How AI helps creating 3D materials from photography with Substance
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THE INDUSTRY STANDARD FOR MATERIAL CREATION AND TEXTURING
Adobe + allegorithmic

Allegorithmic is joining the Adobe family.

Art by Omar Taher, based on a concept by Jeff Delgado
OUR COMMUNITY
A COMPREHENSIVE TOOLSET

SOFTWARE

CONTENT

SUBSTANCE DESIGNER

SUBSTANCE PAINTER

SUBSTANCE B2M

SUBSTANCE SOURCE
SUBSTANCE DESIGNER: MATERIAL CREATION SOFTWARE
SUBSTANCE PAINTER : 3D PAINTING
Substance parametric materials are supported by all major engines and tools.

It is the industry standard for PBR materials in real-time and raytracing.

**GAME ENGINES**

- Unreal Engine
- Unity
- CryEngine

**MODELING & ANIMATION**

- Maya
- 3ds Max
- Cinema 4D
- Modo
- Catia
- Houdini

**RENDERERS**

- NVIDIA Iray
- V-Ray
- Redshift
- Corona
- Arnold

and more...
ONE SUBSTANCE FILE

MULTIPLE RENDERERS

Raytraced

Real-Time
READY TO USE PARAMETRIC MATERIALS

MATERIALS CREATION & CAPTURE

UNIFIED MATERIAL LIBRARY
READY TO USE PARAMETRIC MATERIALS

MATERIALS CREATION & CAPTURE

3D MODEL TEXTURING

VR / AR EXPERIENCE

SCENE RENDERING

UNIFIED MATERIAL LIBRARY
READY TO USE PARAMETRIC MATERIALS

MATERIALS CREATION & CAPTURE

UNIFIED MATERIAL LIBRARY

LIBRARY MANAGEMENT

3D MODEL TEXTURING

VR / AR EXPERIENCE

SCENE RENDERING
NEW STANDALONE PRODUCT IN THE SUBSTANCE ECOSYSTEM

Art by Josip Vrändecic
DEDICATED TO

AUGMENTED MATERIAL CREATION

Art by Josip Vrandecic
SERVICES

CREATE MATERIAL LIBRARIES

EXPLORE CONTENT

PIN YOUR IDEAS

MANAGE MATERIALS
OUR TARGET USERS

ArchViz Expert
- Explore Libraries
- Create Collections
- Tweak Materials
- Mix Materials
- Render

3D Artist
- Import Scans
- Create Material
- Hybrid Material
- Manage

CMF Designer
- Mood board
- Browse Collections
- Generate variations
- Manage

Technical Director
- Review
- Compare
- Batch
- Manage
PROCEDURAL

CAPTURE

ARTIFICIAL INTELLIGENCE

ARTISTRY

Art by Josip Vrandecic
PROCEDURAL ARTIFICIAL INTELLIGENCE
CAPTURE ARTISTRY

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PROCEDURAL
CAPTURE
ARTISTRY

ARTIFICIAL INTELLIGENCE

Art by Josip Vrindecic
DELIGHTING AN IMAGE WITH DEEP LEARNING
CONTEXT
Create a Material from a Single Image

4K Picture

4K Material
Delighting: From picture to basecolor
Why delighting?

Scan as basecolor

Correct basecolor
DATASET GENERATION
How To Obtain Training Pairs?
Dataset Generation Overview

SUBSTANCE FILE

SUBSTANCE
SOURCE

MATERIALS

SUBSTANCE
AUTOMATION TOOLKIT

RENDERS
Substance File to Materials: Random Seed Variation

Albedo
Substance File to Materials: Parameters Variation

Albedo
Substance File to Materials: Parameters Variation

Albedo
Material to Renders: Lighting Conditions

PBR material

SUBSTANCE AUTOMATION TOOLKIT
Material to Renders: Lighting Conditions
Patches Extraction

2048 x 2048

512 x 512 crops
Data generation summary

- ~300 Substance files
- ~1800 materials
- ~25000 renders
- ~380000 training pairs
NETWORK ARCHITECTURE
Model Overview

input → NEURAL NETWORK → mask → ground truth → output → LOSS
U-Net: Convolutional Networks for Biomedical Image Segmentation
O. Ronneberger, P. Fischer and T. Brox
In MIC-CAI, pages 234-241. Springer 2015
Delighter architecture

Conv 3x3, BN, ReLU
Conv 1x1
Max Pool 2x2
Upsampling NN, Conv 2x2
Skip connection
Delighter architecture - Receptive field
Poisson Reconstruction for High Resolution Inputs

Input 4x4 crops

Before / After Poisson solving
Influence of Padding

0-Padding

Mirrored
RESULTS
Qualitative Results - On test set
Qualitative Results - On test set
Qualitative Results - On test set
Qualitative Results - On pictures
Qualitative Results - On pictures
Qualitative Results - On pictures
Qualitative Results - On pictures
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Qualitative Results - On pictures
Example of Failure Case
Example of Failure Case
Speed Benchmark

Inference on a GPU (GV100) for a batch of 16 images in ms per image

- Tensorflow FP32 1st inference: 306.75 ms
- Tensorflow FP32 other inference: 44.31 ms
- cudNN FP32: 53.14 ms
- cudNN FP16: 37.04 ms
- cudNN TensorCore: 21.13 ms

Legend:
- Remaining
- Convolutions
PERSPECTIVES
Model Overview

- **Input**
- **Shadow Mask**
- **Outputs**
  - Basecolor
  - Height Map
- **Ground Truth**
  - Basecolor
  - Height Map

**Losses**
- \( \text{LOSS}_b \)
- \( \text{LOSS}_h \)
Model architecture

- Conv 3x3, BN, BReLU
- Conv 5x5, BN, BReLU
- Conv 1x1
- Max Pool 2x2
- Upsampling NN, Conv 2x2
- Skip connection

Dimensions:
- 3 x 64²
- 128 x 128
- 256 x 256
- 512 x 512
- 1024 x 1024
- 2048 x 2048

Height:
- RGB mask
- Skip connection
Early results

Input  Extracted basecolor  Ground truth basecolor  Extracted Height  Ground truth Height
DEMO TIME
CURRENTLY IN PRIVATE BETA

MORE NEWS TOMORROW
Q&A

SUBSTANCE
ALCHEMY