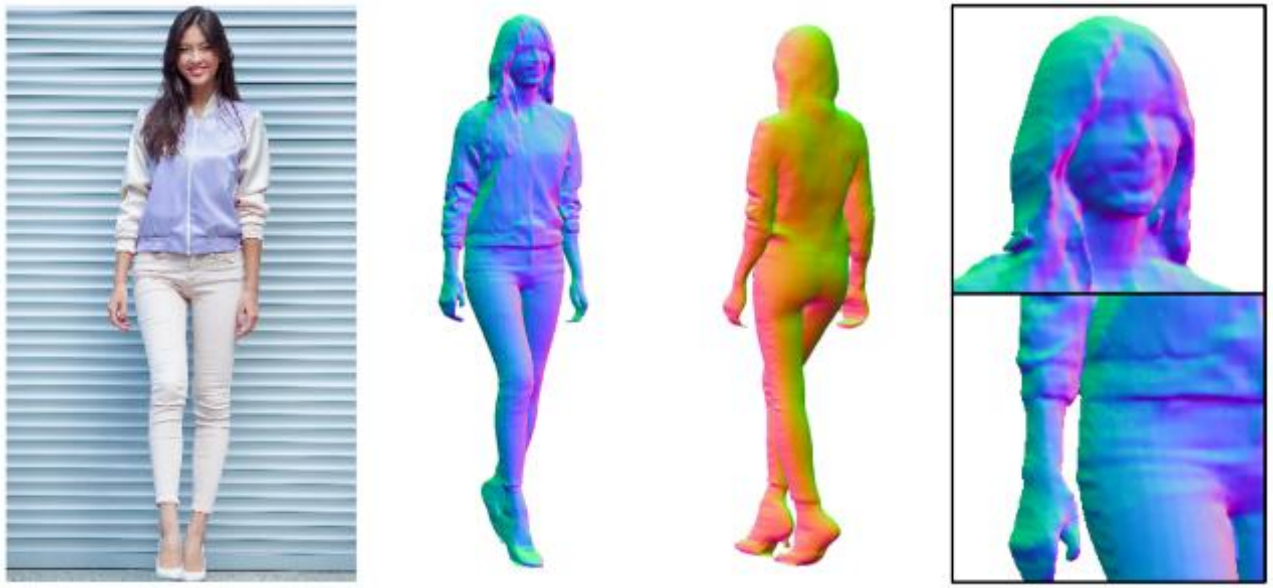
Neural Radiance Fields and How To Control Them

