DeFINe – Deep Facial Inpainting Network

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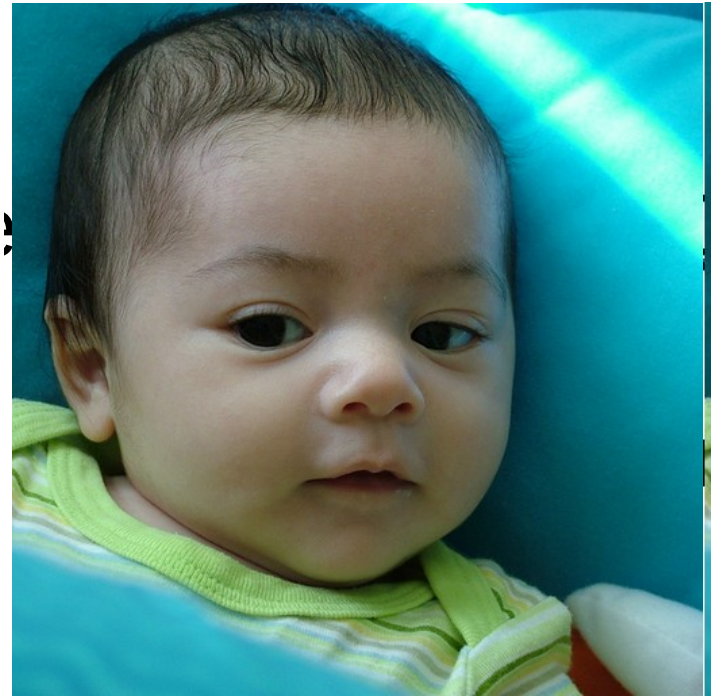
Recap - Motivation

- Durchführung eines Projektes mit nahezu unbegrenzten Daten
- Verbesserung existierender Inpainting Lösungen in Bezug auf Gesichtsrekonstruktion
- Einfaches Retuschieren von z.B Passfotos, Porträts

Daten

- Trainingsdaten: Flickr-Faces-HQ Dataset (FFHQ)
- Masken: QD-IMD: Quick Draw Irregular Mask Dataset
- 70.000 Gesichter und 50.000 Masken
- Auflösung: 512x512

