Neural Surface and Style Reconstruction

Fabian Visser

1st Supervisor: Nail Ibrahimli
2nd Supervisor: Liangliang Nan
Coreader: Lukas Uzolas
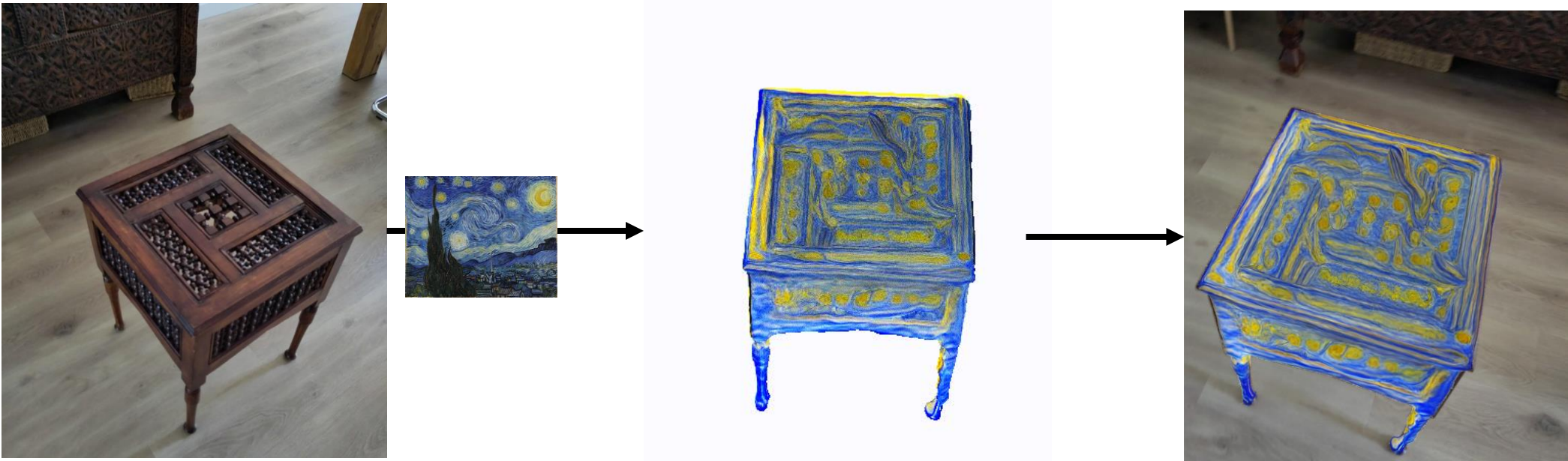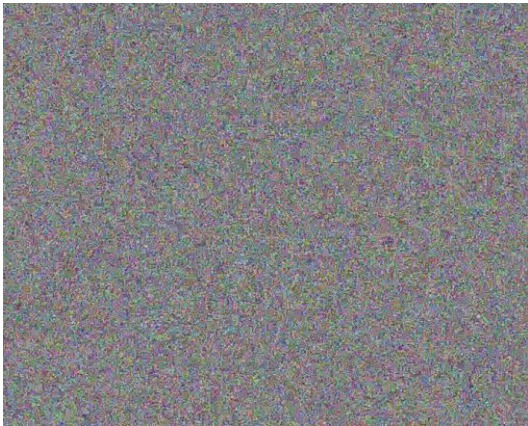
Motivation

Leerman, J. 2014

Mordvintsev, A. 2018
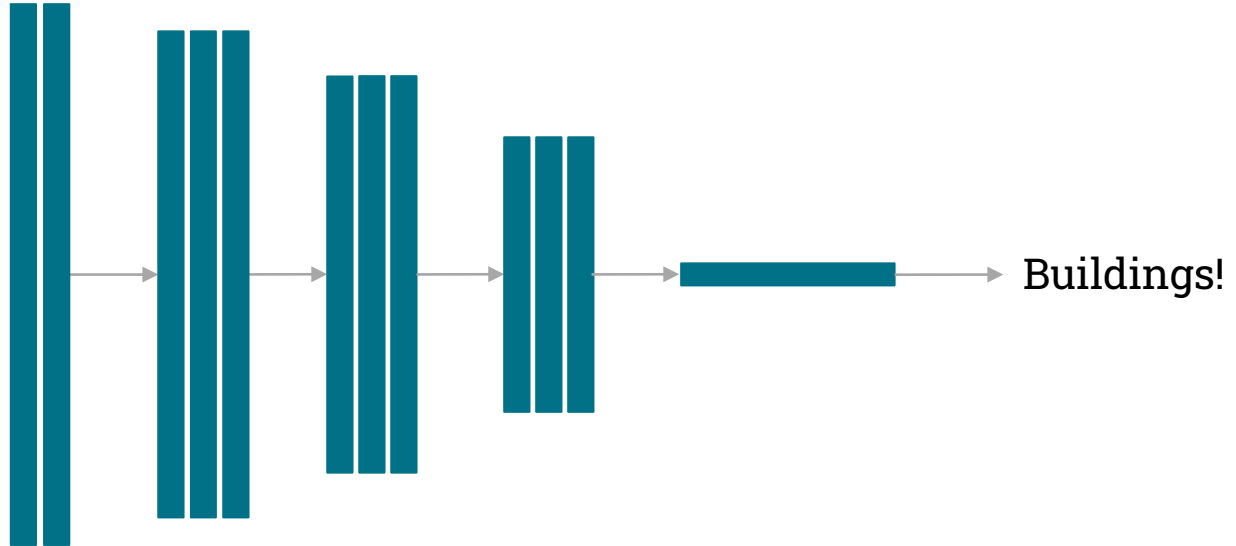
TUDelft

Motivation

Neural Style Transfer

Gatys, L. 2016

TUDelft

4

VGG-16

Buildings!

Simonyan, K. 2014

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Neural Style Transfer

Content Extraction

VGG-16

10 steps

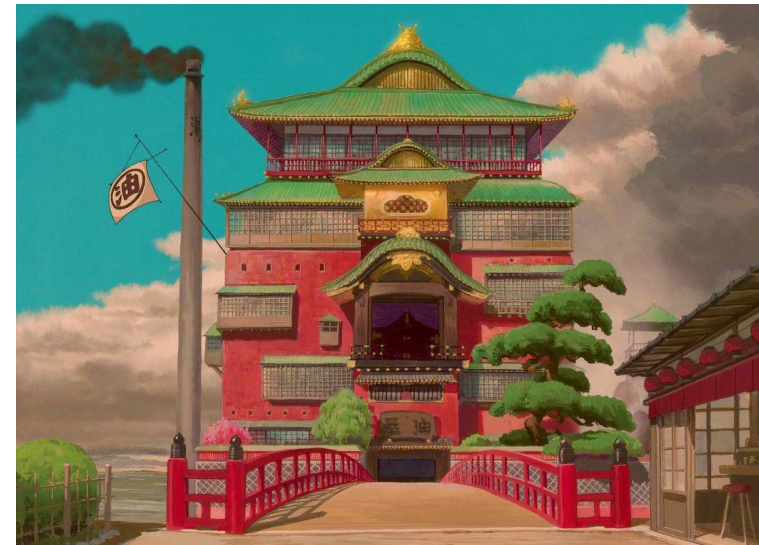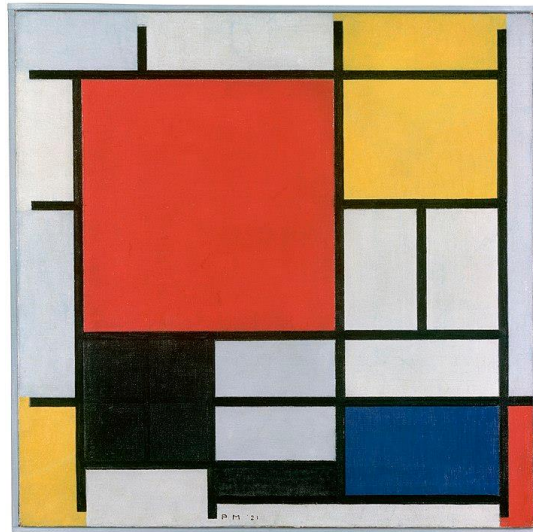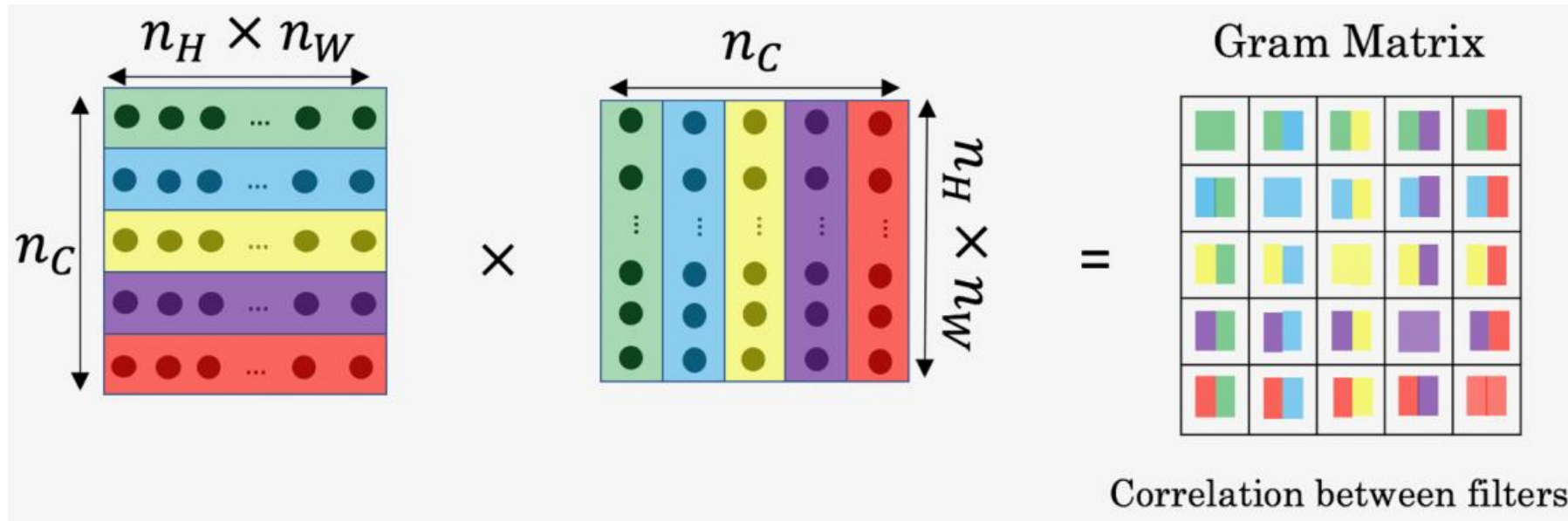50 steps
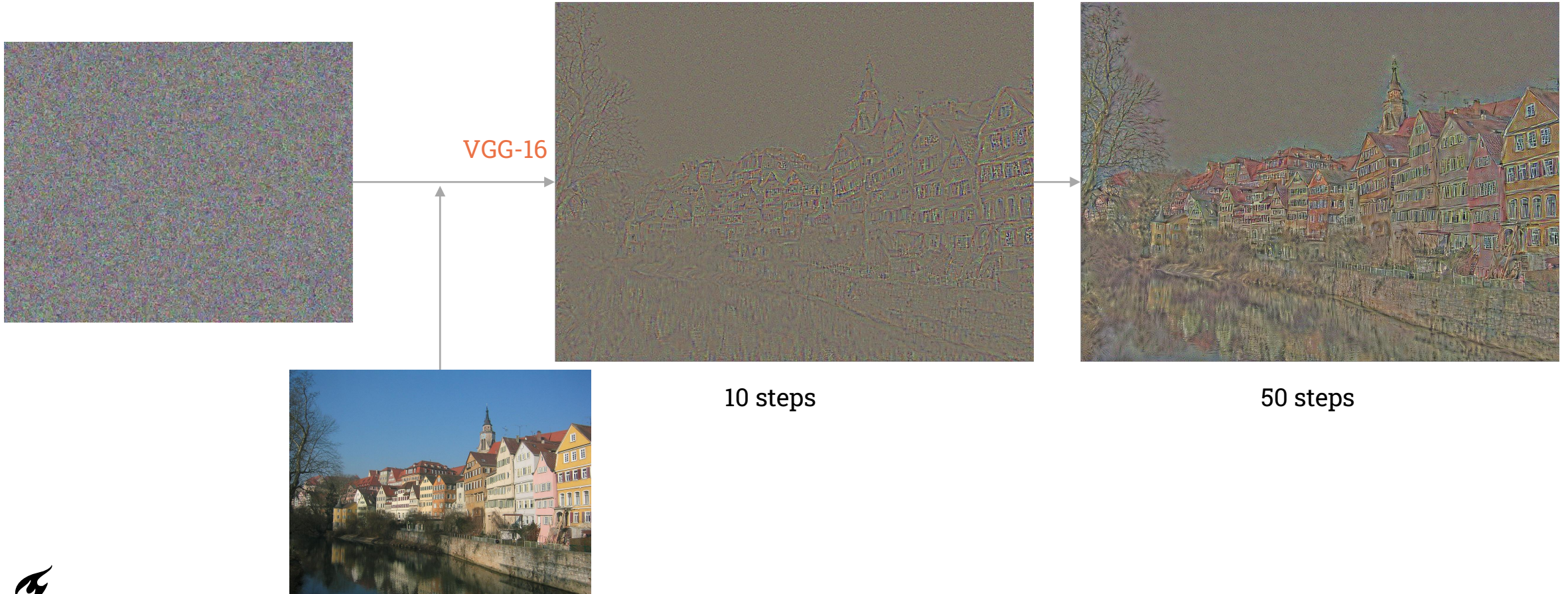
What is Style?