Kacper Kania

Human Rendering



Applications

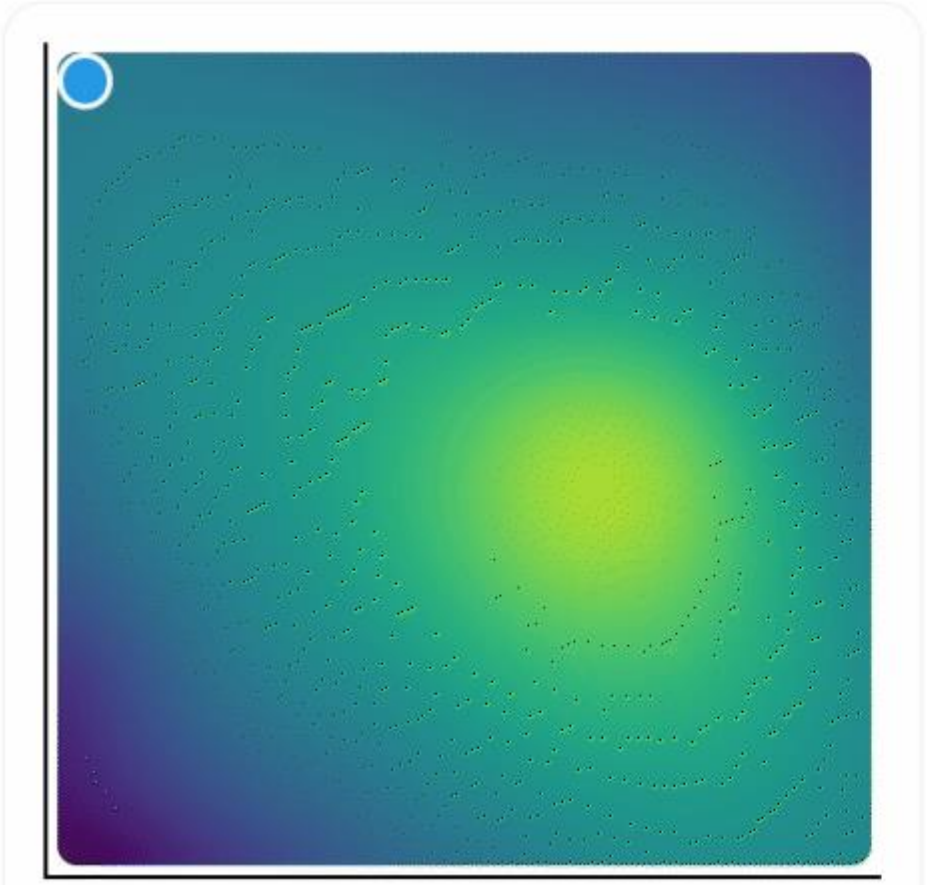


Applications




Problems

Problems

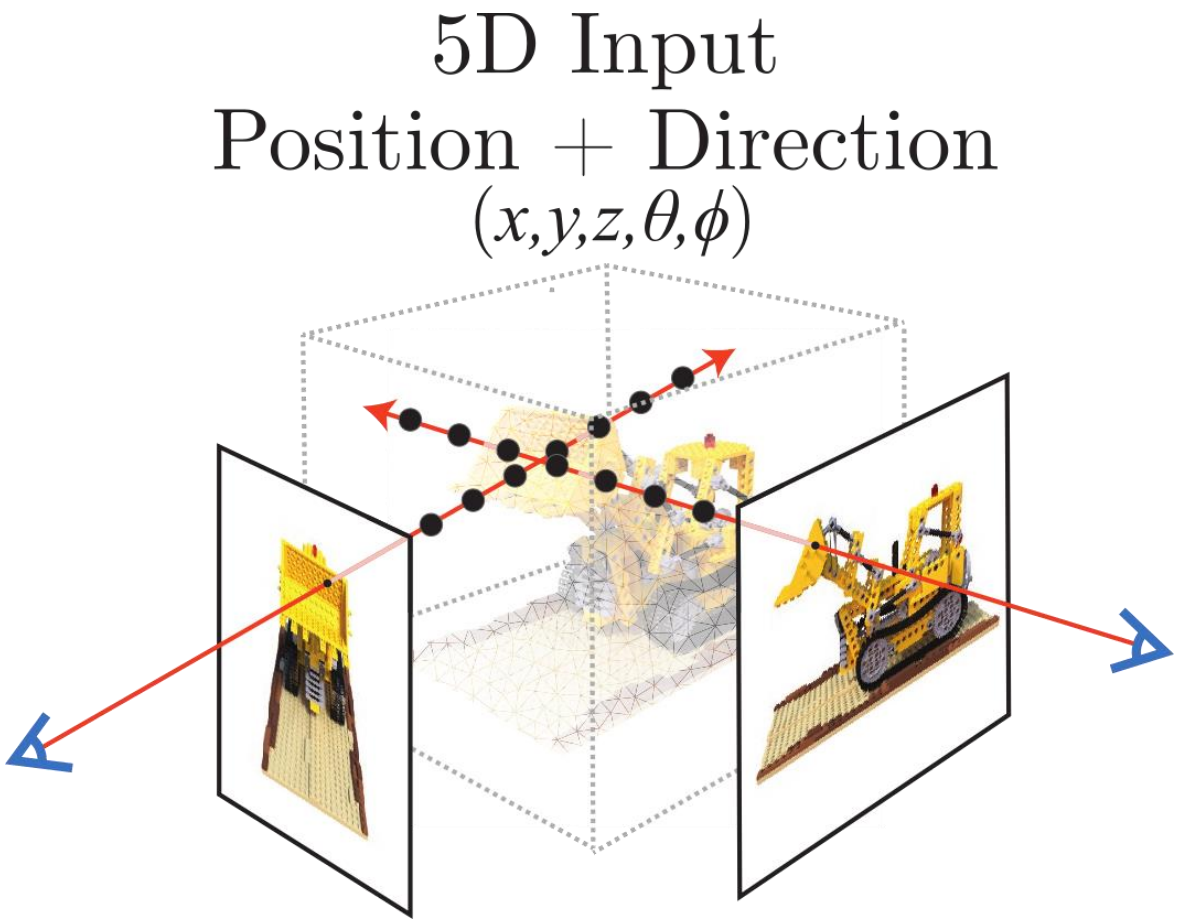


3D Photography with Neural Radiance Fields

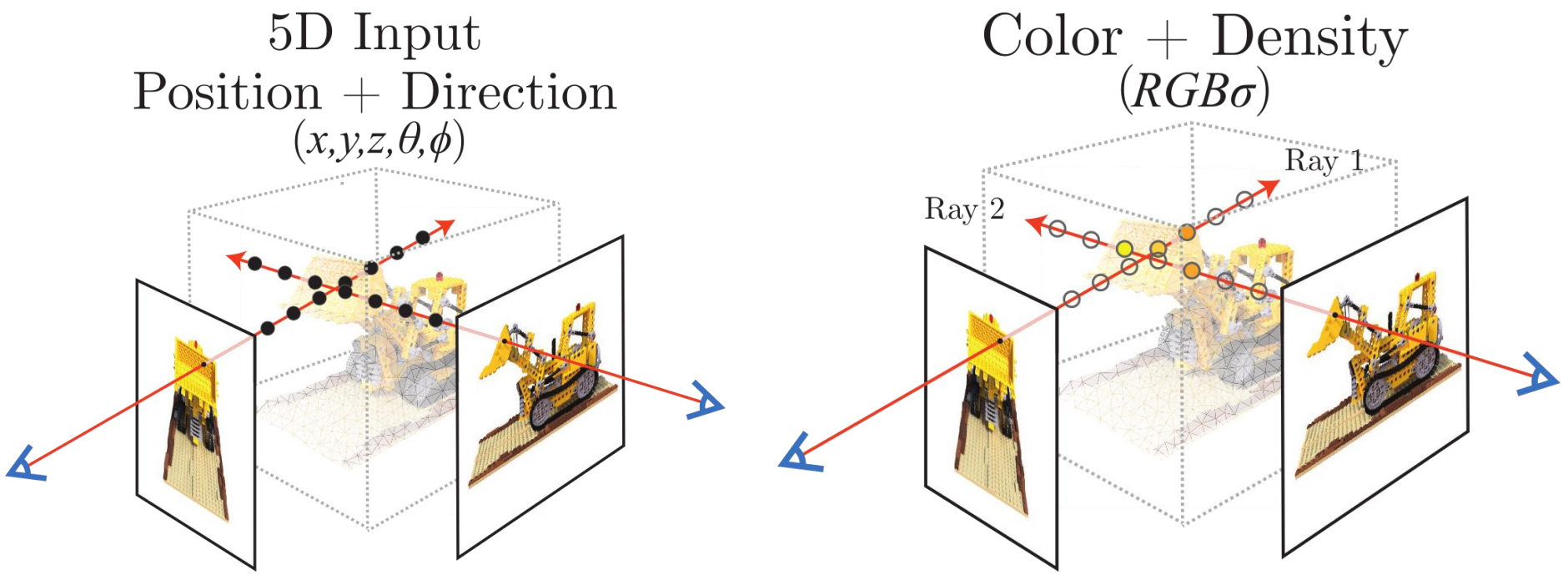
NeRFs

NeRFs

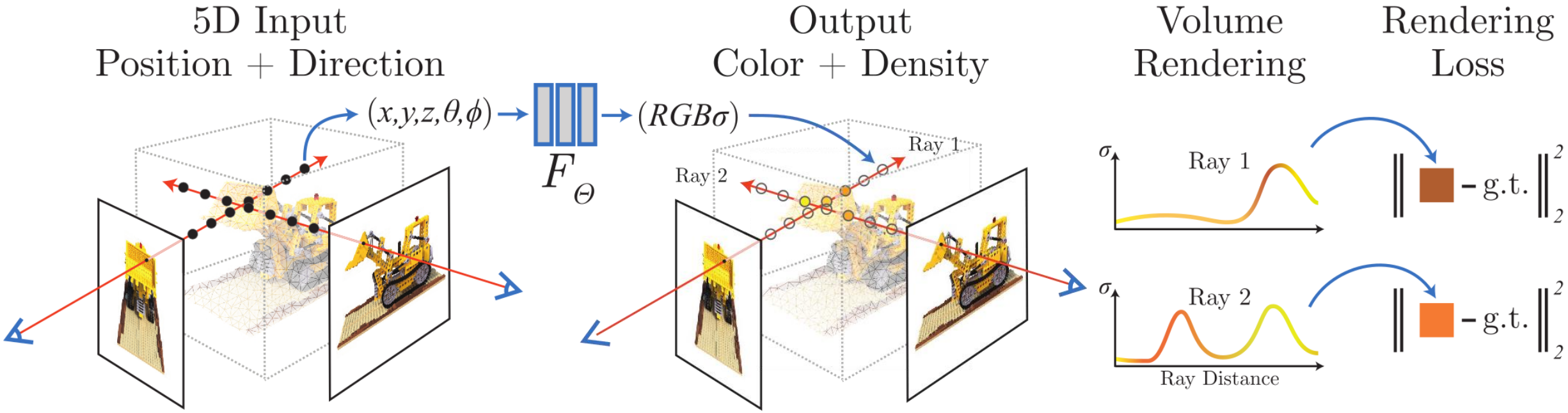
NeRFs



NeRFs


5D Input
Position + Direction
