TRAVERSE RESEARCH

Machine Learning-Enhanced Graphics: an overview

NEXT SLIDE

MACHINE LEARNING-ENHANCED GRAPHICS:
AN OVERVIEW

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TRAVERSE RESEARCH

GOAL

01 Photorealistic graphics

02 High resolution

03 High refresh rate

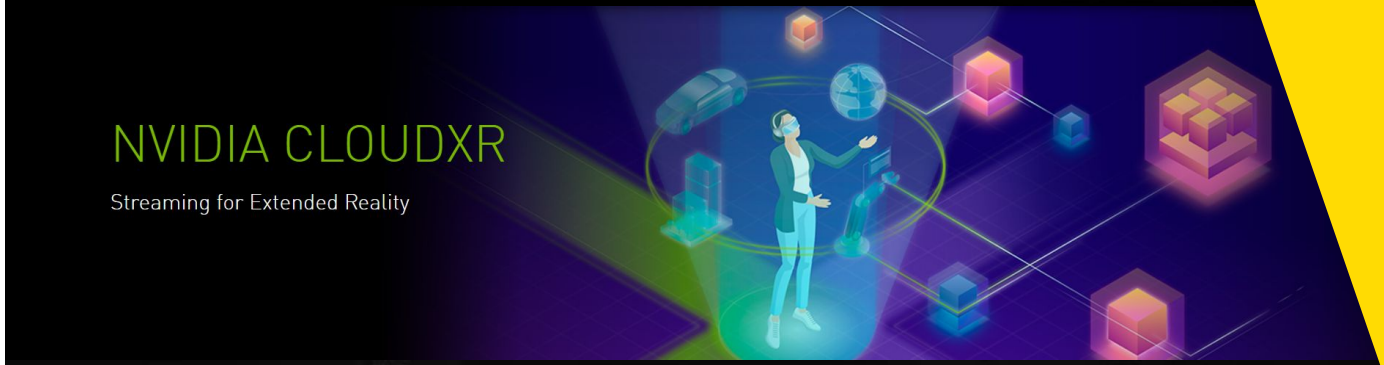
04 Scalable to a variety of devices

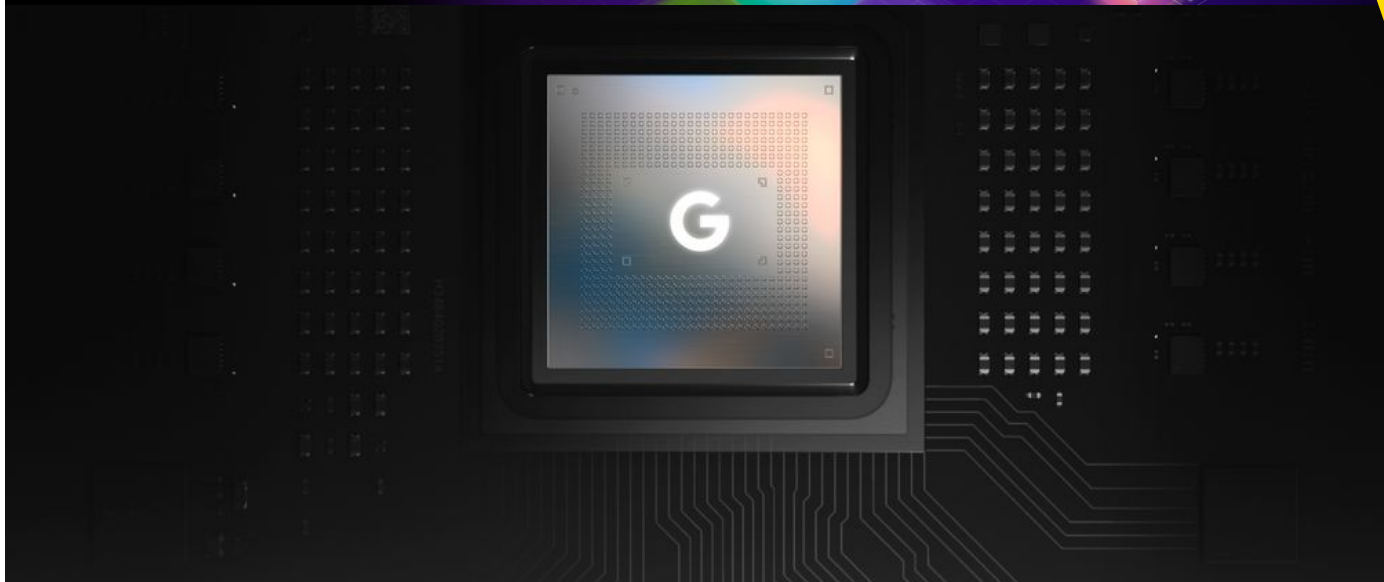
HARDWARE SOLUTIONS

01 Specialized hardware for graphics
- Nvidia RT cores

02 Cloud solution
- Nvidia CLOUD XR

03 Specialized hardware for Machine Learning
