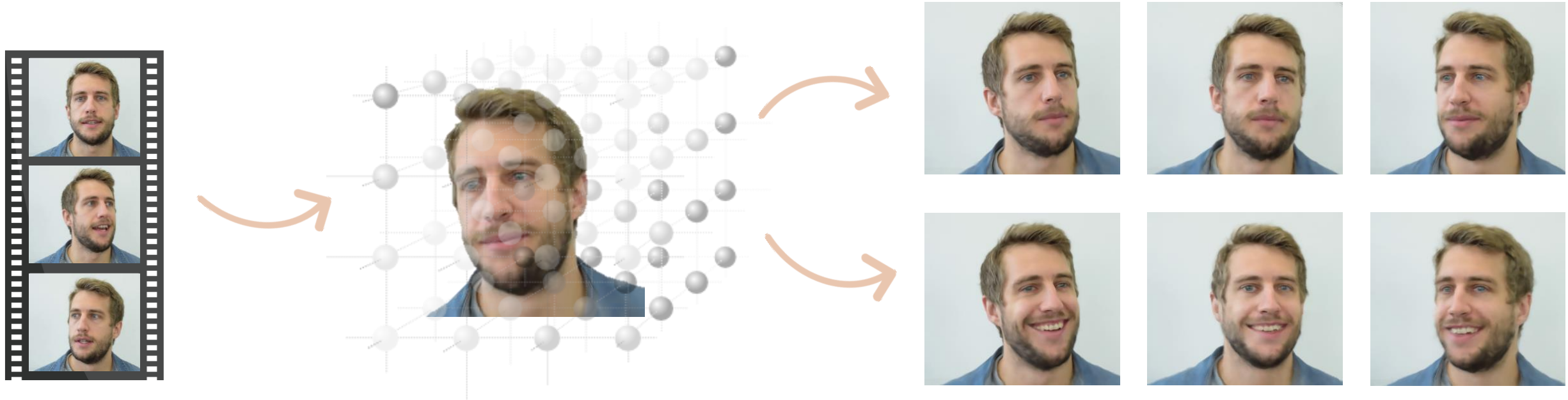


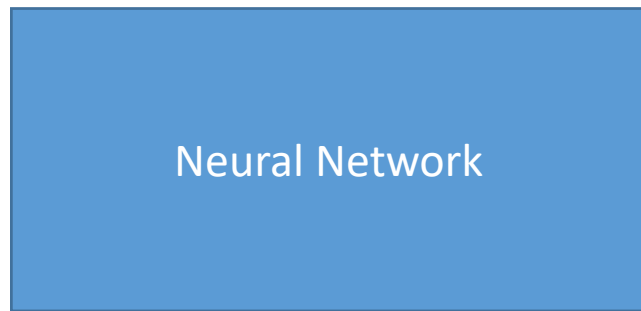
# Neural Rendering and Beyond



Visual Computing Group

Prof. Matthias Nießner

# What is Neural Rendering?



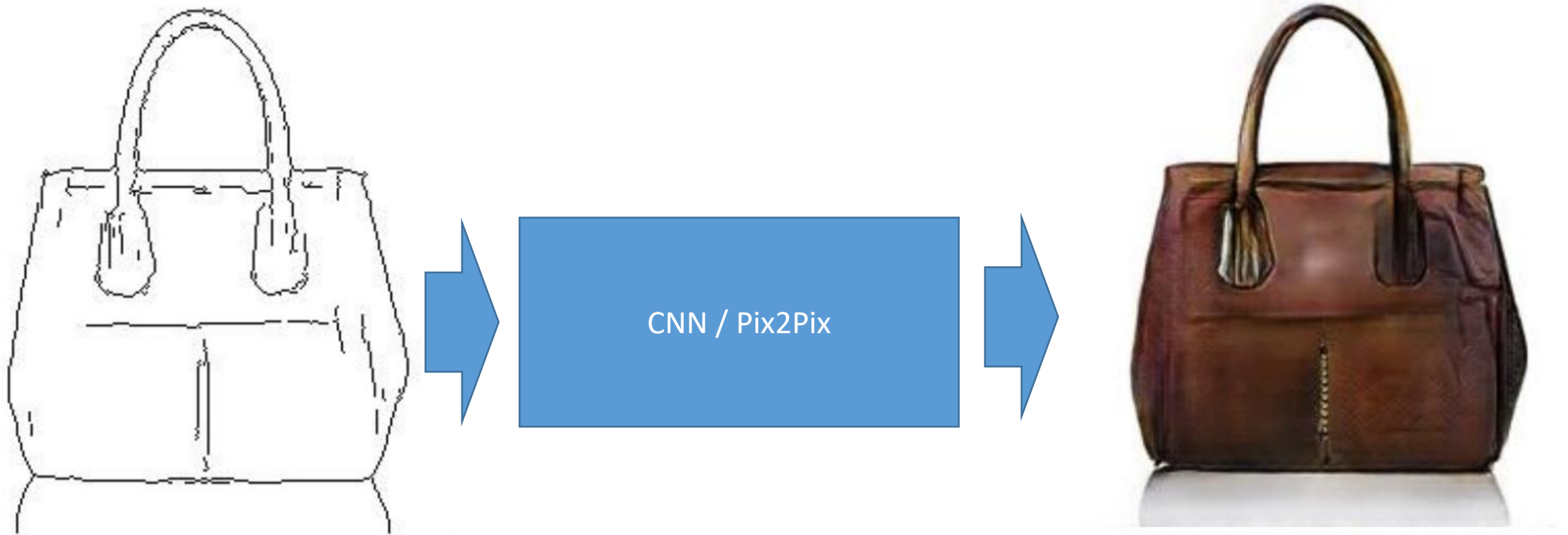
# Capture the World



Photo-realistic Reconstruction

# Conditional GANs for Neural Rendering

# Conditional GANs for Neural Rendering



# Conditional GANs for Neural Rendering



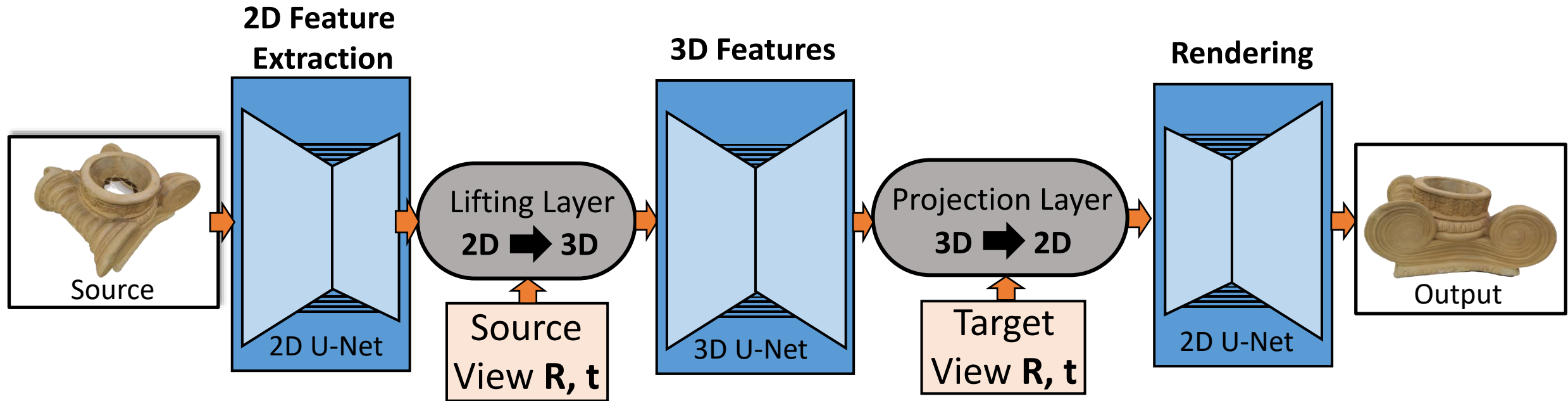
Fix rendered images?

# Videos still challenging for cGANs...

Pix2Pix [Isola et al. 2017]



# DeepVoxels: Explicit 3D Features



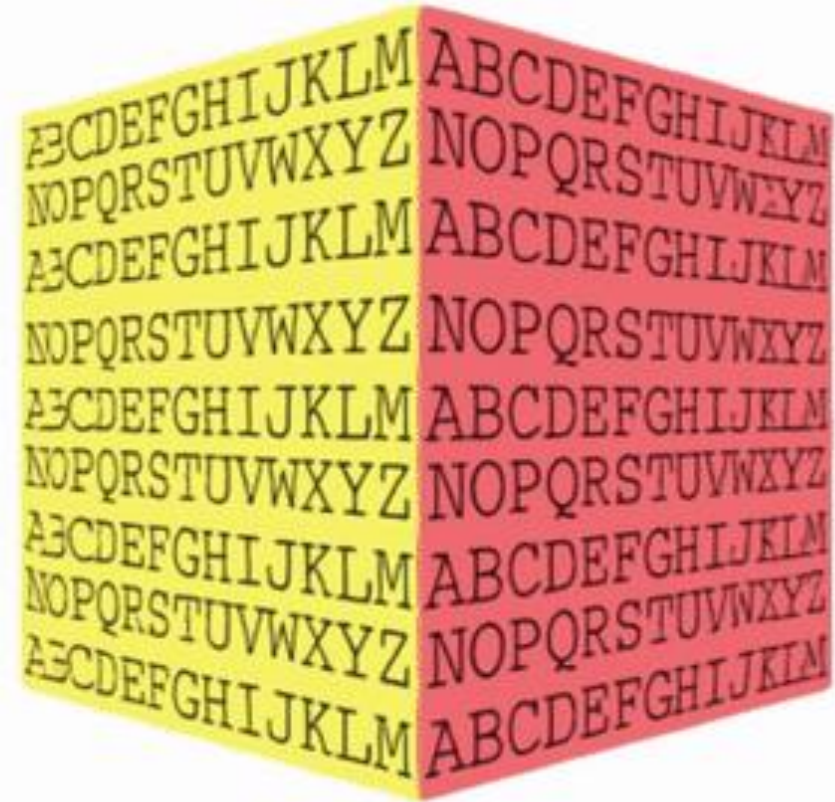
Simplified overview for novel view synthesis

# DeepVoxels: Explicit 3D Features

Pix2Pix [Isola et al. 2017]

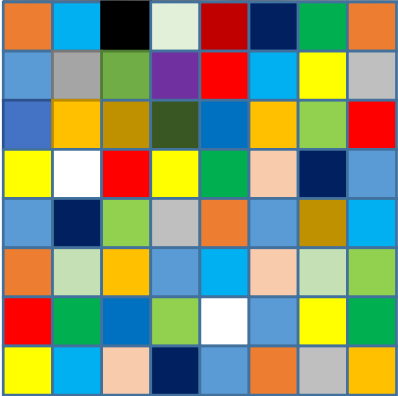


DeepVoxels (Ours)



