Hochschule Düsseldorf
University of Applied Sciences

HSD

3DGS FOR VIRTUAL PRODUCTIONS



JENS HERDER, SUMMER SCHOOL 2026


00:53
00:53
03:03
00:53
PGM
00:53
00:53
00:53
00:53
KEY1 JIB
KEY2 ROB
00:54
HANDCAM
1 BA Multiviewer
[Intro - Moderator befindet sich in die Mitte]
Guten T
PRMPT
For educational use on
NDI
OSC HOST
STOP
Kameras und Tracking
JIB und PickMe Button
Capture
Motion Capture
Relevanz Virtuelles Studio
AR-Bildmischer
Abspann
[Balt2026]

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[Hoel2026]

3DGS GAUSSIAN SPLATS

- PortalCam from Xgrids
- Lidar and 4 Cameras
- 500 GB Memory
- Scanning 7-70 Minutes
- Processing 1-4 Hours




[Pre2026]

GAUSSIAN SPLATS FOR LIGHT AND SCHADOWS

- Tobias Preuss, Master thesis
- Many high resolution pictures are used for generation the Gaussian Splats
- HDR Gaussiann Splats for light simulation necessary
- Gaussian Splats receiving light and shadow, rendering using raytracing
- Rendering with Houdini / Redshift

GAUSSIAN SPLATS

- NeRFs (Neuronal Radiance Fields)
  - Machine Learning
- Effizient directional color coding using spherical harmonics

$$\mathcal{N}(\mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right)$$



GAUSSIAN SPLATS
WITH PARAMETERS



SPLATTING PROCESS

POSITION (XYZ)
(x, y, z)

SCALING (S)
(s_x, s_y, s_z)

ROTATION (R)
Quaternion
(q_0, q_1, q_2, q_3)
Rotation

OPACITY (A)
0.85

COLOR (SH)
$c_{lm} = c_{lm}$ ..., ...

- **Spherical Harmonics**
  Spherical Harmonics coefficients with cellerats of 3D reconstruction
- **Differentiable Rendering**
  Gaussian splat for 3D anta cloud

- **Spherical Harmonics**
  Spherical Harmonics that conlies Spherical Horvencon coefficiens coefficients
- **Differentiable Rendering**
  Differentiable rendering reconstruction

04

Spherical Harmonics

Core idea:

Instead of a fixed color, each Gaussian saves a function:

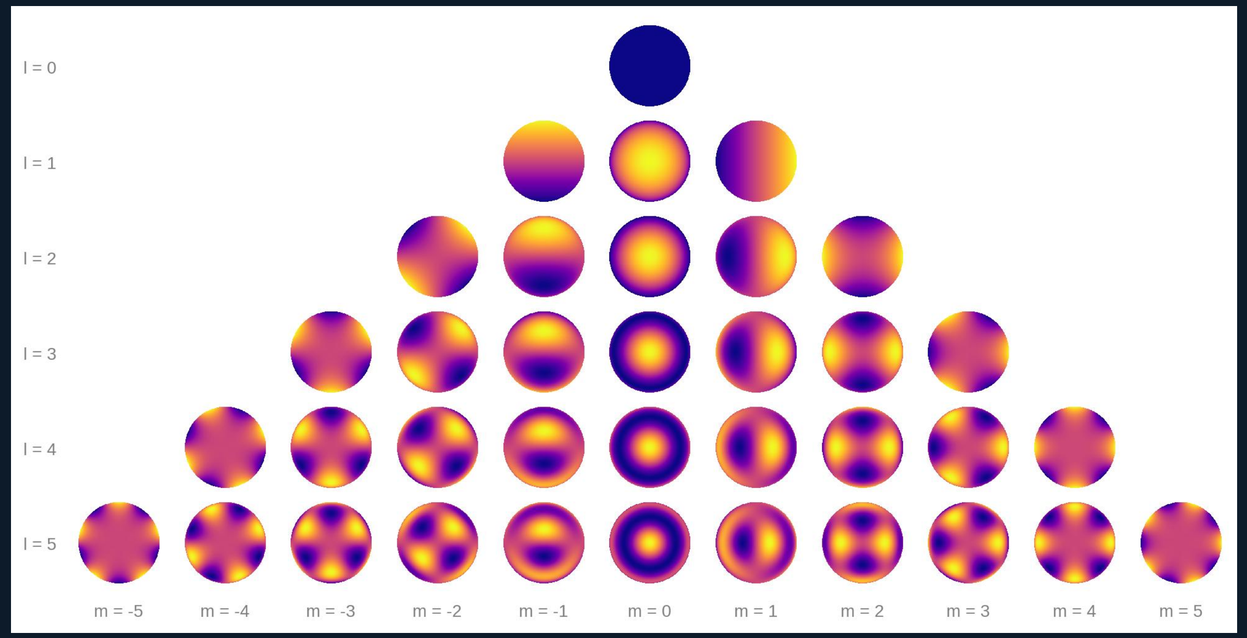
"What color do I see from which direction?"