- Nvidia Tensor Cores
- Google Tensor





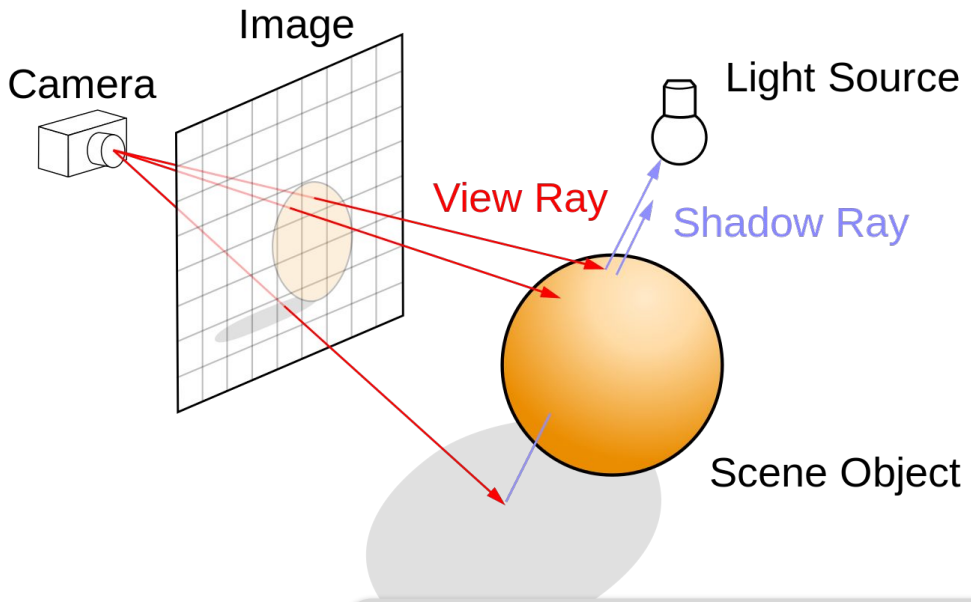
NEURAL NETWORKS

01 Black box

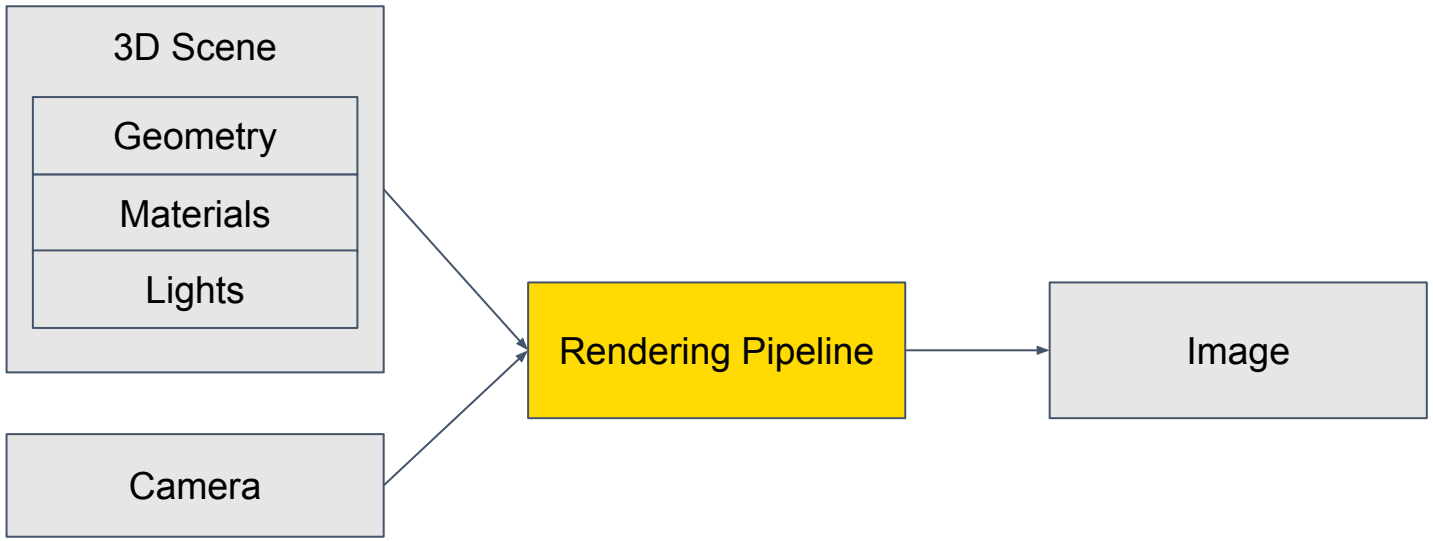
02 Fixed size

03 Fixed compute

RENDERING PIPELINE



Ray Tracing
https://en.wikipedia.org/wiki/Ray_tracing_(graphics)

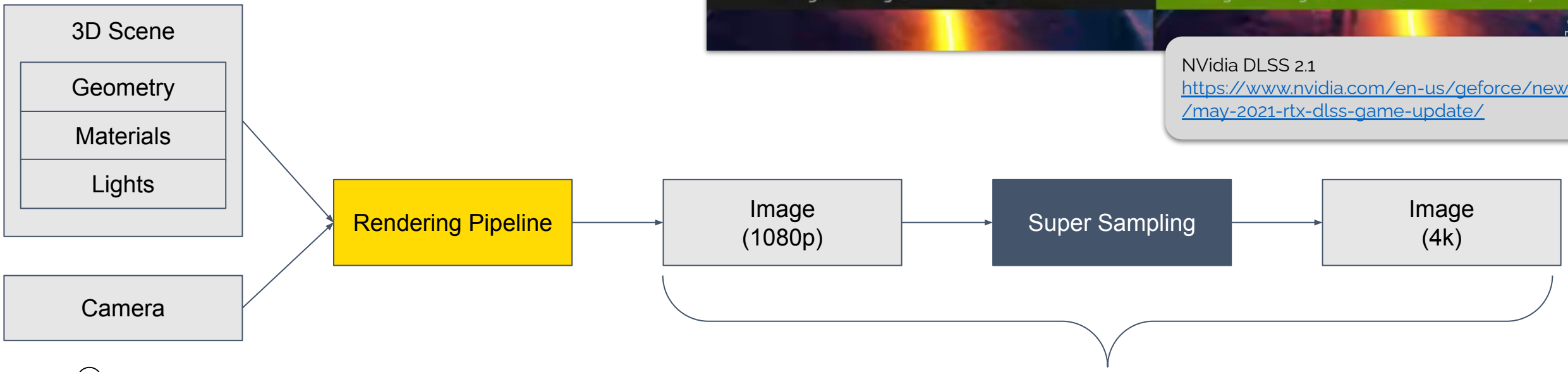


SUPER SAMPLING

01 Render at lower resolution = higher frame rate

02 Neural Network increases the resolution

NVidia DLSS 2.1
https://www.nvidia.com/en-us/geforce/news/may-2021-rtx-dlss-game-update/