(x,y,z,θ,ϕ)
Color + Density
$(RGB\sigma)$
Ray 1
Ray 2
Volume
Rendering
σ
Ray 1
σ
Ray 2

NeRFs


5D Input
Position + Direction
(x,y,z,θ,ϕ)
F_Θ
Output
Color + Density
$(RGB\sigma)$
Ray 1
Ray 2
Volume
Rendering
Rendering
Loss
σ
Ray 1
Ray 2
Ray Distance
- g.t.
- g.t.

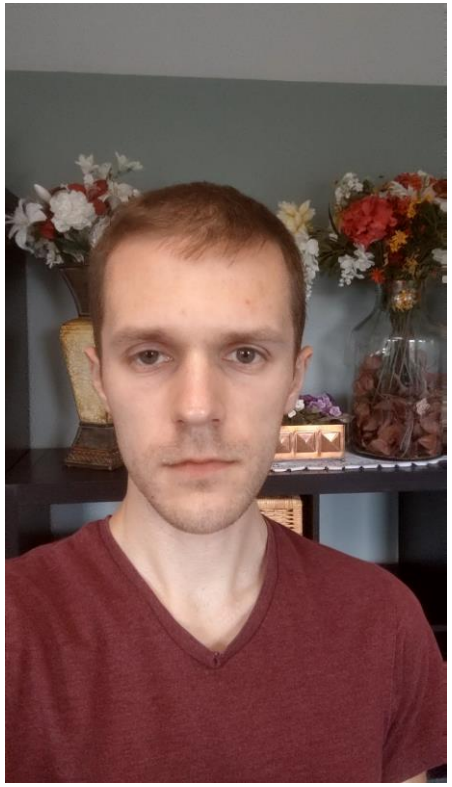
CoNeRF: Controllable Neural Radiance Fields

