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MAX PLANCK INSTITUTE
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UNIVERSITY OF SCIENCE
AND TECHNOLOGY



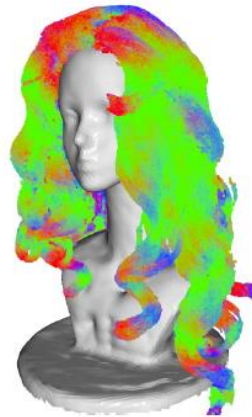
香港城市大學
City University of Hong Kong

MonoHair

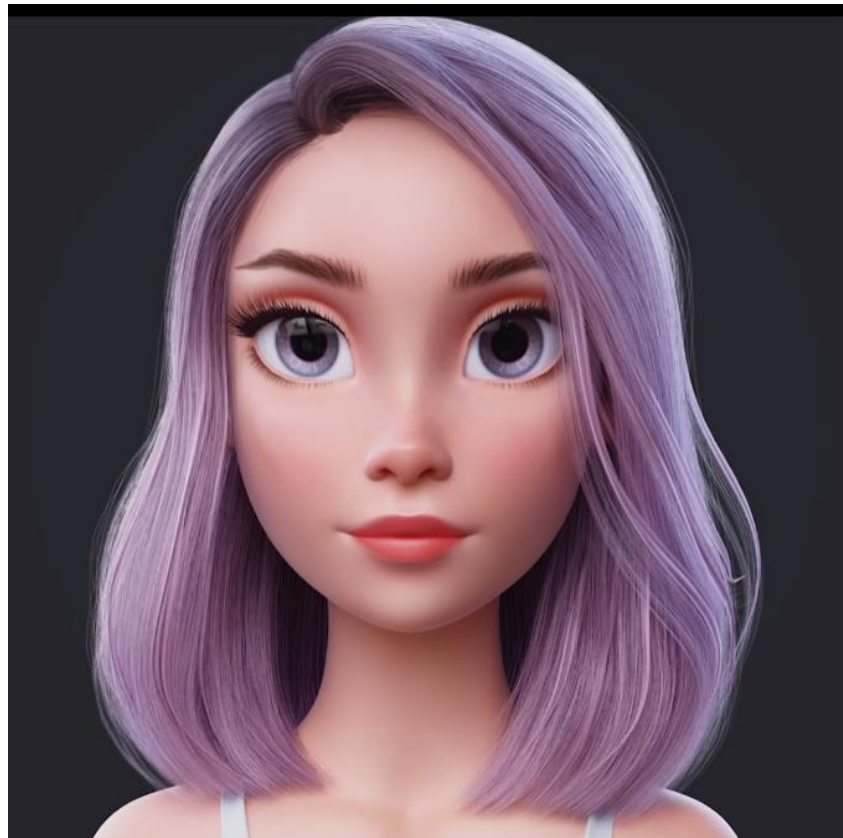
High-Fidelity Hair Modeling from a Monocular Video

Keyu Wu¹ Lingchen Yang² Zhiyi Kuang¹ Yao Feng^{2,4} Xutao Han¹
Yue fan shen¹ Hongbo Fu^{3,5} Kun Zhou¹ Youyi Zheng¹

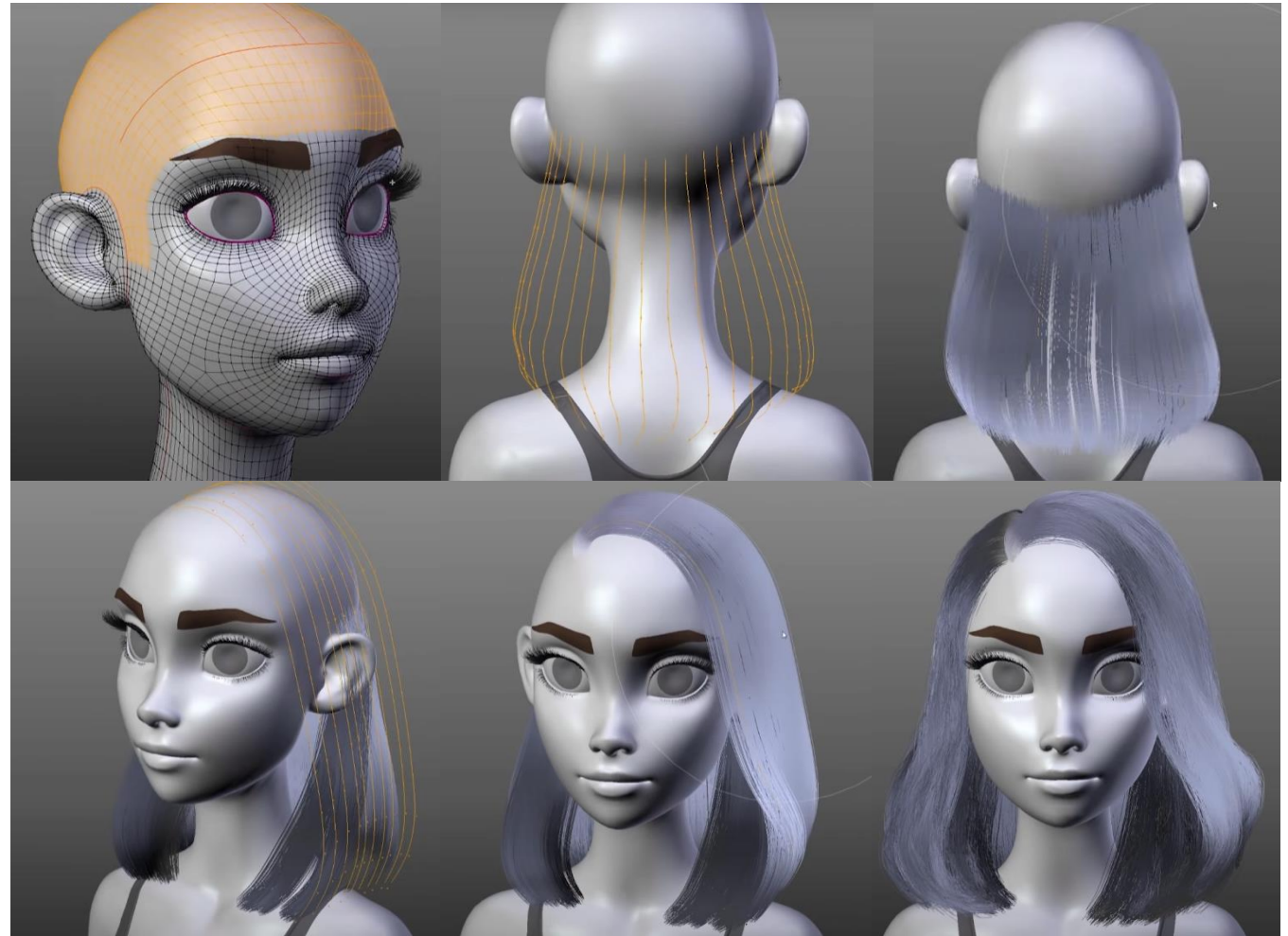
¹ Zhejiang University ² ETH Zurich ³ City University of Hong Kong
⁴ Max Planck Institute for Intelligent Systems
⁵ Hong Kong University of Science and Technology