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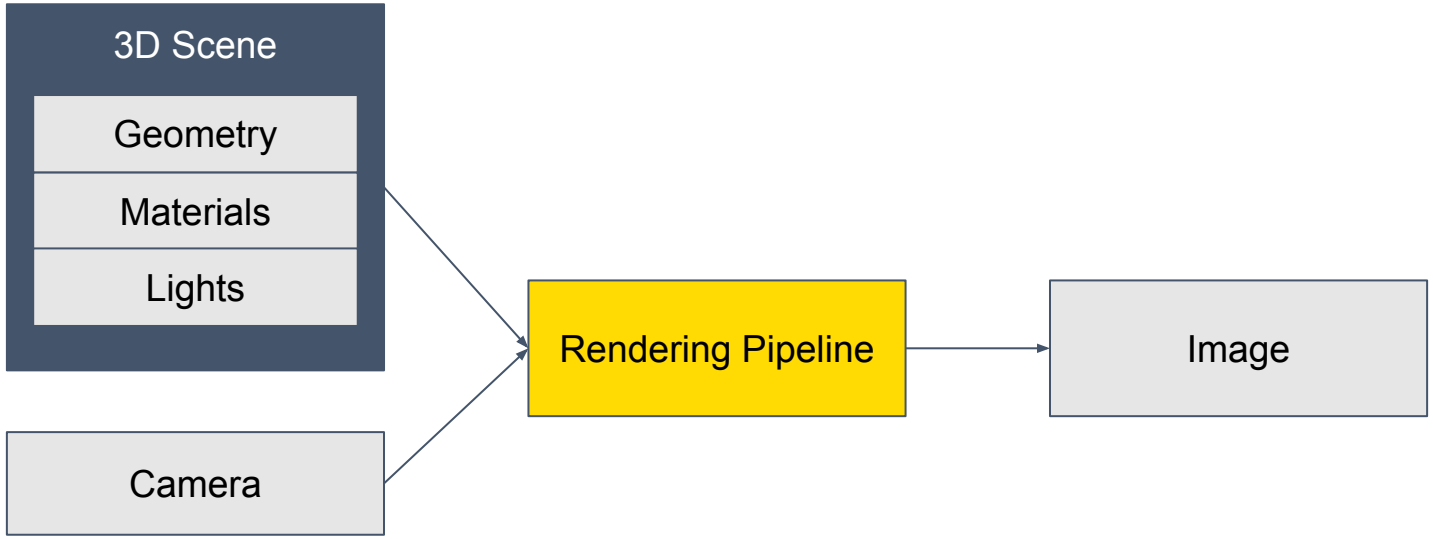
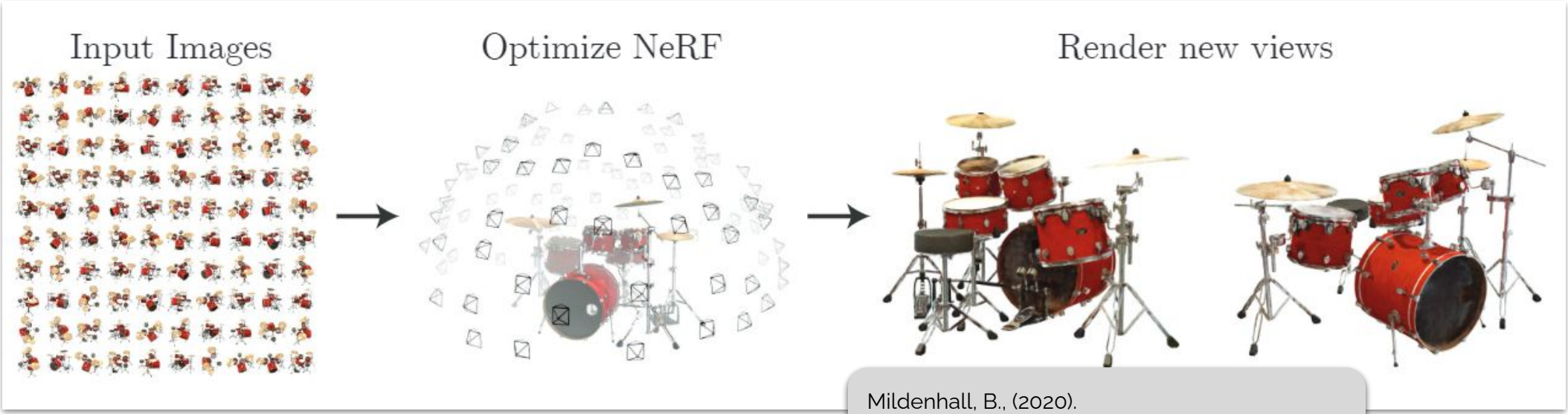
NEURAL SCENE



01 inverse graphics: 3D scene from an image

02 Novel view synthesis: given multiple images create a 3D scene

03 NeRF

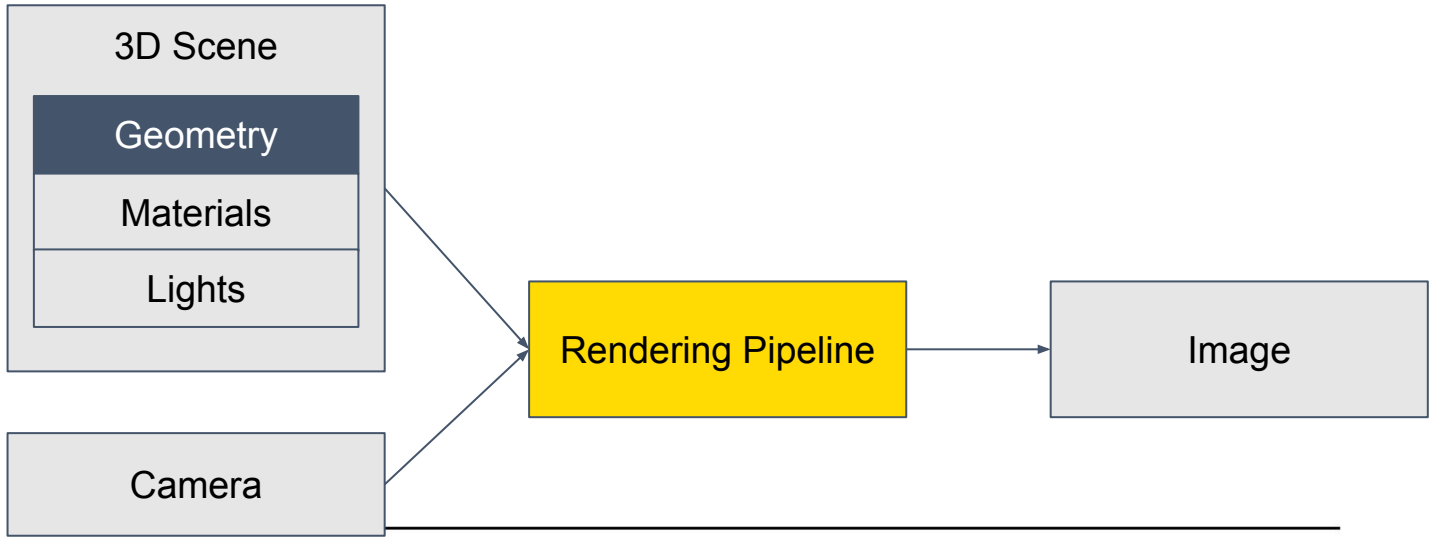


Mildenhall, B., (2020).
NeRF: Representing scenes as neural radiance fields for view synthesis.