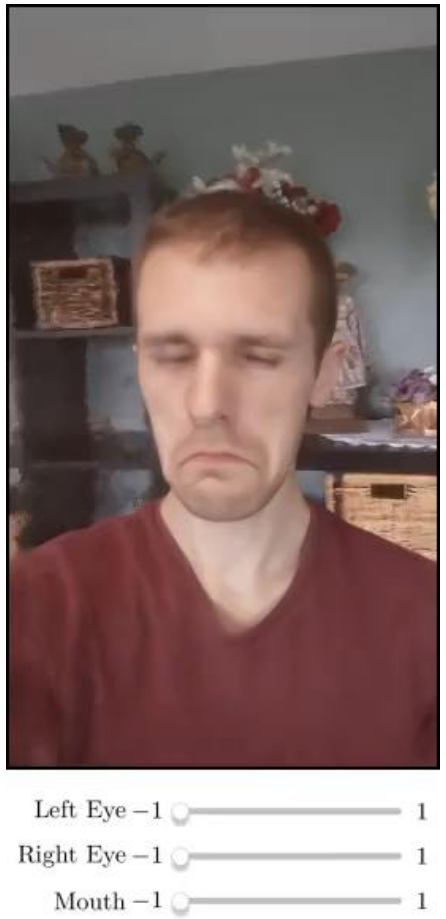
Kacper Kania[1,2] Kwang Moo Yi[1] Marek Kowalski[4]
Tomasz Trzciński[2] Andrea Tagliasacchi[3,5]

University of British Columbia[1] Warsaw University of Technology[2]
University of Toronto[3] Microsoft[4] Google Research[5]

Project webpage: conerf.github.io

Manipulating 3D photography





Proposed method

Video

Annotated samples

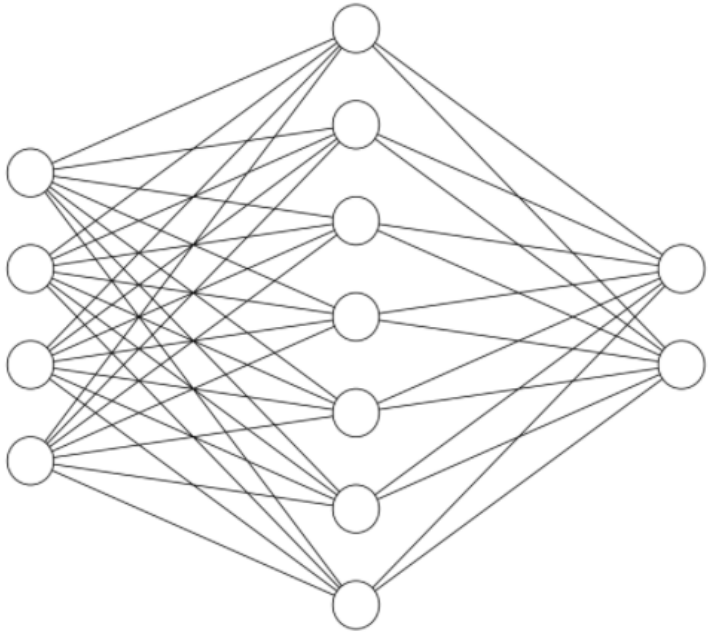
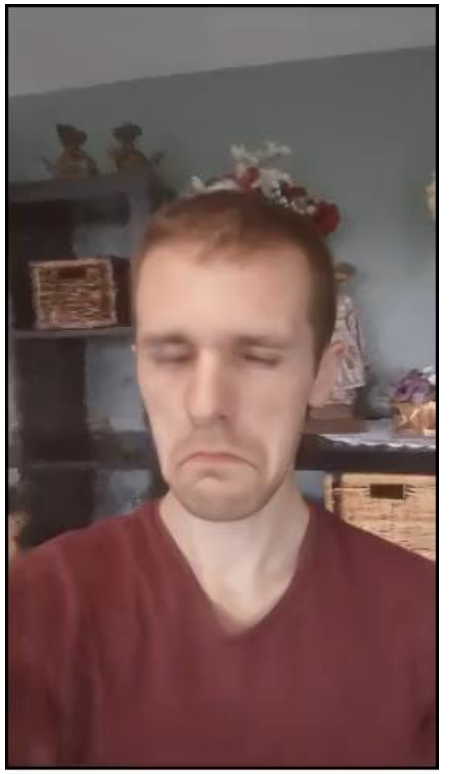
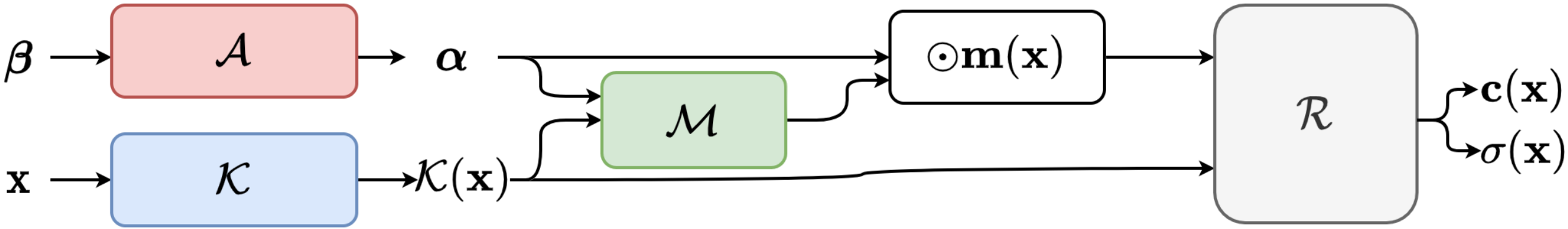


