



16TH EUROPEAN CONFERENCE ON  
**COMPUTER VISION**

[WWW.ECCV2020.EU](http://WWW.ECCV2020.EU)

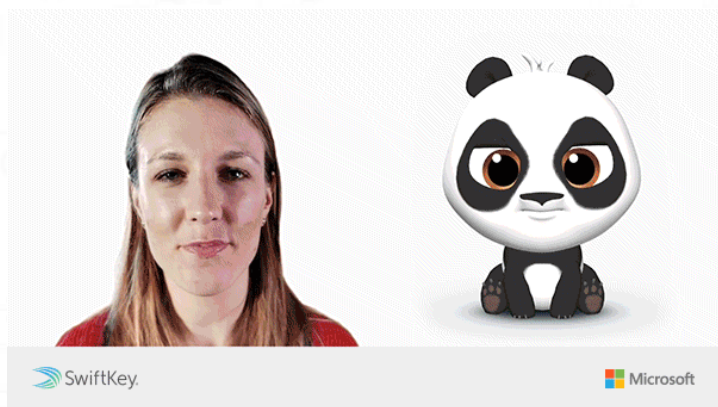
# Personalized Face Modeling for Improved Face Reconstruction and Motion Retargeting

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# Motivation

Face modeling is important for applications like face recognition and codec avatars;  
Existing face modeling methods are either not sufficient or come with significant overhead