NEURAL GEOMETRY

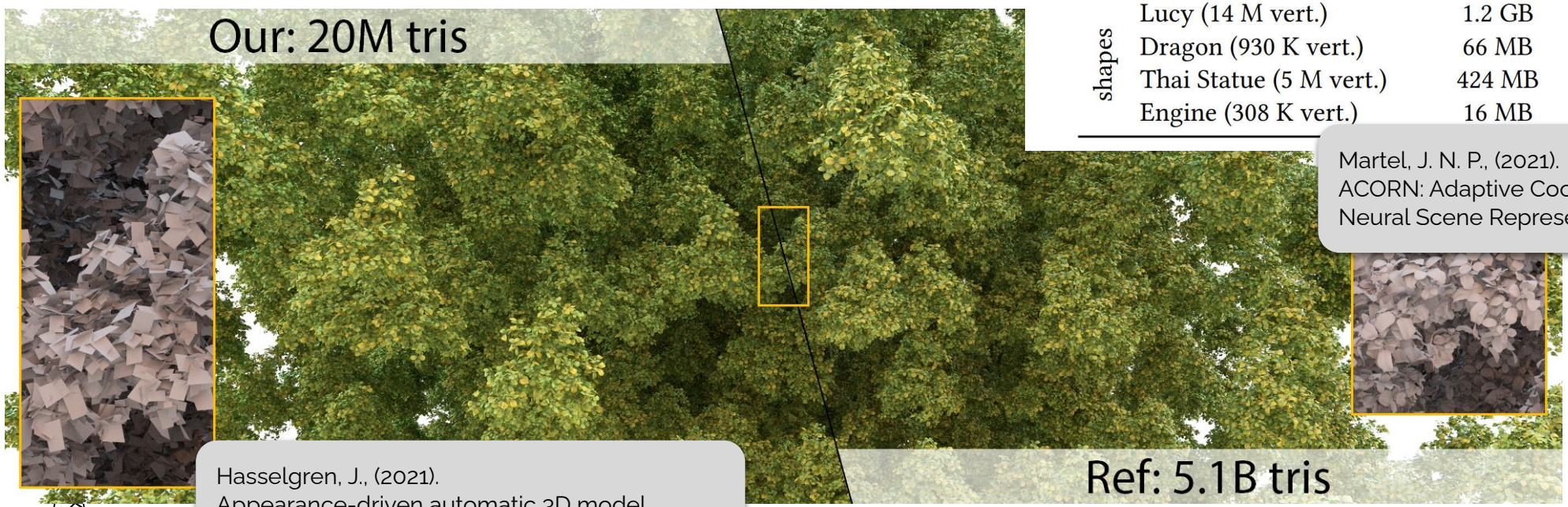
01 ACORN:
compress signal with neural network

02 autoLOD
reduces the amount of triangles



		Uncompressed	Compressed	ACORN
img.	Pluto (8192×8192)	n/a	192 MB	38 MB
	Tokyo (19456×51200)	2.8 GB	169 MB	670 MB
shapes	Lucy (14 M vert.)	1.2 GB	380 MB	68 MB
	Dragon (930 K vert.)	66 MB	27 MB	68 MB
	Thai Statue (5 M vert.)	424 MB	126 MB	68 MB
	Engine (308 K vert.)	16 MB	4.4 MB	68 MB

Martel, J. N. P., (2021).
ACORN: Adaptive Coordinate Networks for Neural Scene Representation.



Hasselgren, J., (2021).
Appearance-driven automatic 3D model simplification.

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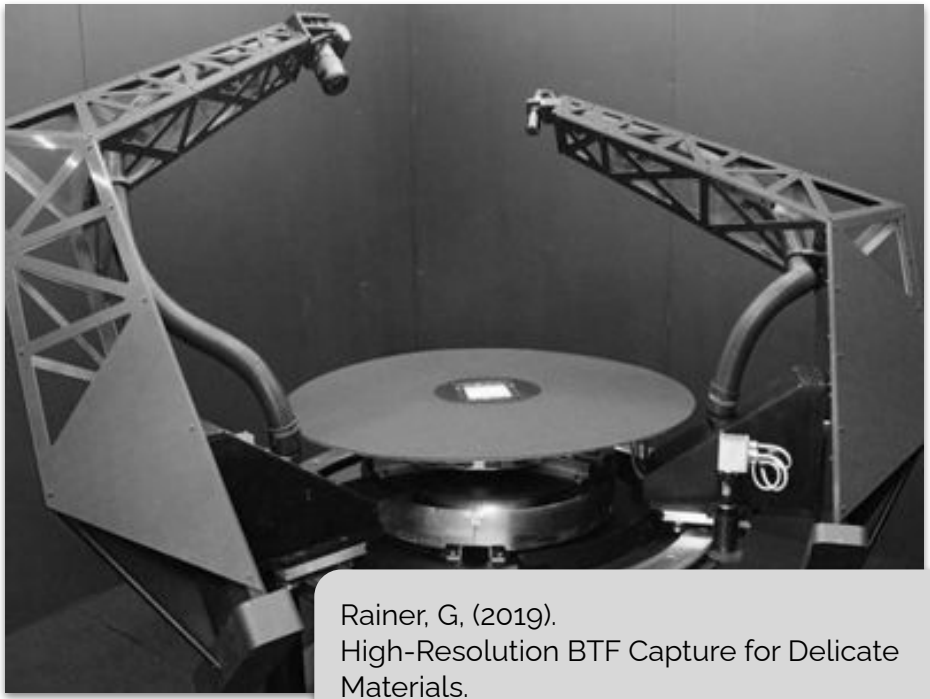
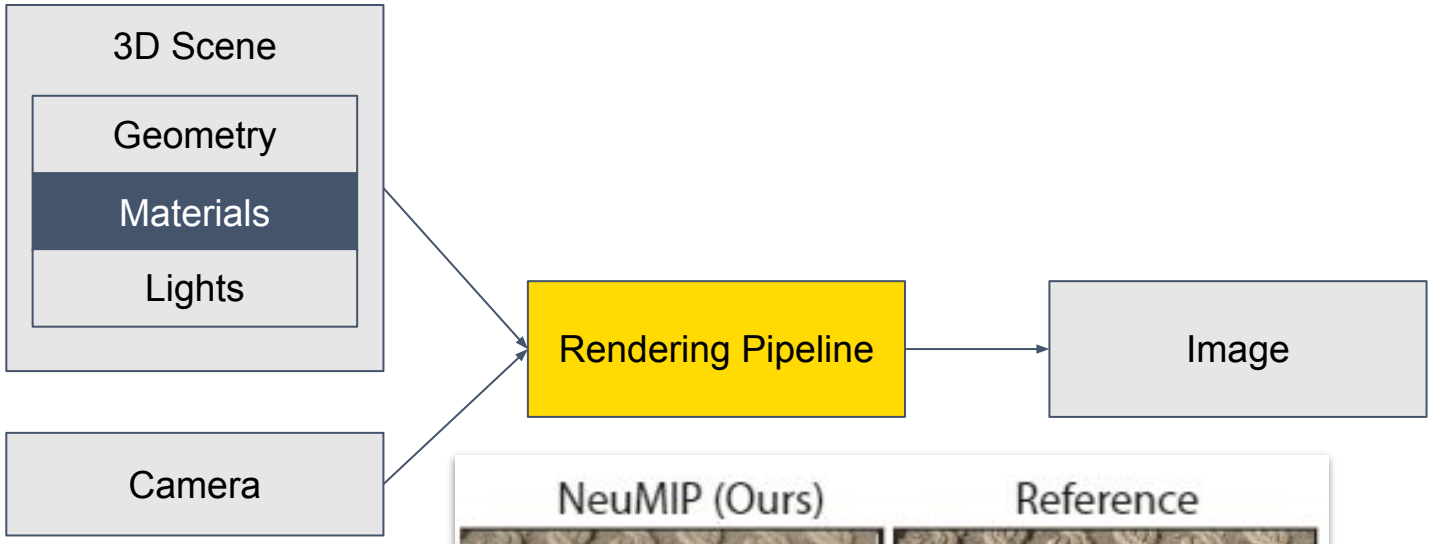
NEURAL MATERIALS