Introduction



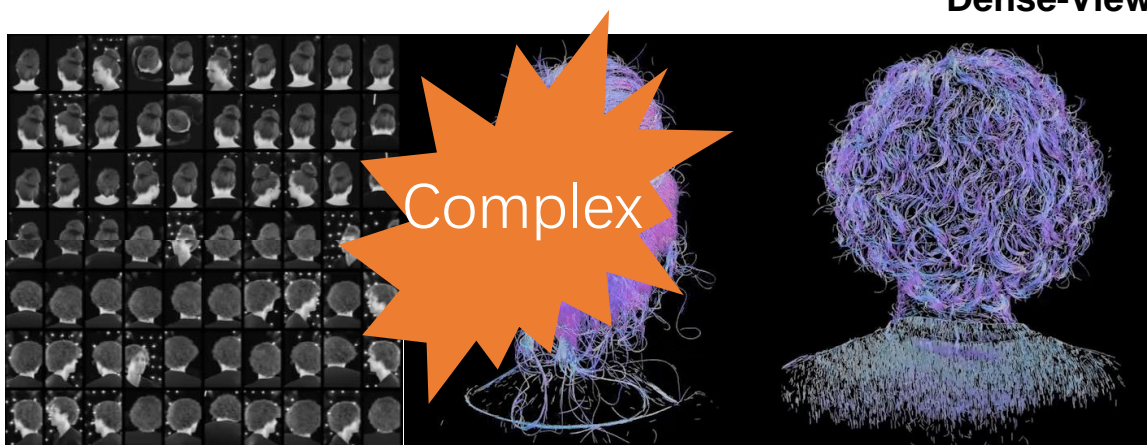
Blender Hair Tutorial



Reference: https://www.youtube.com/watch?v=KpVyTc_72z0

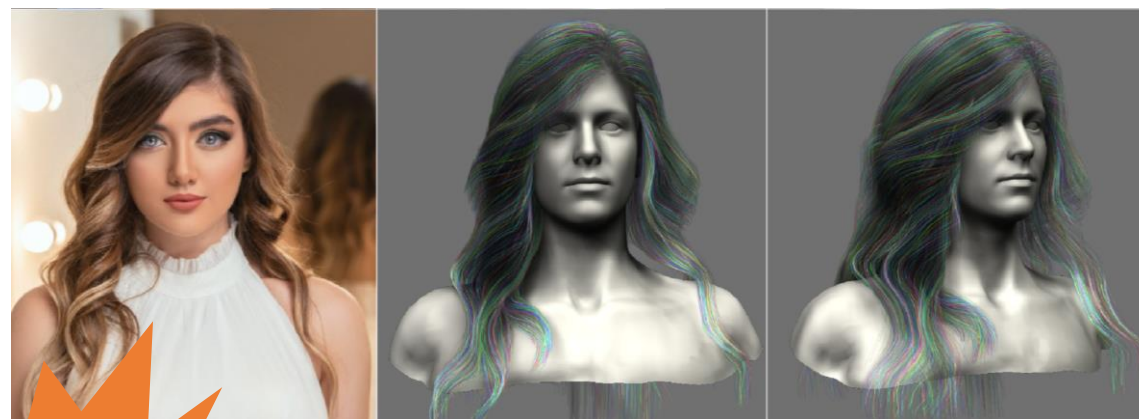
Motivation

Dense-View



Nam et al. Strand-accurate Multi-view Hair Capture. CVPR, 2019

Single-View



alHDHair: Automatic High-fidelity Hair Modeling from a Single Image Using Implicit Models. CVPR, 2022

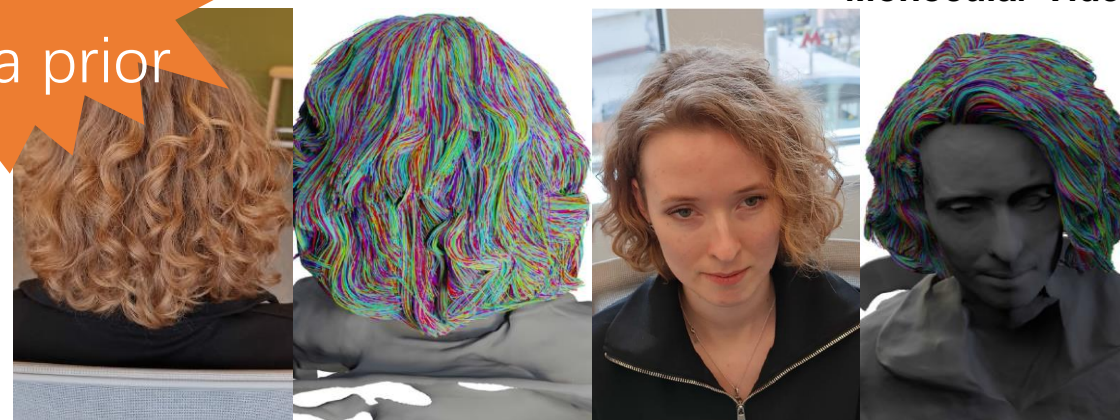
Sparse-View



Kuang et al. DeepMVSHair: Deep Hair Modeling from Sparse Views. ACM SIGGRAPH Asia, 2022

