses and search space

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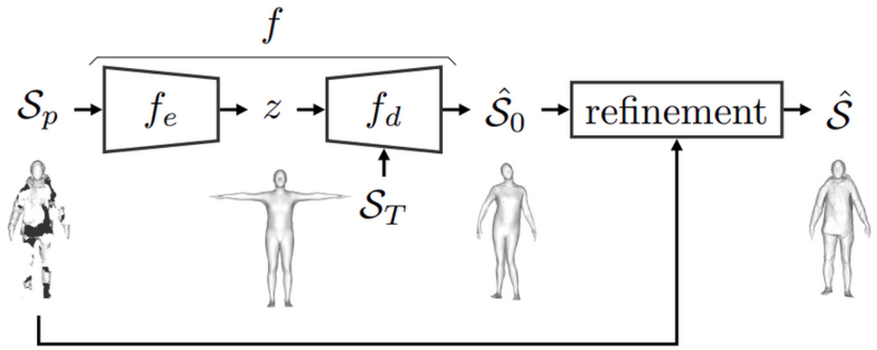
Related Work

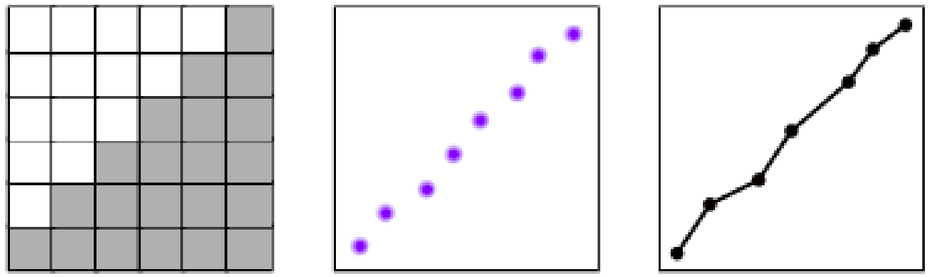
Shape Completion

SMPL-based



- Limited in terms of poses and search space

Voxel, point cloud and mesh-based



- Limited for describing the topology

""Occupancy networks: Learning 3d reconstruction in function space." *CVPR* 2019.

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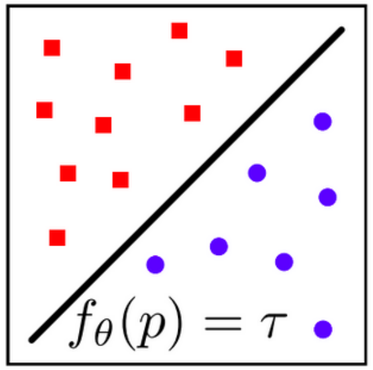
Related Work

Shape Completion



Implicit Representation

- Can describe arbitrary poses and topology
- Can preserve fine details

""Occupancy networks: Learning 3d reconstruction in function space." *CVPR* 2019.

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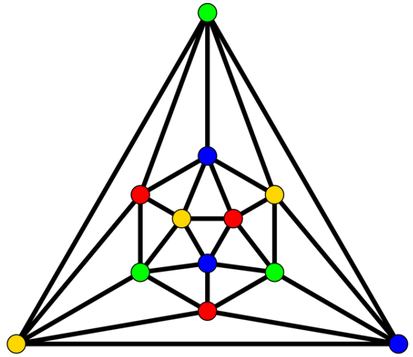
Related Work

Texture Completion

Predicting 3D Vertex-Color (IFNet-Texture)



- Low texture resolution

Inpainting Texture Atlas (3DBoosTeR)

- Not using 3D Shape Information

"Implicit feature networks for texture completion from partial 3d data." ECCV, 2020.
"3dbooster: 3d body shape and texture recovery." ECCV 2020.