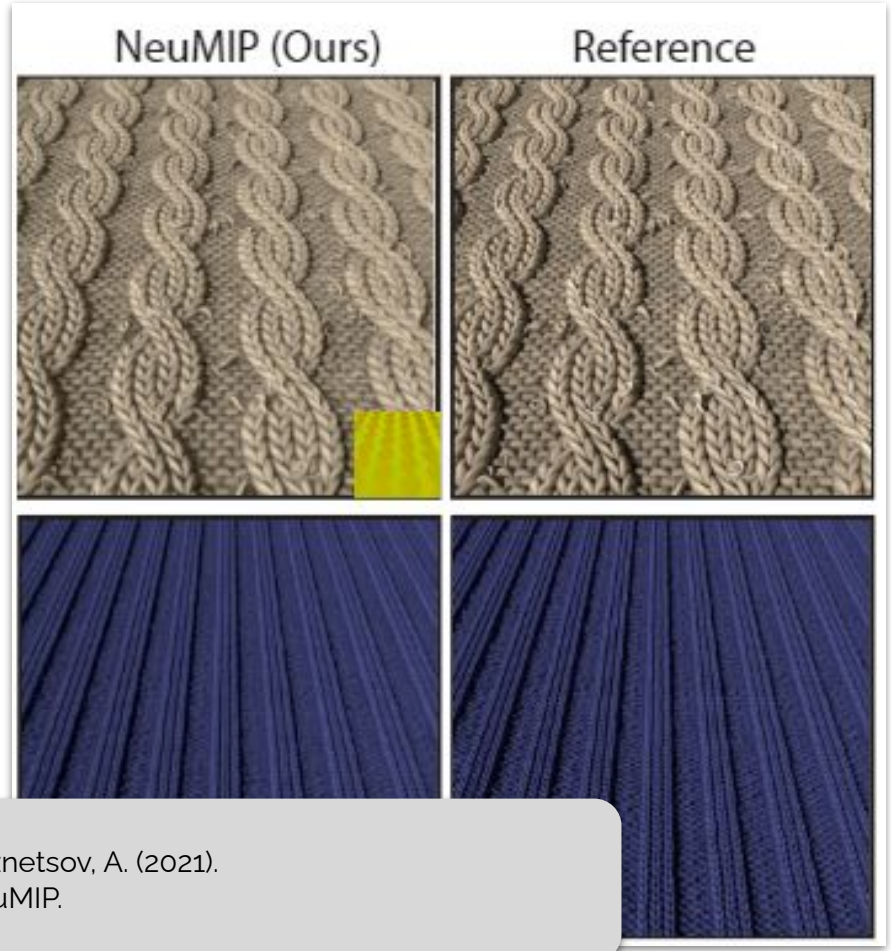
01 BTF: real-life captures

02 Neumip: Neural network material



Rainer, G, (2019).
High-Resolution BTF Capture for Delicate Materials.





Kuznetsov, A. (2021).
NeuMIP.