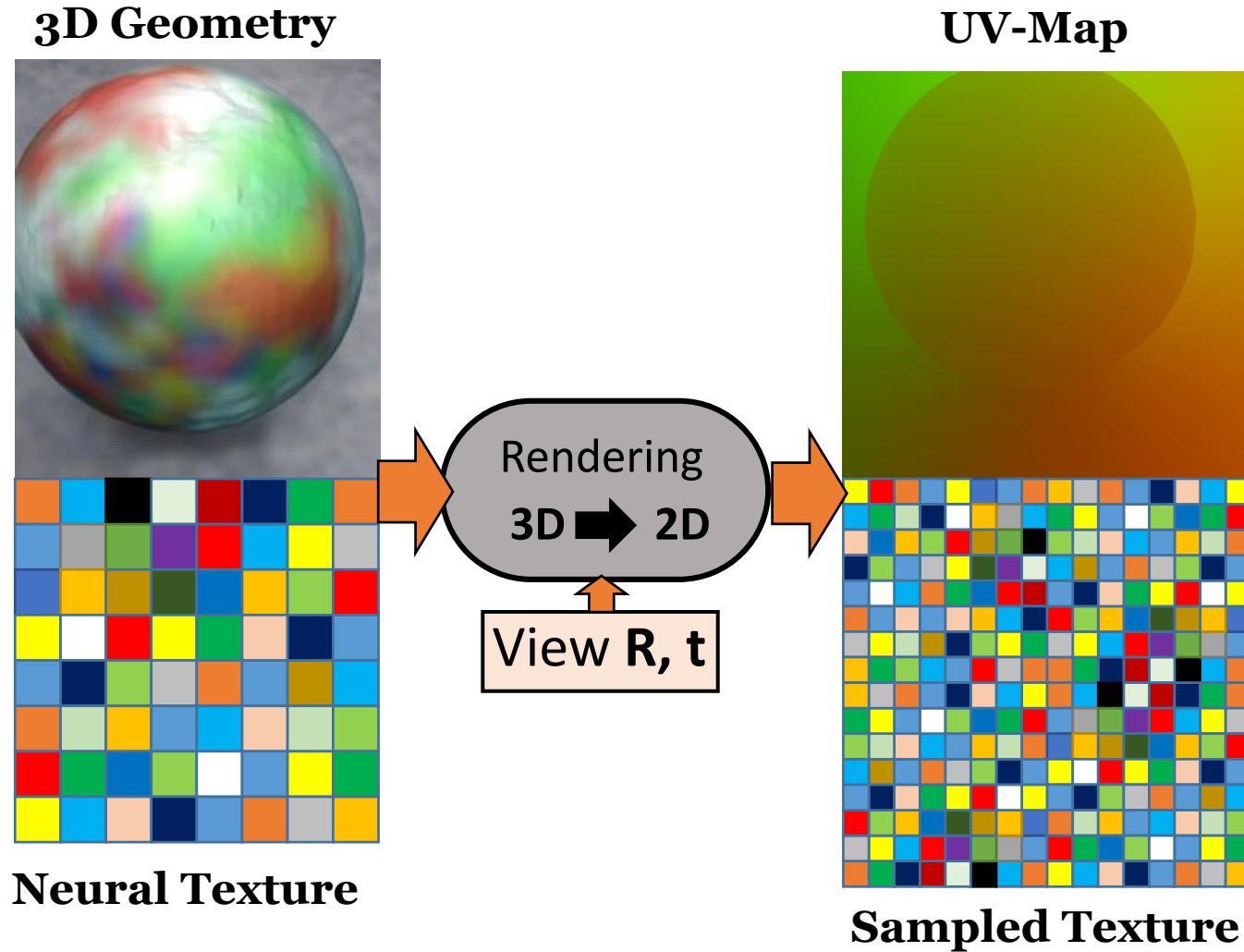
# Neural Textures: Features on 3D Mesh

**3D Geometry**

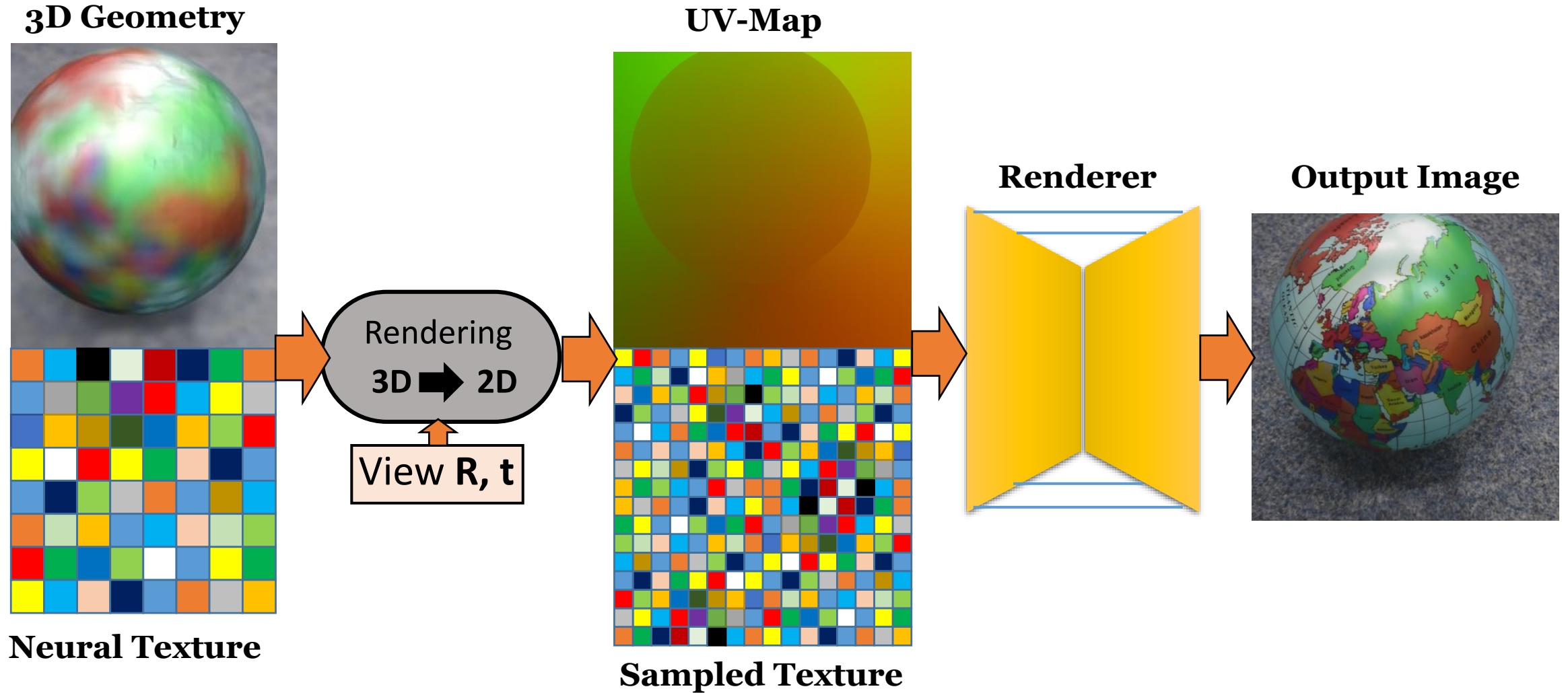


**Neural Texture**

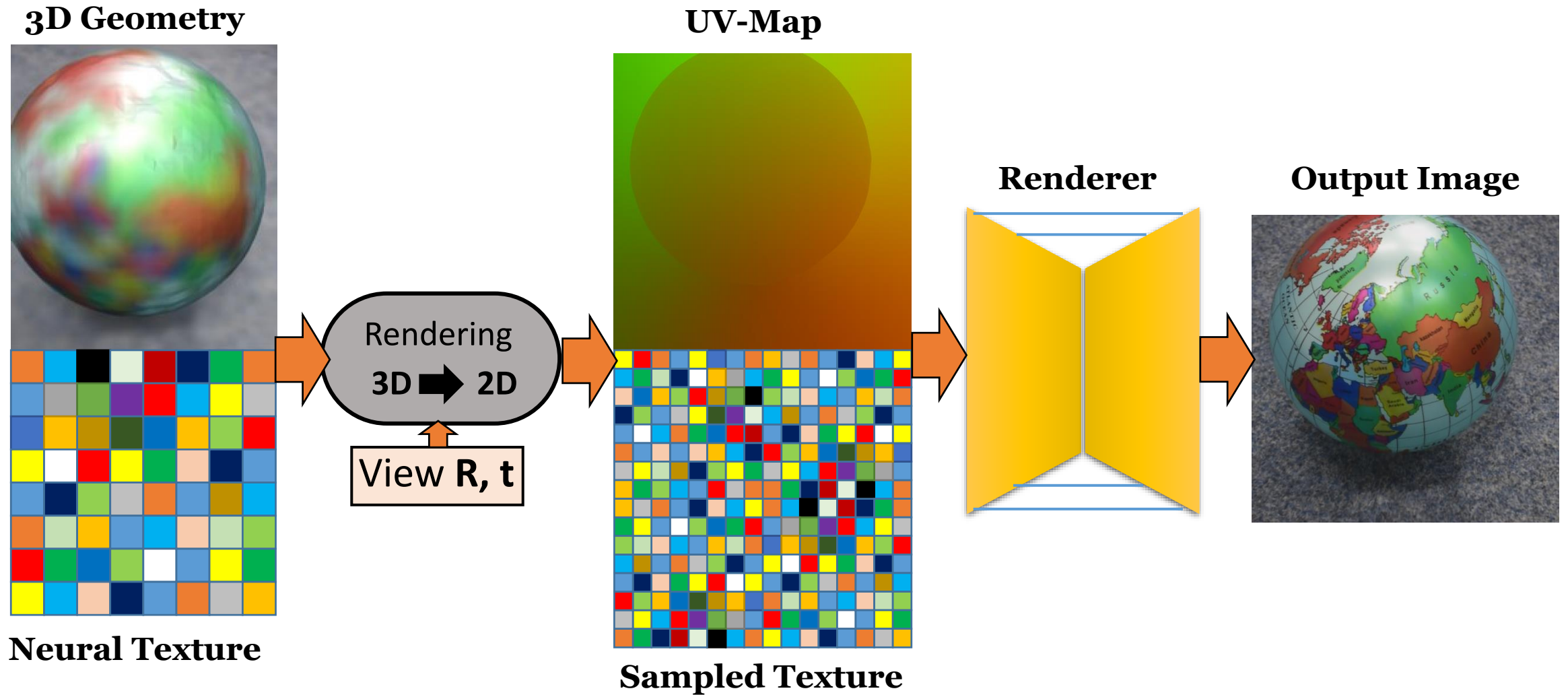
# Neural Textures: Features on 3D Mesh



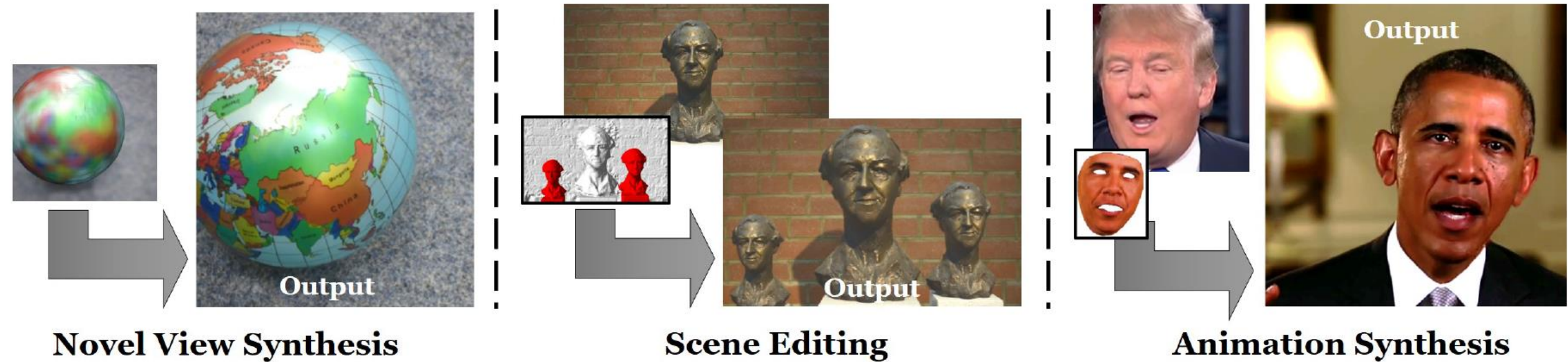