Over-rely
data prior

Monocular Video



Vanessa et al. Neural Haircut: Prior-Guided Strand-Based Hair Reconstruction ICCV, 2023

Video Capture

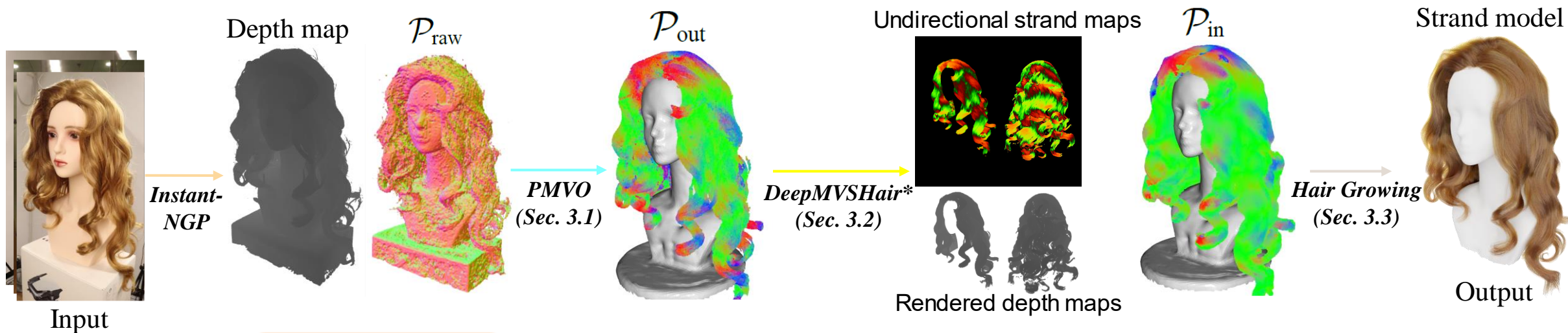


Results Preview



- Robust
- Realistic
- High-Fidelity
- Complex

Pipeline



Monocular video preprocessing

Initialization

Employ Instant-NGP & render a depth map for each view

PMVO

Filter out the noise of \mathcal{P}_{raw} & optimize the 3D direction for each 3D point