Meyer Schapiro: "the constant form - and sometimes the constant elements, qualities, and expression - in the art of an individual or a group [...], exemplified in a motive or pattern".
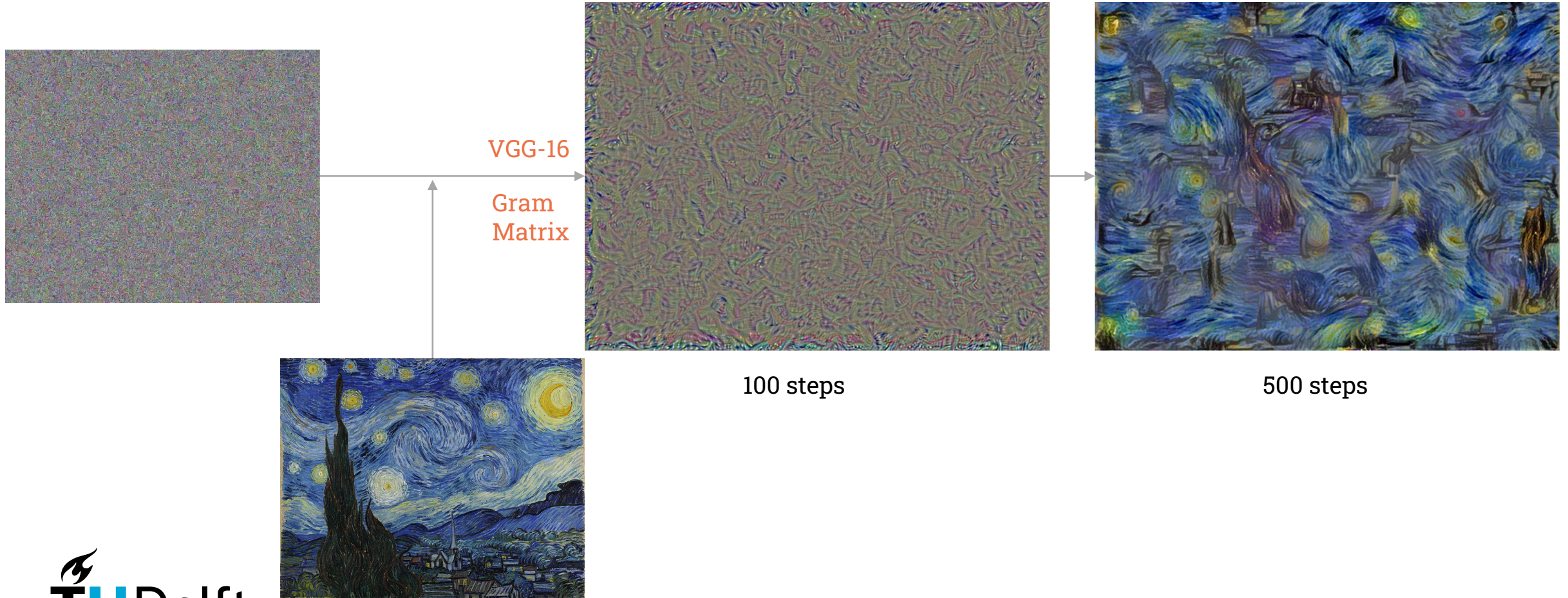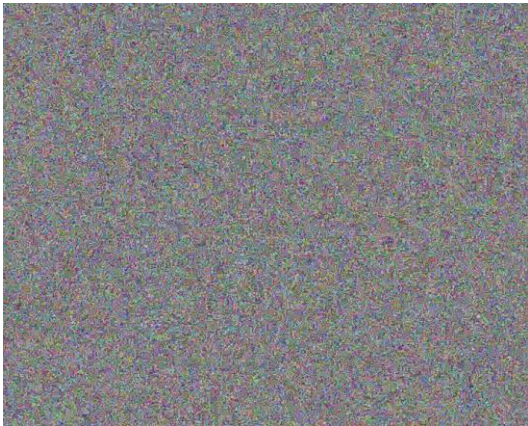
Gram Matrix