# Neural Textures: Features on 3D Mesh



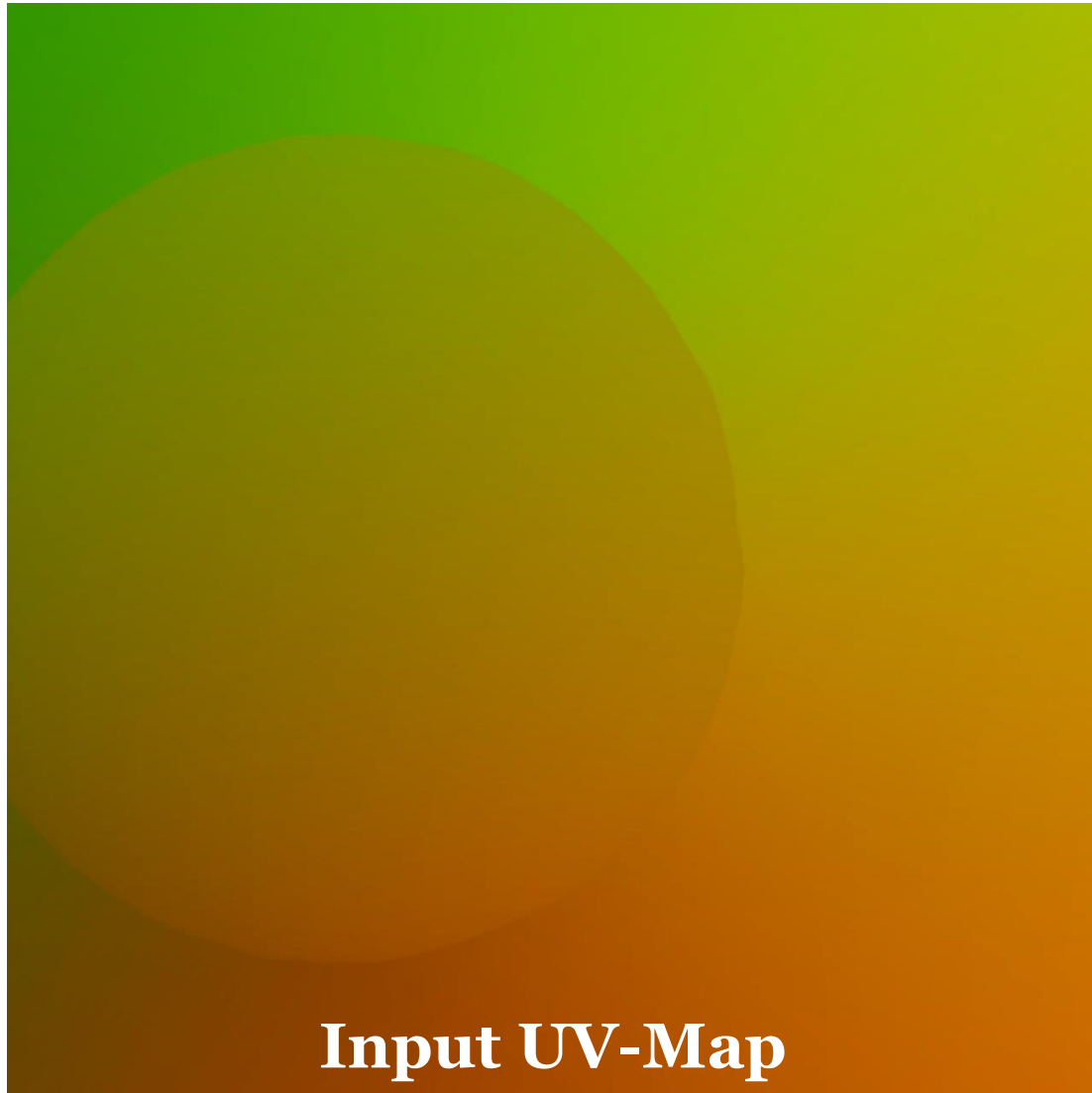
# Neural Textures: Features on 3D Mesh



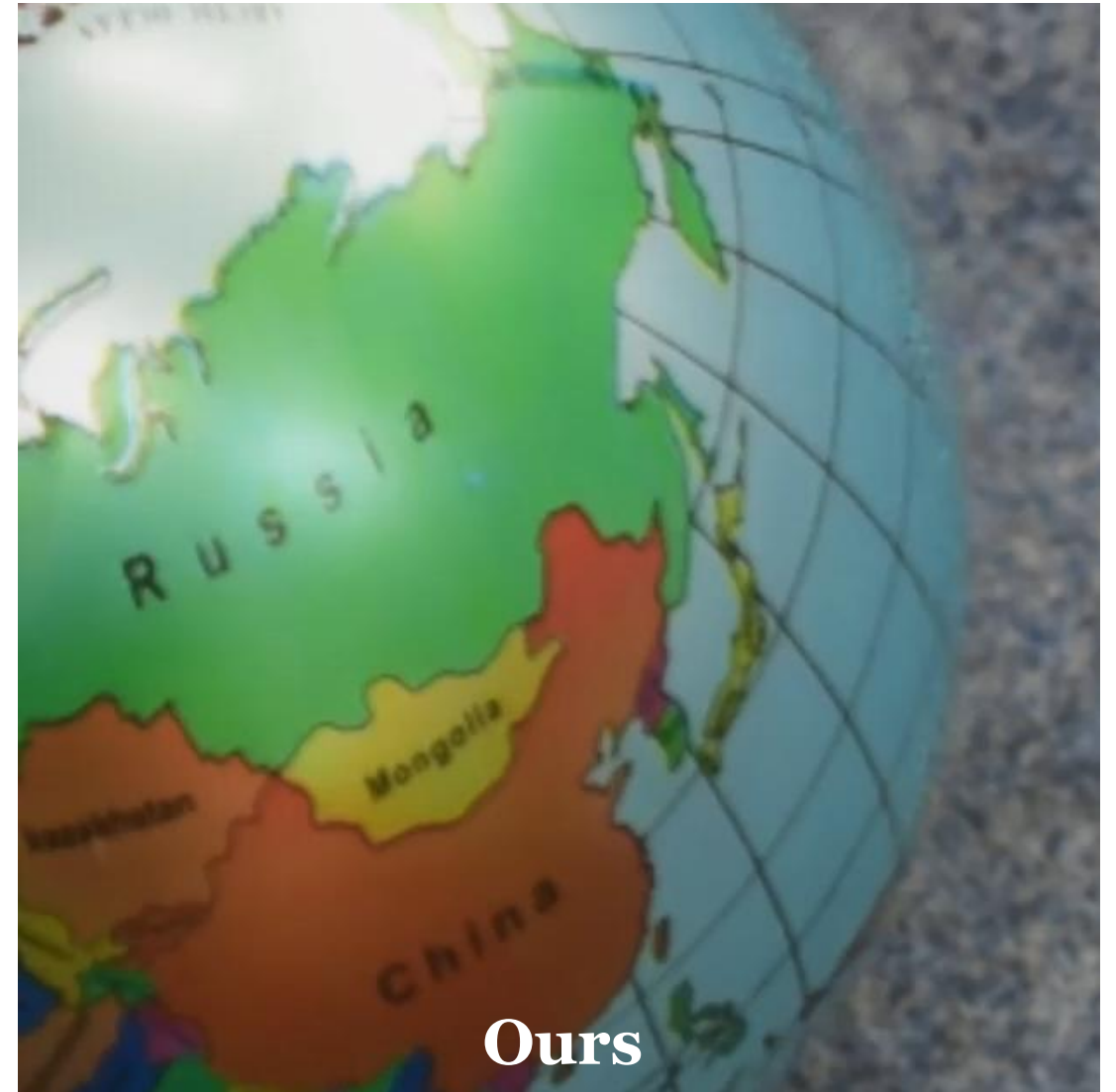
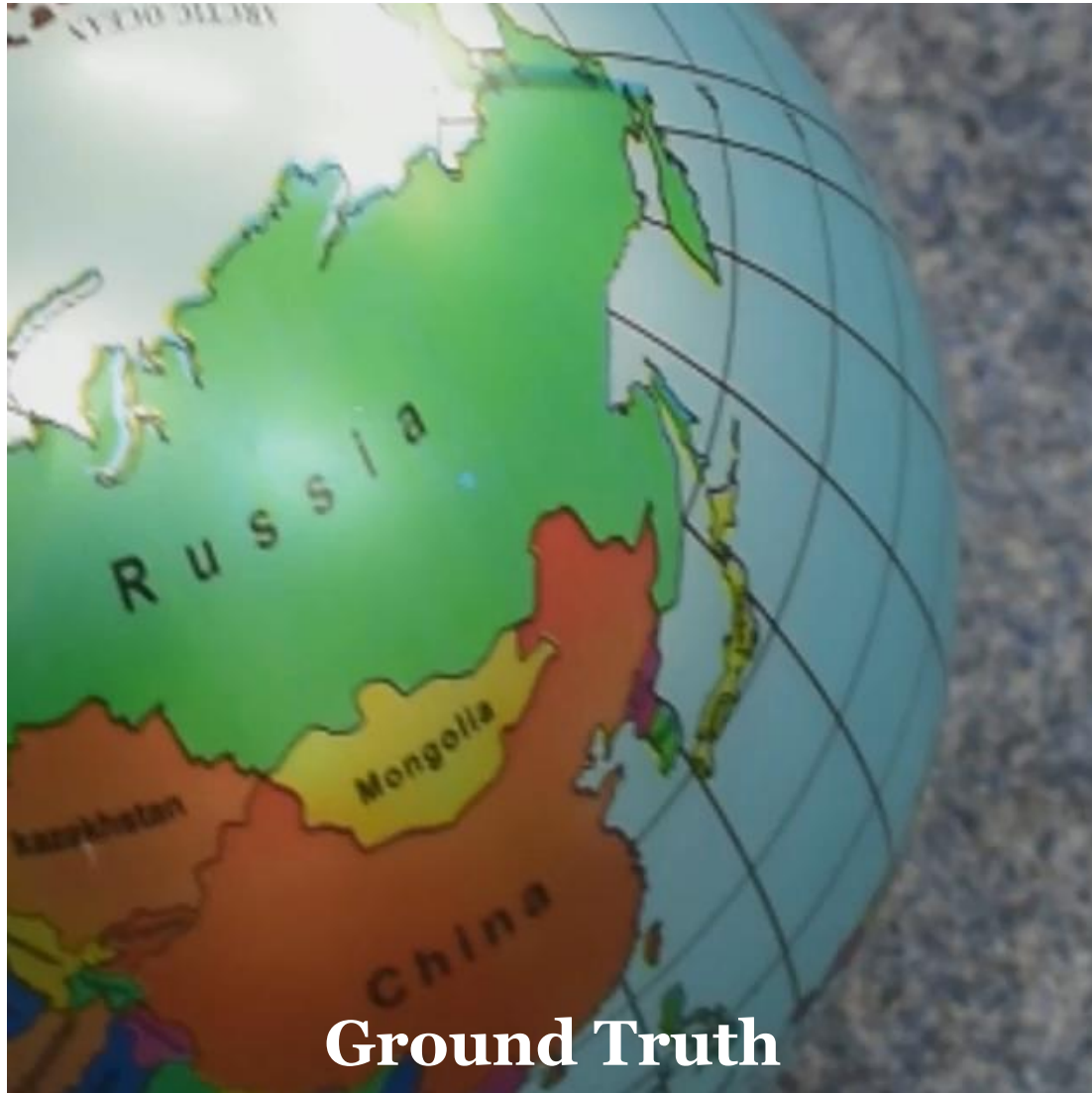
# Neural Textures: Features on 3D Mesh