DeepMVSHair*

Render an undirectional strand map & a depth map with 16 fixed views

Infer an inner structure

Hair Growing

Generate strands & connect to scalp & remove ambiguity

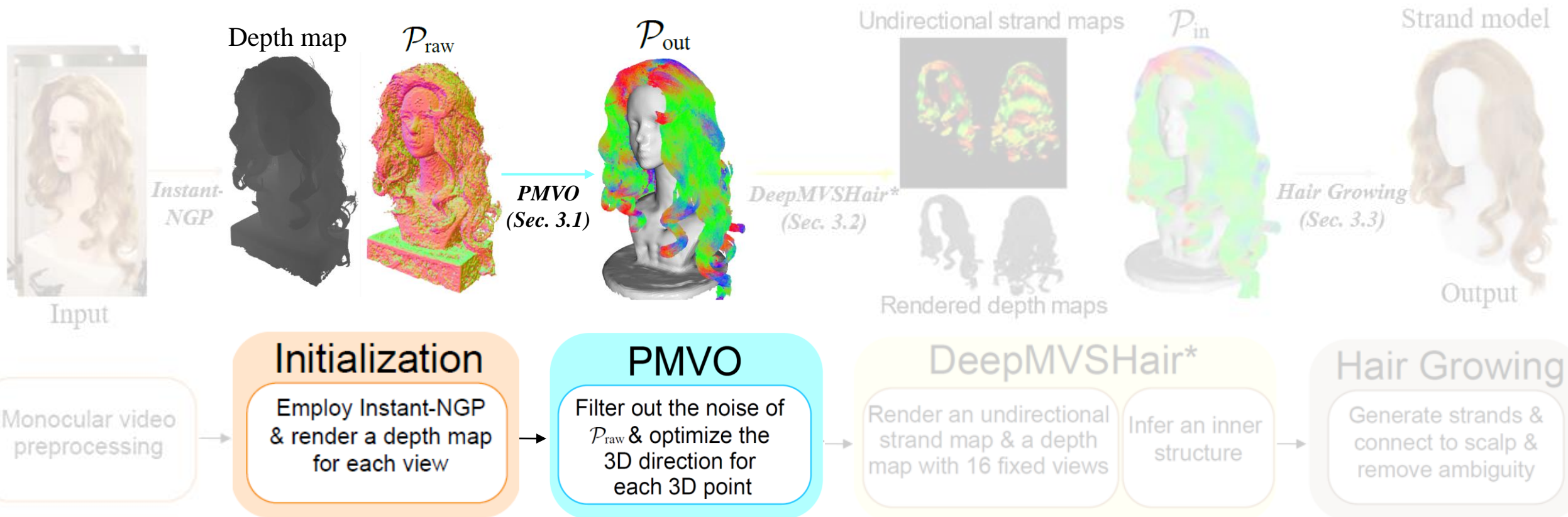


Initialization
Employ Instant-NGP
& render a depth map
for each view

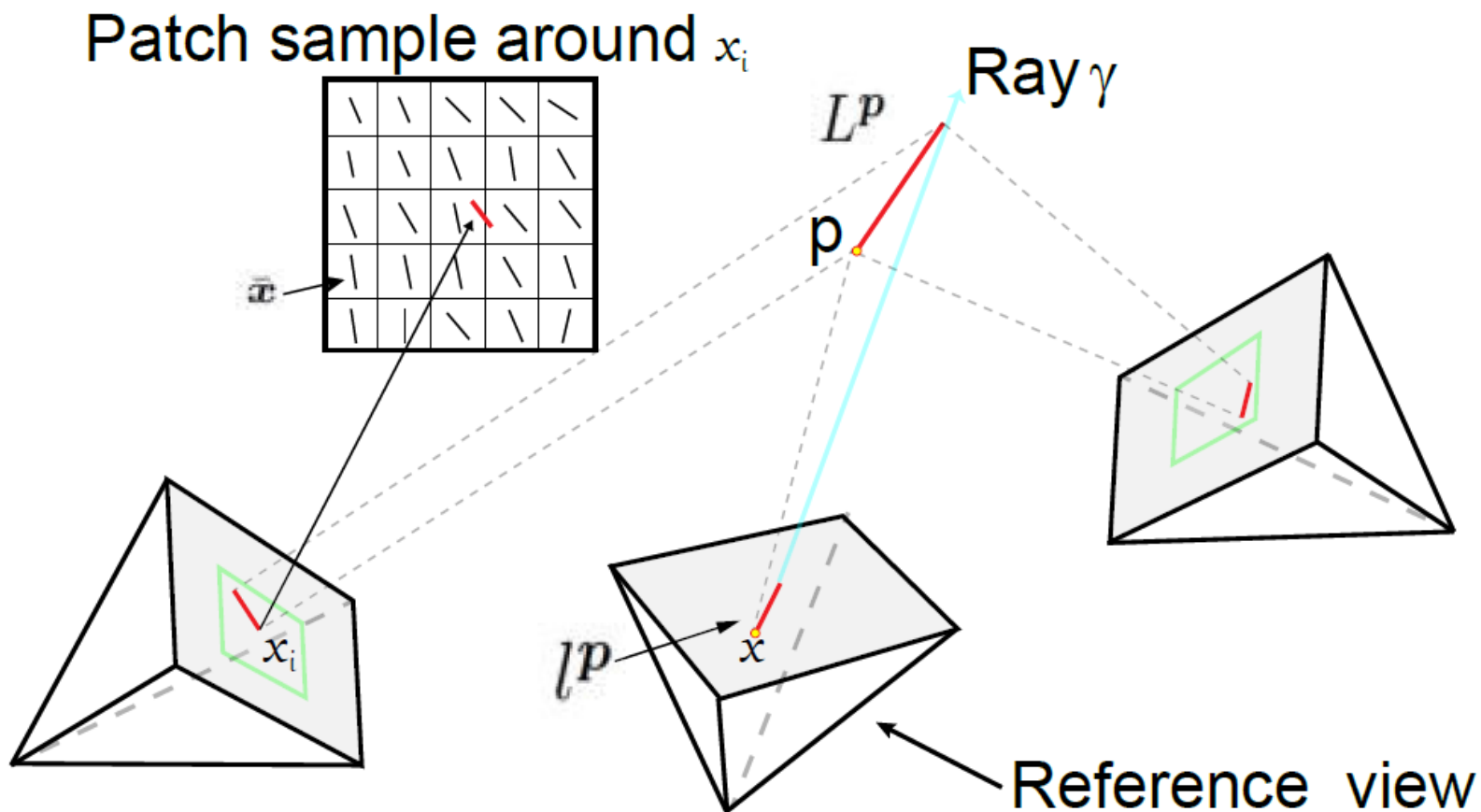
Noisy &
Not strand



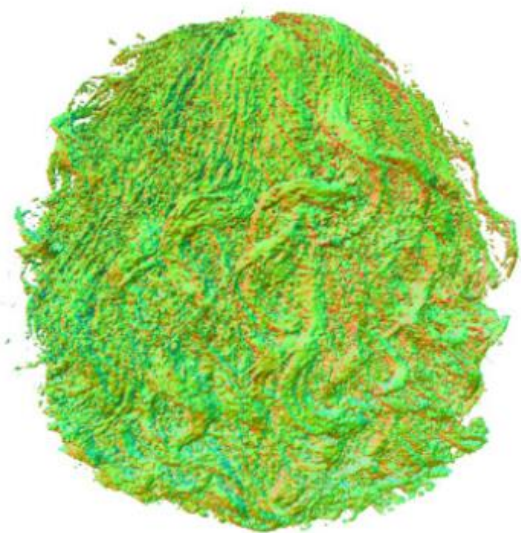
Pipeline



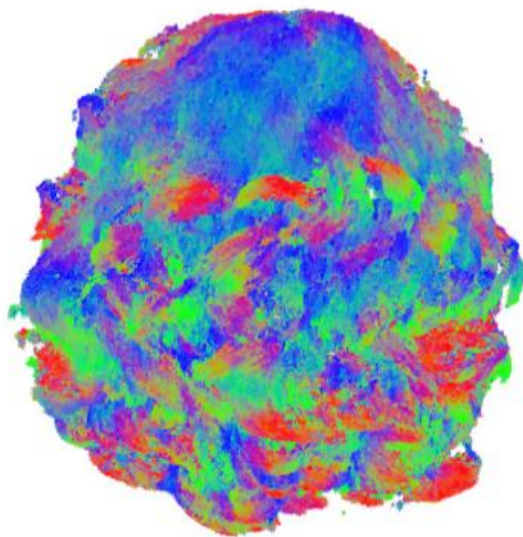
Patch-based Multi-view Optimization (PMVO)



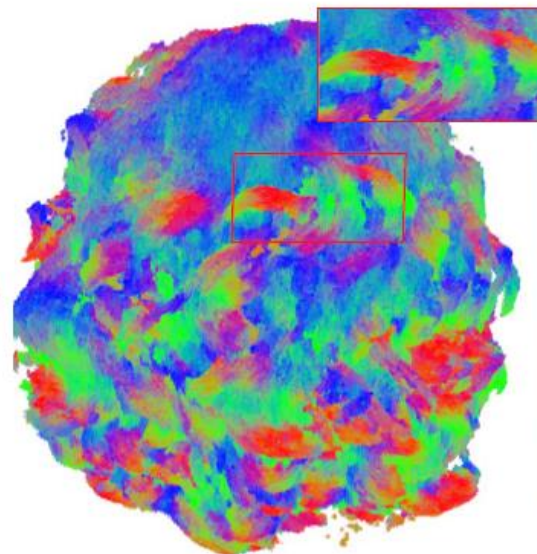
Patch-based Multi-view Optimization (PMVO)