Order 0: constant color

Order 1: simple gradient

Order 2: soft reflection

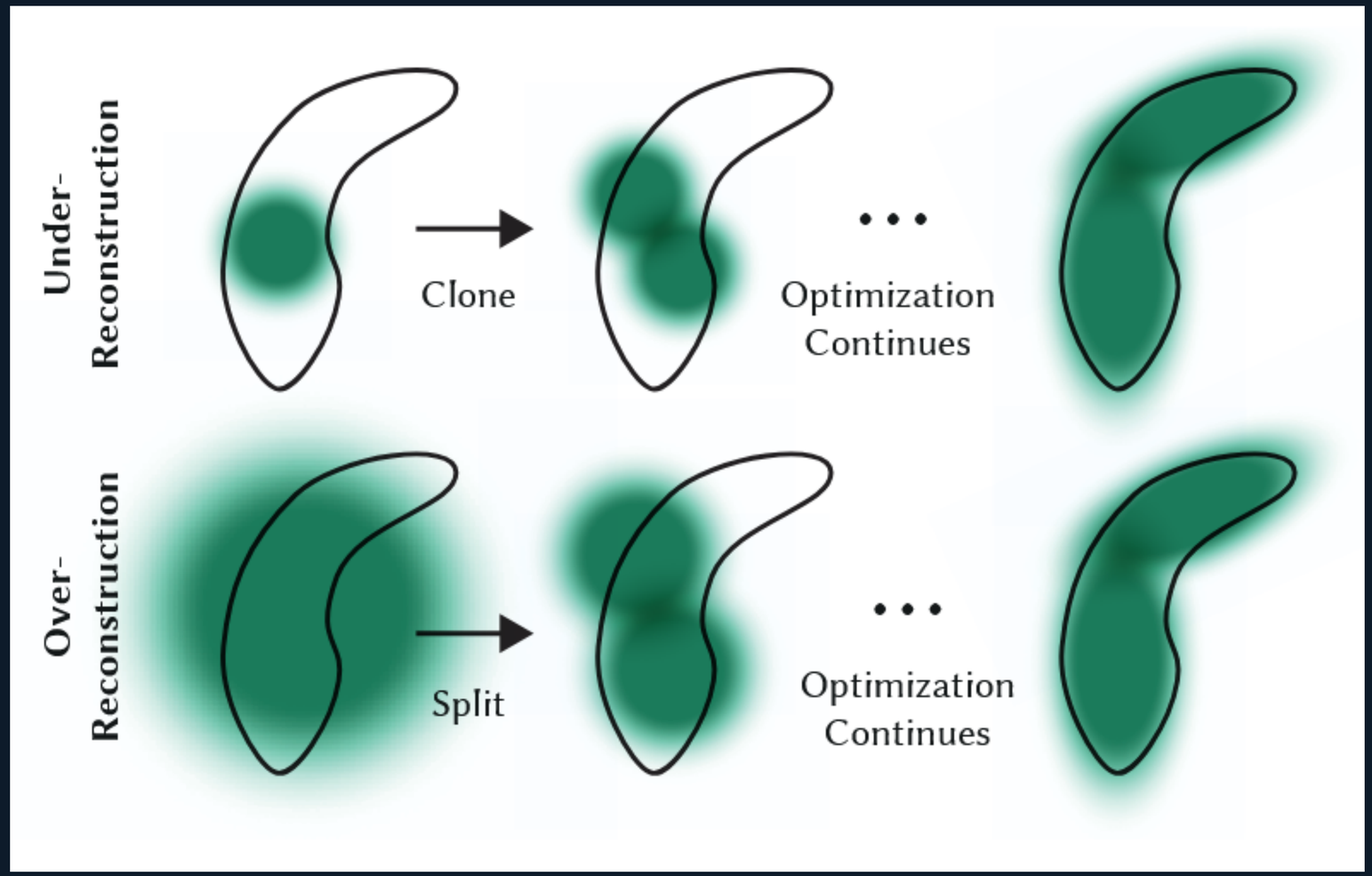
Order 3: fine details



"Higher orders = more details in direction dependence, but also more calculation effort."

05

Densification



3DGS WORLD MODELS

- from image
- from prompts
- SpAItial.ai
  - Echo-2



GAUSSIAN SPLATS

- Easy scanning and fast rendering
- AI can be used for generating Gaussian Splats
  - from small number of images
  - from prompts
- Easy Digital Twins as Sets



TAKEAWAY

- VR and AR
  - Overcome space and time
  - Ideal and efficient interaction
  - Ultimate display with no limits
  - Media consumer platform
  - Used for content creation
  - Accessibility can be improved using sign language avatars
- Scene understanding
  - Enable better and easy camera control
- 3DGS and AI
  - Easy content production, any place at any time

LINKS

- Virtual Sets and Virtual Environment Lab
  - https://vsvr.medien.hs-duesseldorf.de/
- Gaussian Splats of the Virtual Studio in a Browser
  - https://lcc-viewer.xgrids.com/pub/dbcyxq-hsd-vsvr-virtual-studio
- Vision Pro HMD at the Virtual Studio with Gaussian Splats
  - https://hsd.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=2bf0a287-c7ff-4068-9411-b3f501495583
- [IVS2022] Interactive Virtual Studio - MoCap - Tech Demo „Bulletproof"
  - https://vsvr.medien.hs-duesseldorf.de/productions/ivs2022/

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