# Novel View-Point Synthesis



# Novel View-Point Synthesis



# Scene Editing

Input  
Sequence



Geometry  
Editing



# Scene Editing



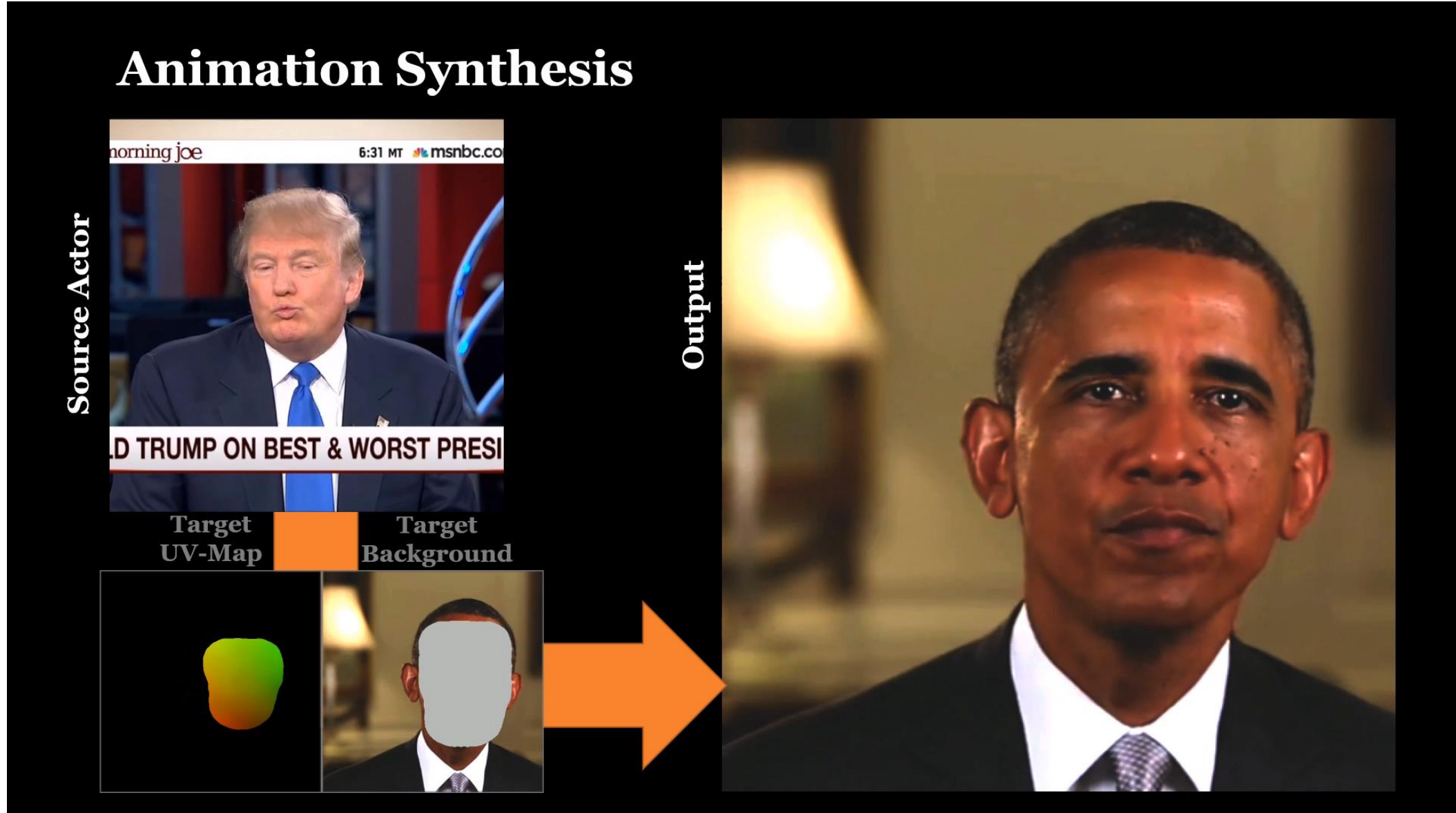
Siggraph'19 [Thies et al.]: Neural Textures