Microsoft SwiftKey Puppets

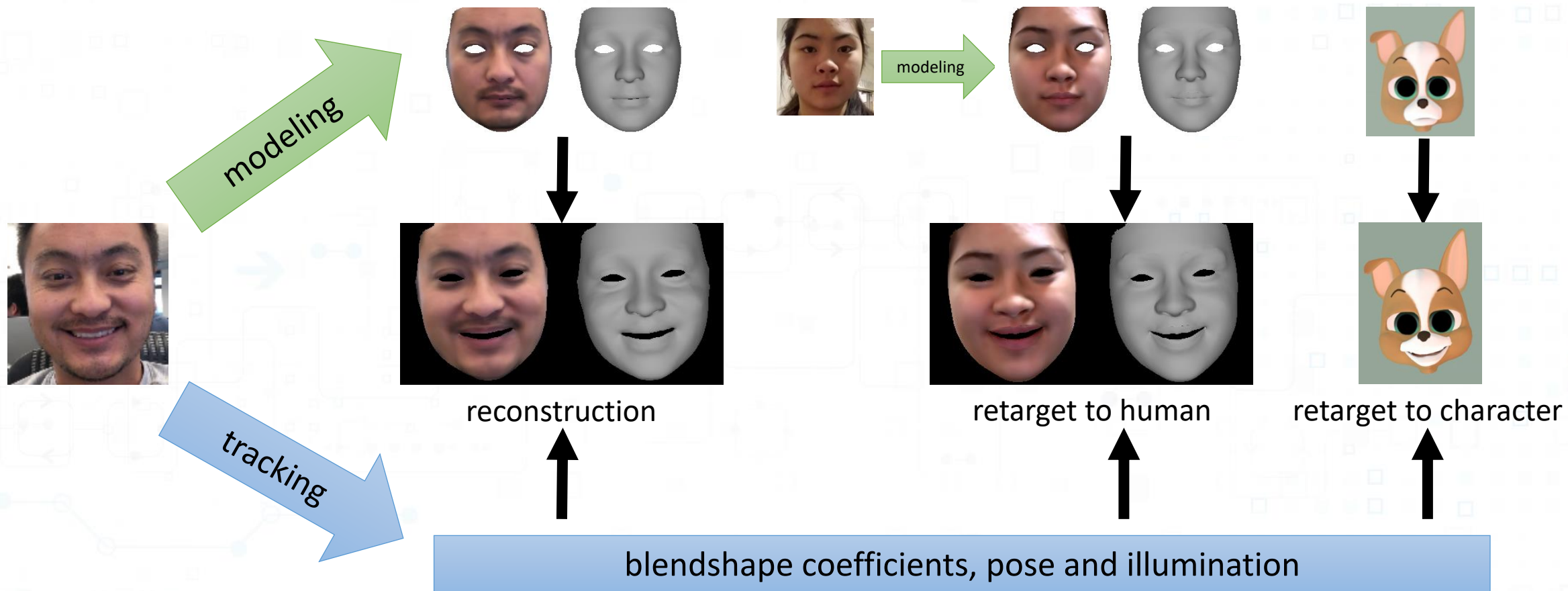


BioID Face Recognition

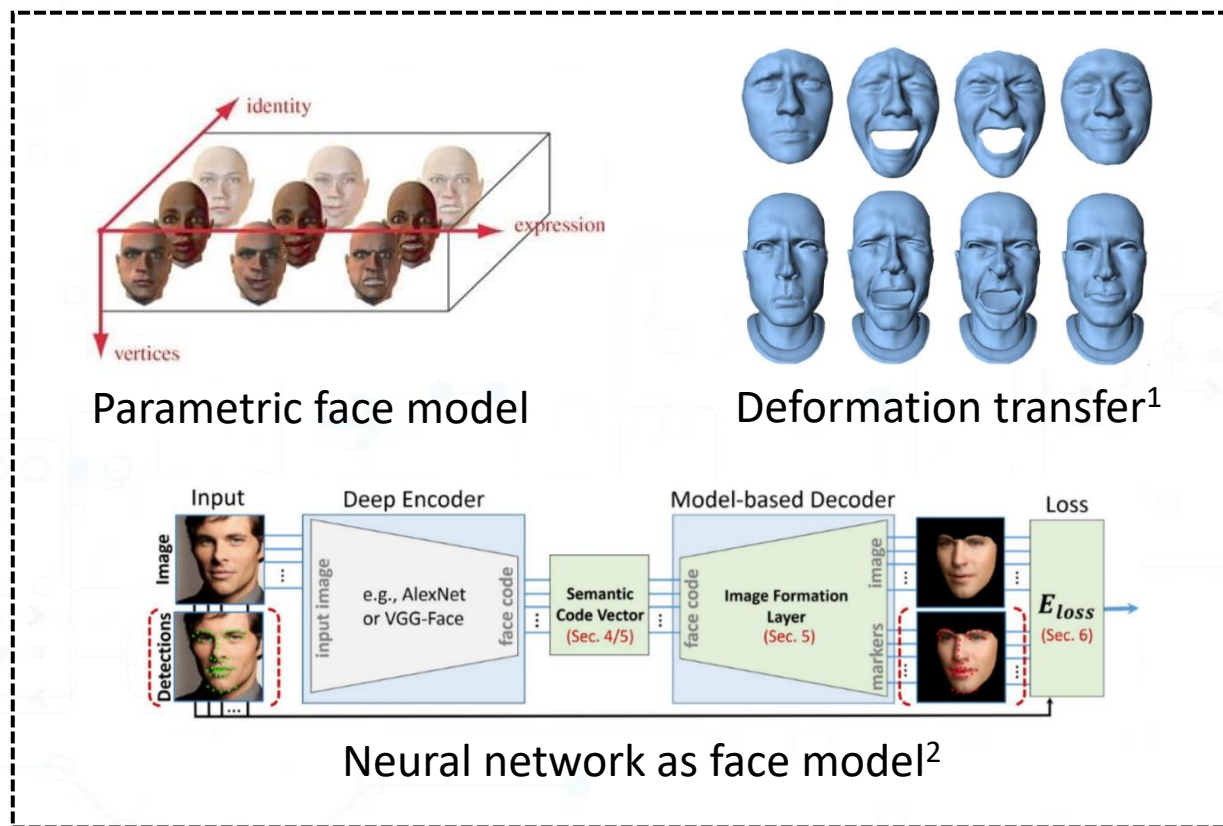


Facebook Codec Avatars

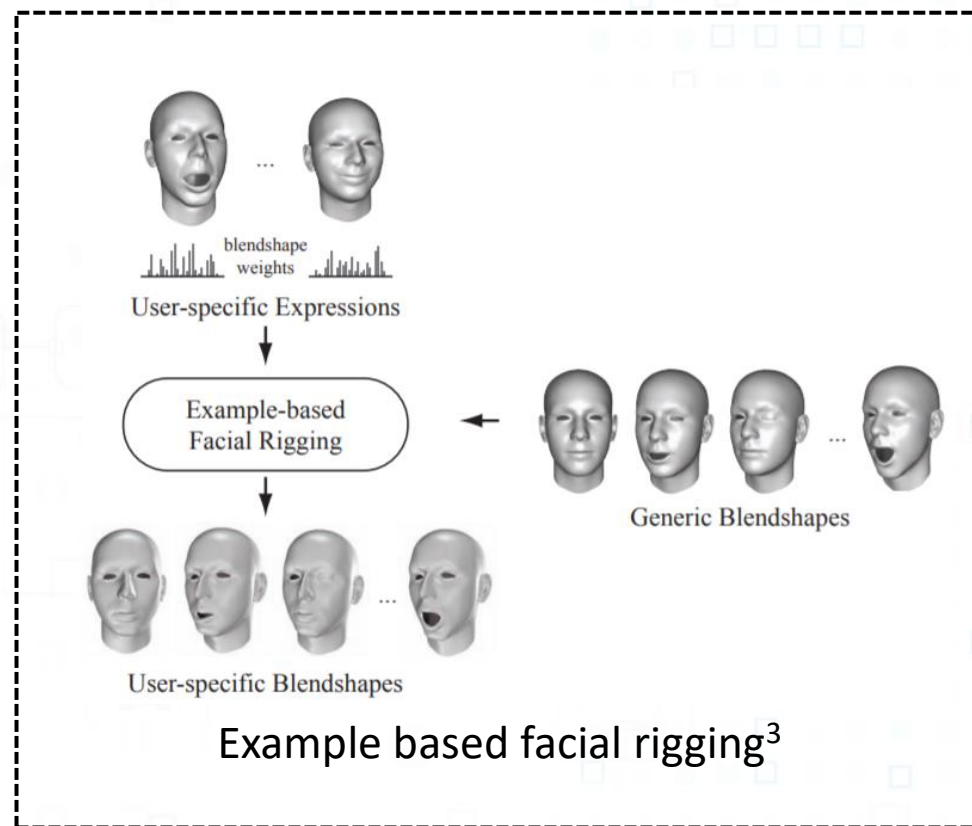
# Goal



# Related Works



Learning based approaches



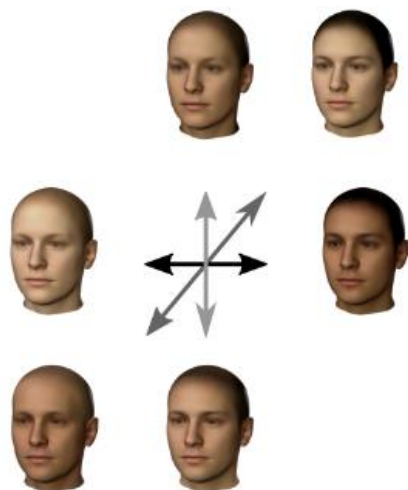