$$n_H \times n_W$$

$$n_C$$

$$n_C$$

$$n_H \times n_W$$

× = Gram Matrix

Correlation between filters

Yellow + Swirls =

Neural Style Transfer

Style Extraction

VGG-16

Gram Matrix

100 steps

500 steps

Neural Style Transfer

3D Reconstruction

Mesh

Nan, L. 2018

Radiance Field

Ibrahimli, N. 2023
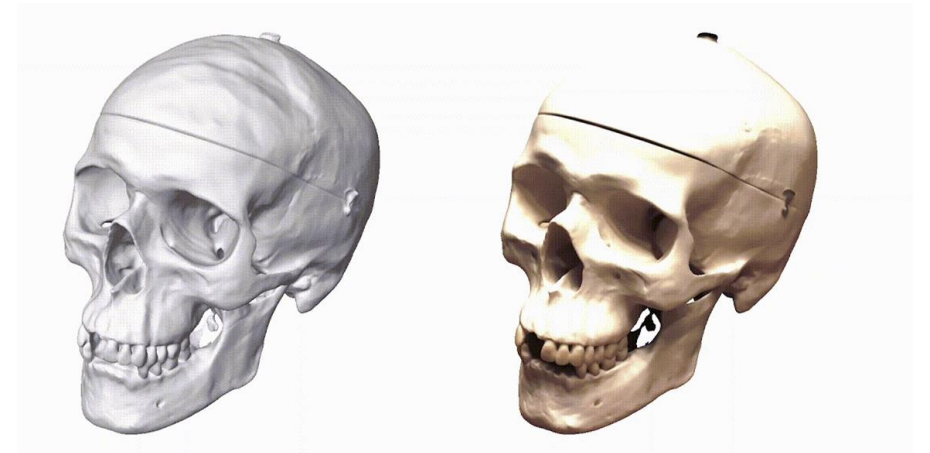
IDR

Yariv, L. 2020

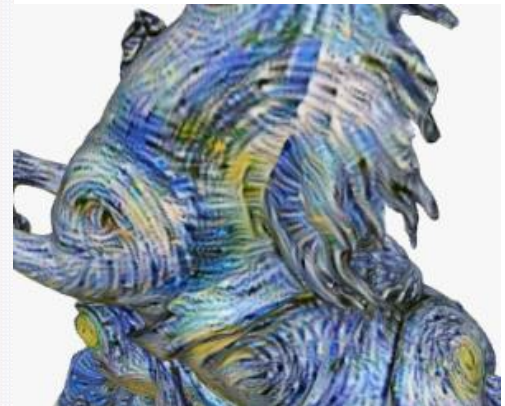# Previous Works

ARF

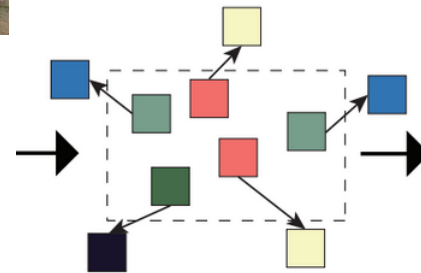Texture-based
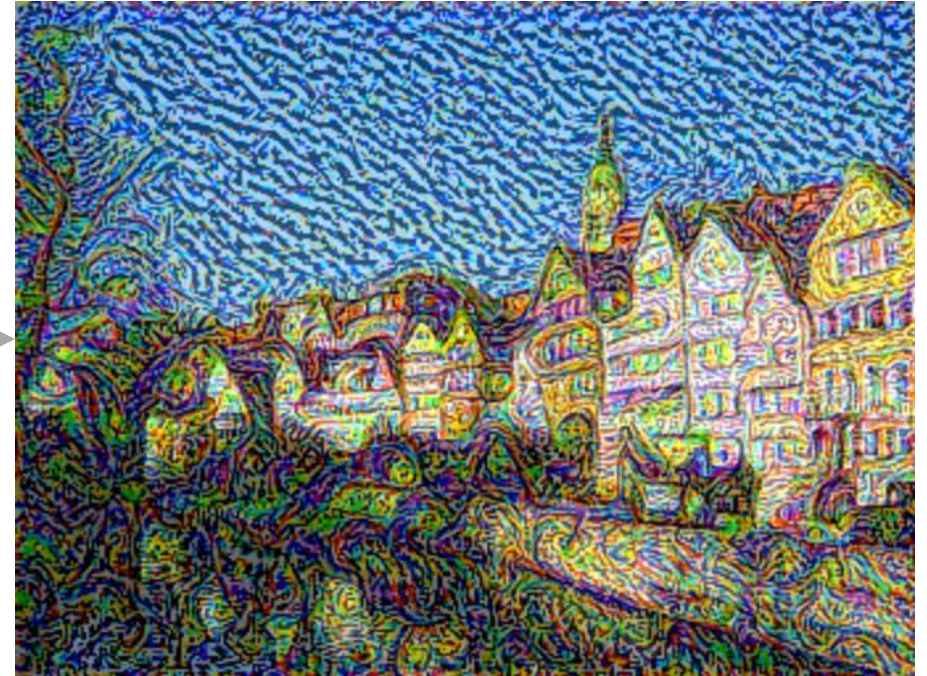
ARF's approach to style transfer

Nearest Neighbor Feature Matching

VGG-16

NNFM

Implicit Differentiable Renderer
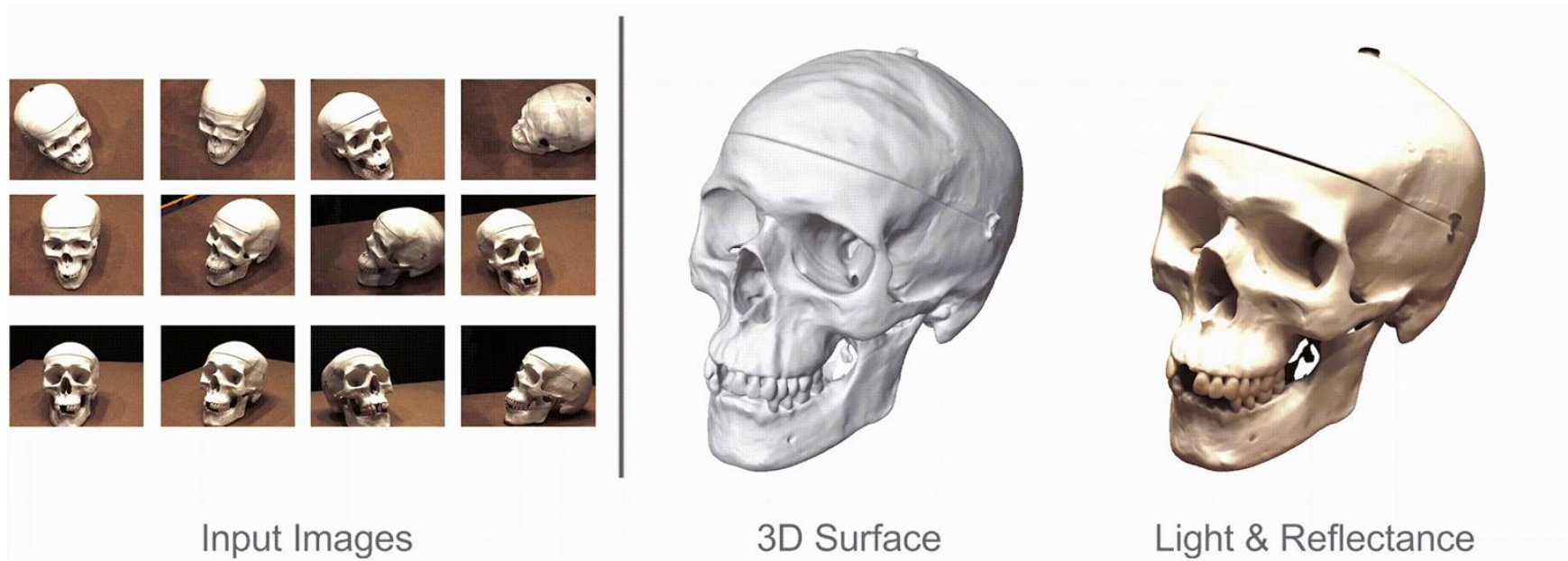
Input Images   3D Surface   Light & Reflectance

Yariv, L. 2020

TUDelft

Implicit Differentiable Renderer

f

Geometry

$\mathcal{M}$

Appearance
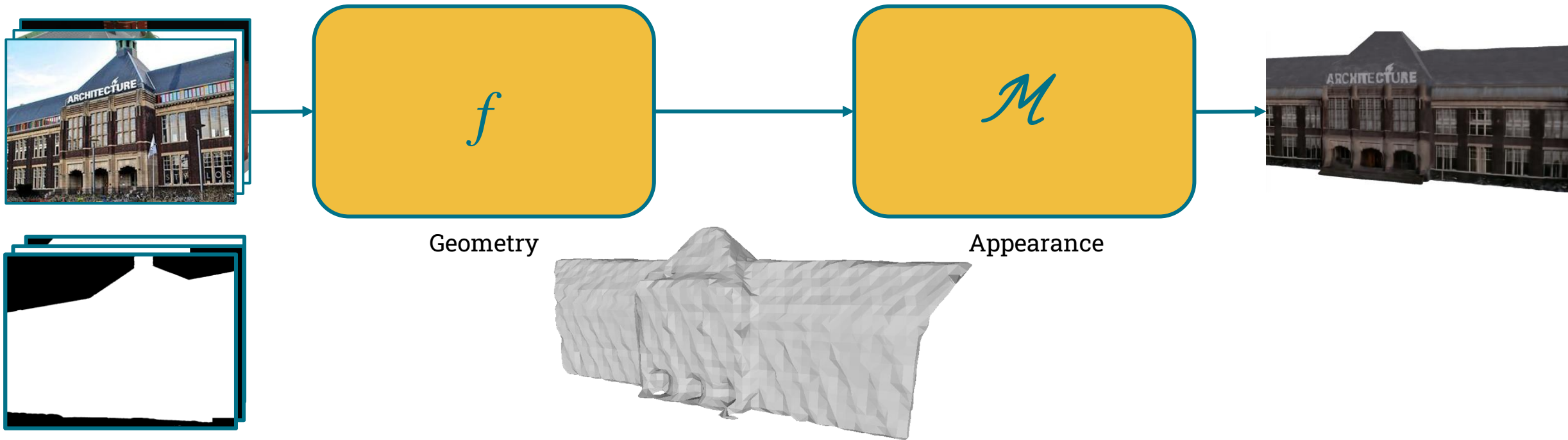
Implicit Differentiable Renderer