# Scene Editing

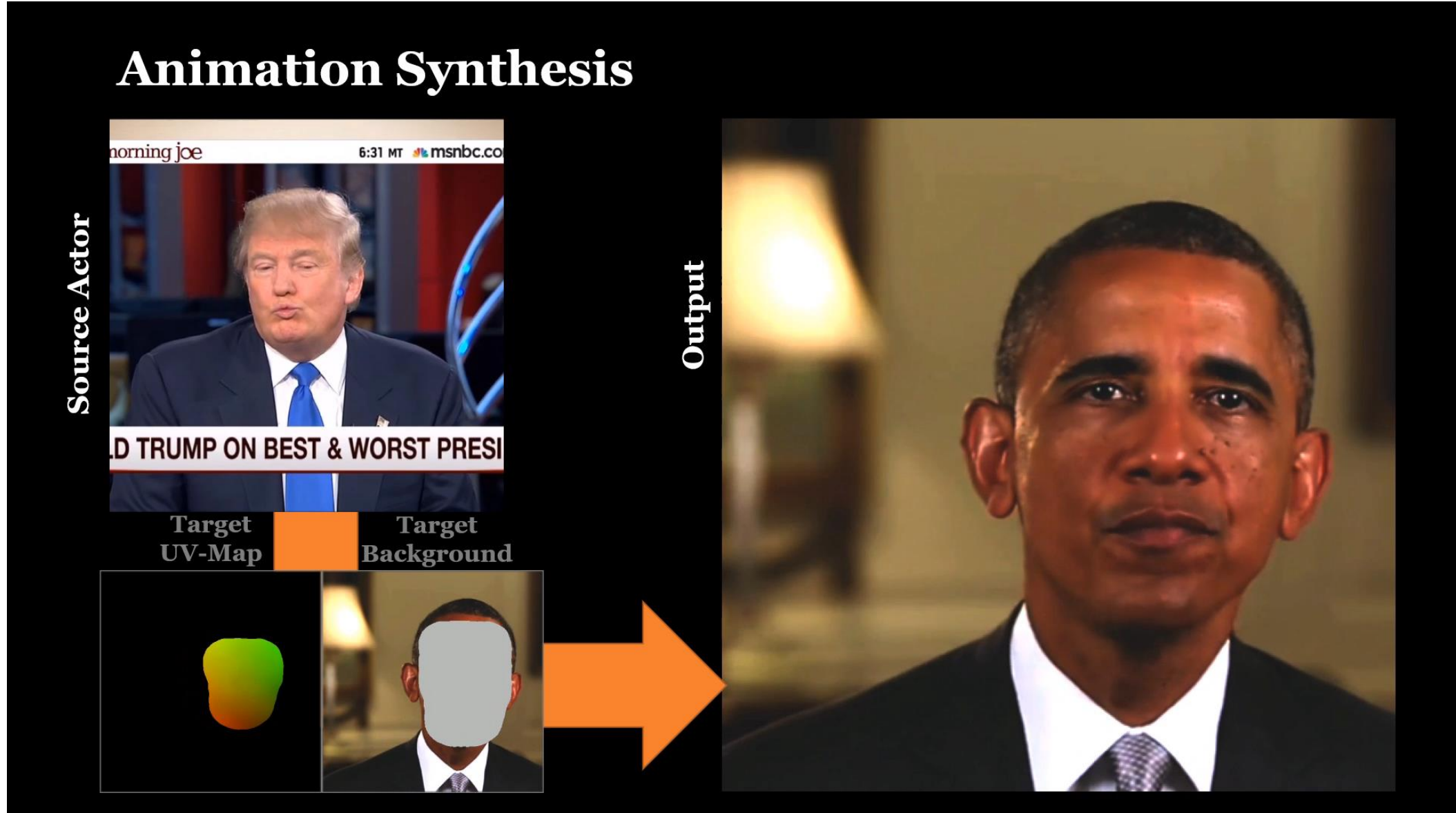


Siggraph'19 [Thies et al.]: Neural Textures

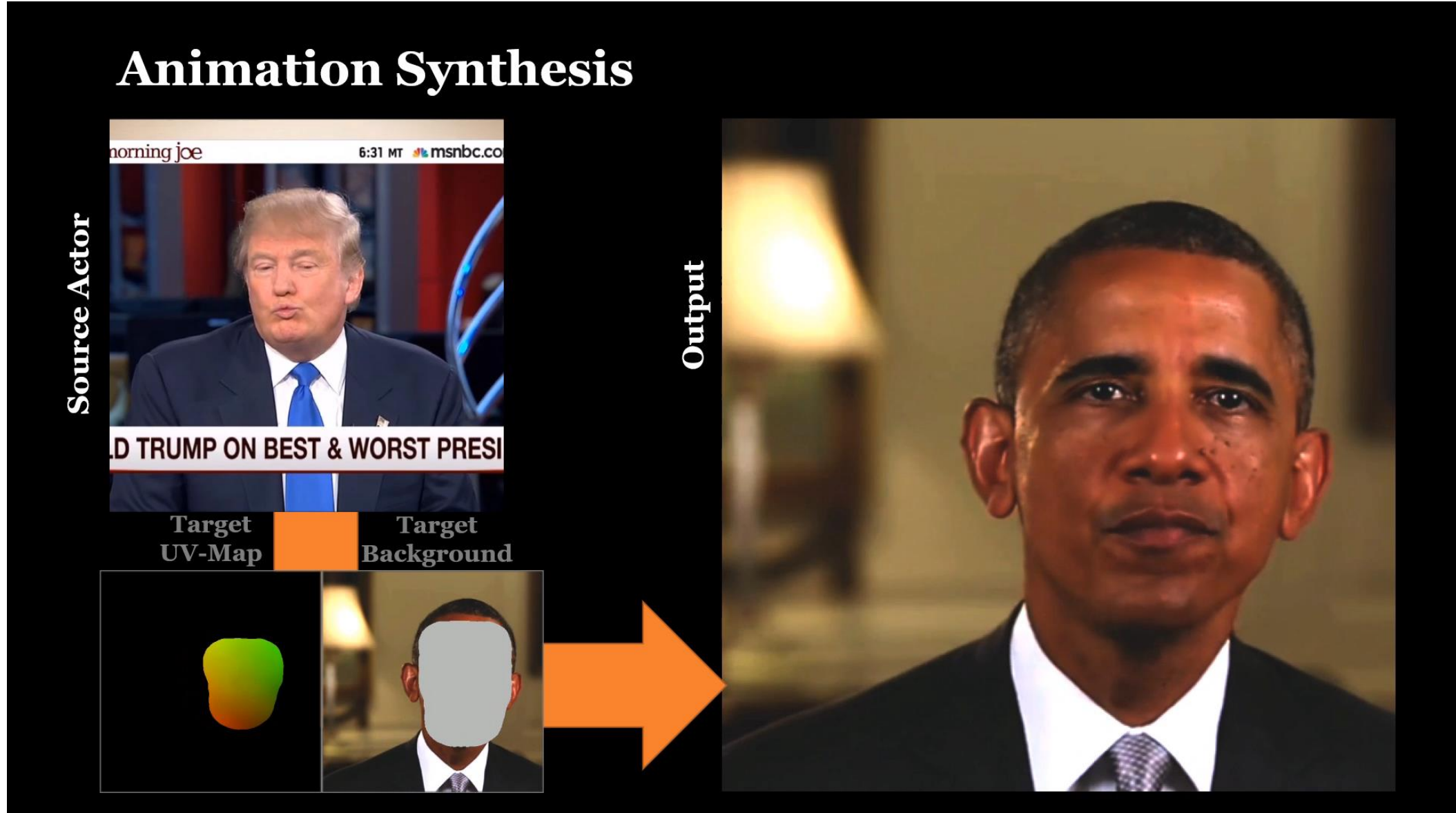
# Facial Animation



# Facial Animation



# Facial Animation



# Neural Radiance Fields

## NeRF

Representing Scenes as Neural Radiance Fields for View Synthesis

ECCV 2020 Oral - Best Paper Honorable Mention

[Ben Mildenhall](#)<sup>\*</sup>  
UC Berkeley

[Pratul P. Srinivasan](#)<sup>\*</sup>  
UC Berkeley

[Matthew Tancik](#)<sup>\*</sup>  
UC Berkeley

[Jonathan T. Barron](#)  
Google Research

[Ravi Ramamoorthi](#)  
UC San Diego

[Ren Ng](#)  
UC Berkeley

<sup>\*</sup>Denotes Equal Contribution



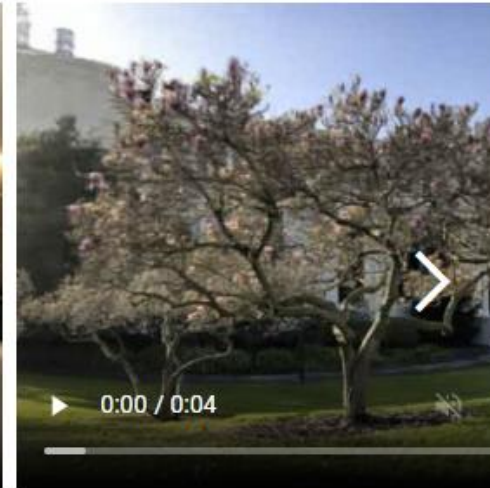
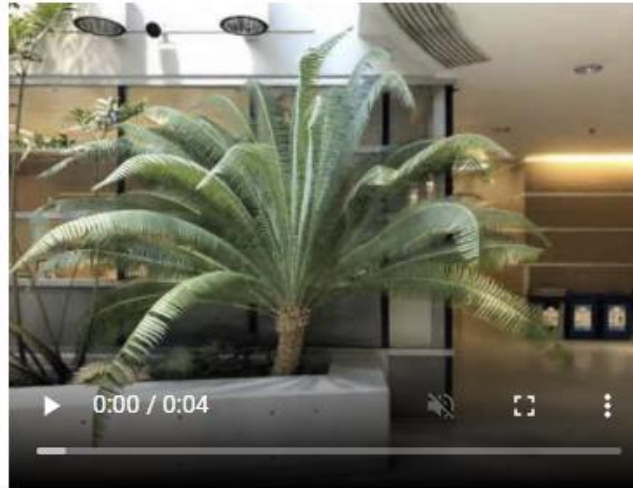
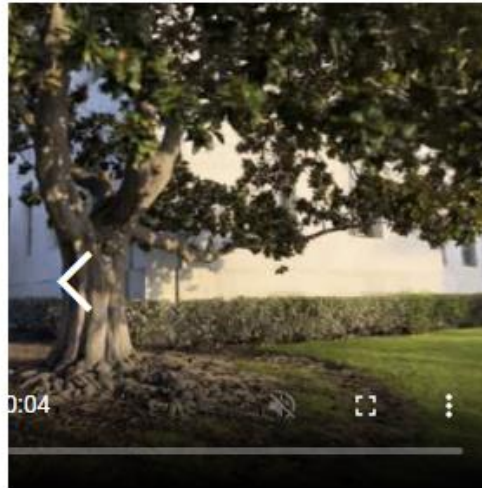
Paper



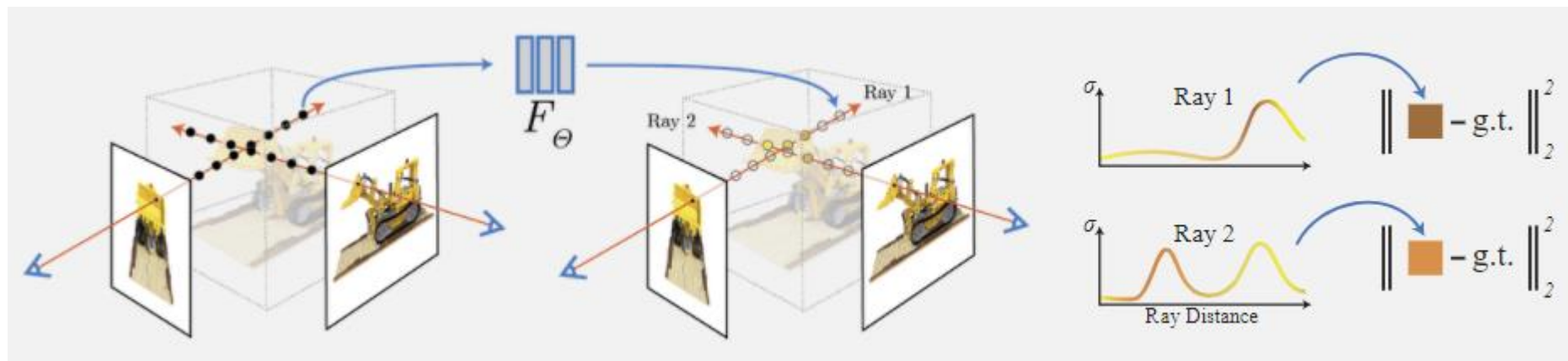
</Code>



Data

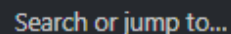


# Neural Radiance Fields



$$(x, y, z, \theta, \phi) \rightarrow \begin{array}{c} \text{Feature Extractor} \\ F_{\theta} \end{array} \rightarrow (RGB\sigma)$$

← → ↻ 🔒 github.com/yenchenlin/awesome-NeRF

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main 1 branch 0 tags

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Code

yenchenlin Merge pull request #12 from cfoster0/main ...

b5034fd 2 hours ago 43 commits

 citations Added NeRV 10 hours ago

 LICENSE Initial commit 12 days ago

 README.md      Typo fix.      10 hours ago

## Awesome Neural Radiance Fields

A curated list of awesome neural radiance fields papers, inspired by [awesome-computer-vision](#).

- Papers

A curated list of awesome neural radiance fields papers

nerf

 [Readme](#)