(a) Raw point cloud



(b) Line map



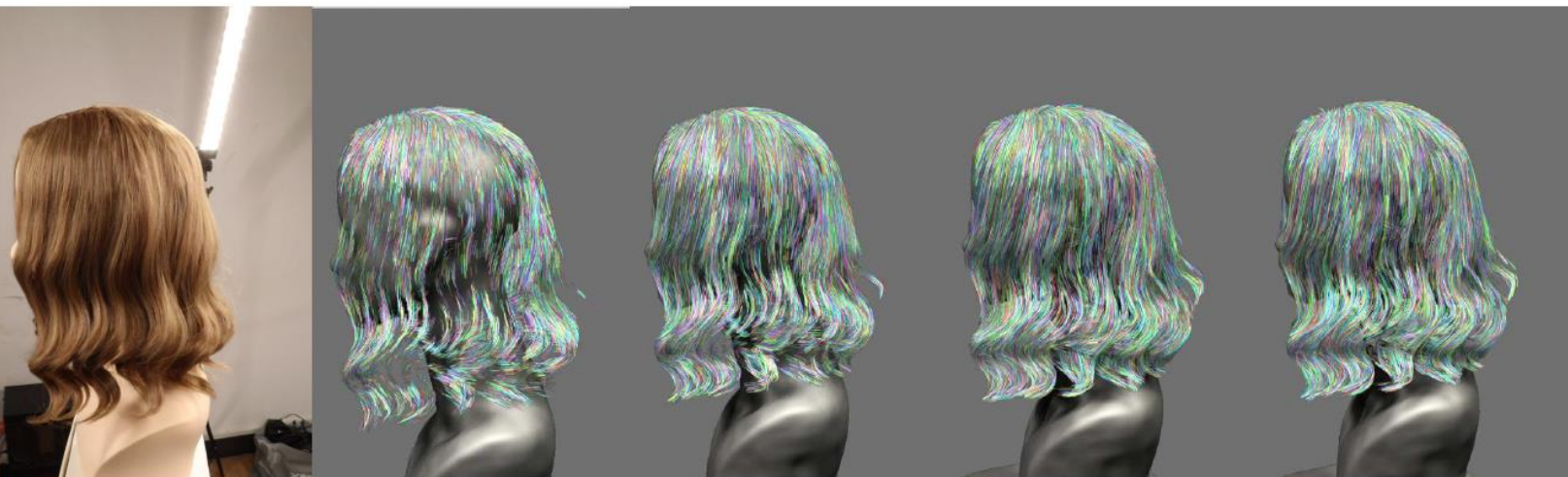
(c) Refined line map



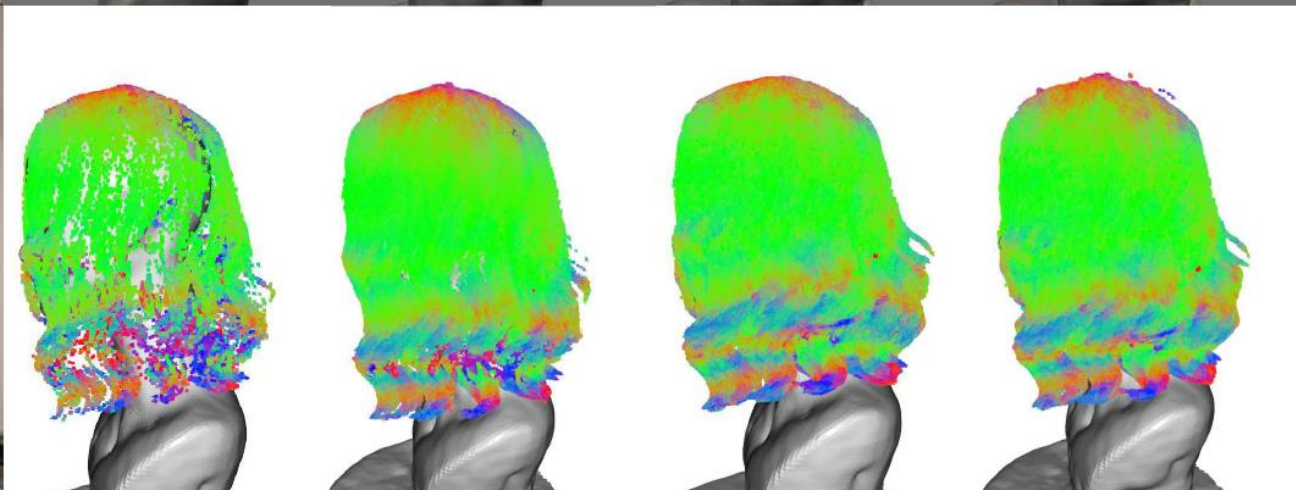
(d) Image

Patch-based Multi-view Optimization (PMVO)