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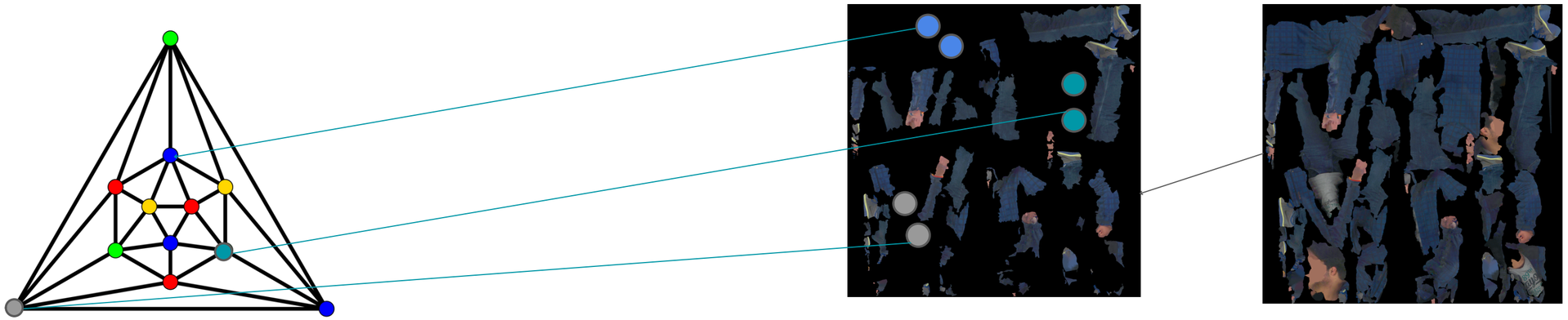
Related Work

Texture Completion

Predicting 3D Vertex-Color

Refining Texture Atlas



Employing **3D vertex colors** while **completing 2D Texture Atlas**

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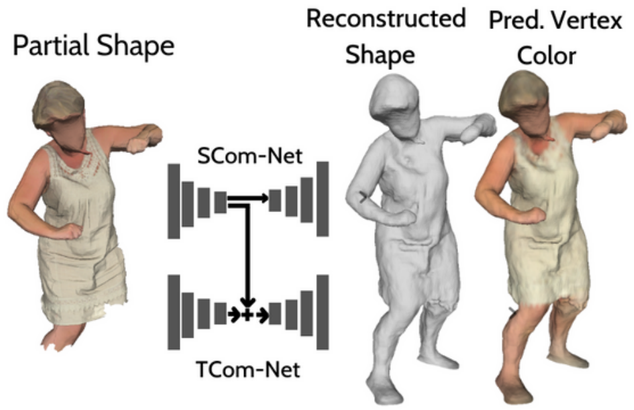
Proposed Approach - Method Overview



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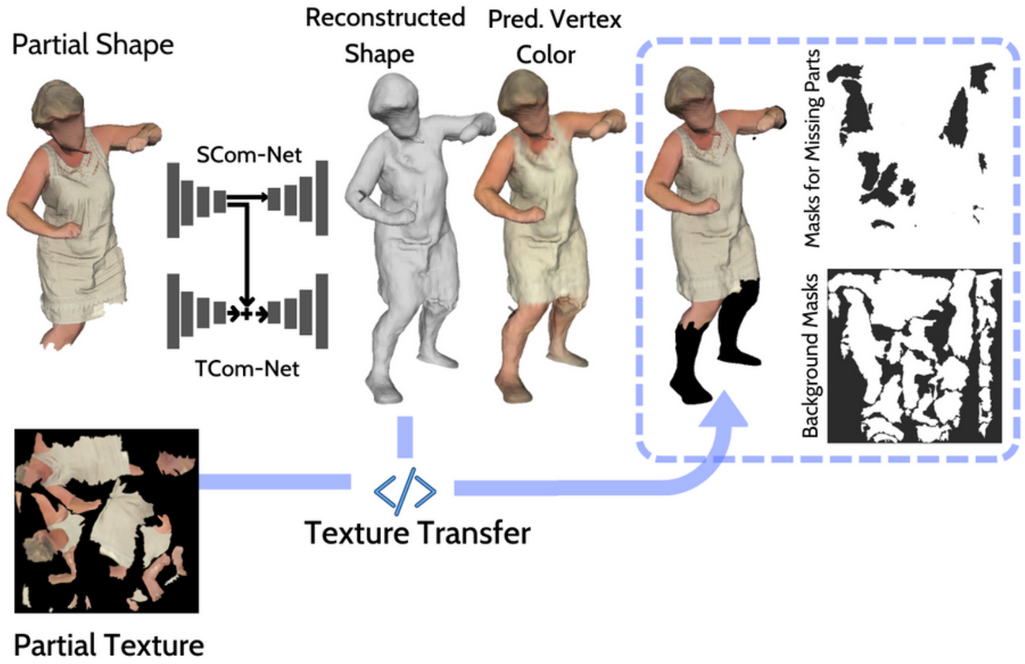
Proposed Approach - Method Overview