 MIT License

No releases published

## Packages

No packages published

Contributors 8

# Dynamic Neural Radiance Fields for 4D Avatars

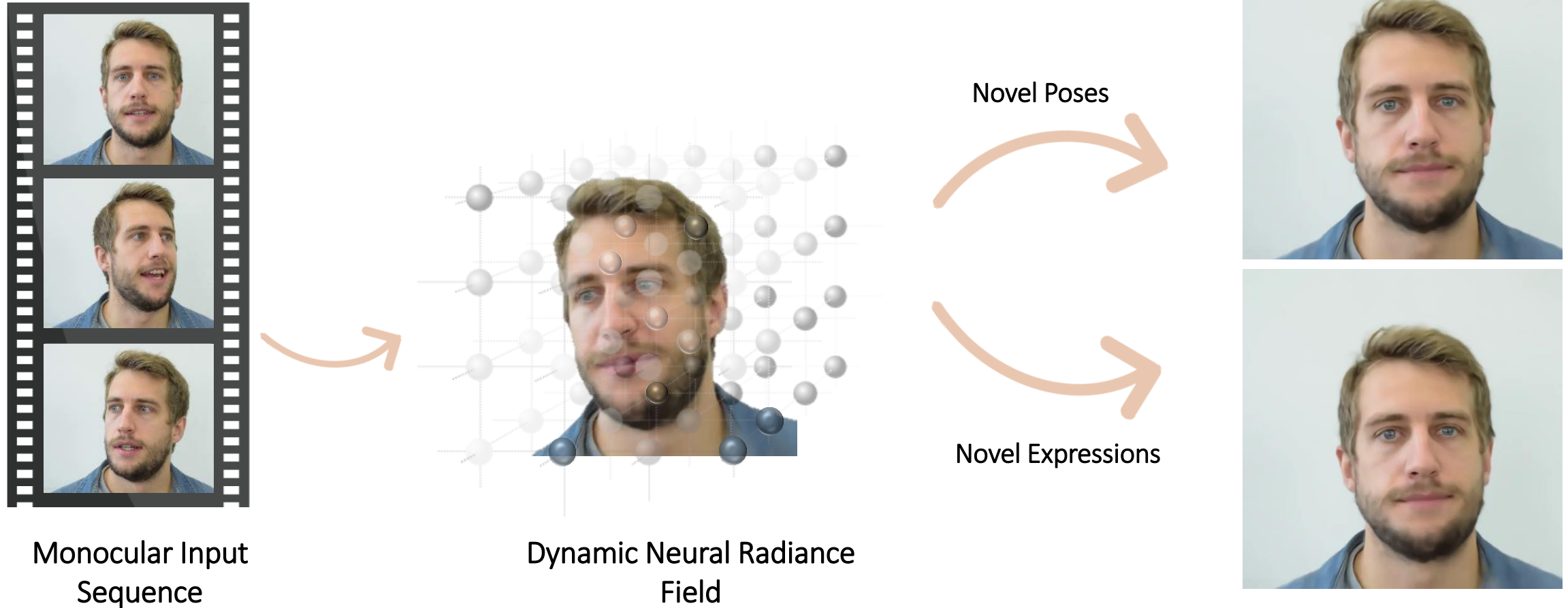


Monocular Input  
Sequence

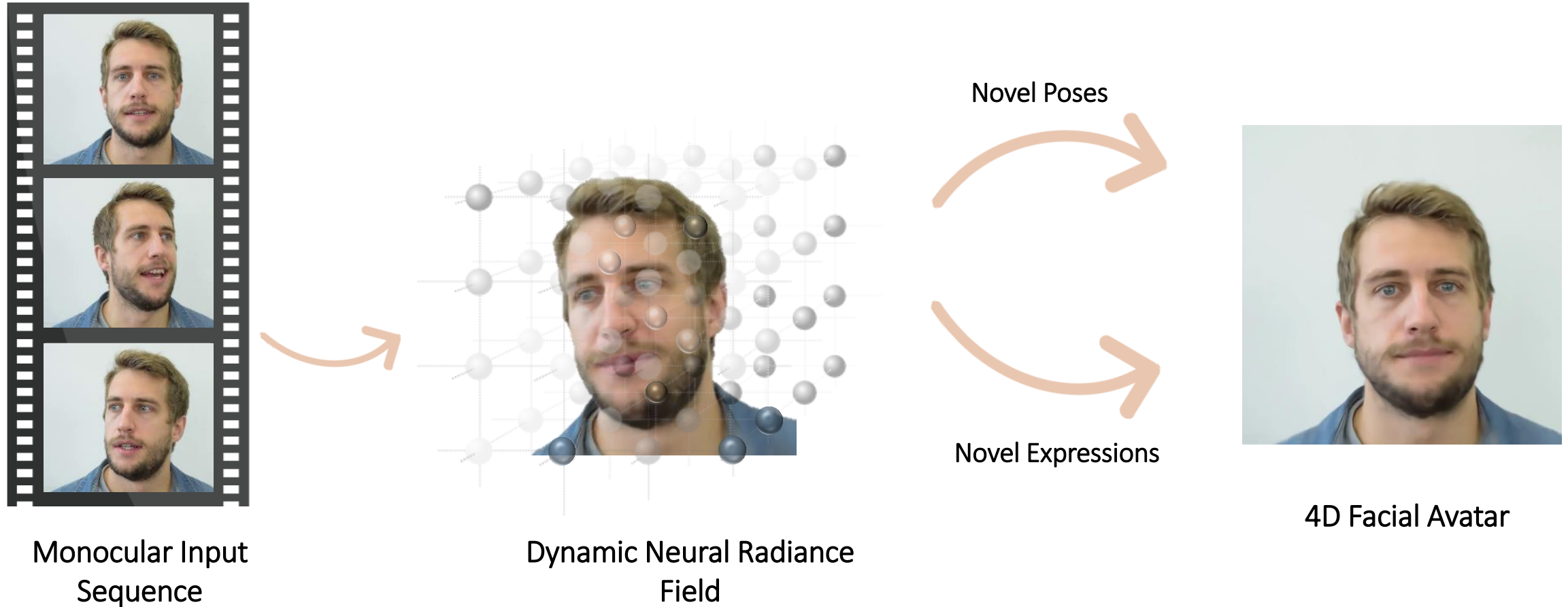


Dynamic Neural Radiance  
Field

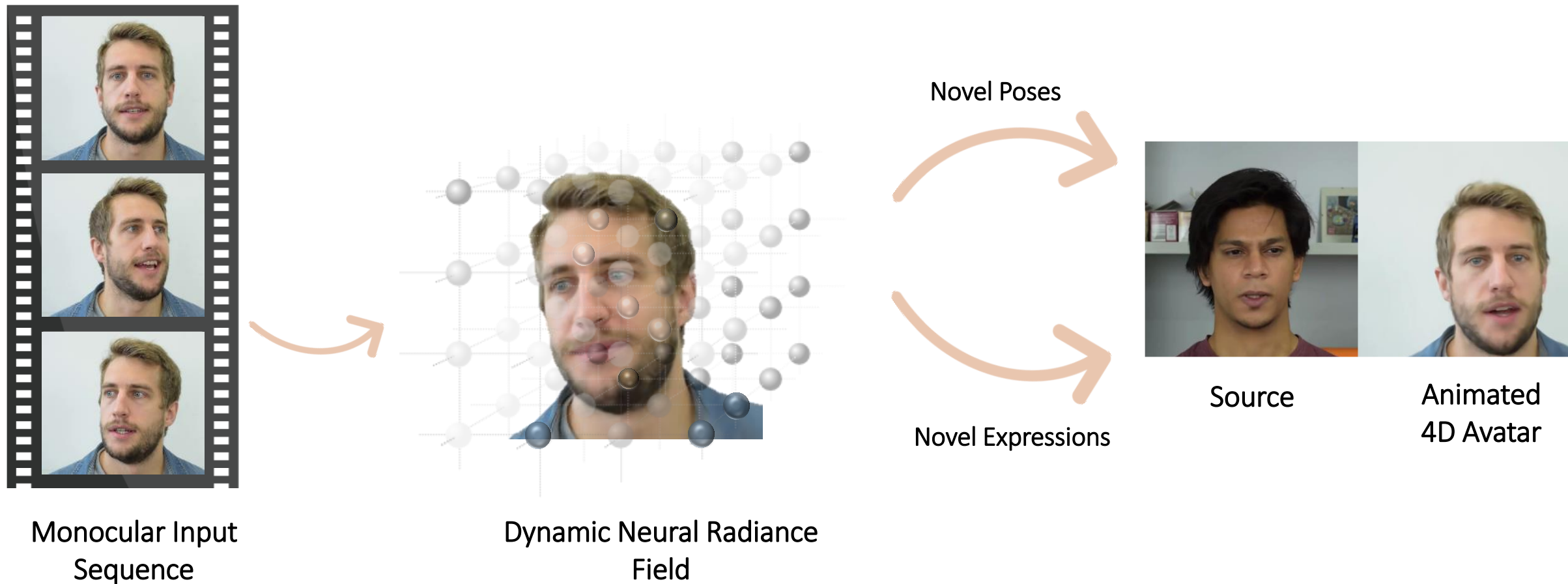
# Dynamic Neural Radiance Fields for 4D Avatars



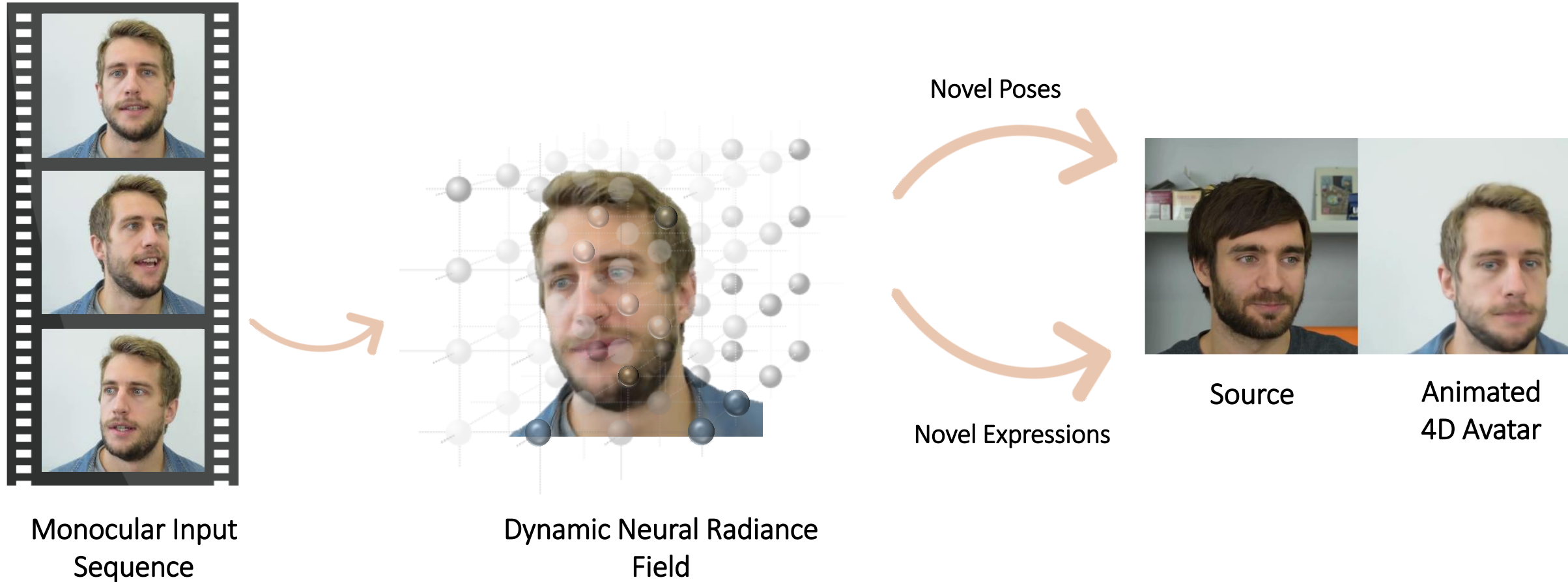
# Dynamic Neural Radiance Fields for 4D Avatars