Implicit Differentiable Renderer

Implicit Differentiable Renderer

f

Geometry

$\mathcal{M}$

Appearance
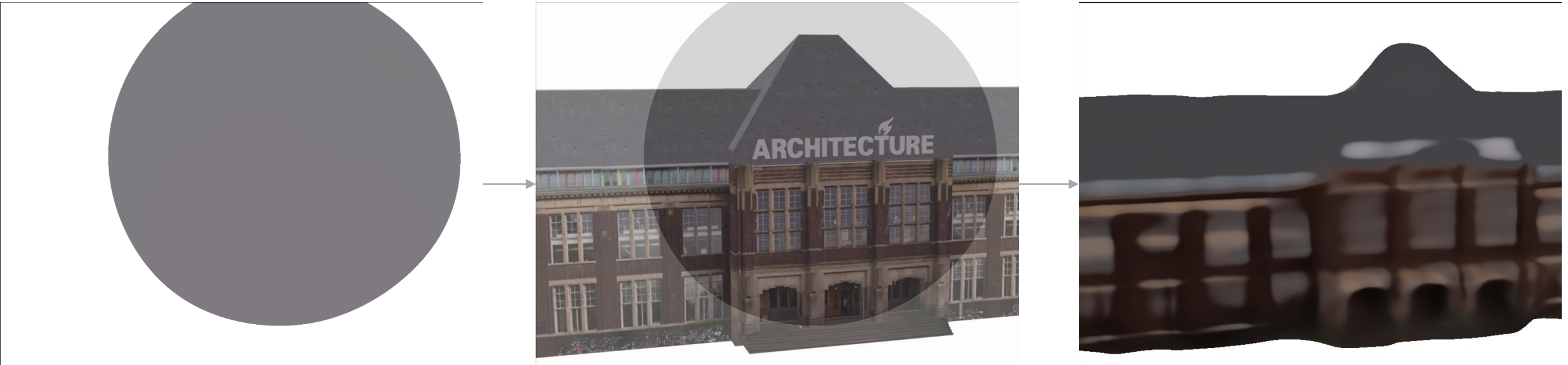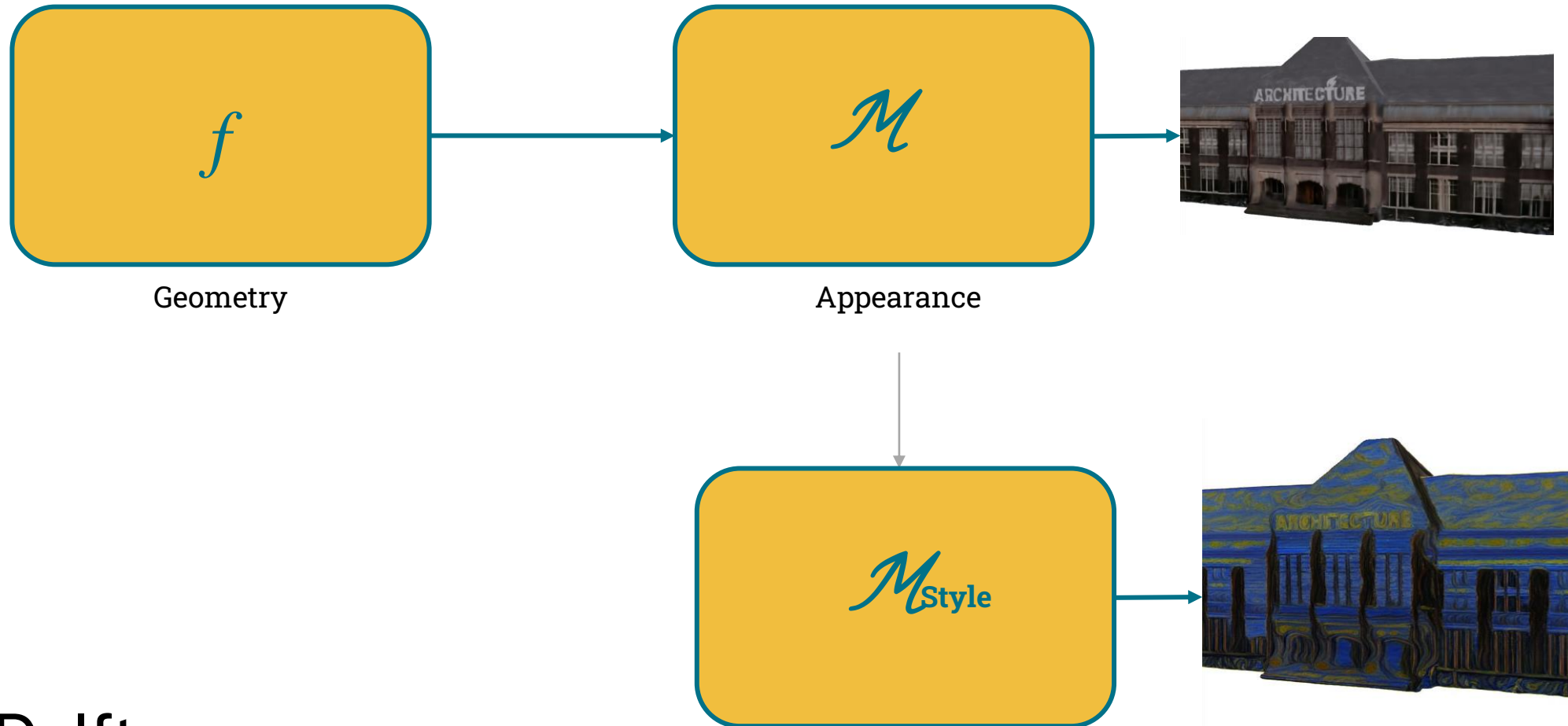
$\mathcal{M}_{Style}$

Research Question

To what extent can a styled 3D reconstruction from a set of content images and a style image be created such that style consistency is present across all views.
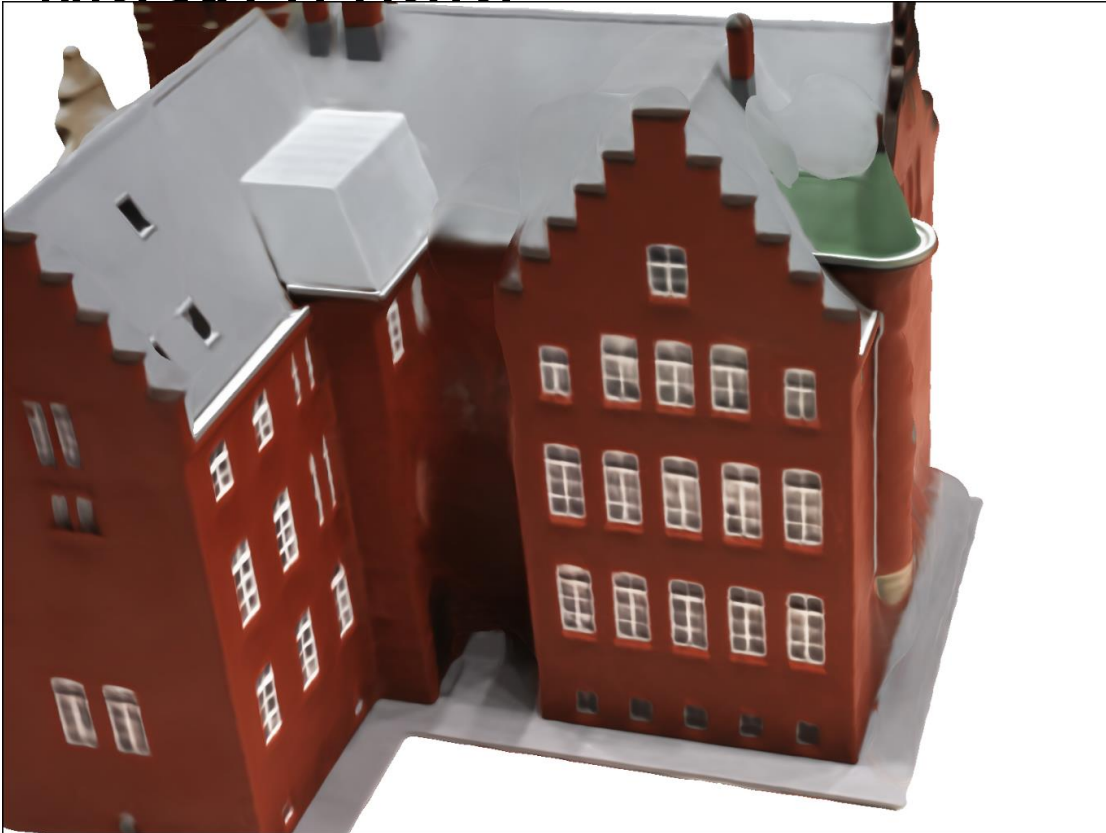
- What style transfer method creates the most faithful result for 3D style transfer?
- How does our method compare to other 3D style transfer methods?
- What effect do the parameters have on the final result?