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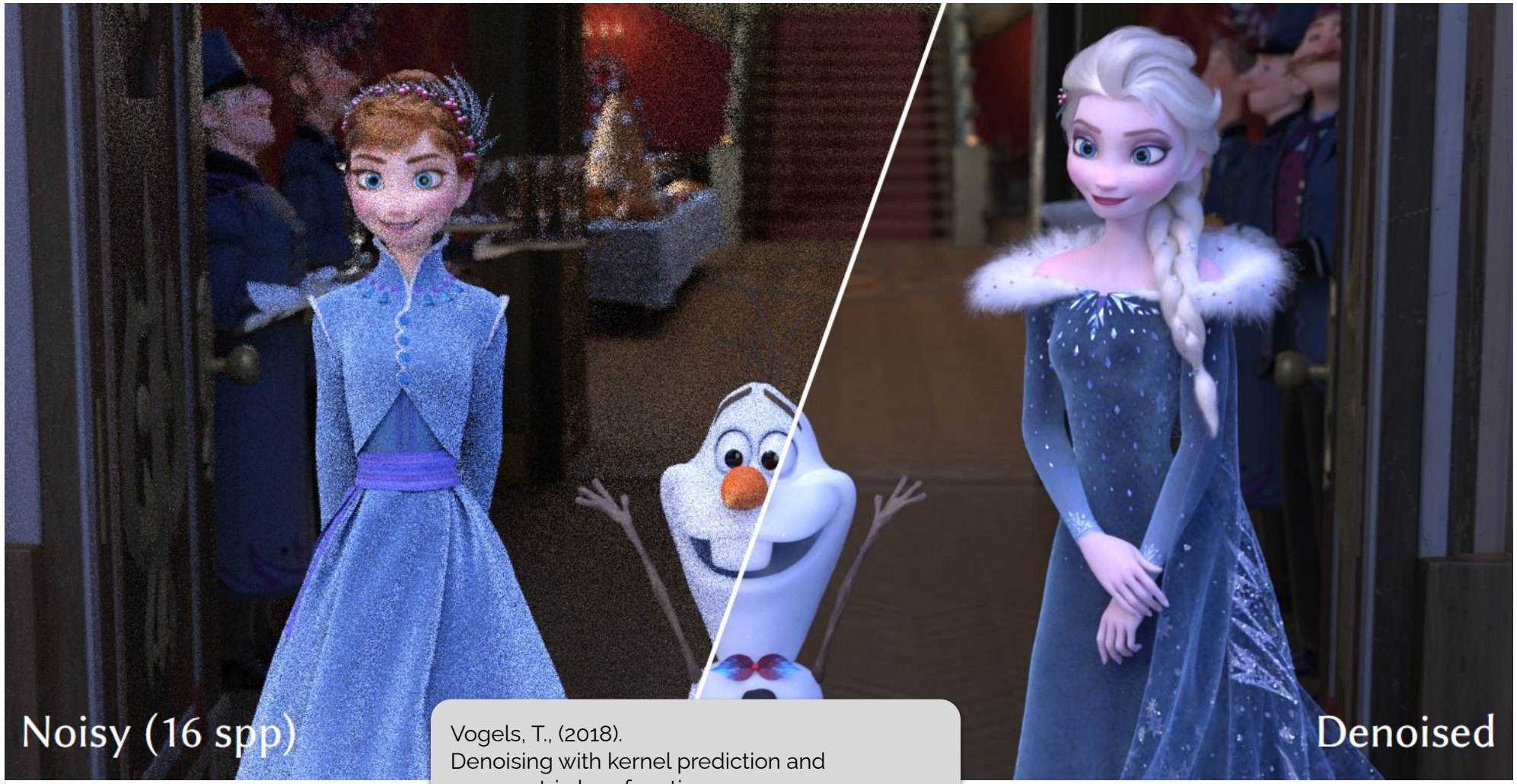
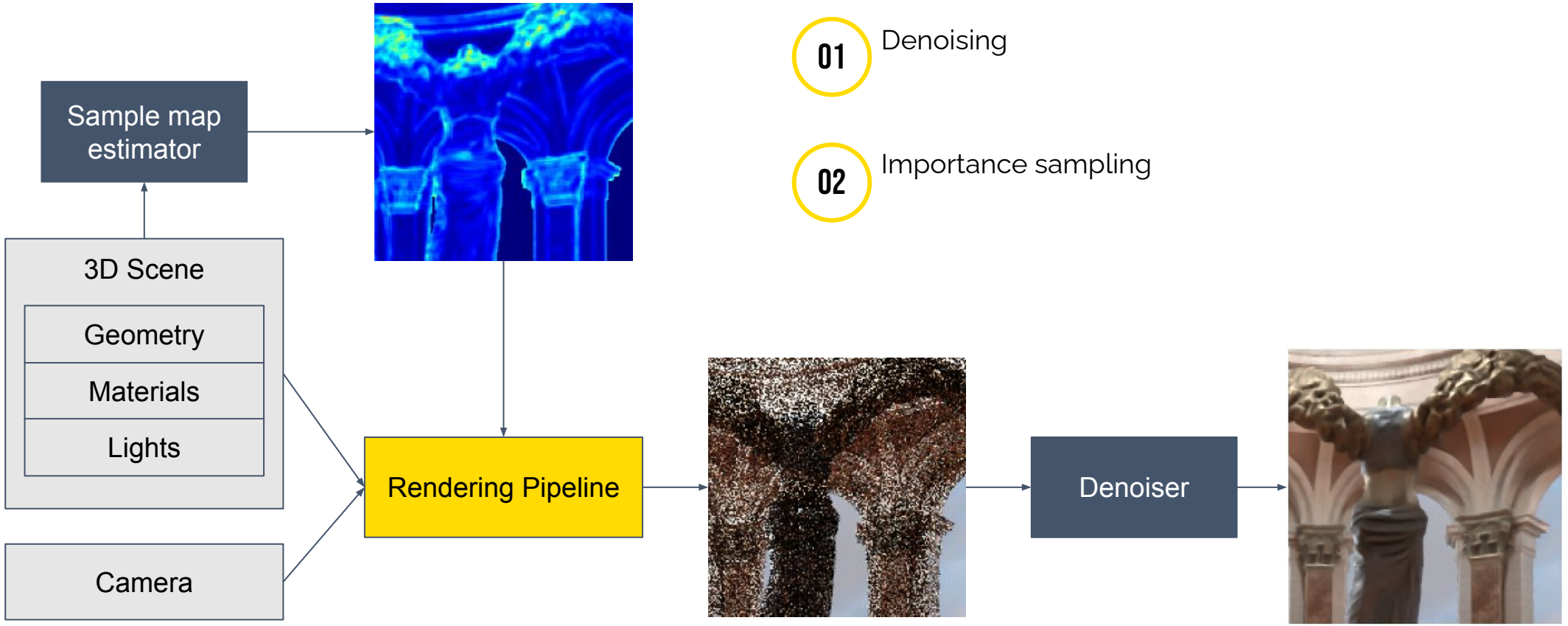
PRODUCTION RENDERING



Vogels, T., (2018).
Denoising with kernel prediction and asymmetric loss functions.