Optimization based approaches

<sup>1</sup>Deformation Transfer for Triangle Meshes, Sumner and Popovic, *SIGGRAPH 2004*

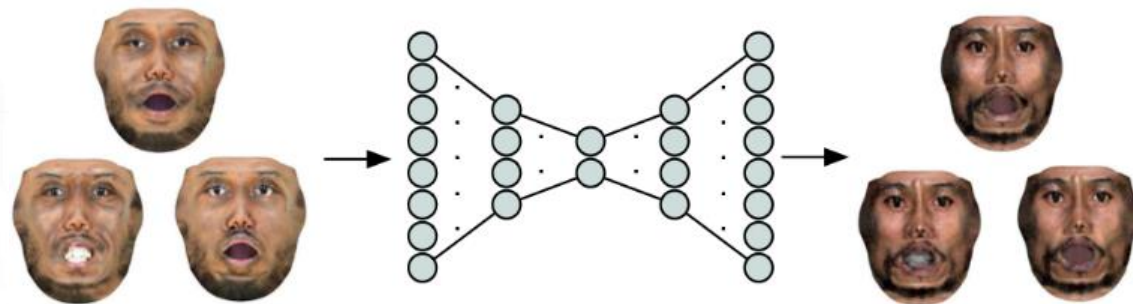
<sup>2</sup>MoFA: Model-based Deep Convolutional Face Autoencoder for Unsupervised Monocular Reconstruction, A. Tewari et al., *ICCV 2017*