Performance with different path size



Patch size	1	3	5	7
Time	~30min	~ 90min	3h-4h	6h-8h



Image

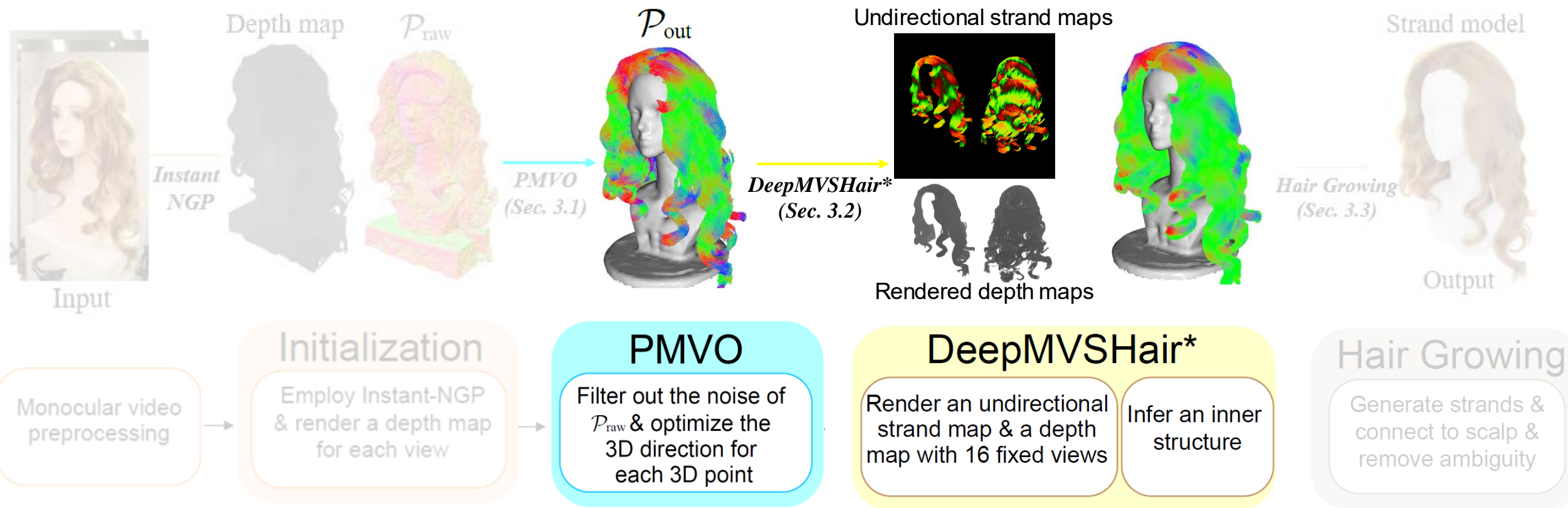
Pacth size 1

Pacth size 3

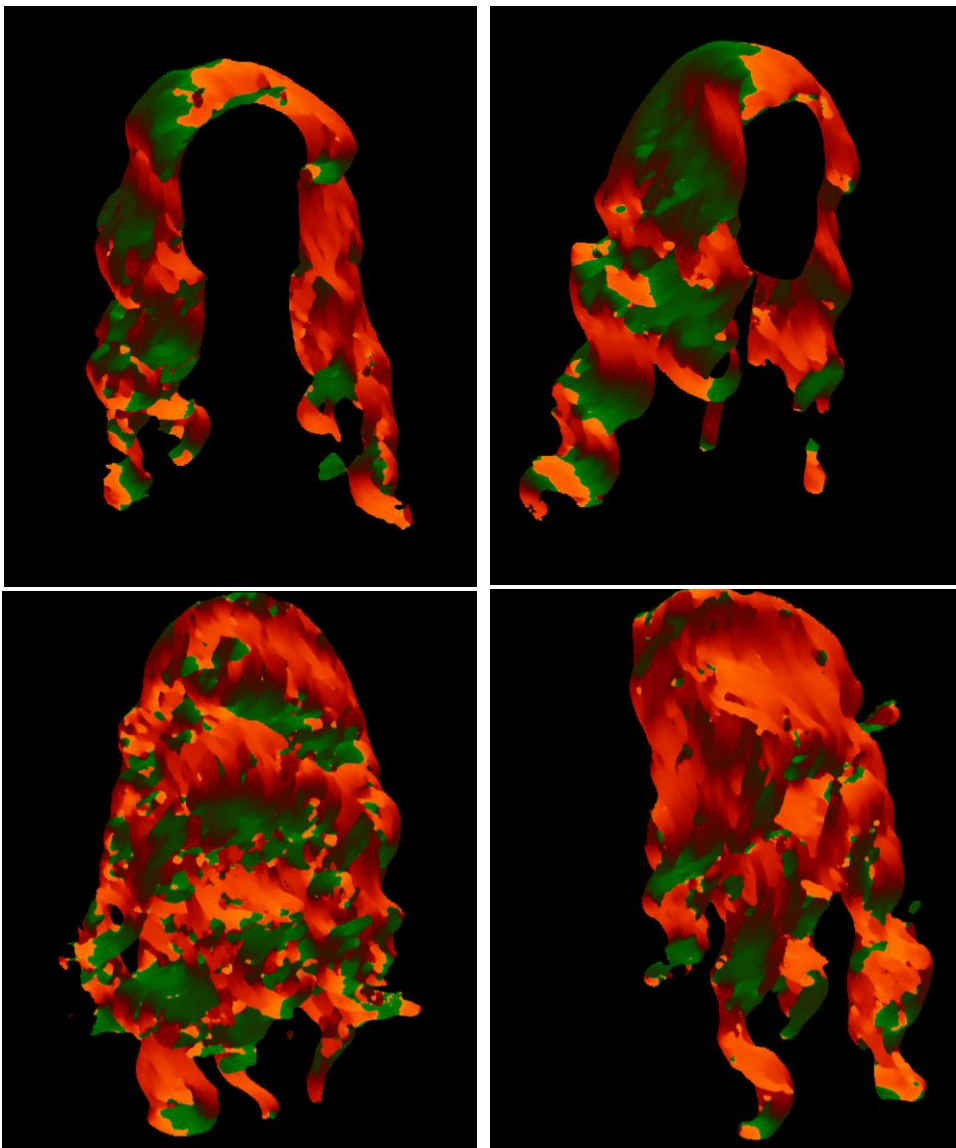
Pacth size 5

Pacth size 7