Image synthesis



Pipeline



$\boldsymbol{\beta}$ – learnable latent

$\boldsymbol{\alpha}$ – predicted attributes

$\mathbf{x}$ – coordinates

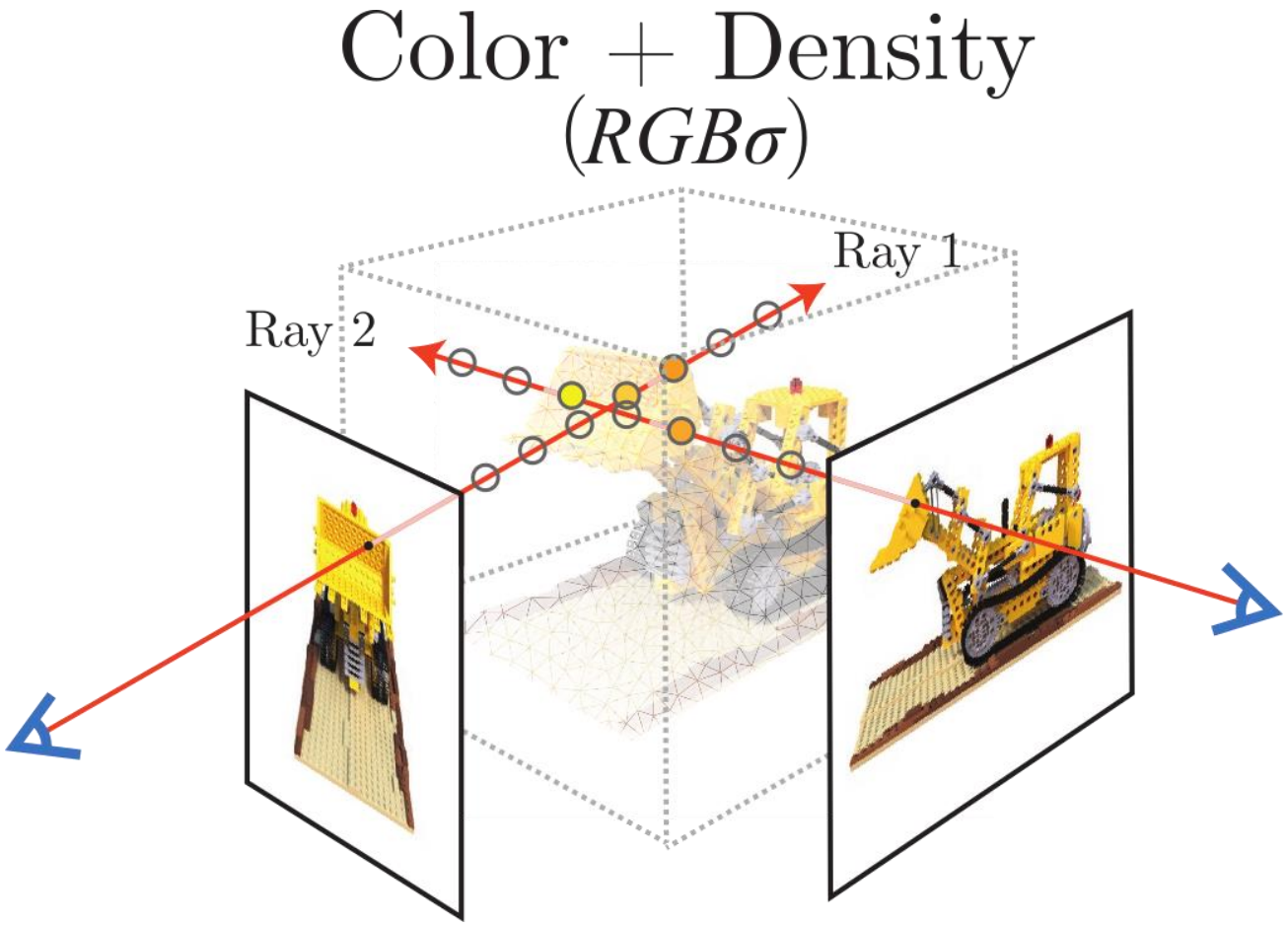
$\mathcal{K}$ – canonicalization network