PRODUCTION RENDERING



01 Denoising

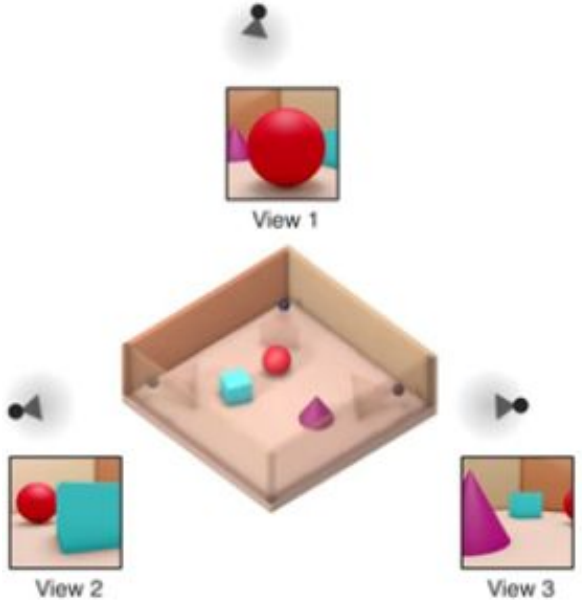
02 Importance sampling

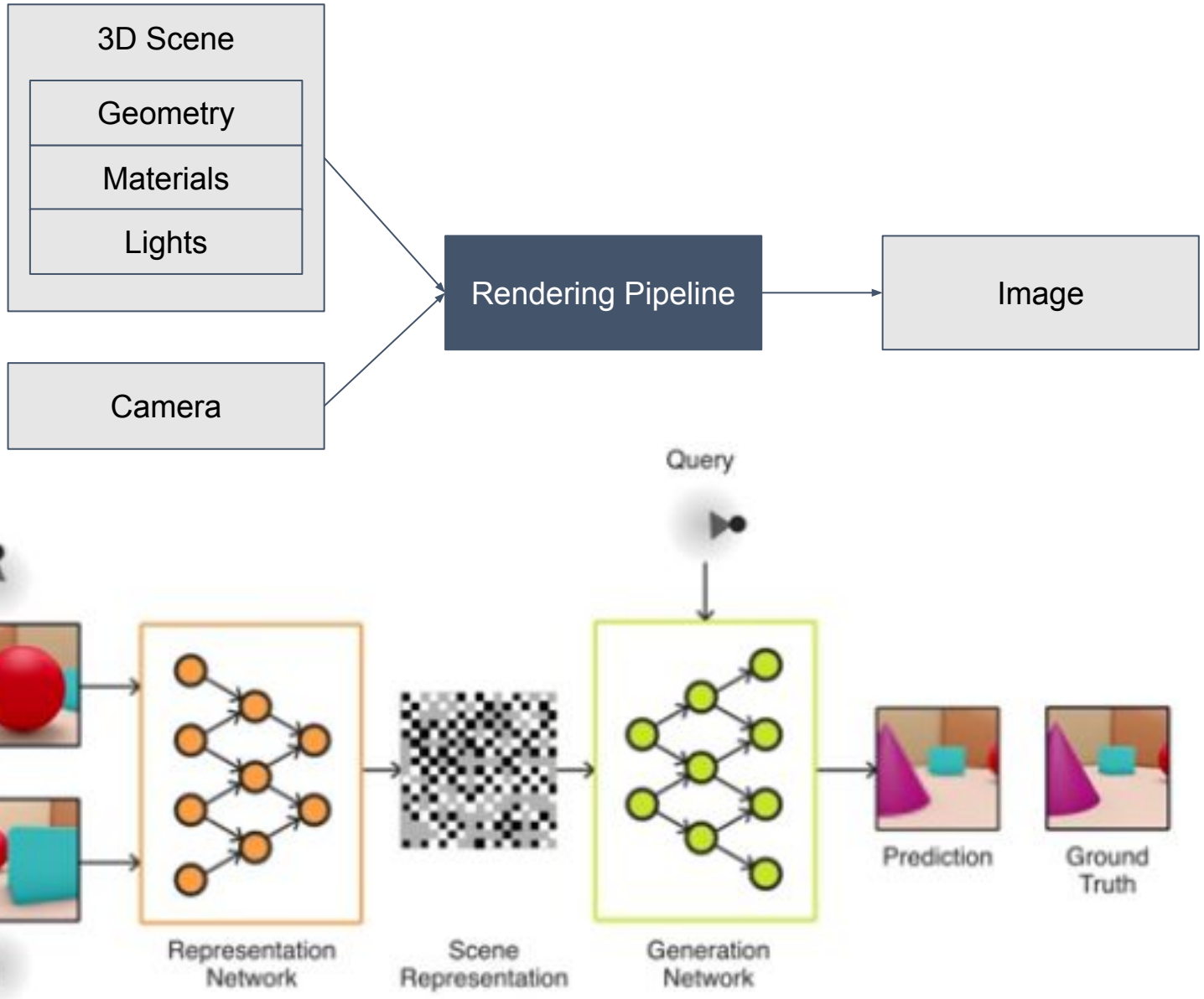
Hasselgren, J., (2020).
Neural temporal adaptive sampling and denoising.