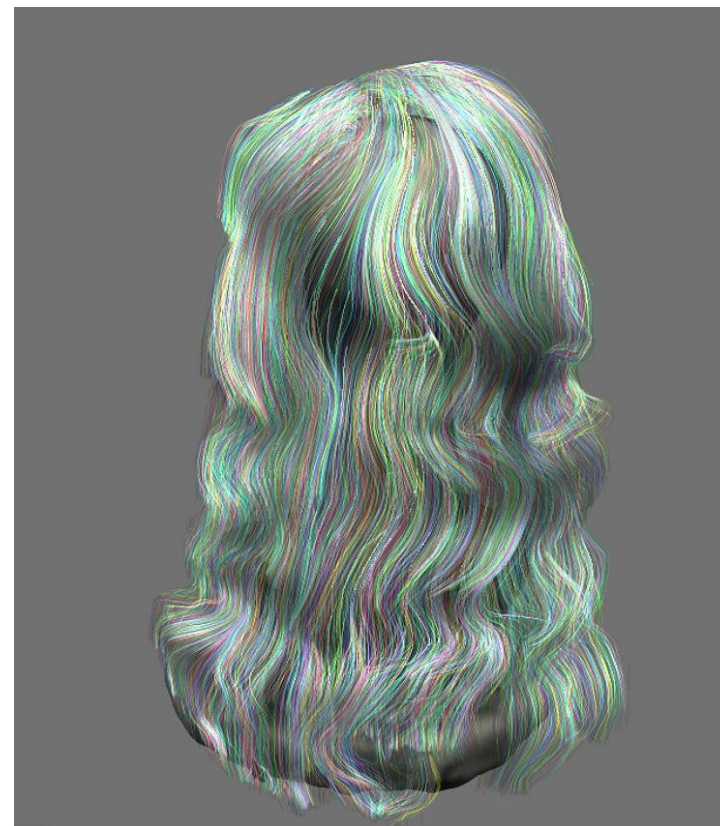
Pipeline



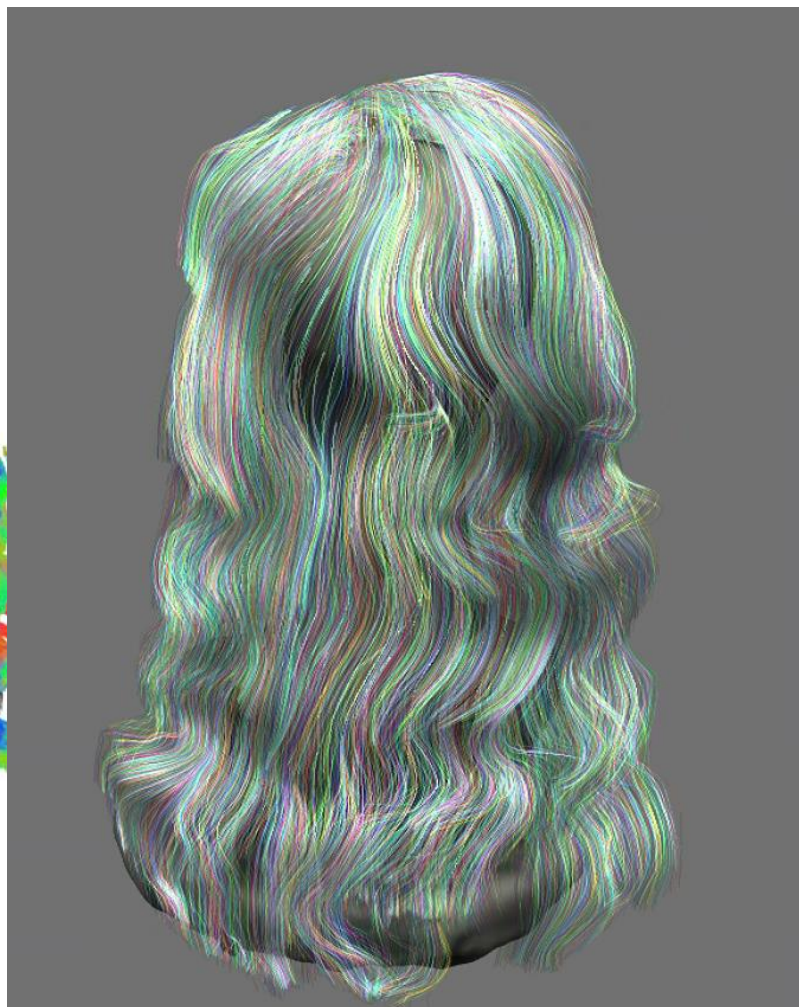
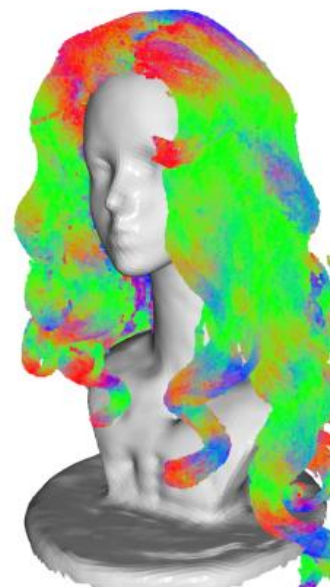
Inner Inference



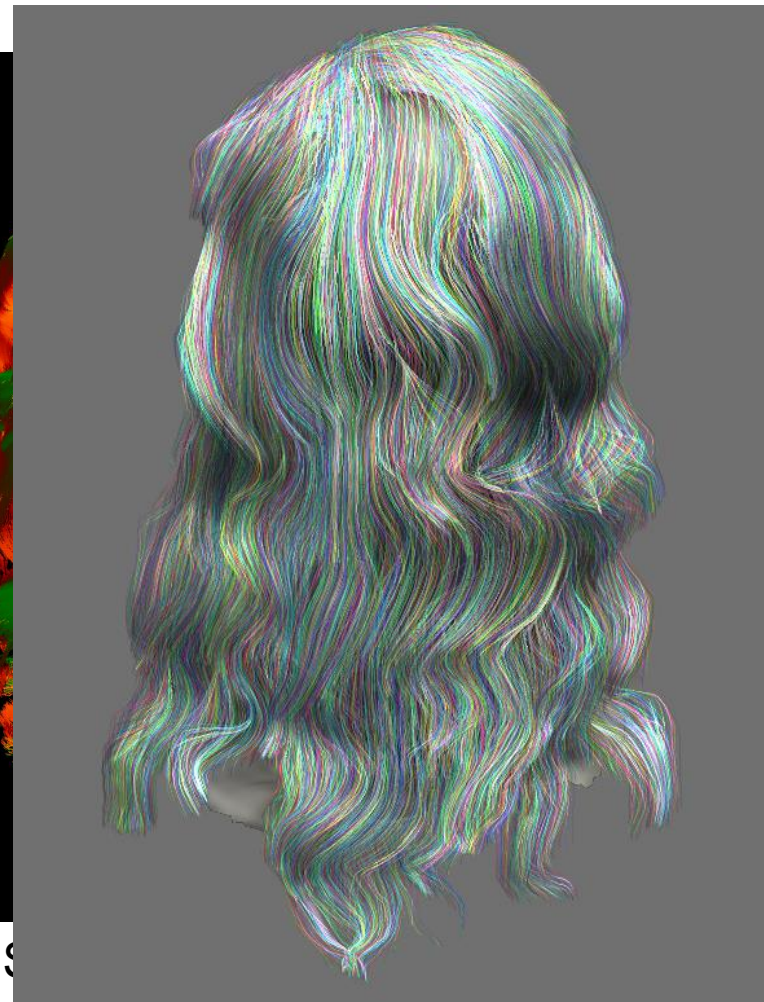
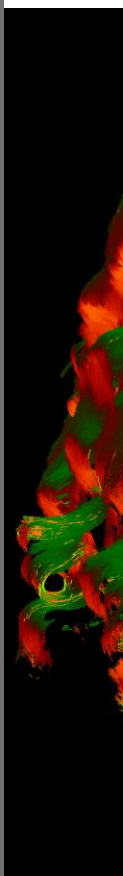
DeepMVSHair