$\mathcal{M}$ – masking network

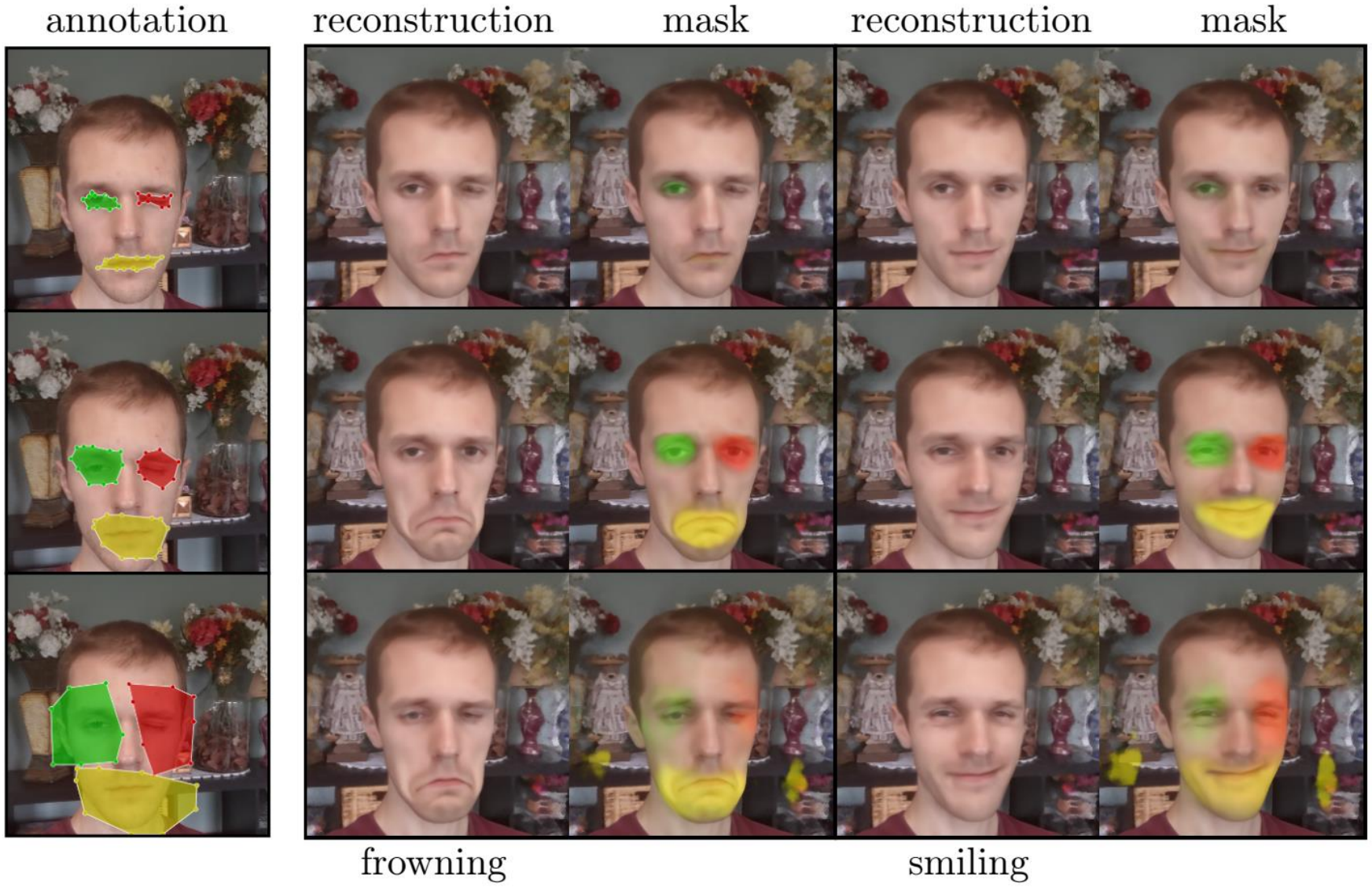
$\mathcal{R}$ – rendering network

Canonicalization

Rendering



Filling the annotations



Qualitative results

Qualitative results

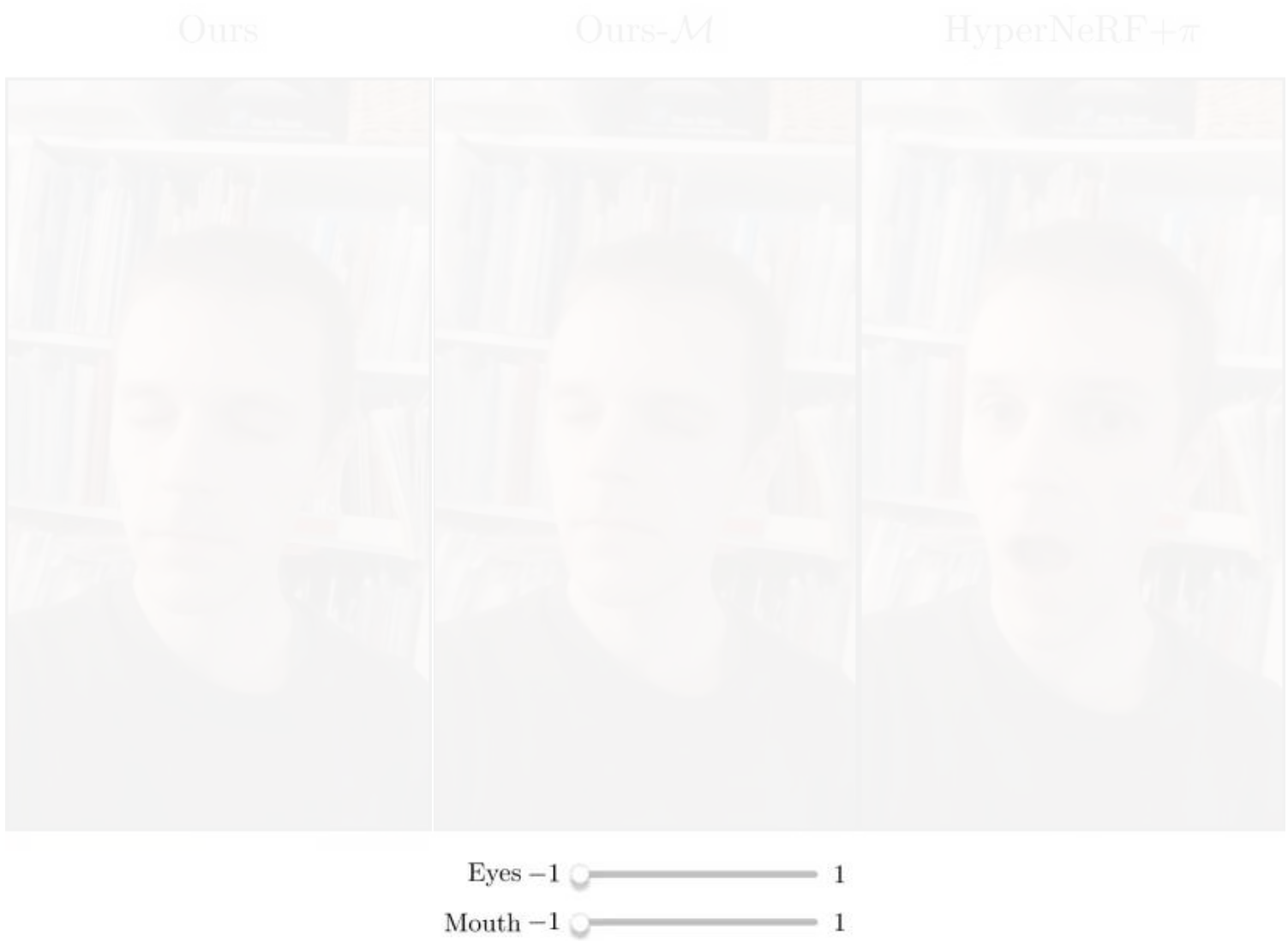
40 BPM

48 BPM

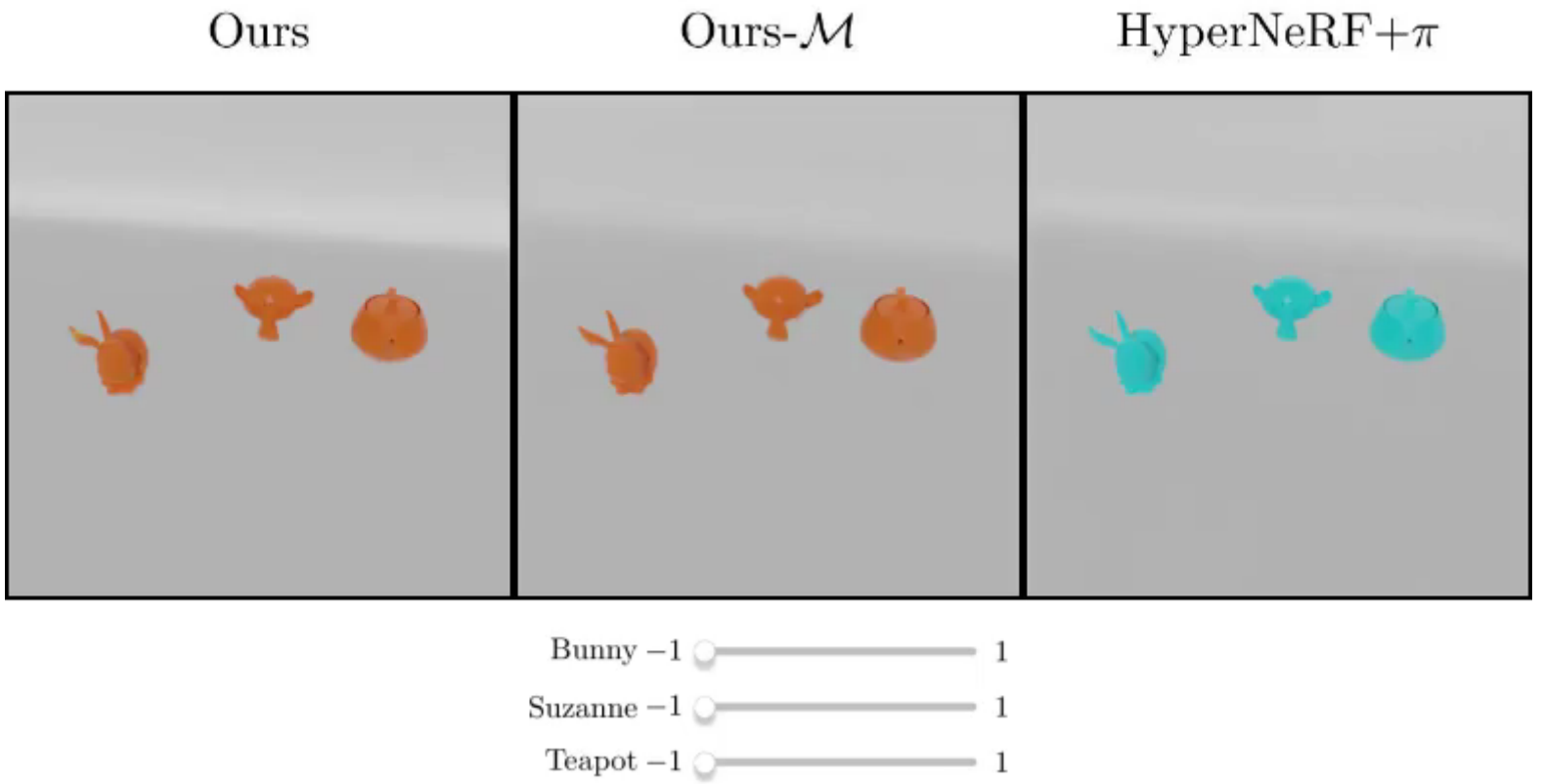
120 BPM

0 BPM

Qualitative results



Qualitative results



Quantitative results

Method	PSNR ↑	MS-SSIM ↑	LPIPS ↓
NeRF	28.795	0.951	0.210
NeRF + Latent [30]	32.653	0.981	0.182
NeRFies [35]	32.274	0.981	0.180
HyperNeRF [36]	32.520	0.981	0.169
Ours-$\mathcal{M}$	32.061	0.979	0.167
Ours	32.342	0.981	0.168

Quantitative results

	Real (interpolation)			Synthetic (novel view & attr.)		
Model	PSNR ↑	MS-SSIM ↑	LPIPS ↓	PSNR ↑	MS-SSIM ↑	LPIPS ↓
Base ($\mathcal{L}_{\text{recon}}$)	32.457	0.981	0.168	24.407	0.718	0.173
$+\mathcal{L}_{\text{enc}}$	32.478	0.982	0.167	27.018	0.871	0.164
$+\mathcal{L}_{\text{enc}} + \mathcal{L}_{\text{attr}}$	32.254	0.981	0.167	27.322	0.873	0.147
$+\mathcal{L}_{\text{enc}} + \mathcal{L}_{\text{attr}} + \mathcal{L}_{\text{mask}}$	32.342	0.981	0.168	**32.394**	**0.972**	**0.139**