TUDelft
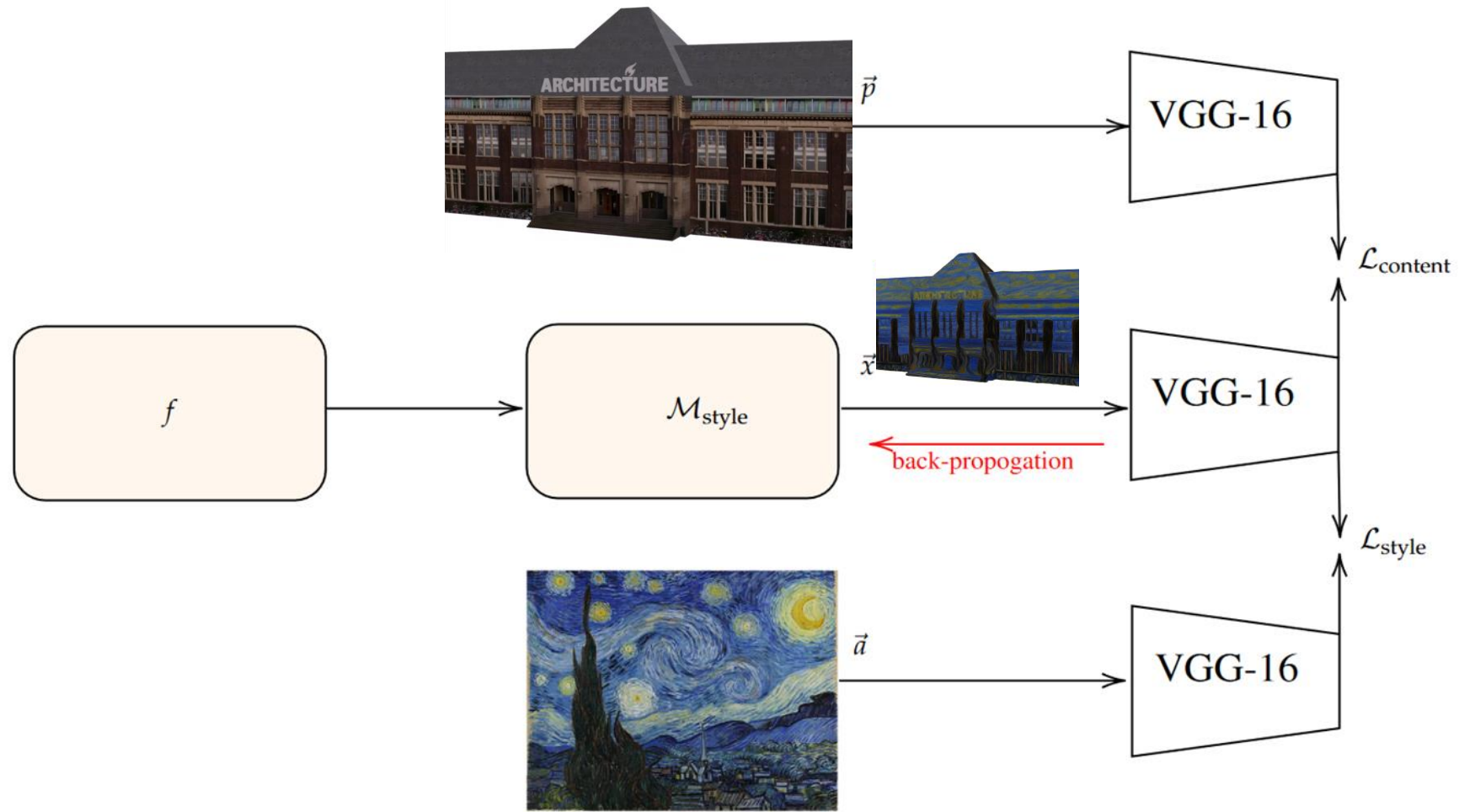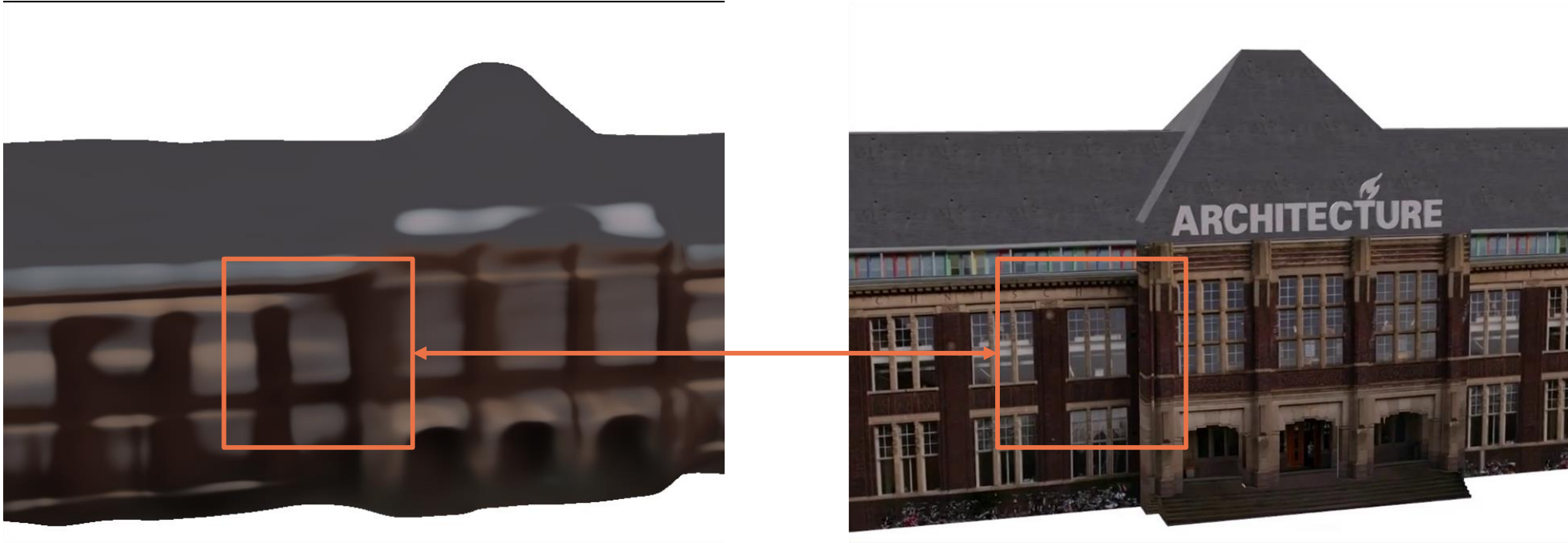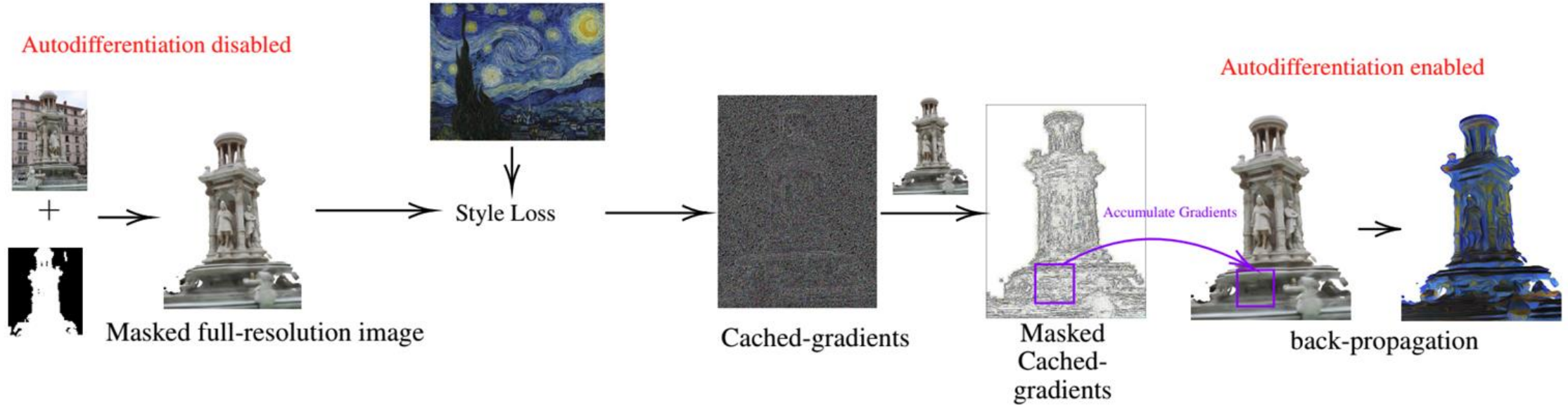
Method

Problem 1

Masked data

Problem 2

Sparse pixel-sampling

Masked deferred back-propagation

Method

10 steps

100 steps

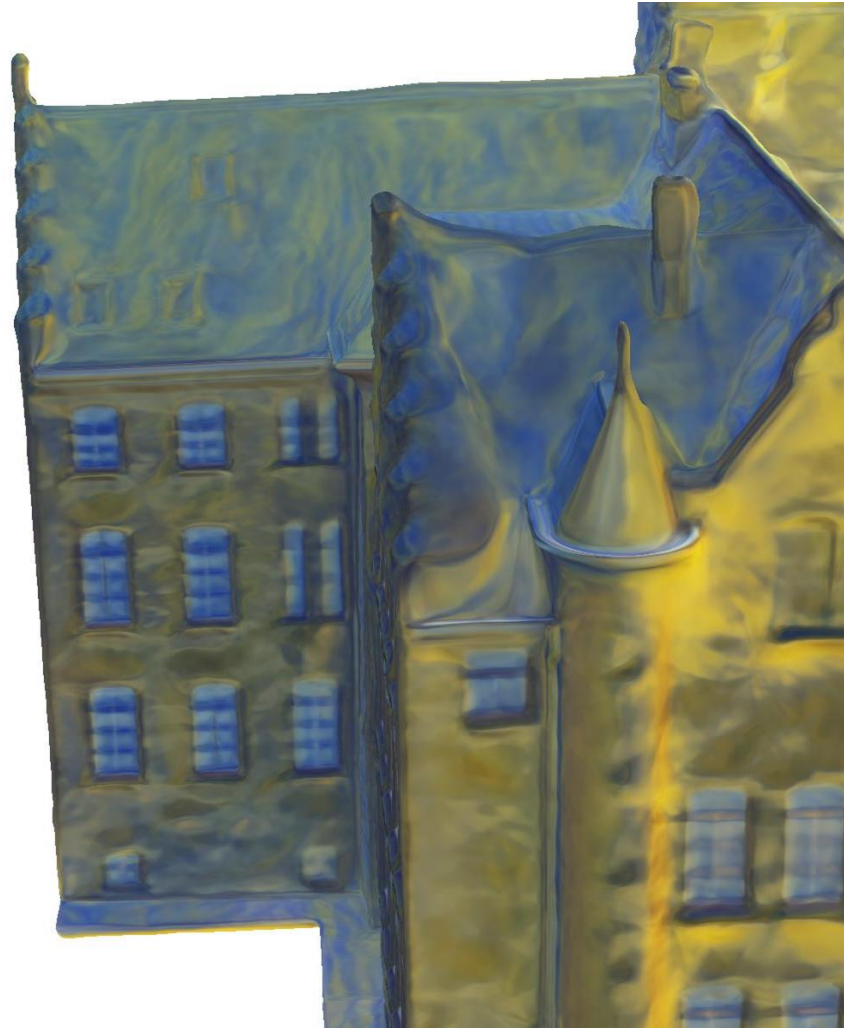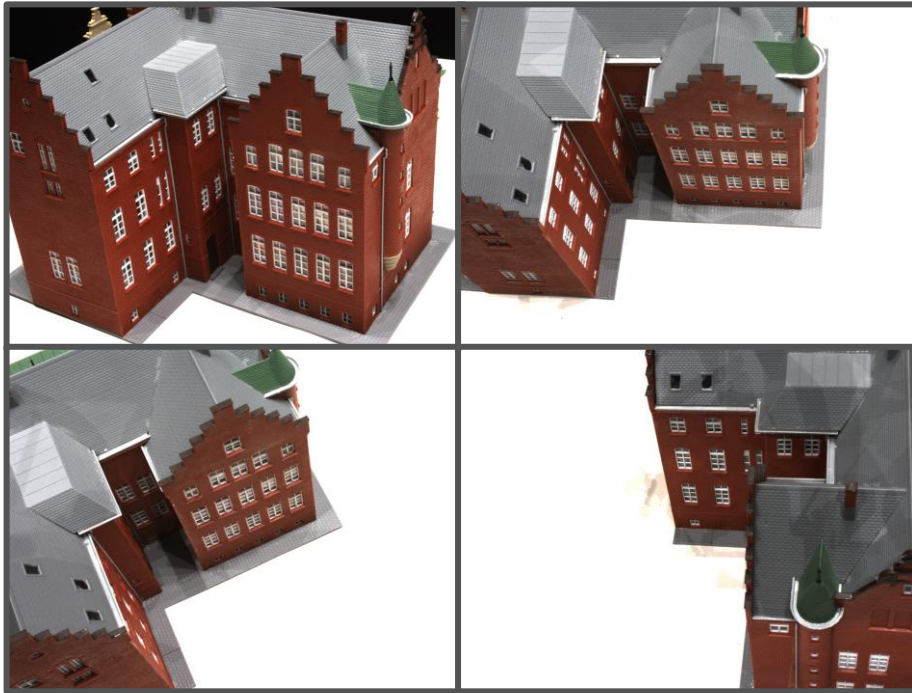# Why train using different views?