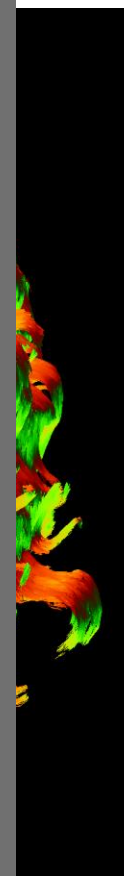
Inner Inference



DeepMVSHair

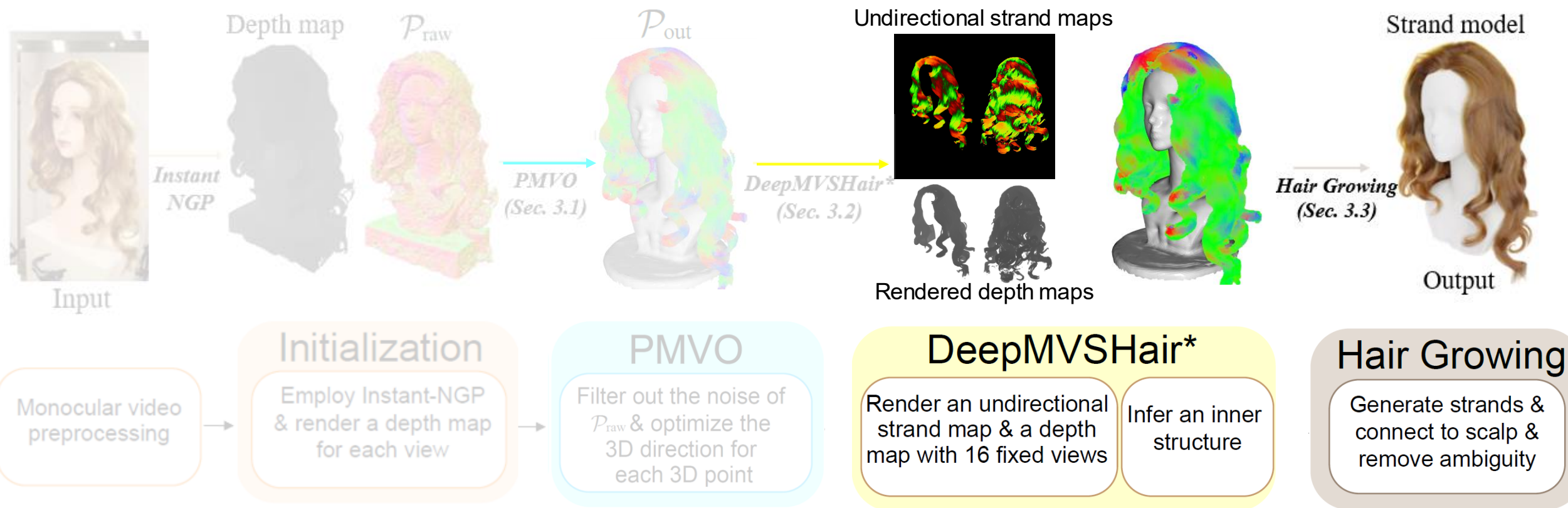


DeepMVSHair*

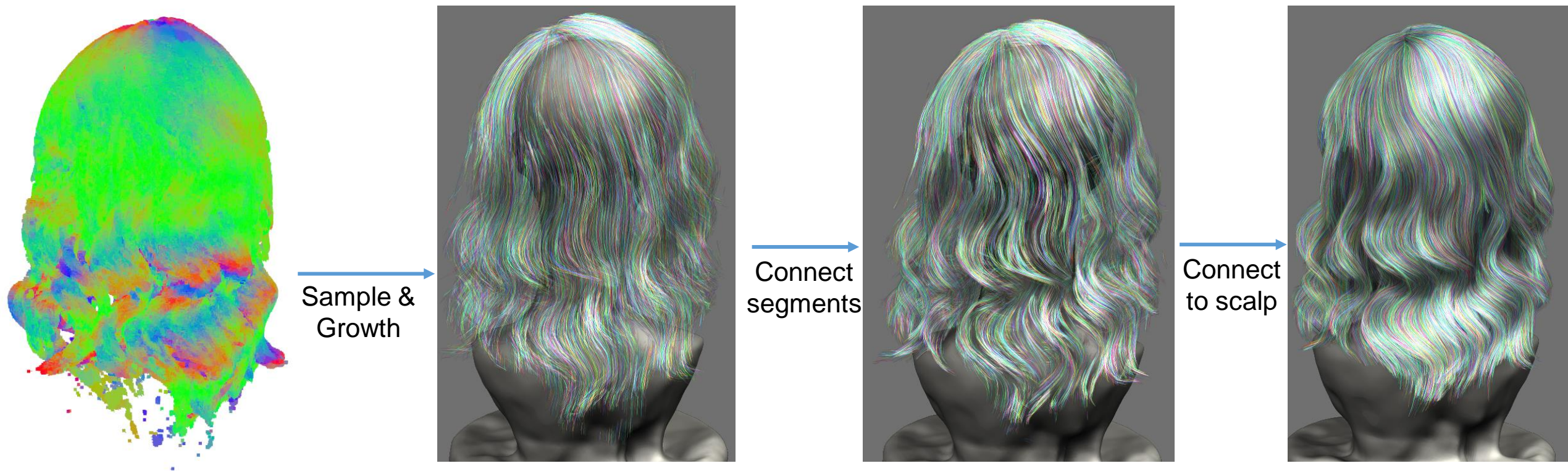


nd map

Pipeline



Hair Growing



Results