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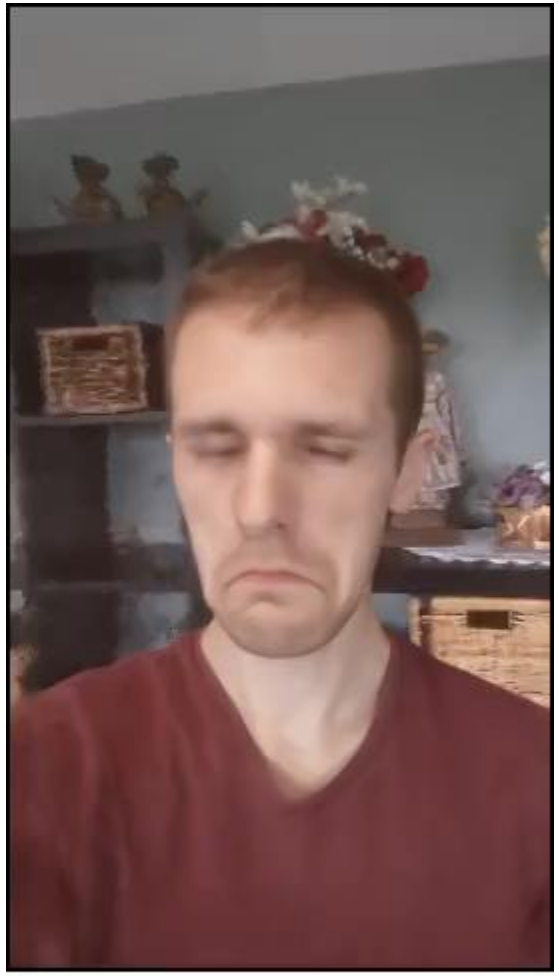
Final remarks



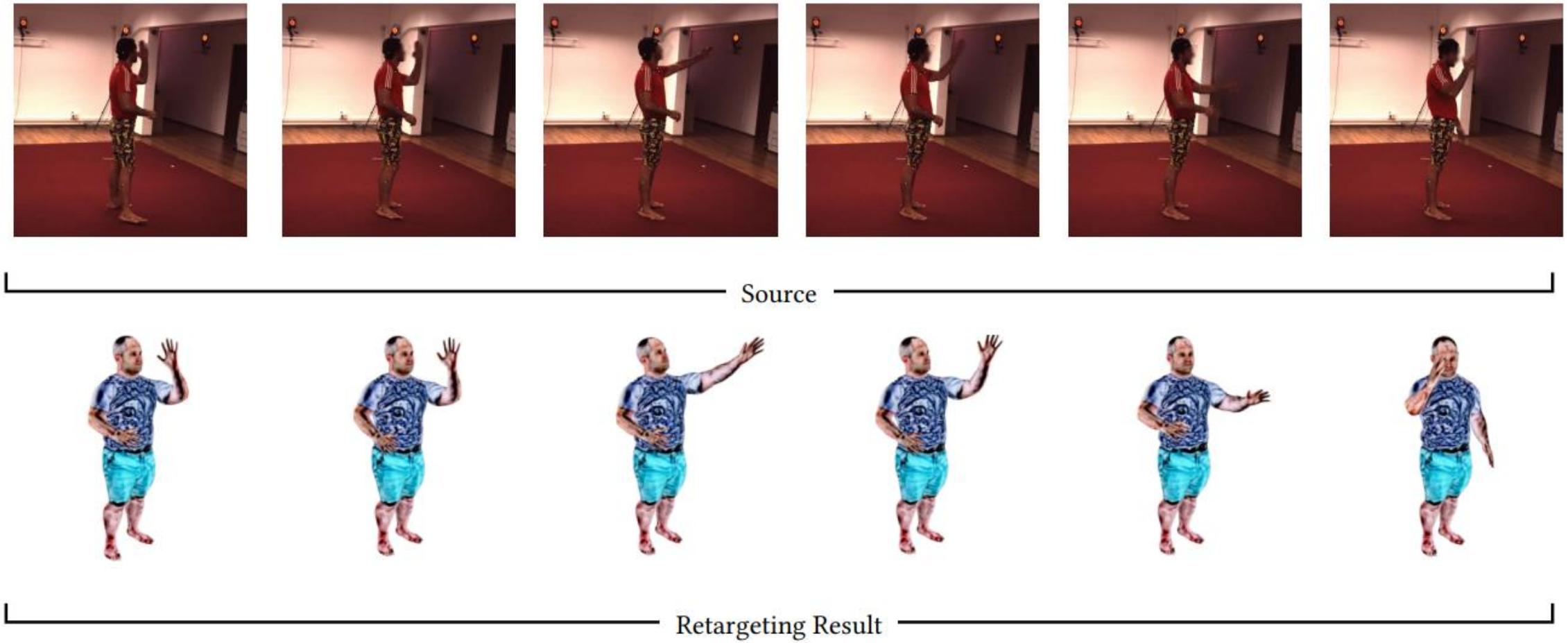
Limitations

Original

0 BPM

40 BPM

Extensions



A-NeRF: Surface-free Human 3D Pose Refinement via Neural Rendering

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