<sup>3</sup>Example-Based Facial Rigging, H. Li et al., *SIGGRAPH 2010*

# Related Works



Parametric texture model<sup>1</sup>

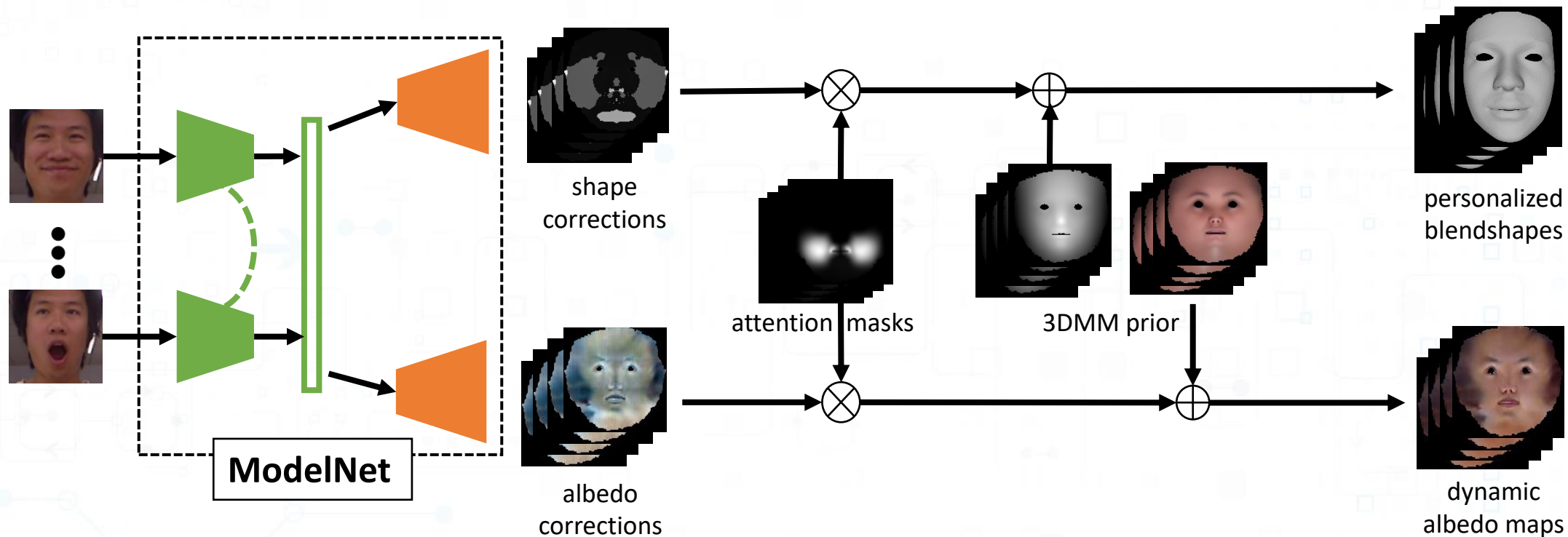


Face texture synthesis<sup>2</sup>

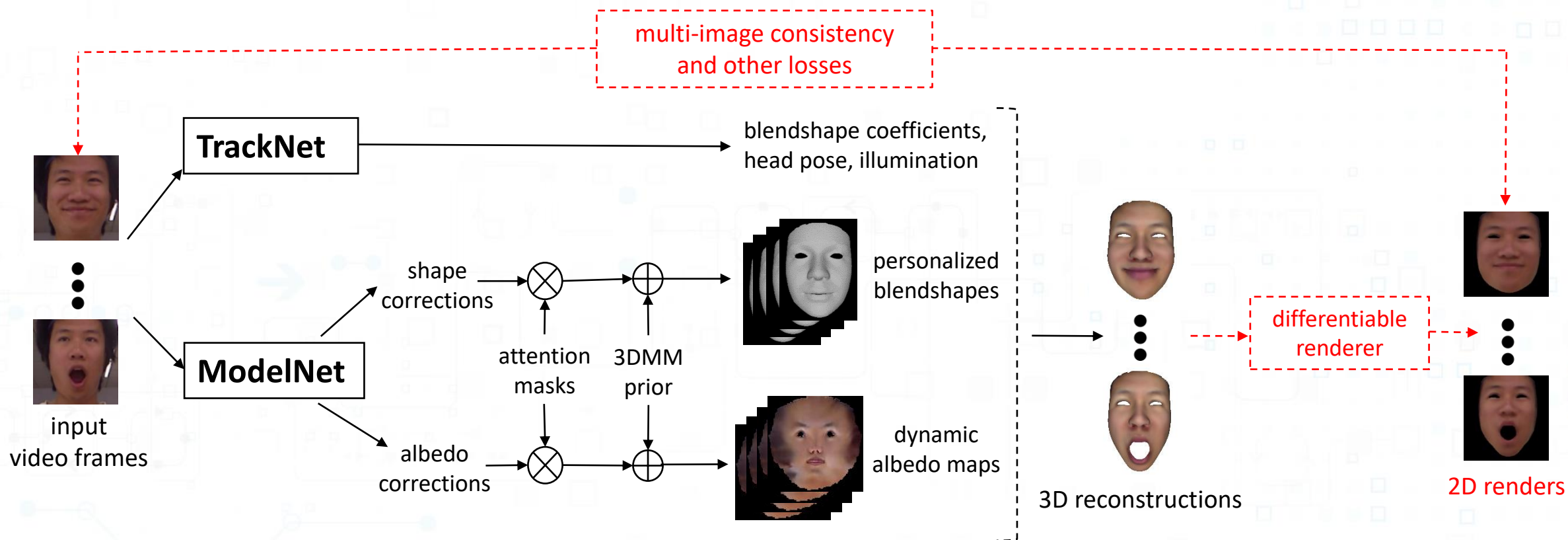
<sup>1</sup>3D Morphable Face Models - Past, Present and Future, B. Egger et al., *ACM TOG June 2020*

<sup>2</sup>Realistic Dynamic Facial Textures from a Single Image using GANs, Olszewski et al., *ICCV 2017*