Why train using different views?

Datasets

DTU   Jensen, R. 2014

BlendedMVS   Yao, Y. 2020

TUDelft

Creating a Dataset

BK Building   van Faassen. 2023

Coffee Table

Implementation

colmap/**colmap**

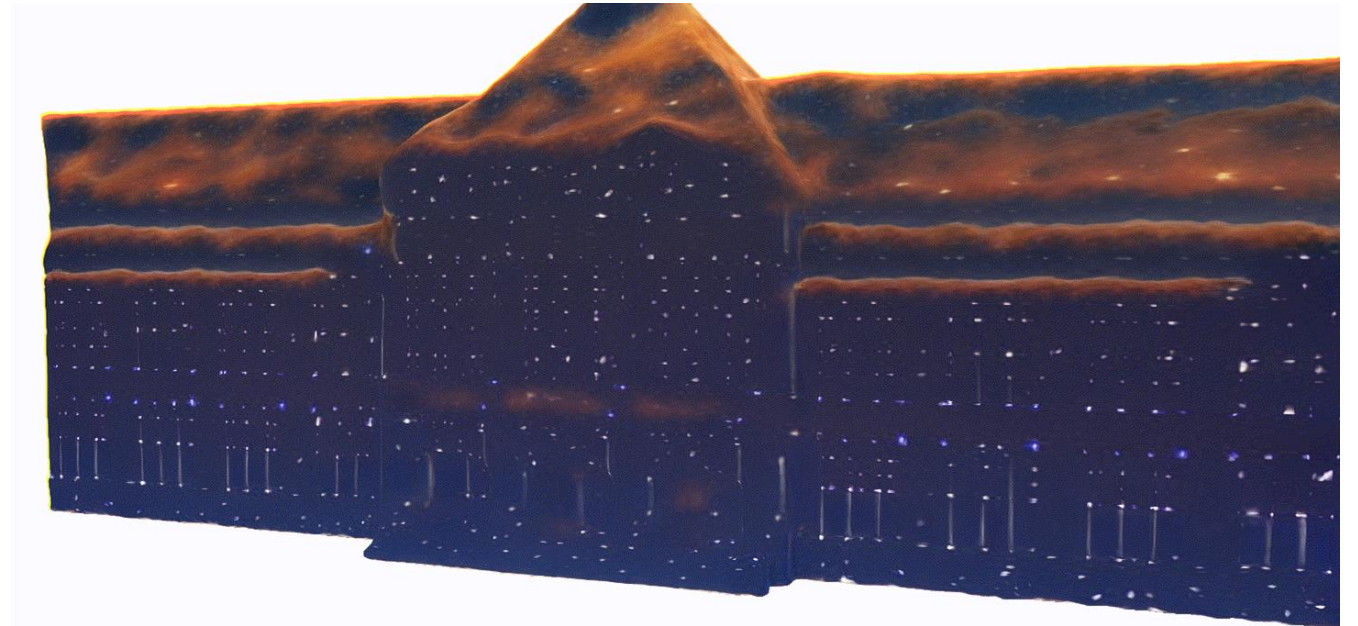COLMAP - Structure-from-Motion and Multi-View Stereo