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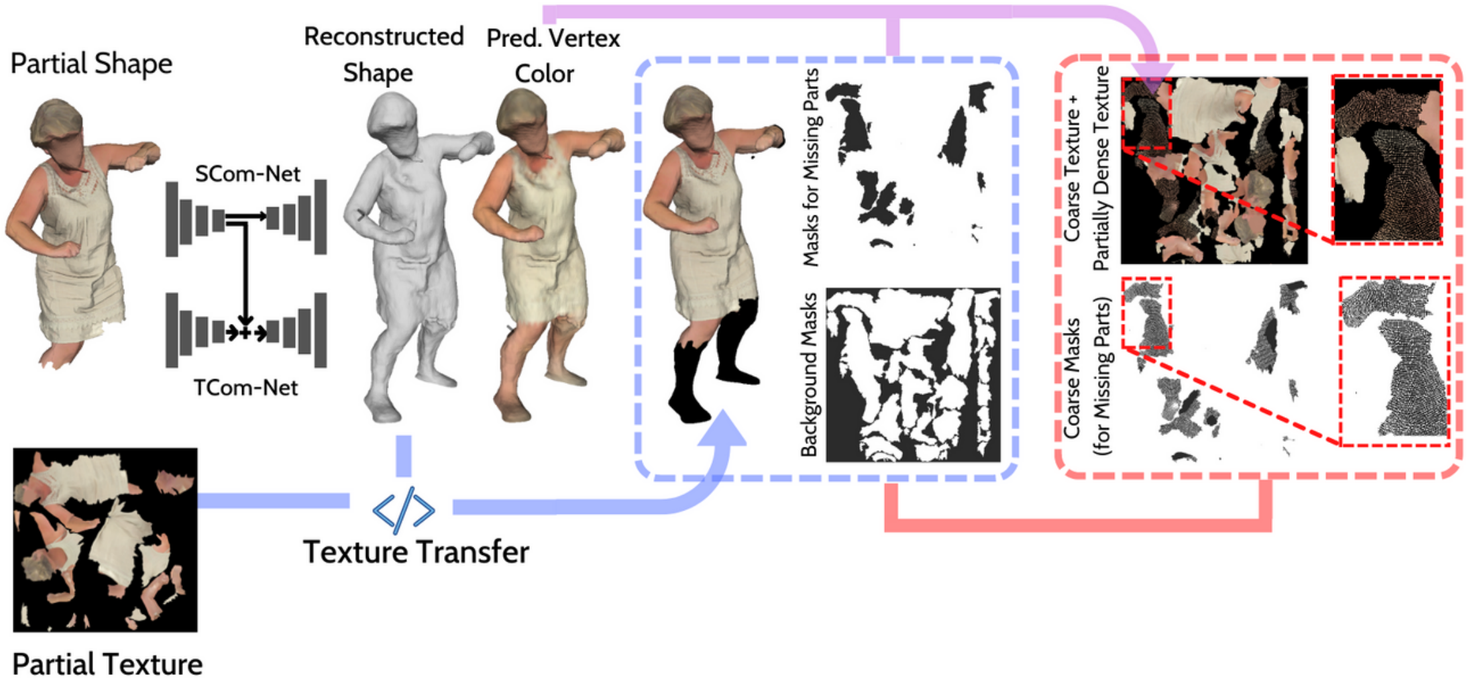
Proposed Approach - Method Overview