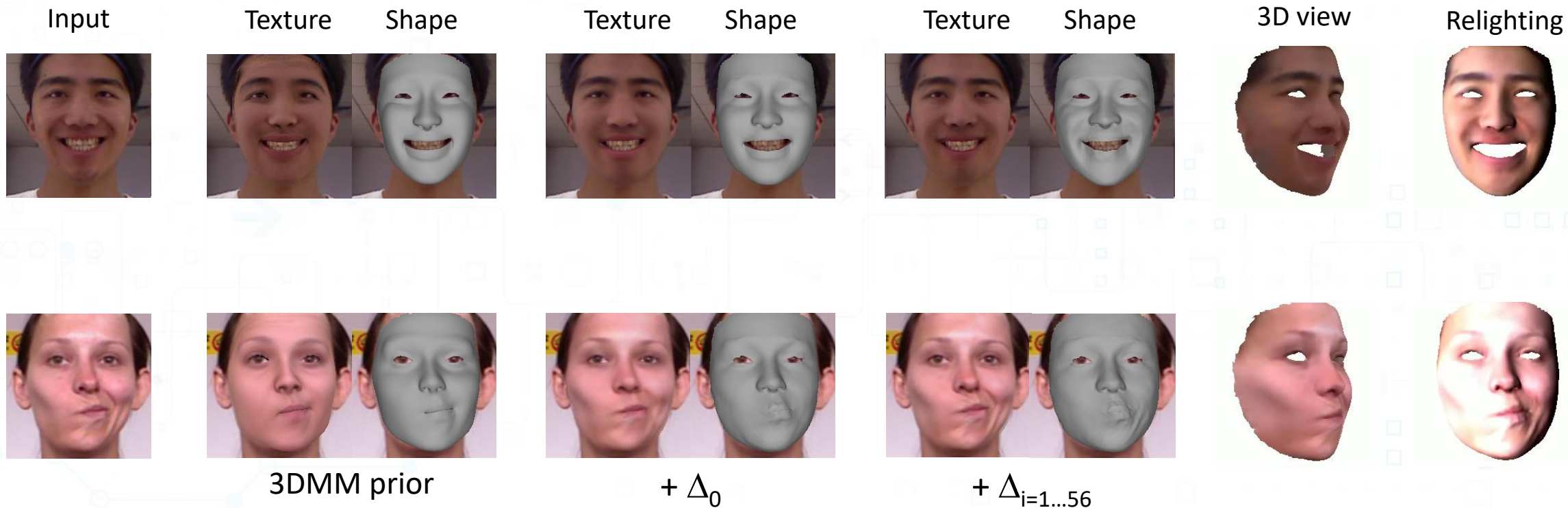
# Personalized Modeling Network



# Full Framework



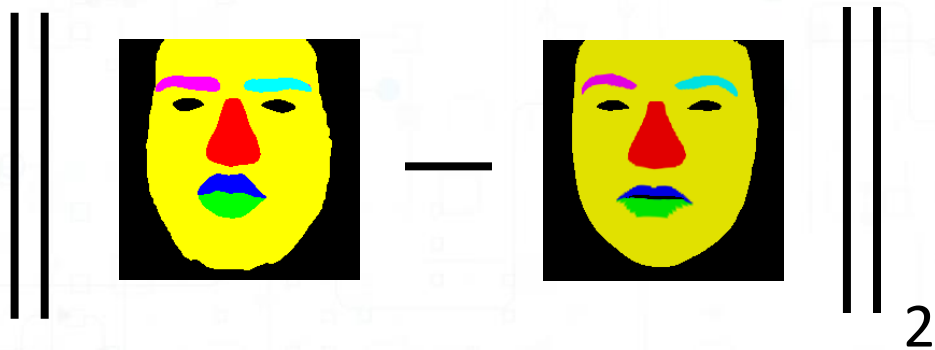
# Improvement with corrections





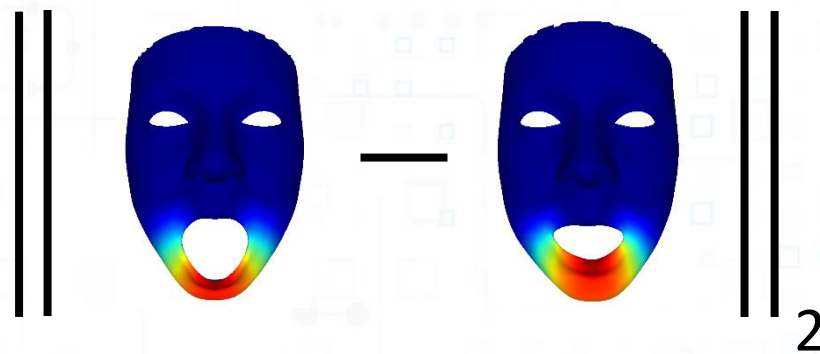
# Novel Training Constraints

Face parsing loss



- Disentangles geometry from albedo
- Provides stronger supervision than 2D landmarks