# Dynamic Neural Radiance Fields for 4D Avatars



# Dynamic Neural Radiance Fields for 4D Avatars



# Method – 3DMM



Input Frames



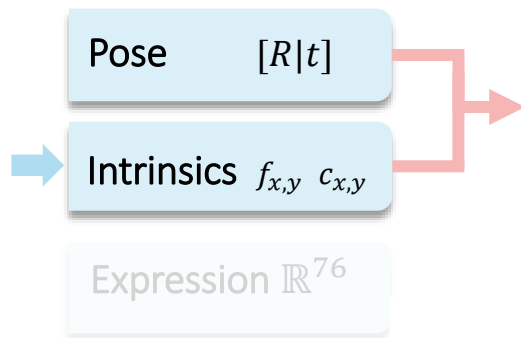
# Method – 3DMM



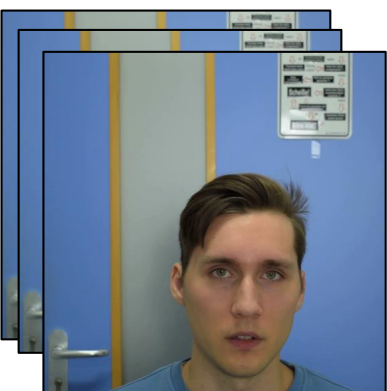
Input Frames



3DMM



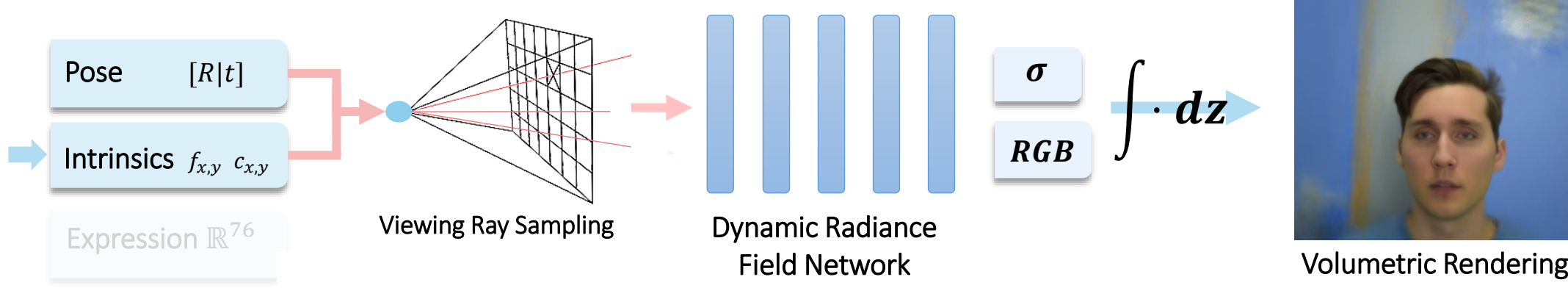
# Method - Background



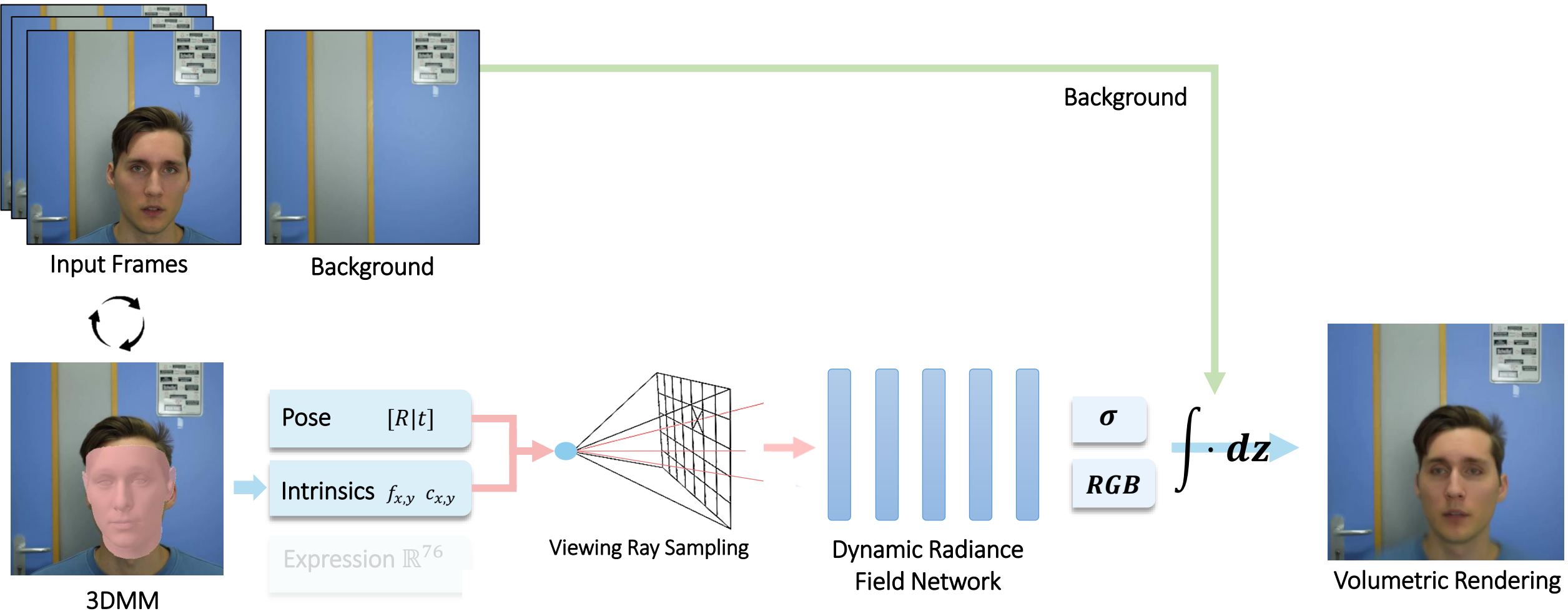
Input Frames



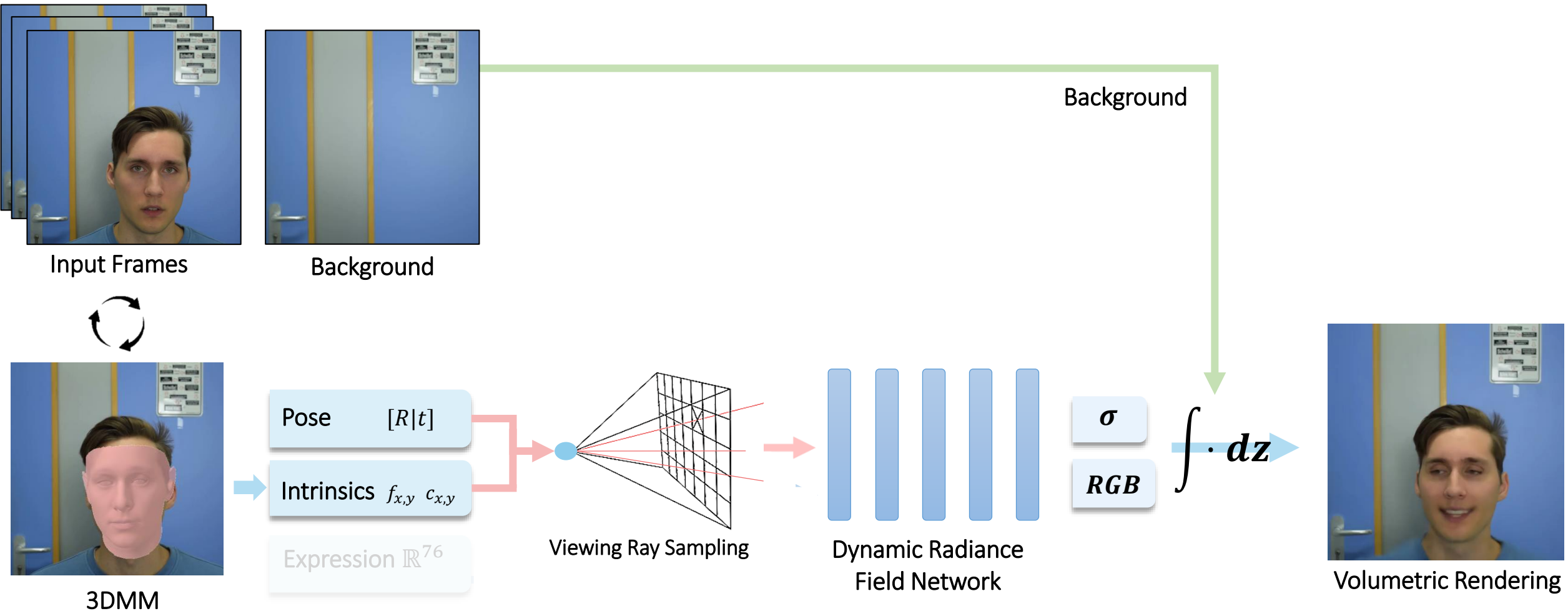
3DMM



# Method - Background



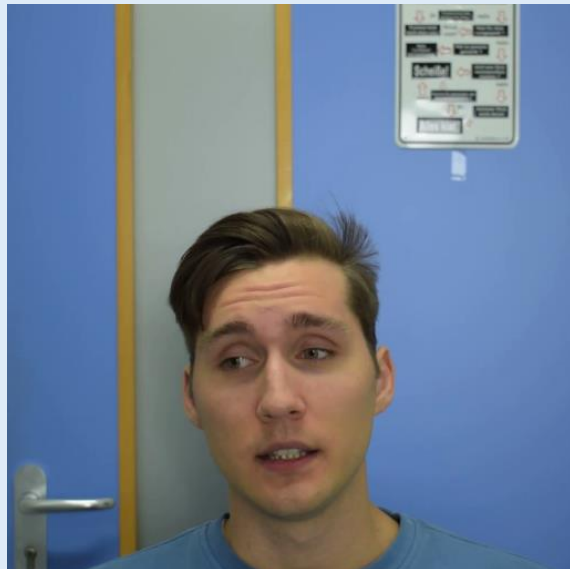
# Method - Dynamics



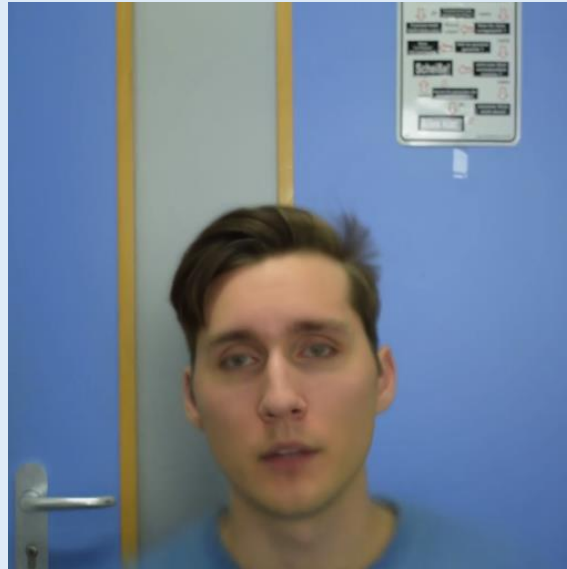
# Method - Dynamics

Background

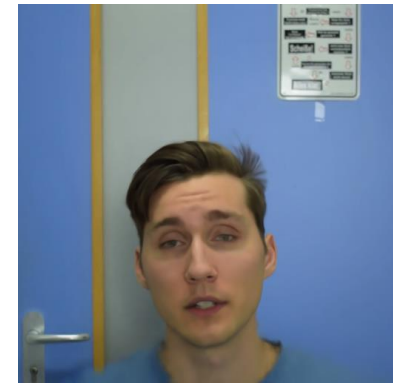
Ground Truth



No Expression Conditioning

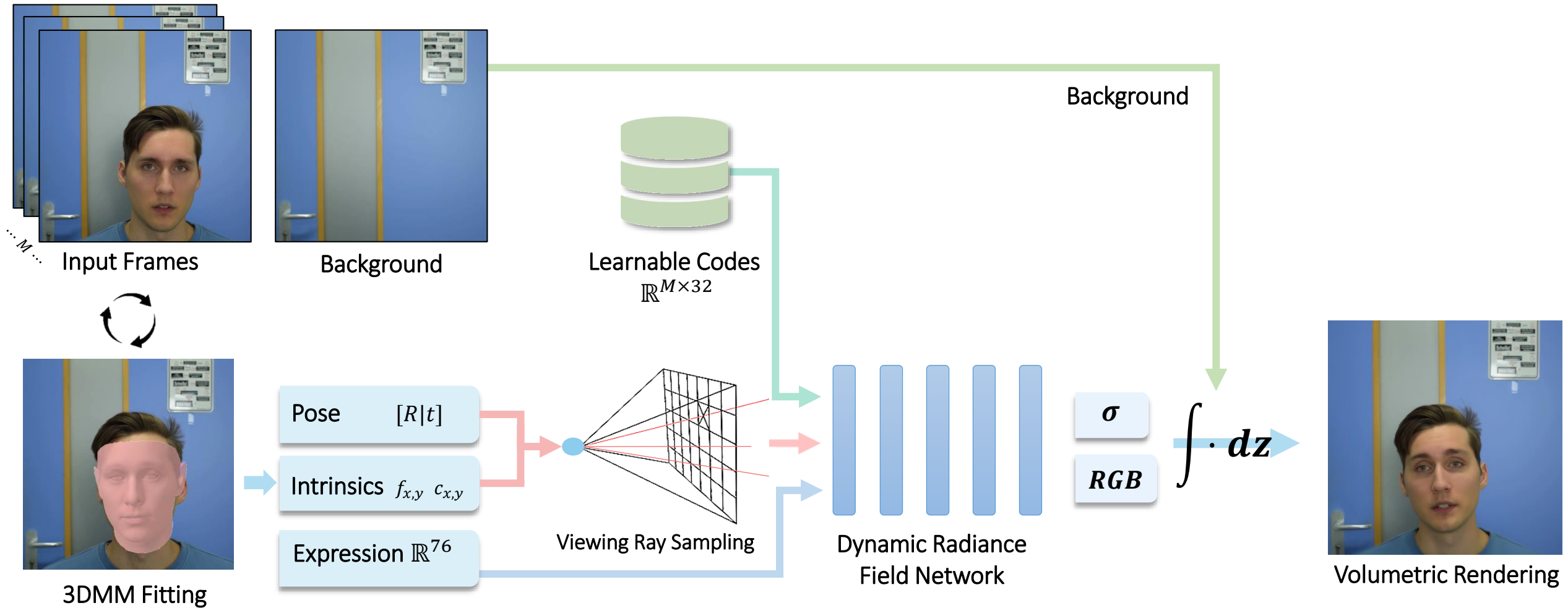


With Expression Conditioning



Volumetric Rendering

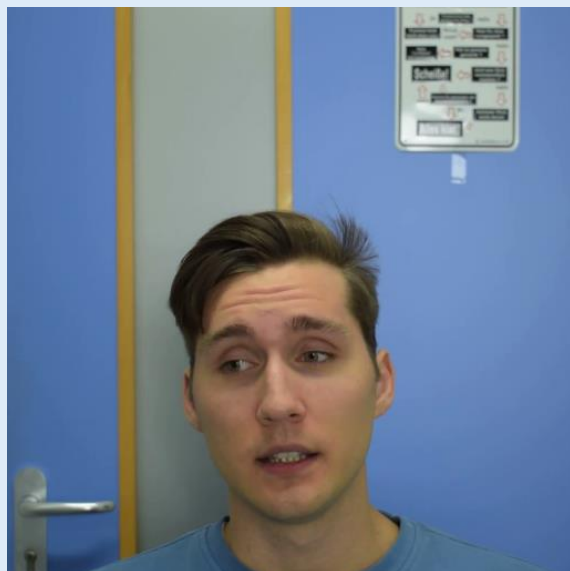
# Method - Dynamics



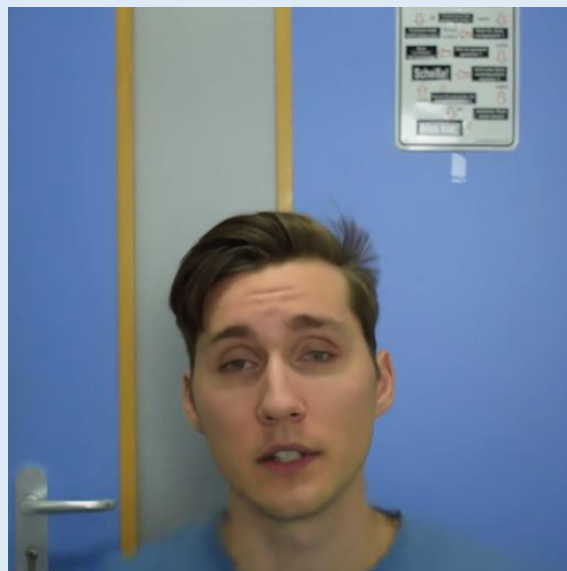
# Method - Dynamics

Background

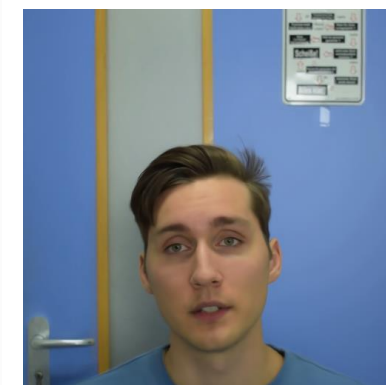
Ground Truth



No Latent Code



With Latent Code

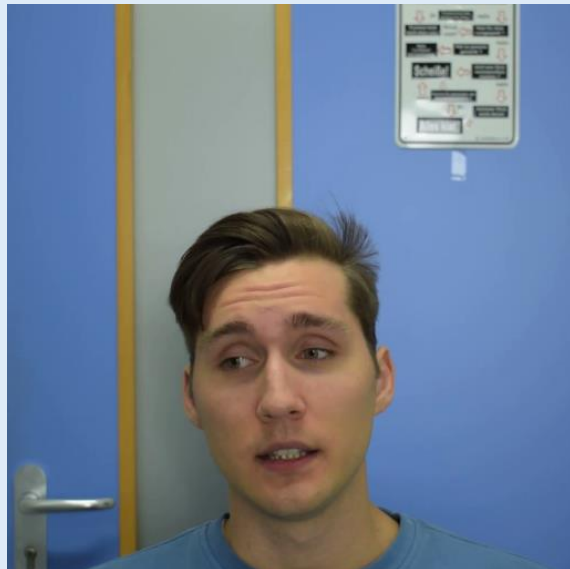


Volumetric Rendering

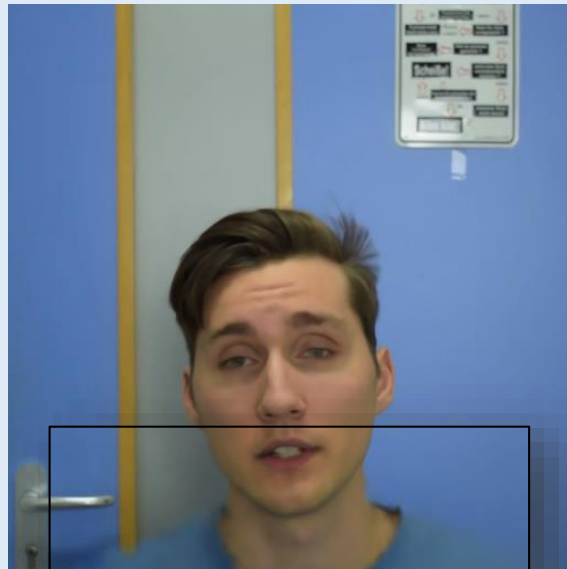
# Method - Dynamics

Background

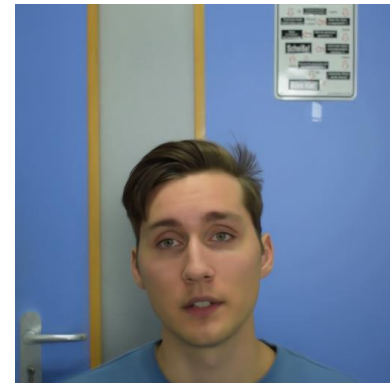
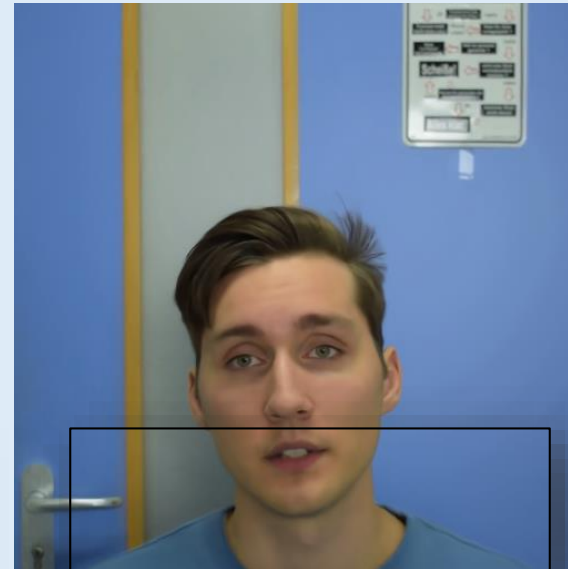
Ground Truth



No Latent Code



With Latent Code



Volumetric Rendering

# Results



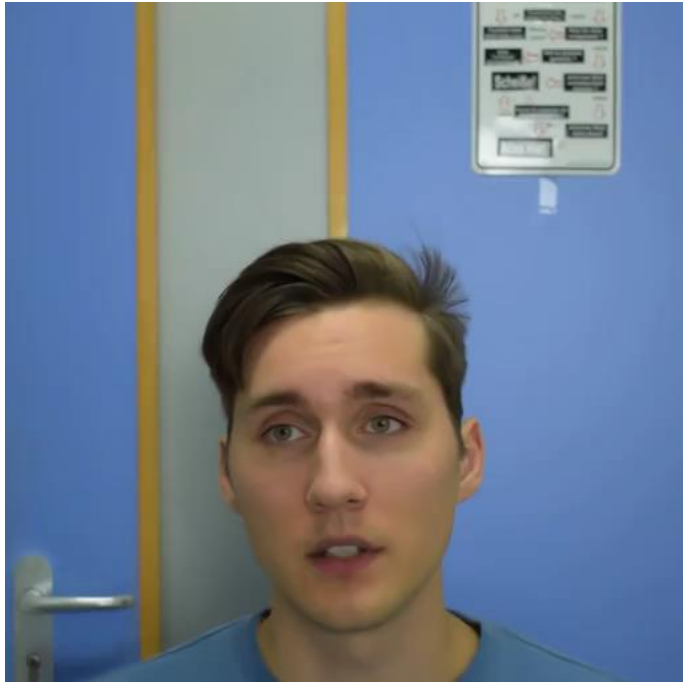
Control Pose



Control Expression

Estimated Normals

# Results



Unseen Expressions  
Fixed Pose



Estimated Normals