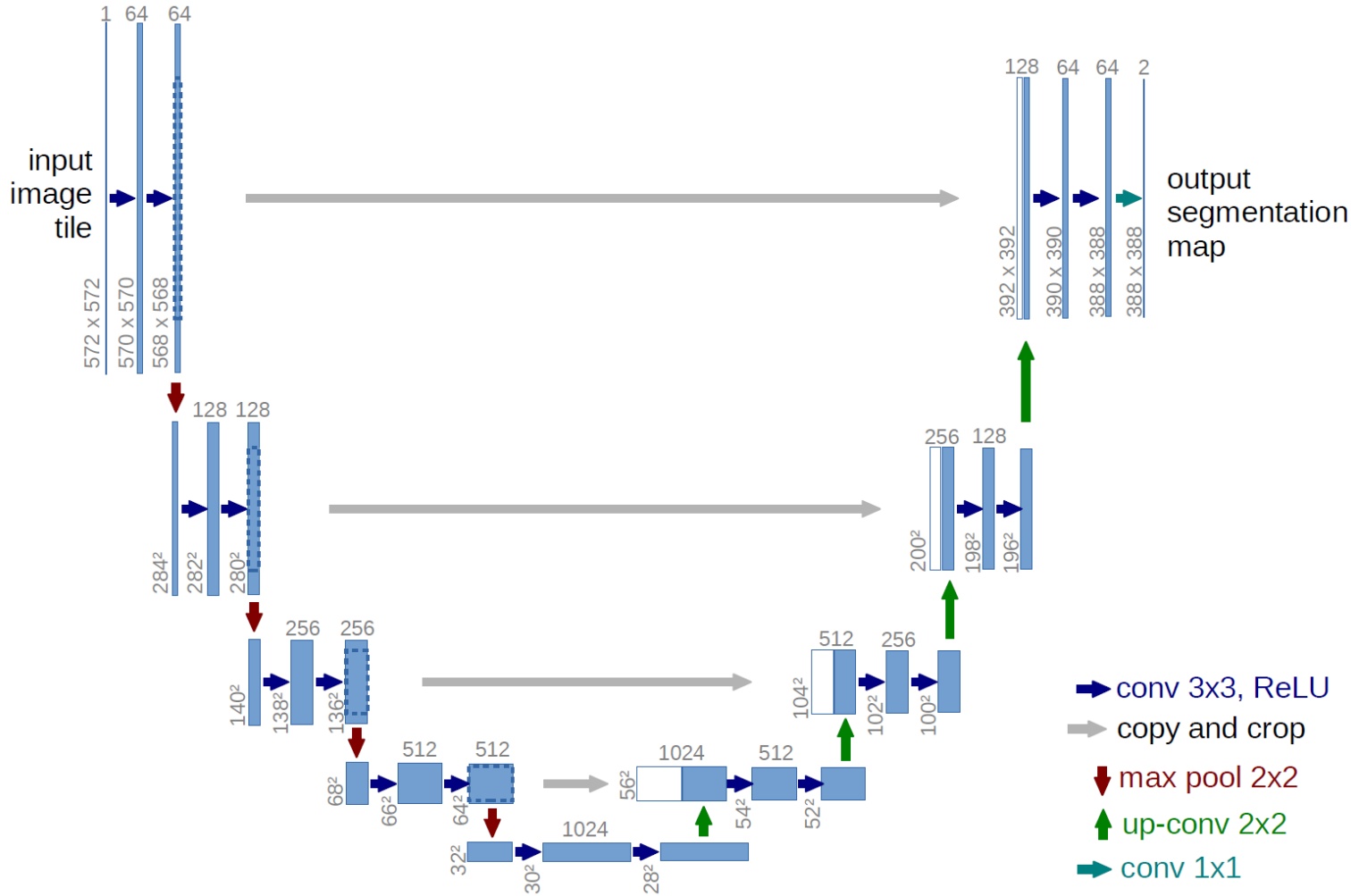


Model

- U-Net Architektur (Convolutional Networks for Biomedical Image Segmentation (Ronnenberger et al.)

Mod

- U-N
  Ima


input image tile
output segmentation map
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1

al

Model

- U-Net Architektur: “Convolutional Networks for Biomedical Image Segmentation” (Ronnenberger et al.)
- Upsampling statt Transposed Convolution
- Stride statt Max-Pooling
- Partial Convolutions: “Image Inpainting for Irregular Holes Using Partial Convolutions” (Liu et al.)

Partial Convolution

$$x' = \begin{cases} W^T (X \odot M) \frac{sum(1)}{sum(M)} + b & \text{falls sum(M)} > 0 \\ 0 & \text{sonst} \end{cases}$$

- X ➡ Bild oder Ausgabe vom vorherigen Layer
- W ➡ Gewichte der Conv. Filter
- M ➡ Zu X gehörende binäre Maske (0: maskiert, 1: originales Bild)
- 1 ➡ Einser-Matrix der Form 512x512x3
- B ➡ Bias der Conv. Filter
- $\odot$ ➡ Elementweise Multiplikation

Partial Convolution – Anpassung der Maske

$$m' = \begin{cases} 1 & \text{falls } \mathrm{sum}(\mathrm{M}) > 0 \\ 0 & \text{sonst} \end{cases}$$

Zielstellung:
Einfluss von verschiedenen Lossfunktionen

Lossfunktionen - V0

- Einfacher L1 Loss
- $L = \frac{1}{N}||O - GT||_1$

Lossfunktionen - V1

- $L_{hole} = \frac{1}{N}||(1 - M) \odot (O - GT)||_1$
- $L_{valid} = \frac{1}{N}||(M) \odot (O - GT)||_1$

Lossfunktionen - V2

- $L_{hole} = \frac{1}{N}||(1 - M) \odot (O - GT)||_1$
- $L_{valid} = \frac{1}{N}||(M) \odot (O - GT)||_1$
- $L_{perceptual} = \sum_{p=0}^{P-1} \frac{||\Psi_p^O - \Psi_p^{GT}||1}{N} + \sum_{p=0}^{P-1} \frac{||\Psi_p^C - \Psi_p^{GT}||1}{N}$

Perceptual Loss – Was ist das?