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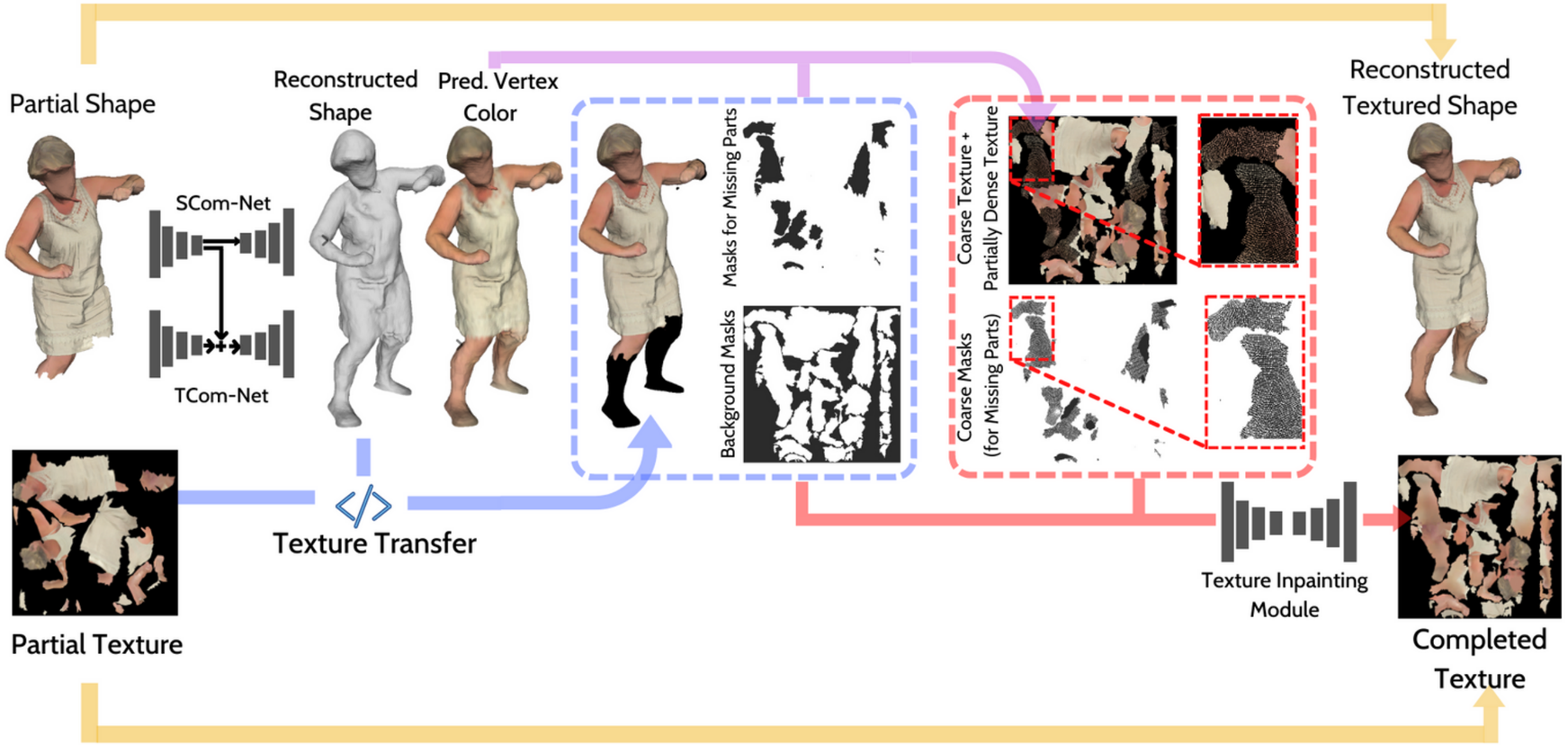
Proposed Approach - Method Overview



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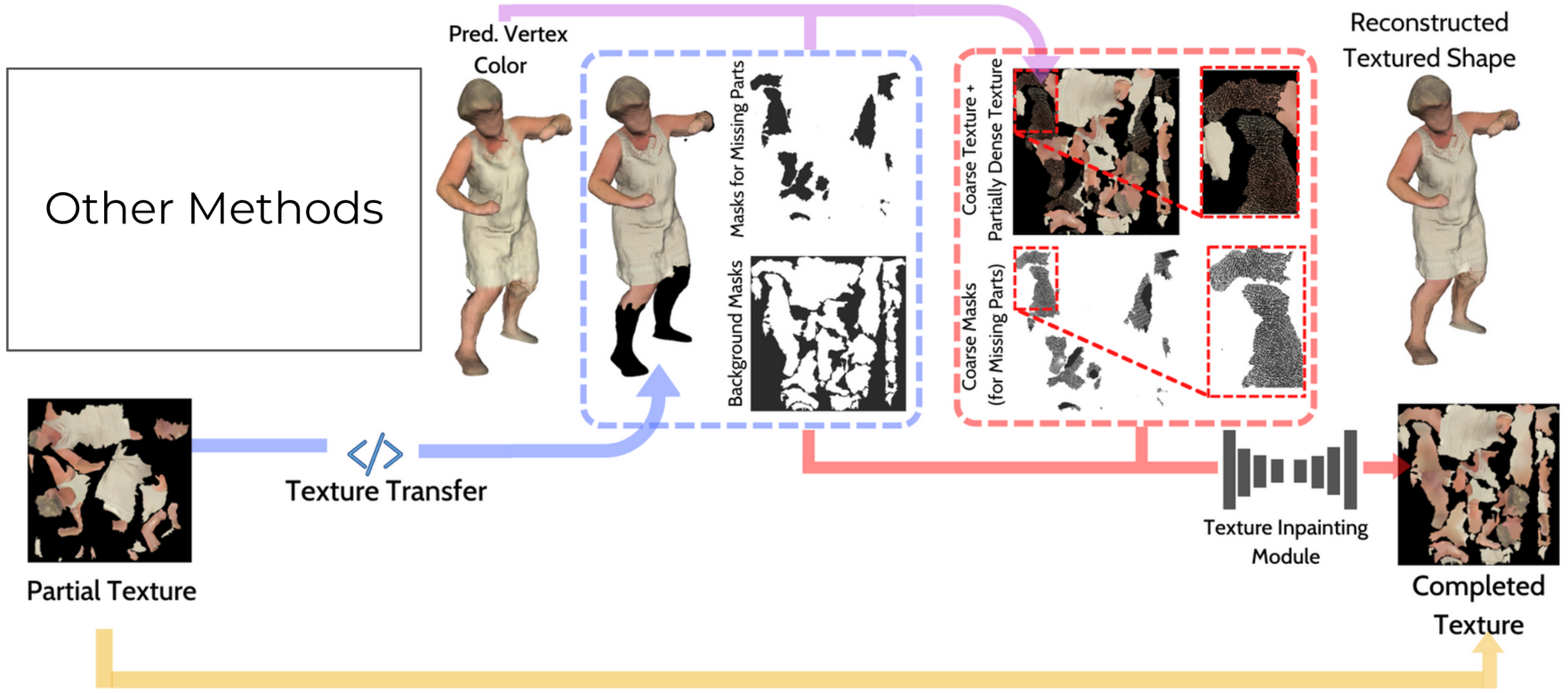
Proposed Approach - Method Overview