NEURAL RENDERING

01 Rendering pipeline replaced by neural network

02 Generative Query Networks
- from few observations

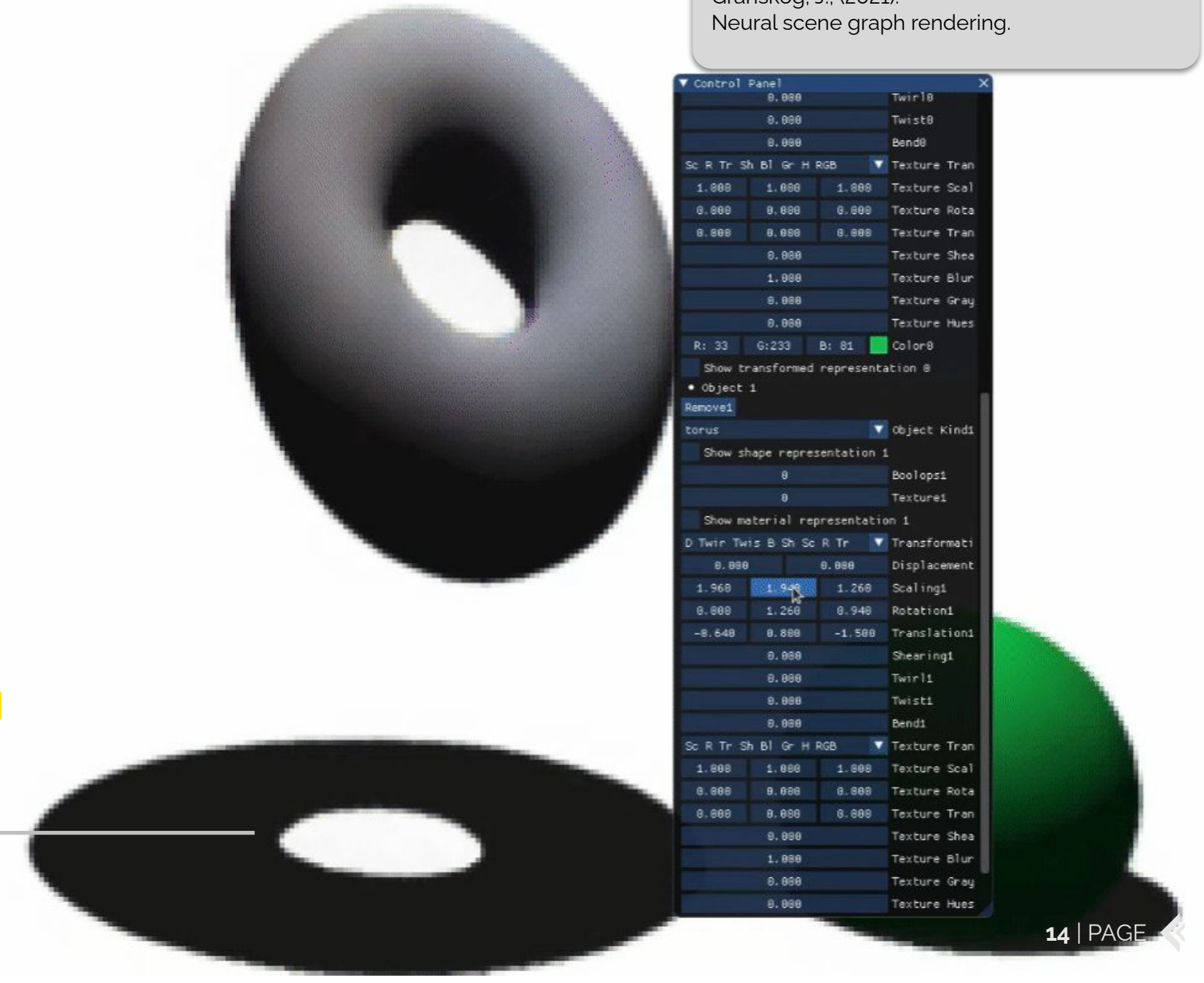




Eslami, S. M. A., (2018).
Neural scene representation and rendering.

NEURAL RENDERING

03. Neural scene graph rendering



Granskog, J., (2021).
Neural scene graph rendering.

RECAP

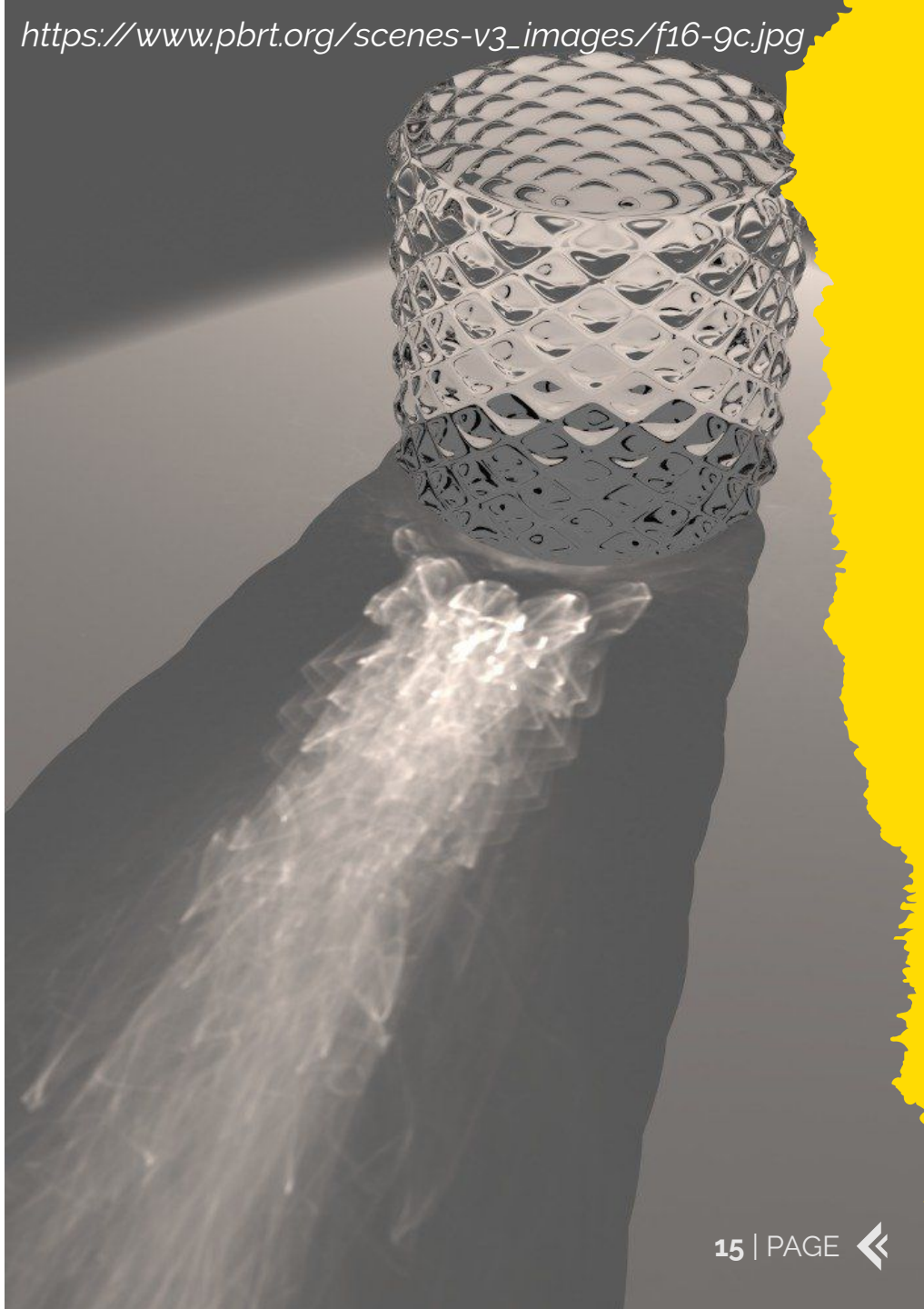
01 With Supersampling, we can render at lower resolution and achieve higher refresh rate

02 With Inverse Graphics we can create a 3D representation from few images/video

03 A Neural Network can represent 3D scenes

04 Speed up Production rendering by optimizing the amount of samples

05 Or simply replace everything with Neural networks




THANK YOU
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