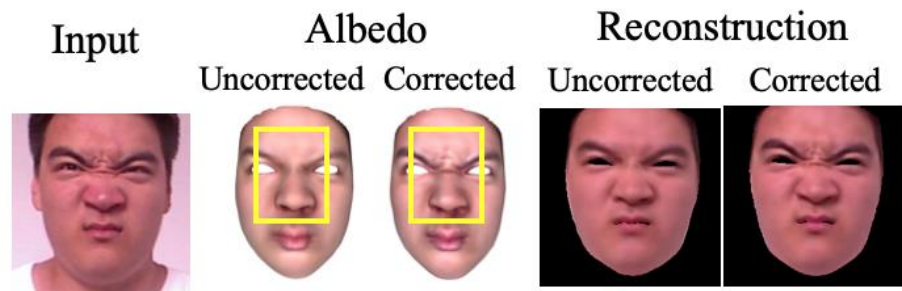
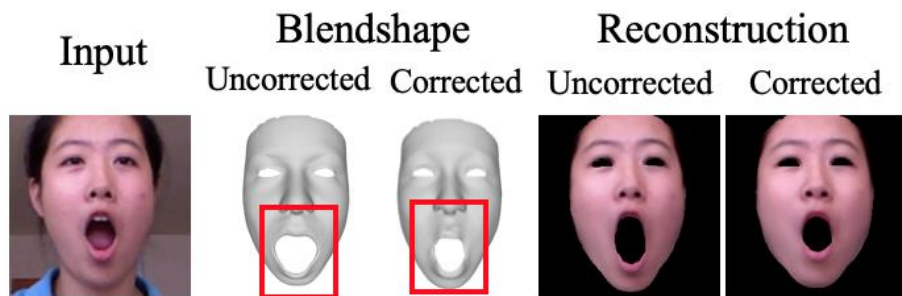
Blendshape gradient loss