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Experimental Evaluation - SHARP Challenge

- Completing 3D Textured Human Body Shapes

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Experimental Evaluation - SHARP Challenge

- Completing 3D Textured Human Body Shapes
- 3000 static human scans with high-res textures
- Large variety of poses and clothing types
- Partial scans with the corresponding complete scans

3DBodyTex.v2

https://cvi2.uni.lu/sharp2022/

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Experimental Evaluation - Quantitative Results

Method	Shape Score(%)	Area Score(%)	Texture Score(%)	Final Score(%)
IFNet-Texture	85.44 ± 2.93	96.26 ± 6.35	81.25 ± 7.61	83.34 ± 6.86
Method Raywit	85.91 ± 7.14	93.96 ± 3.96	83.45 ± 8.43	84.68 ± 7.63
Method Rayee	**86.13 ± 7.32**	96.26 ± 3.61	83.23 ± 8.31	84.68 ± 7.74
Method Janaldo	**89.76 ± 4.97**	**96.76 ± 2.28**	**87.10 ± 6.33**	**88.43 ± 5.56**
TSCom-Net (**Ours**)	85.75 ± 6.15	**96.68± 2.89**	**83.72 ± 6.95**	**84.73 ± 6.5**

Table 1. Quantitative Results for SHARP 2022. The best and second best scores are denoted in **bold-black** and **bold-gray** colors respectively.