Results

Results

TUDelft

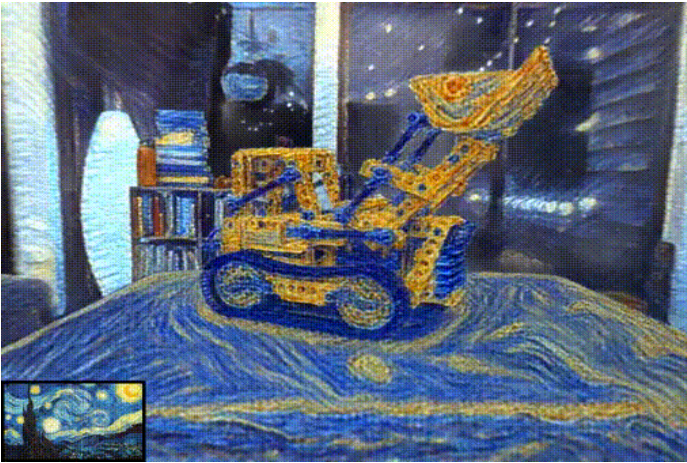# Results

Comparison Study

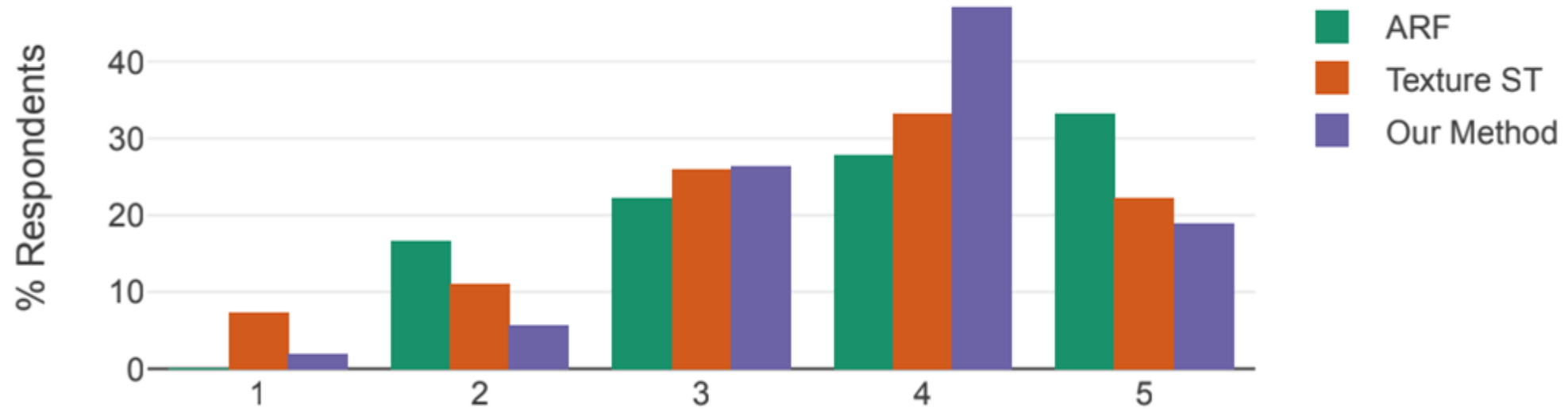
ARF

Texture-based

Our Method

User Study

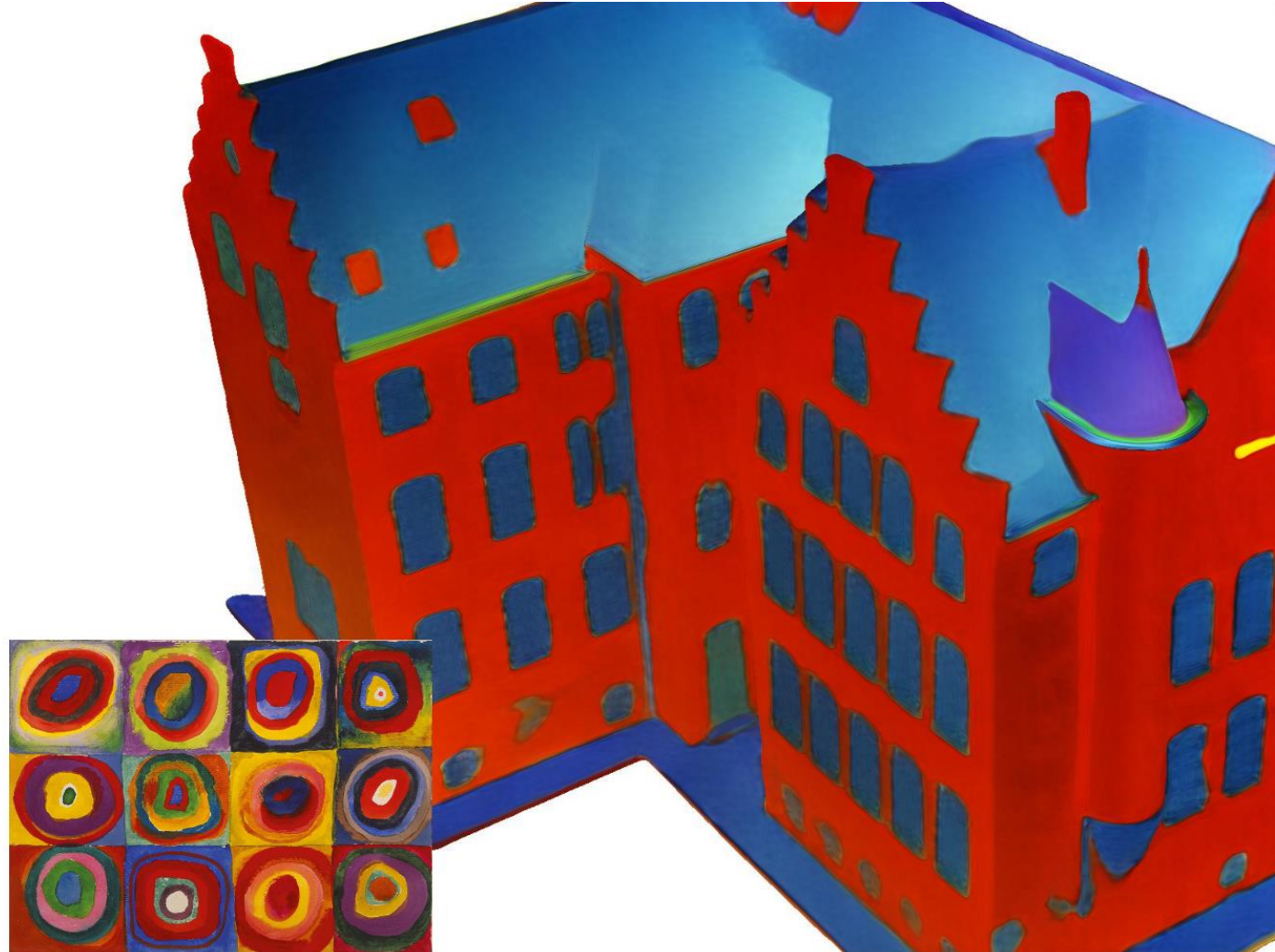ARF: 3.77   Texture ST: 3.49   Our Method: 3.75

55 respondents

NNFM v Gram matrix Styling

Combining NNFM and Gram matrix styling

Content loss

Image Size

300x300
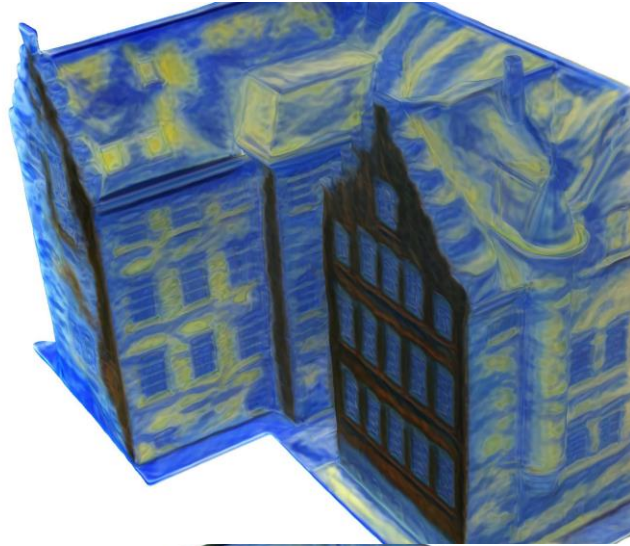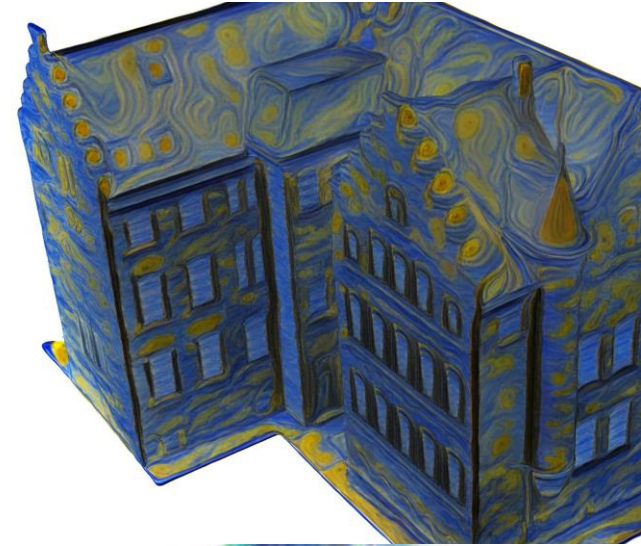

500x500

Convolutional Layer

conv1

conv2

conv3
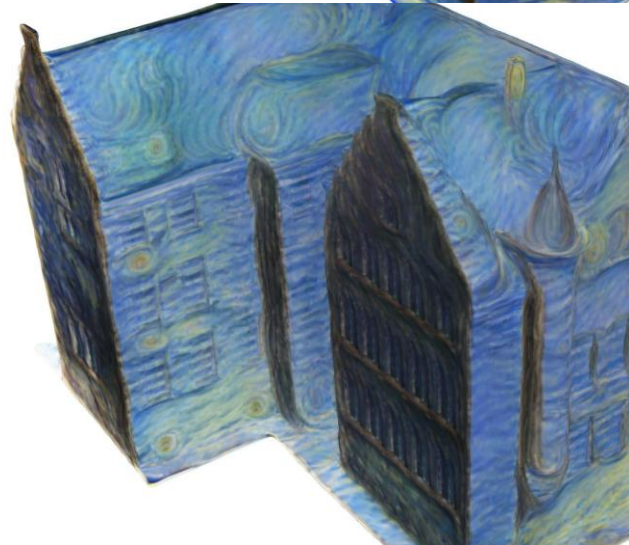
conv4

View and Normal Information

x,n,v,z $\rightarrow$ $\mathcal{M}$
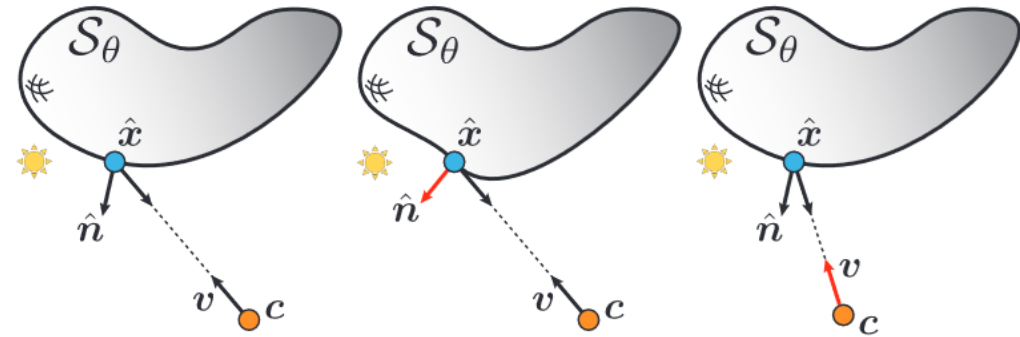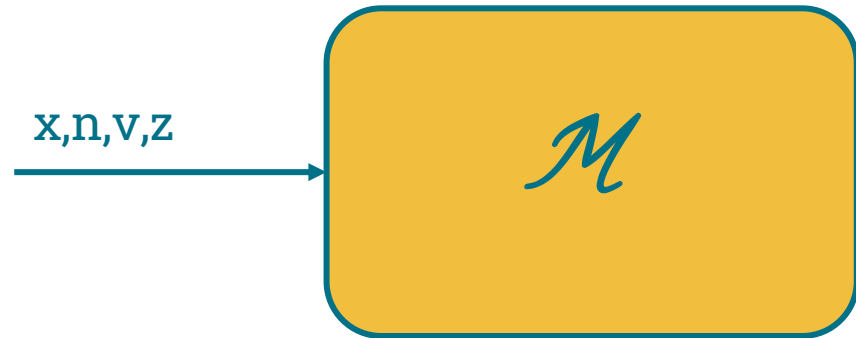
Yariv, L. 2020