- Regularizes geometry correction
- Retains semantic meaning of blendshapes

# Importance of Personalized Modeling

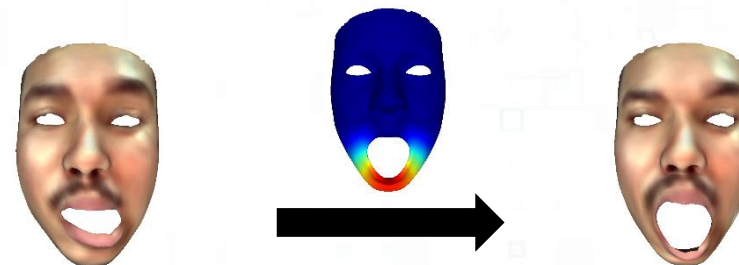
## User-specific face model



## Corrected geometry with parsing loss

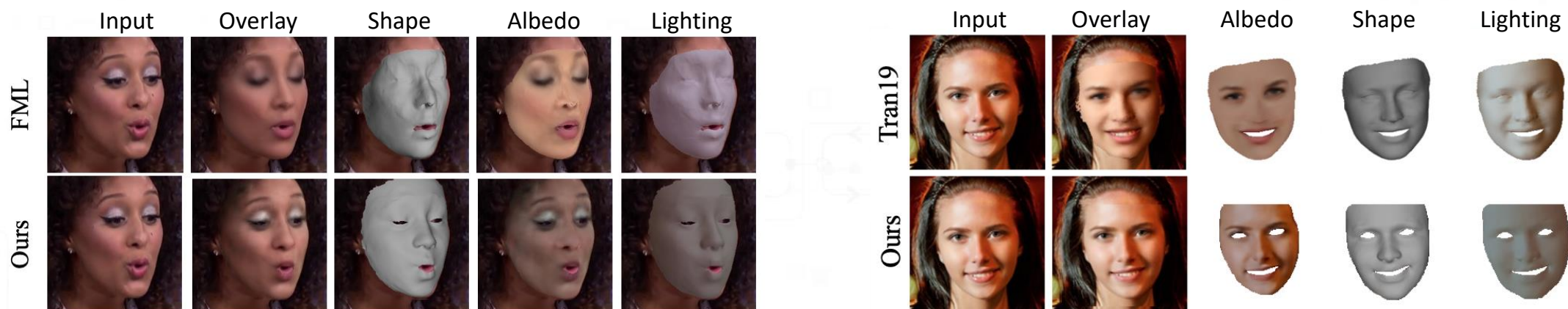


## Semantically correct personalized blendshapes

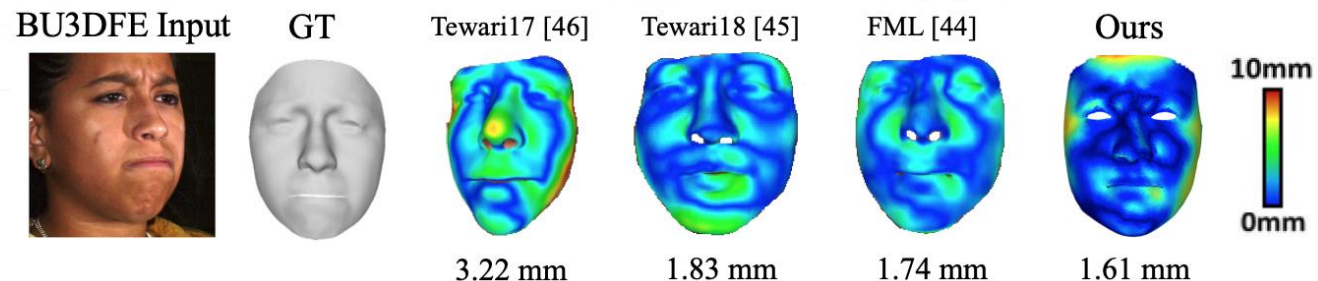


# Evaluation of Face Modeling

## Qualitative Comparison:



## Quantitative Comparison:



# Evaluation of Facial Motion Estimation

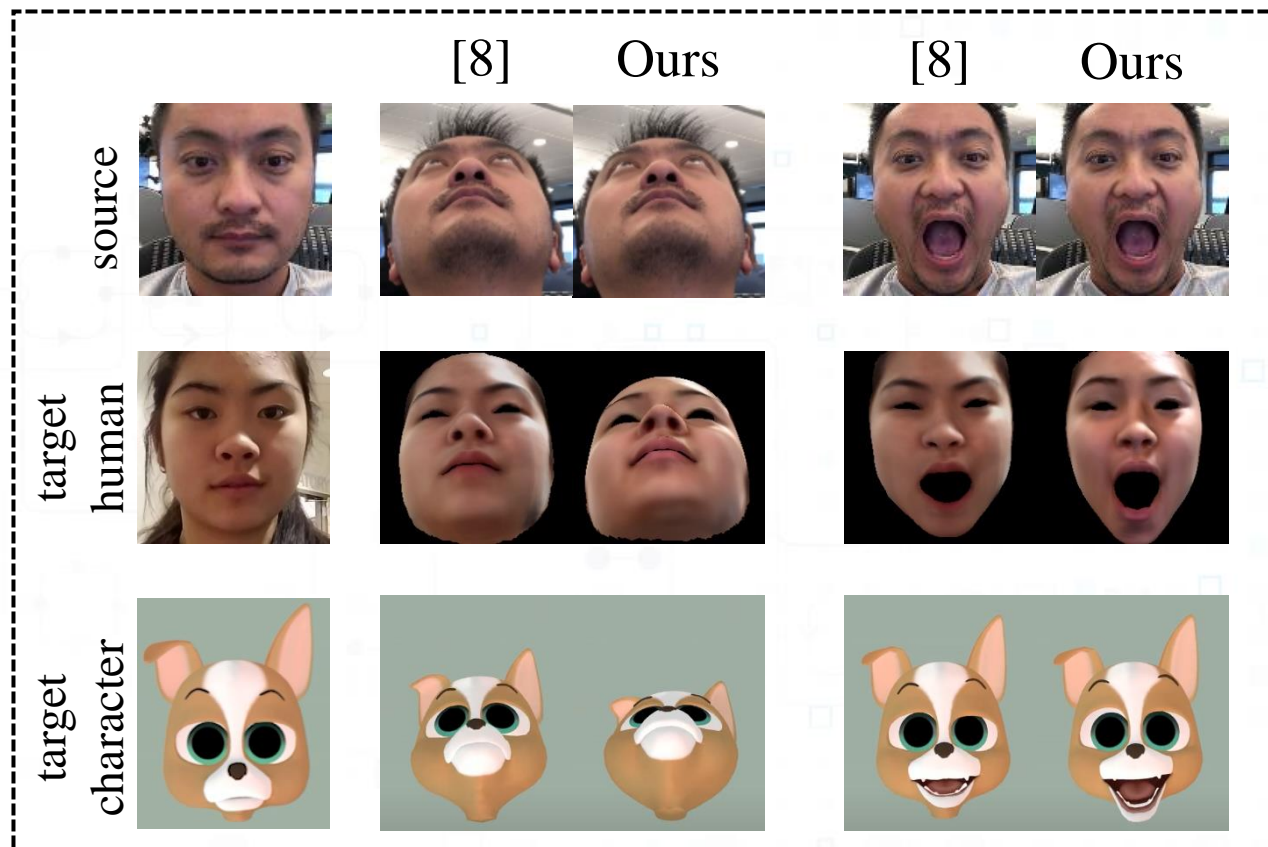
Method	[0-30°]	[30-60°]	[60-90°]	Mean
[58]	3.43	4.24	7.17	4.94
[1]	3.15	4.33	5.98	4.49
[12]	2.75	3.51	4.61	3.62
[8]	2.91	3.83	4.94	3.89
Ours	<b>2.56</b>	<b>3.39</b>	<b>4.51</b>	<b>3.49</b>

Normalized Mean Landmark Error (↓) for images

Method	Sc. 1	Sc. 2	Sc. 3
[54]	0.791	0.788	0.710
[56]	0.748	0.760	0.726
[10]	0.847	0.838	0.769
[8]	0.901	0.884	0.842
Ours	<b>0.913</b>	<b>0.897</b>	<b>0.861</b>