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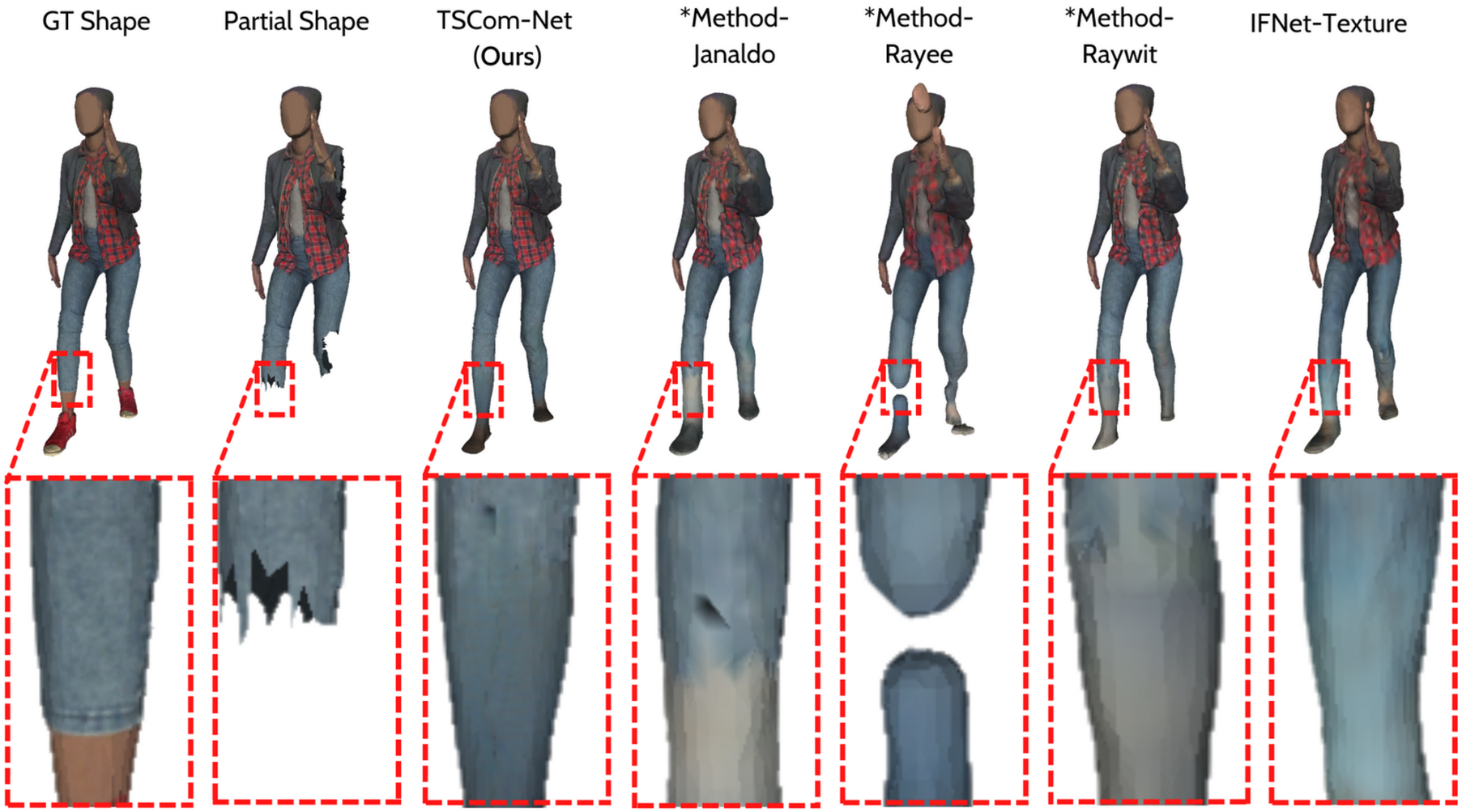
Experimental Evaluation - Qualitative Results