View and Normal Information

n,v both included

no normals

no view direction

Conclusion

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TUDelft

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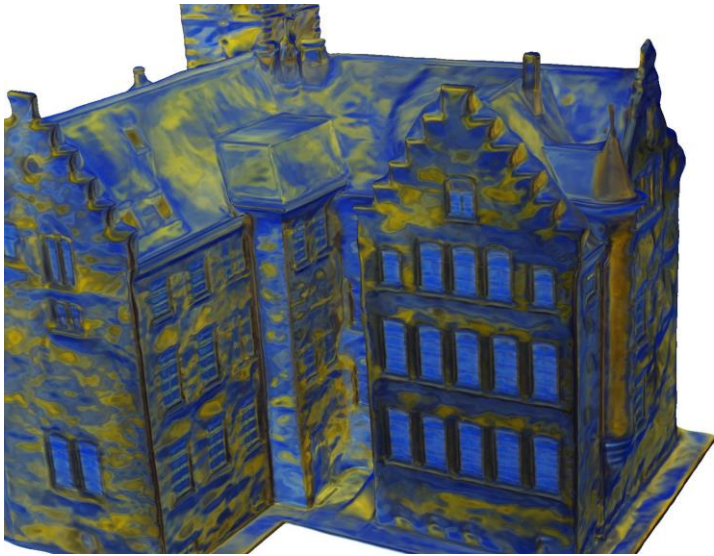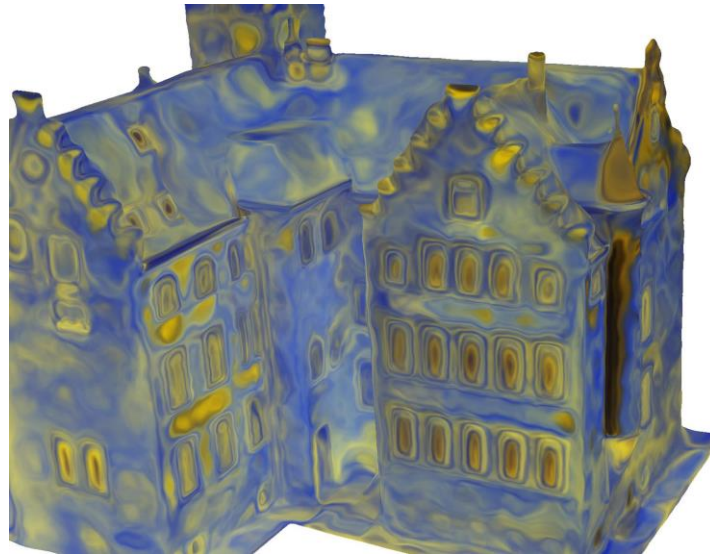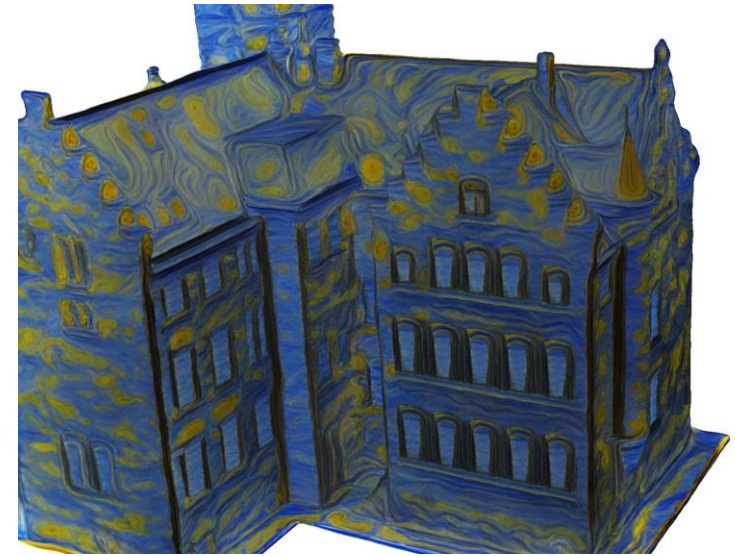
- Sagittis eu volutpat odio facilisis mauris sit amet massa.

- Massa placerat duis ultricies lacus.

  - Odio facilisis mauris sit amet massa.

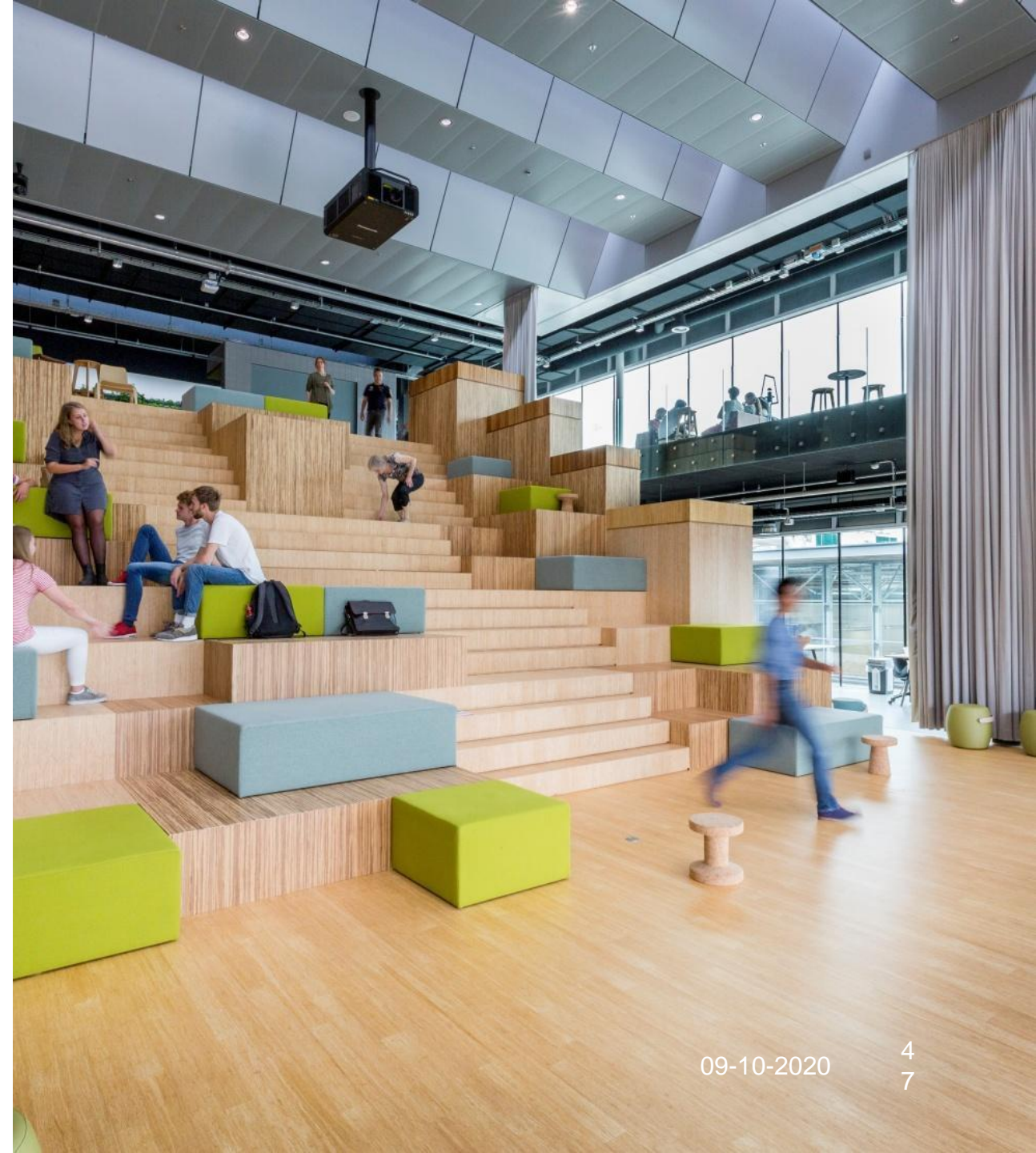*Potenti nullam ac tortor vitae purus faucibus.*

Plaats hier een titel

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- Sagittis eu volutpat odio facilisis mauris sit amet.

- Massa placerat duis ultricies lacus.

  - Odio facilisis mauris sit amet massa.

Potenti nullam ac tortor vitae purus faucibus.

Korte titel

Lorem ipsum dolor sit amet, Consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Eget nunc scelerisque viverra mauris in aliquam. Morbi non arcu risus quis varius quam quisque.

- Sagittis eu volutpat odio.

- Massa placerat duis.

    - Odio facilisis mauris sit.

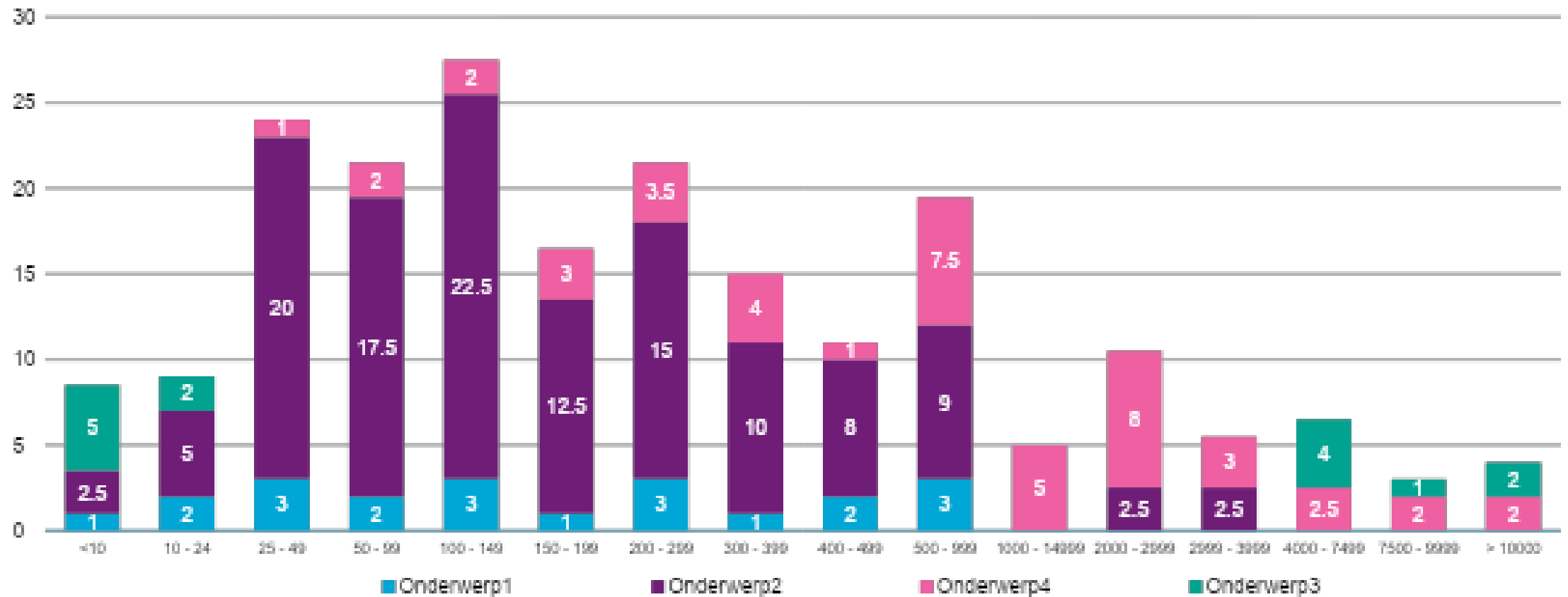*Potenti nullam ac tortor vitae.*

09-10-2020

01

Plaats een hoofstuktitel hier, max. 2 regels

Ruimte voor een subtitel

Plaats hier een titel

Bedankt voor uw aandacht

Naam Spreker