# Comparisons



First Order Motion Models

[Siarohin et al. '19]

Deep Video Portraits

[Kim et al. '19]

Ours

Ground Truth

# Comparisons



First Order Motion Models

[Siarohin et al. '19]

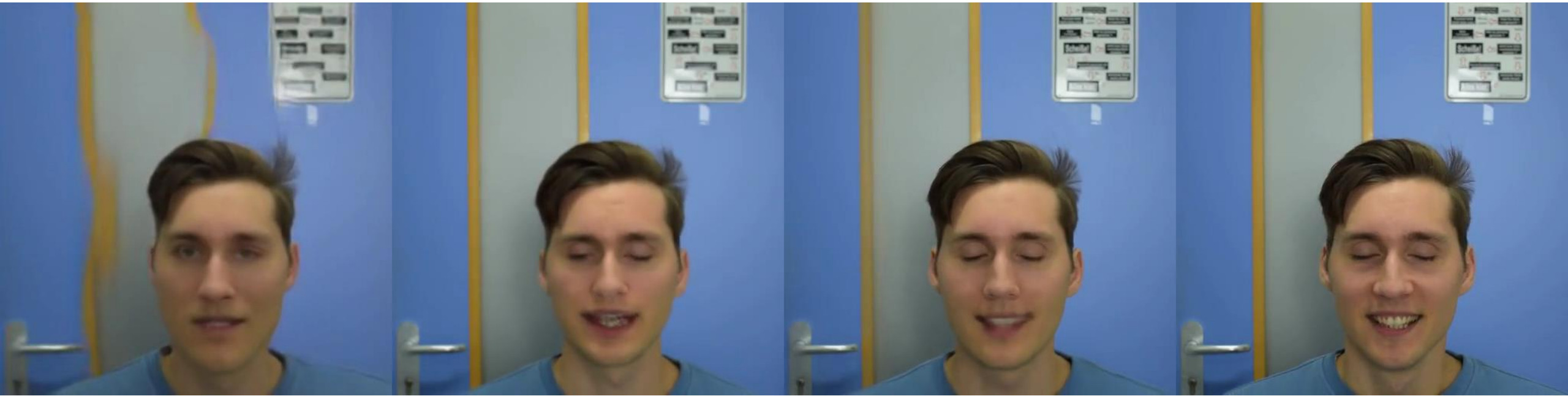
Deep Video Portraits

[Kim et al. '19]

Ours

Ground Truth

# Comparisons



First Order Motion Models

[Siarohin et al. '19]

Deep Video Portraits

[Kim et al. '19]

Ours

Ground Truth

# Applications - Reenactment



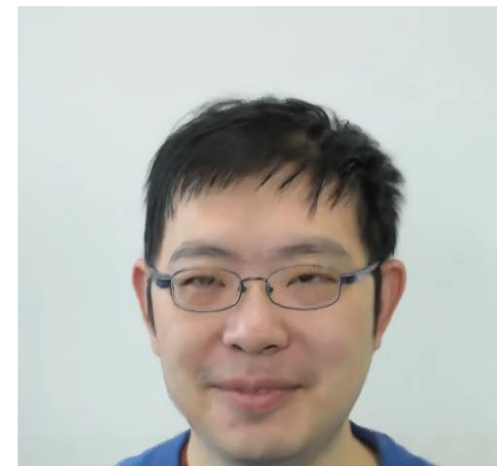
Source Actor



Our Result



Source Actor



Our Result

So why is Neural Rendering so cool?

# Digital 3D Reconstruction



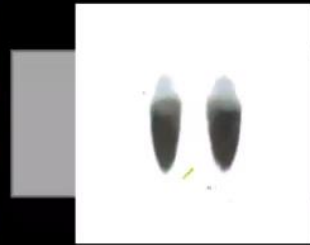
Photo-realistic Reconstruction

# How much can AI do?

**Using a Bounding Box as Proxy**



**Input UV-Map**



**Sampled  
Texture**



**Ours**



**Ground Truth**

# Towards Holograms & AI Avatars 😊





Prof. Dr. Matthias  
Nießner



Dr. Justus Thies



Dr. Yinyu Nie



Angel X. Chang  
Visiting Professor:  
Hans Fischer Fellow  
Princeton University



Leonidas Guibas  
Visiting Professor:  
Hans Fischer Senior  
Fellow  
Stanford University



Luisa Verdola  
Visiting Professor: Hans  
Fischer Senior Fellow  
University of Naples Federico  
II

# Thanks!

## PhD Students



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Andrei Burov



Armen Avetisyan



Barbara Rössle



Dejan Azinović



Ji Hou (侯驥)



Norman Müller



Yawar Siddiqui



Andrei Burov



Guy Gafni



Shivangi Aneja



Dave Zhenyu Chen