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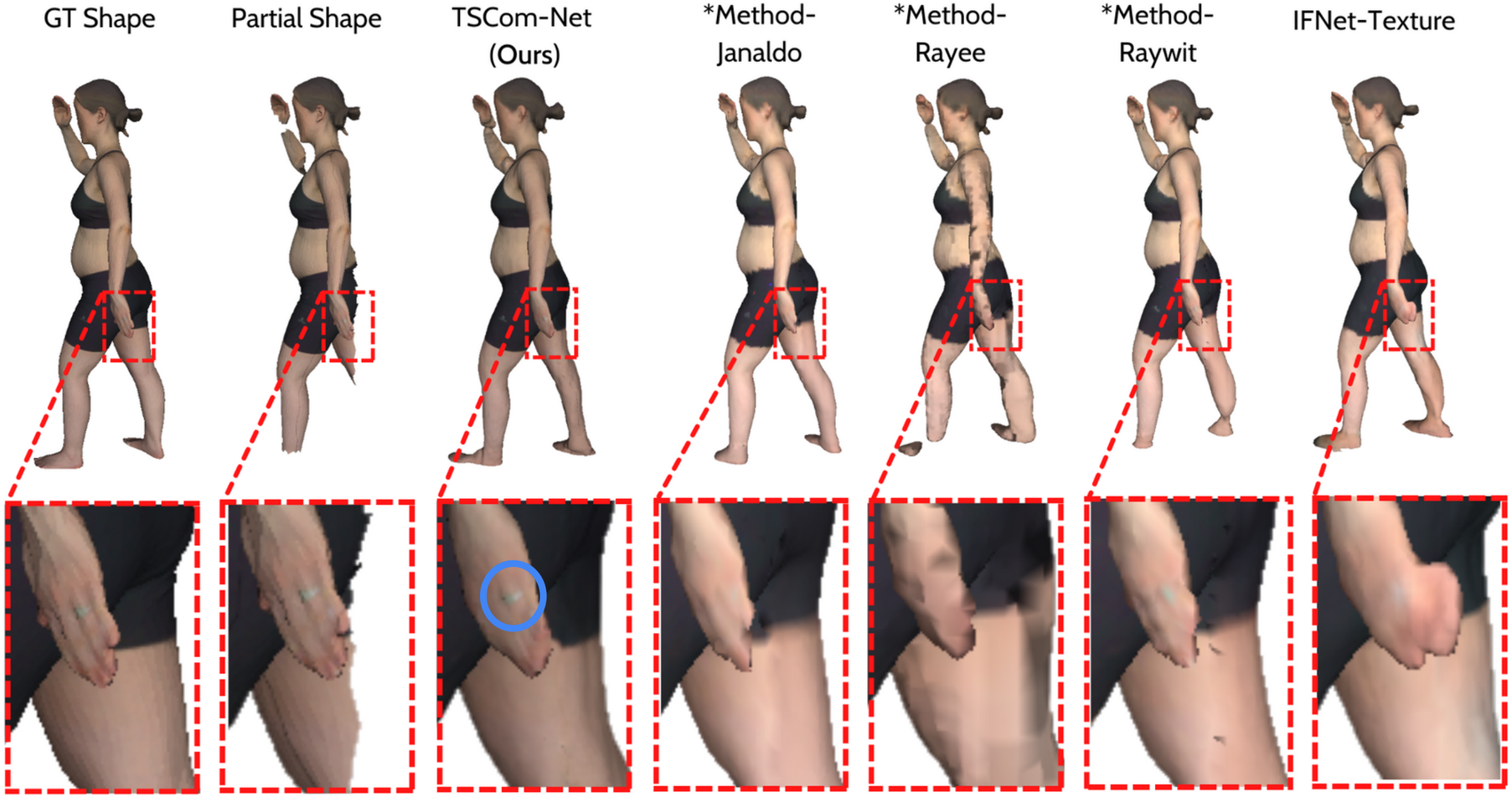
Experimental Evaluation - Qualitative Results