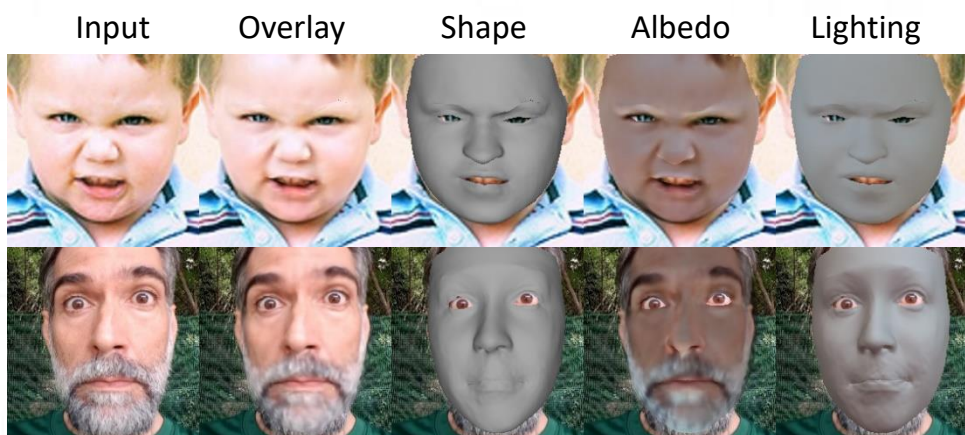
Area Under the Curve (↑) for videos

## Tracking

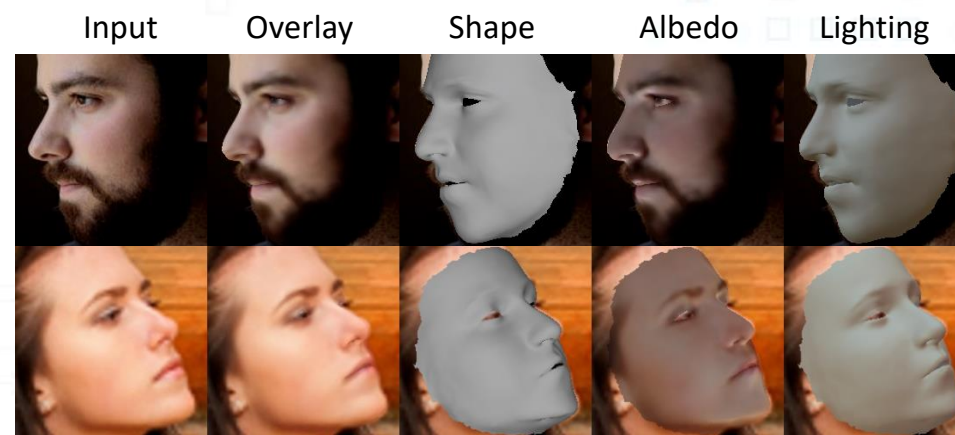


## Retargeting

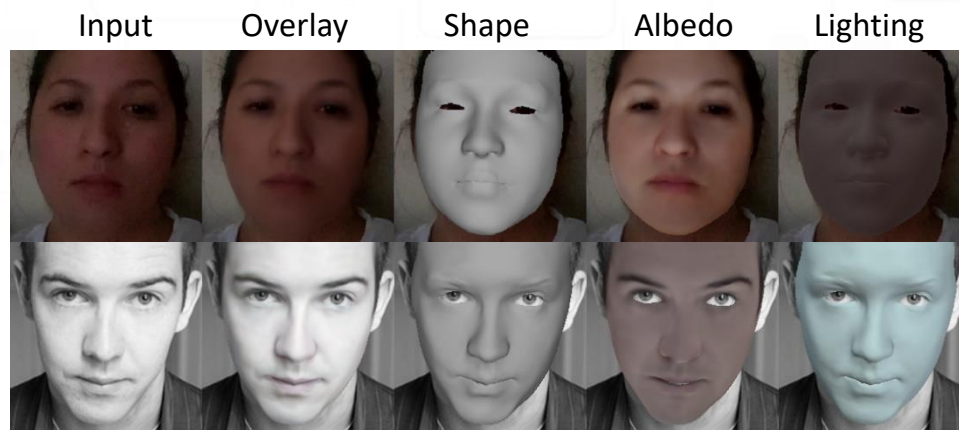
# Results for Static Images



Age



Head pose



Lighting

# Results for Static Images

Input Overlay Shape Albedo Lighting



Expressions

Input Overlay Shape Albedo Lighting



Occlusion



Blur



Facial hair

# Results for Videos

Input



Reconstruction

Texture

Shape



Retargeting to human

Texture

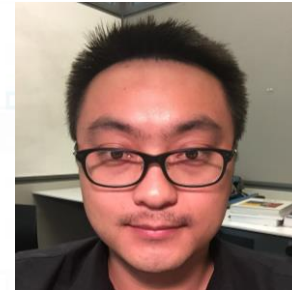
Shape



Retargeting to characters



# Thank you!



Project webpage: <https://homes.cs.washington.edu/~bindita/personalizedfacemodeling.html>