- $$L_{perceptual} = \sum_{p=0}^{P-1} \frac{||\Psi_p^O - \Psi_p^{GT}||1}{N} + \sum_{p=0}^{P-1} \frac{||\Psi_p^C - \Psi_p^{GT}||1}{N}$$
- Ψ ist die Ausgabe des p-ten Layers eines vortrainierten VGG16 Netzes
  - Max-Pool 1, Max-Pool 2, Max-Pool 3
- “Controlling Perceptual Factors in Neural Style Transfer” (Gatys et al in Tübingen!)

Lossfunktionen - V3

- Noch 2 bzw. 3 weitere Lossfunktionen
- Vorstellung im Abschlussvortrag

Training

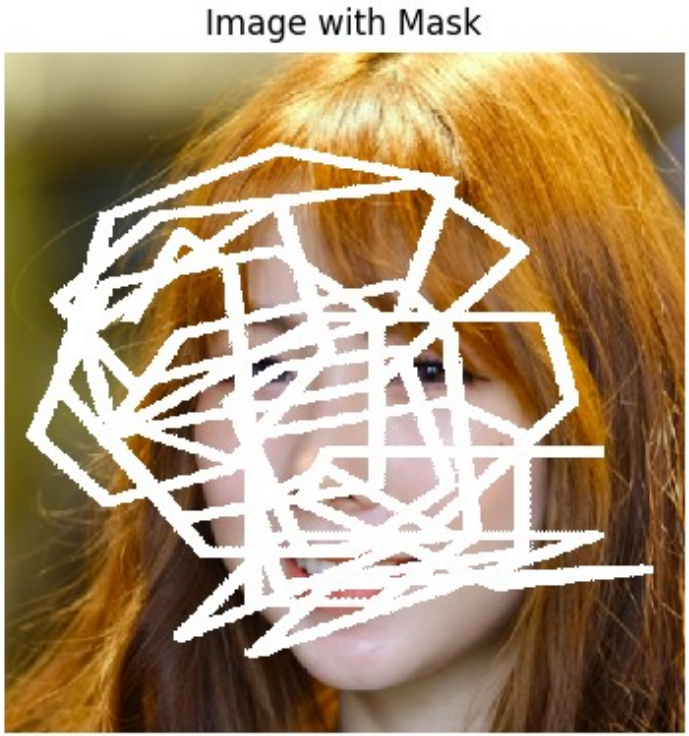
- TCML Cluster
- Batch Size: 16 bzw. 6
- BatchNormalization
- Learning Rate: 2e-4
- 3 Tage