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Experimental Evaluation

Method	Texture Score (%)
Method-Janaldo	87.10± 6.33
Method-Janaldo + Our Texture Refinement	**87.54 ± 6.19**

Table 2. Effectiveness of Our Texture Refinement.

Method-Janaldo

Texture Refinement

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Conclusion

- **Joint implicit networks** for shape and vertex texture prediction

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Conclusion

- **Joint implicit networks** for shape and vertex texture prediction
- **Coarse-to-fine texture inpainting** for high-resolution textures



Conclusion

- **Joint implicit networks** for shape and vertex texture prediction
- **Coarse-to-fine texture inpainting** for high-resolution textures
- Texture refinement module **can be plugged into other methods**.
- Our code will be publicly available at https://cvi2.uni.lu/tscom-net/

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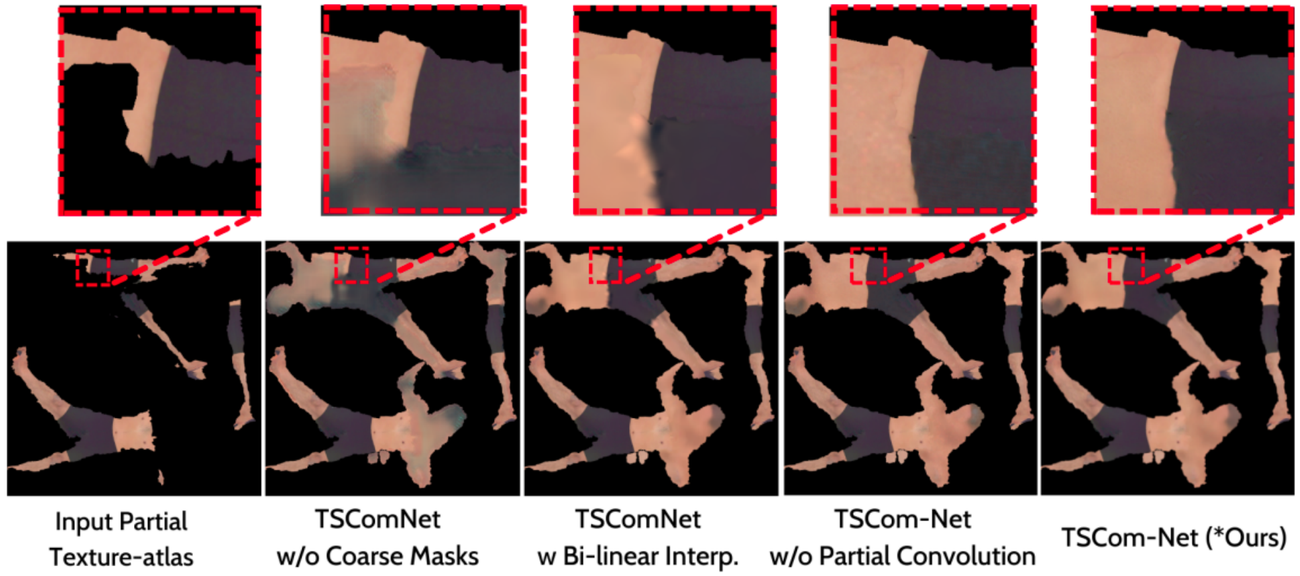
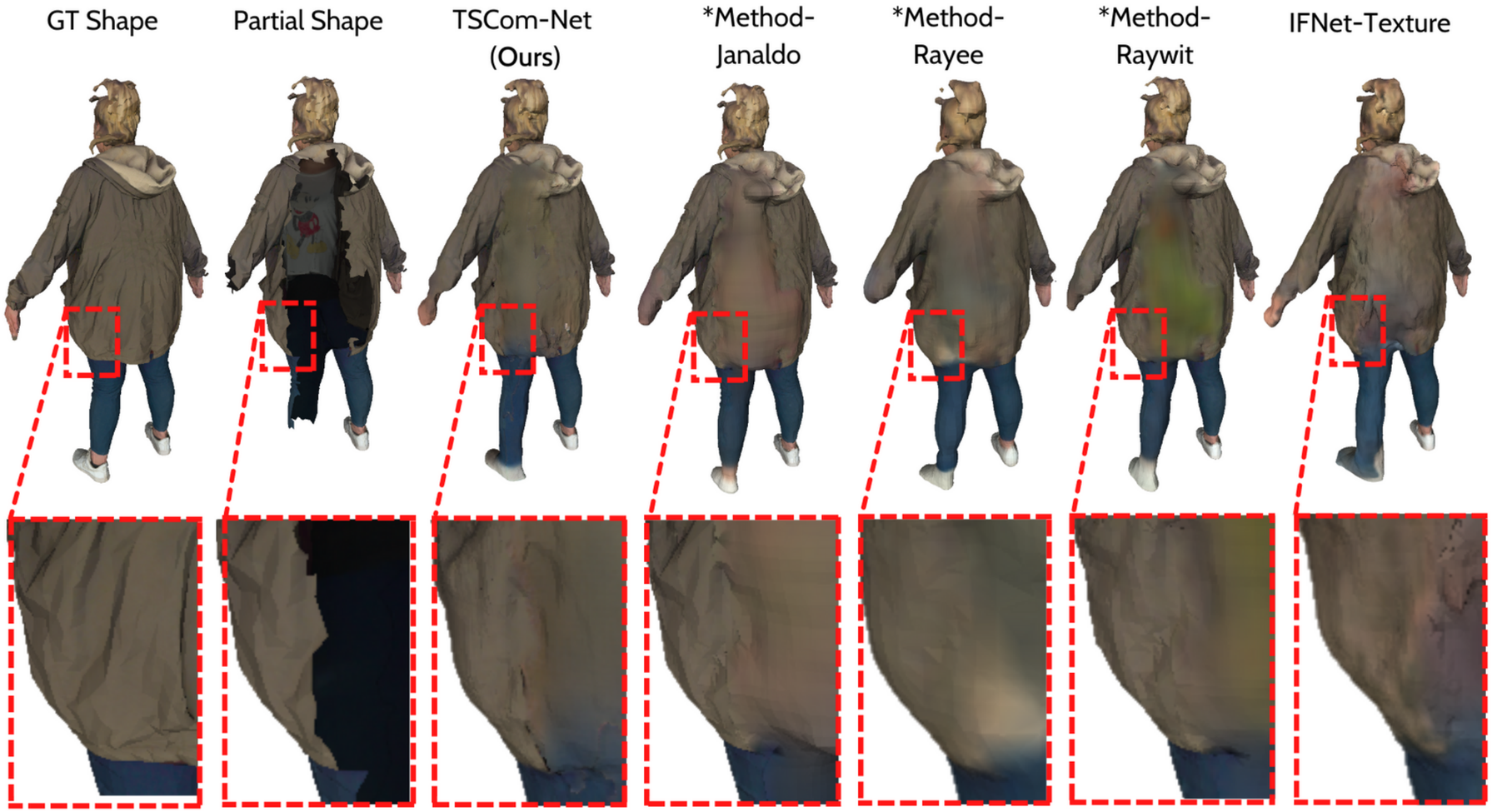
Thank you!

Experimental Evaluation - Ablation Study

Method	Texture Score(%)
IFNet-Texture [9]	81.25 ± 7.61
Texture-transfer Baseline	56.51 ± 18.98
Ours w/o Coarse Masks	81.04 ± 7.92
Ours w/o Tex. Refine.	83.27 ± 7.08
Ours w/ Bilinear Interp.	83.66 ± 6.95
Ours w/o Partial Conv.	83.68 ± 6.96



Experimental Evaluation - Qualitative Results



Experimental Evaluation - Failure Cases