Local Facial Attribute Transfer through Inpainting

Ricard Durall\textsuperscript{1,2,3} Franz-Josef Pfreundt\textsuperscript{1} Janis Keuper\textsuperscript{1,4}

\textsuperscript{1}Fraunhofer ITWM, Germany
\textsuperscript{2}IWR, University of Heidelberg, Germany
\textsuperscript{3}Fraunhofer Center Machine Learning, Germany
\textsuperscript{4}Institute for Machine Learning and Analysis, Offenburg University, Germany
Our goal is to build a system that effectively performs attribute transfer.
We propose to formulate local attribute transfer as an inpainting problem

Our model ATI-GAN: Attribute Transfer Inpainting Generative Adversarial Network

Previous methods [1,2] generating new images (global)
Our approach generating new patches (local)

ATI-GAN is able to utilize local context information to focus on the attributes while keeping the background unmodified resulting in visually sound results.

[1] Y. Choi, et al., Stargan: Unified generative adversarial networks for multi-domain image-to-image translation. (2018)
[2] Z. He, et al., Attgan: Facial attribute editing by only changing what you want. (2019)
Our model is composed of a Reconstructor, a Generator and a Discriminator

\[
\text{Reconstructor} \quad \rightarrow \quad \mathcal{L}_{\text{rec}} = \lambda_{ae}\mathcal{L}_{ae} + \mathcal{L}_{\text{adv}} + \lambda_c \mathcal{L}_{\text{class}}^f.
\]

\[
\text{Generator} \quad \rightarrow \quad \mathcal{L}_{\text{gen}} = \mathcal{L}_{\text{adv}} + \lambda_c \mathcal{L}_{\text{class}}^f + \lambda_{\text{cycle}} \mathcal{L}_{\text{cycle}}.
\]

\[
\text{Discriminator} \quad \rightarrow \quad \mathcal{L}_{\text{disc}} = -\mathcal{L}_{\text{adv}} + \lambda_c \mathcal{L}_{\text{class}}^r.
\]
Evaluating ATI-GAN results

We train ATI-GAN on the CelebA dataset which consists of ~200K celebrity face images with variations in facial attributes.

Evaluation of inpainting results:

| Method       | PSNR (dB) | SSIM  |
|--------------|-----------|-------|
| SIIWGAN [27] | 19.20     | 0.920 |
| SIIDGM [10]  | 19.40     | 0.907 |
| CE [19]      | 21.30     | 0.923 |
| GL [4]       | 23.19     | 0.936 |
| GntInp[12]   | 23.80     | 0.940 |
| GMCNN [28]   | 24.46     | 0.944 |
| GL+LID[29]   | 25.56     | 0.953 |
| ours         | 31.80     | 0.946 |

Evaluation of attribute results:
Results

ATI-GAN formulates attribute transfer as an inpainting problem.

Thank You!