Impressionen

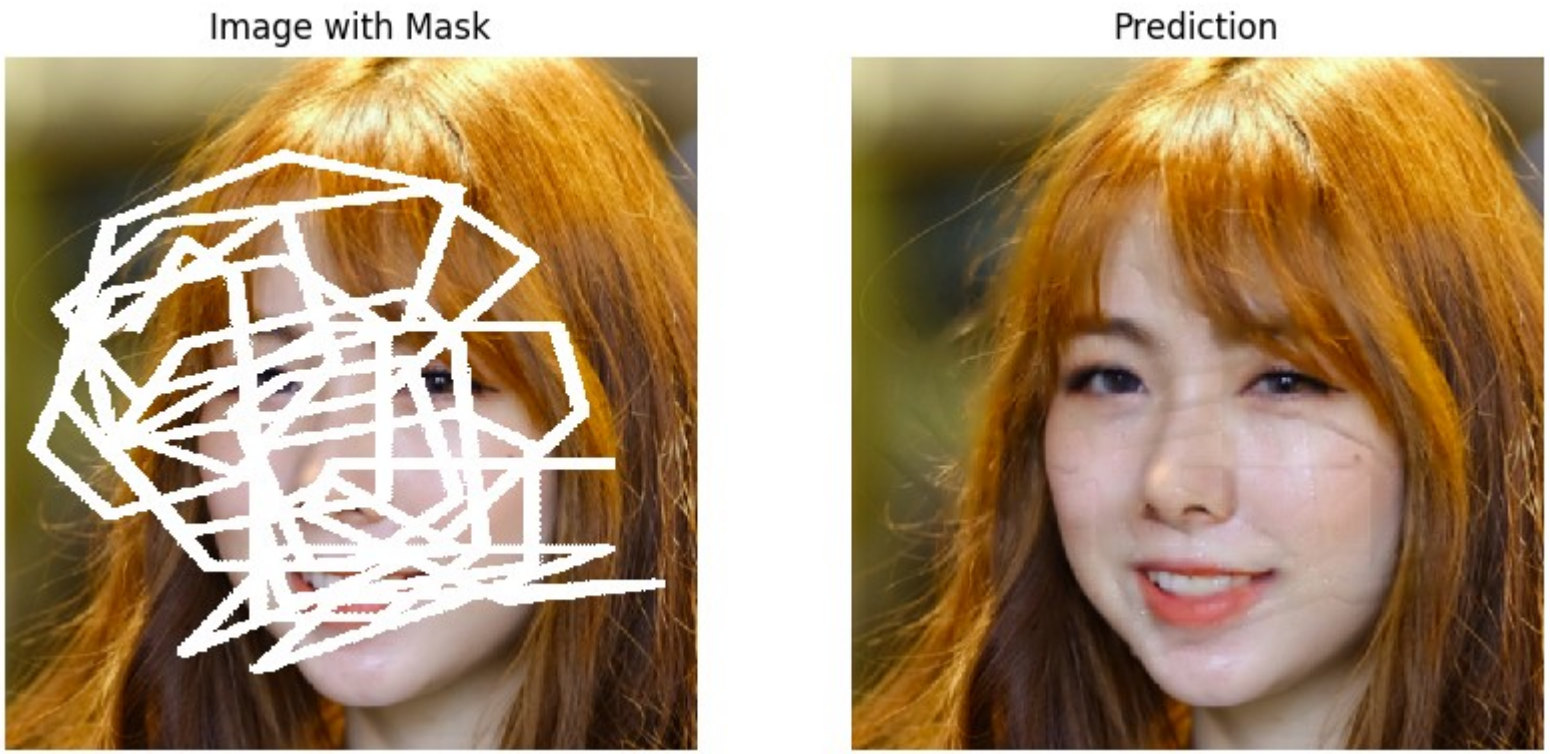
V1

Imp

Vergleich: V0

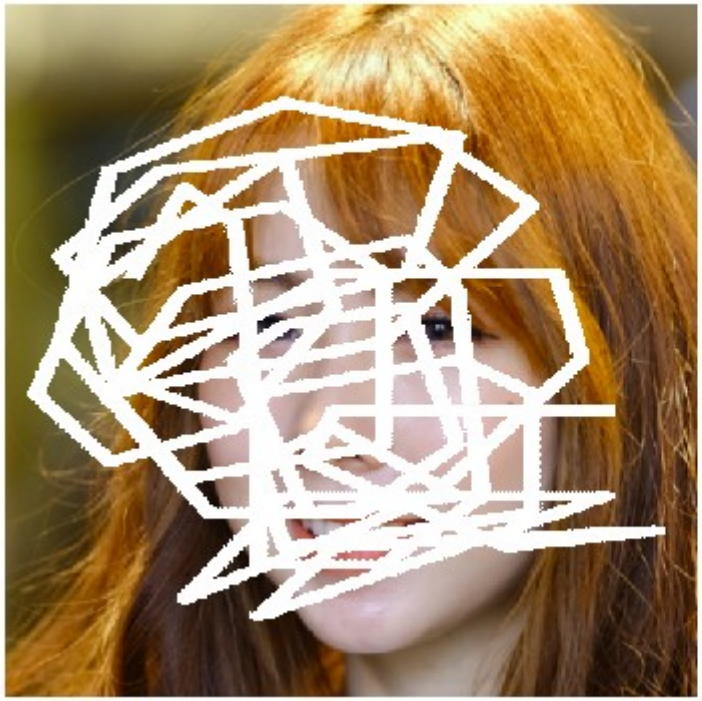


Vergleich: V1



Vergleich: V2

Image with Mask

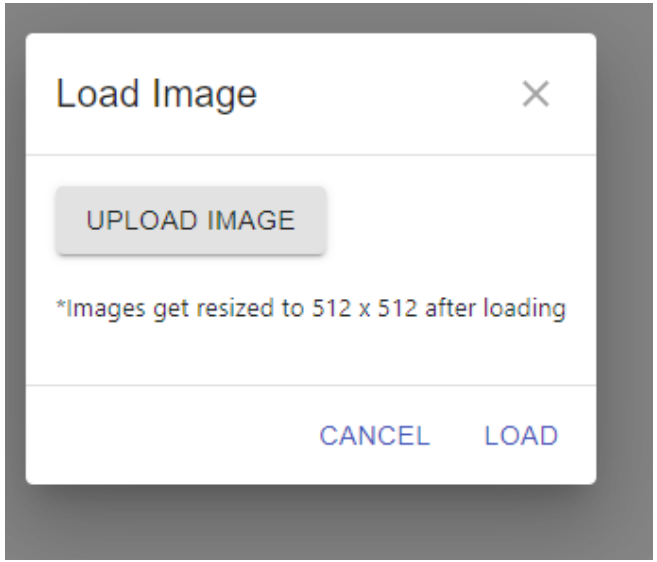


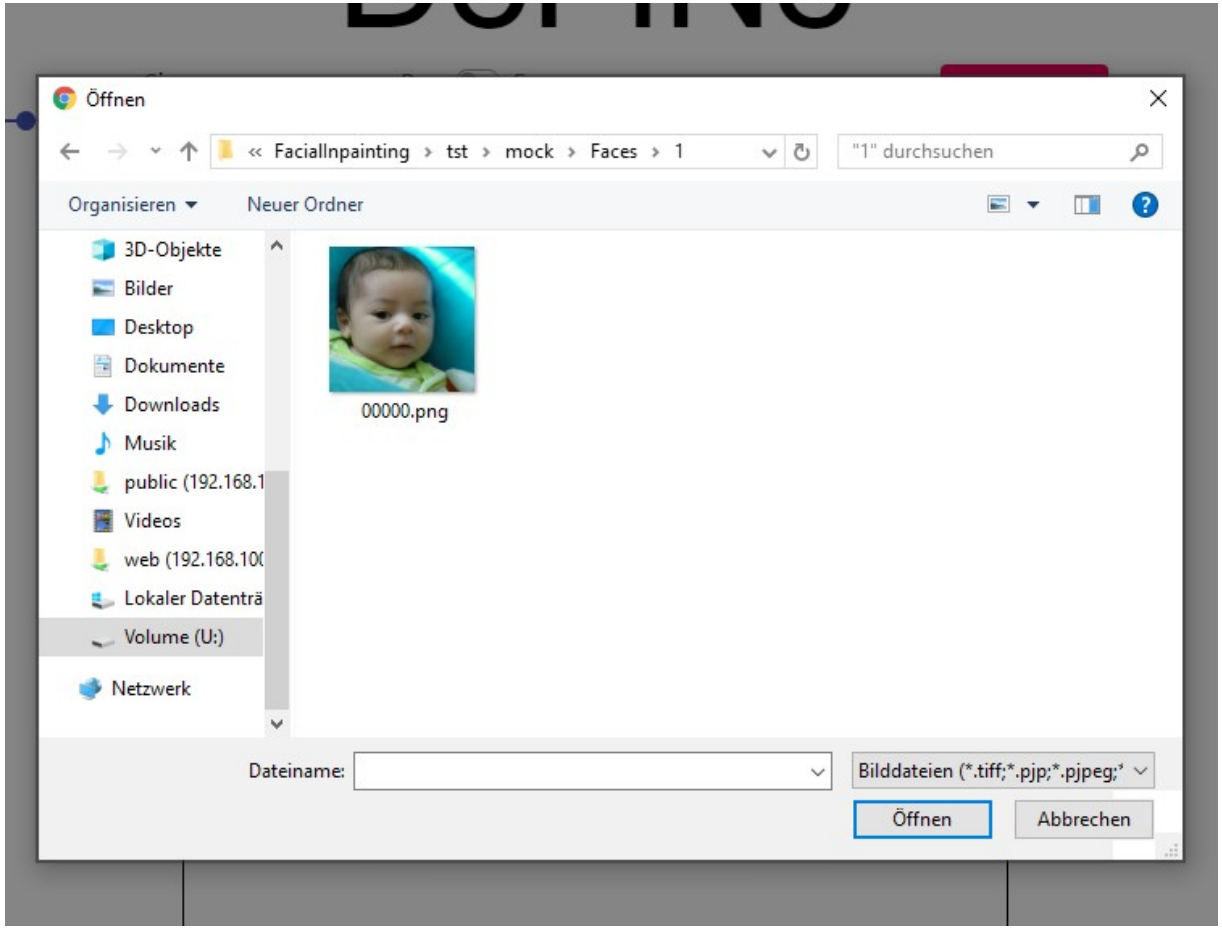
Prediction

GUI

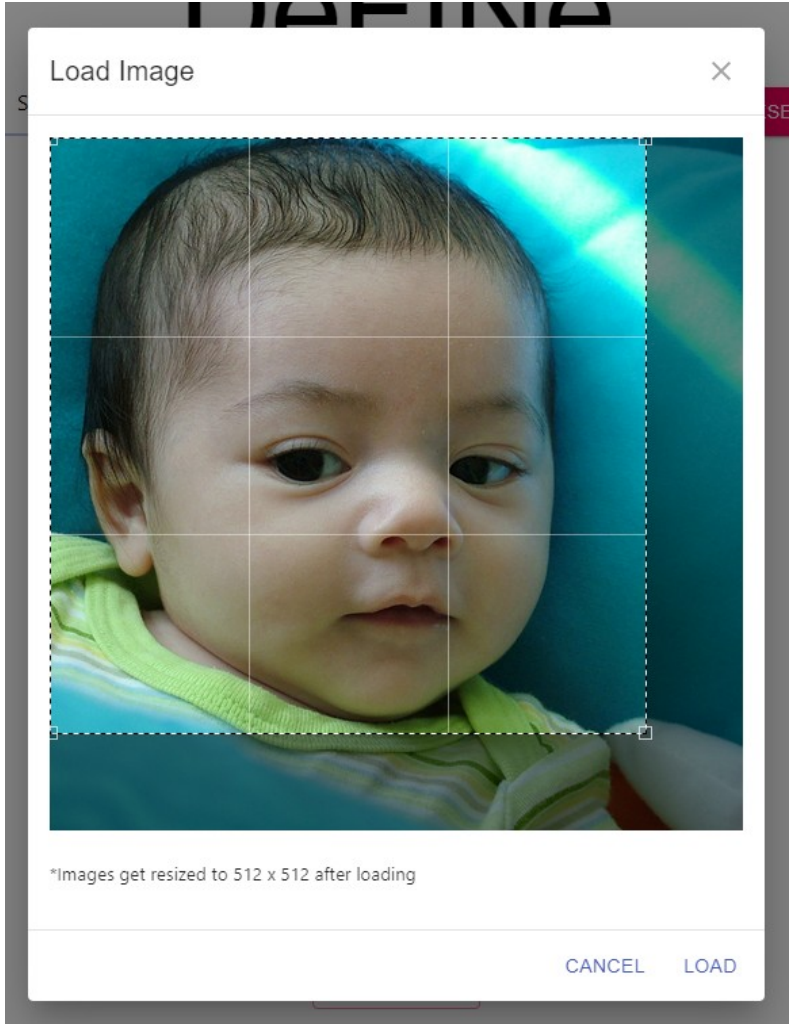

DeFINe
localhost:3000
Apps
Weitere Lesezeichen
DeFINe
Size
Pen
Eraser
RESET
5px
100px
PREDICT
LOAD IMAGE

GUI


Load Image
UPLOAD IMAGE
*Images get resized to 512 x 512 after loading
CANCEL
LOAD


Öffnen
« FacialInpainting › tst › mock › Faces › 1
"1" durchsuchen
Organisieren
Neuer Ordner
3D-Objekte
Bilder
Desktop
Dokumente
Downloads
Musik
public (192.168.1
Videos
web (192.168.10
Lokaler Datenträ
Volume (U:)
Netzwerk
00000.png
Dateiname:
Bilddateien (*.tiff;*.pjp;*.pjpeg;*
Öffnen
Abbrechen

GUI


Load Image
*Images get resized to 512 x 512 after loading
CANCEL
LOAD

GUI


DeFINe
localhost:3000
Apps
Weitere Lesezeichen
DeFINe
20
Size
Pen
Eraser
RESET
5px
100px
PREDICT
LOAD IMAGE

GUI


```
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```

Ausblick

- Implementierung von restlichen Lossfunktionen
- API um GUI und Netzwerk zu verbinden
- GUI styling

Literaturverzeichnis

- https://github.com/NVlabs/ffhq-dataset
- https://github.com/karfly/qd-imd
- https://arxiv.org/abs/1505.04597 U-Net