

Face Generation from Binary Facial Features

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Introduction

- Traditional GAN-based face generators have less control over the latent space.
- We explore how to control face generation from binary descriptive facial features.
- **Motivation** for this comes from a multitude of potential applications such as digital police sketch artist, attribute based scenery generation, etc.

Dataset

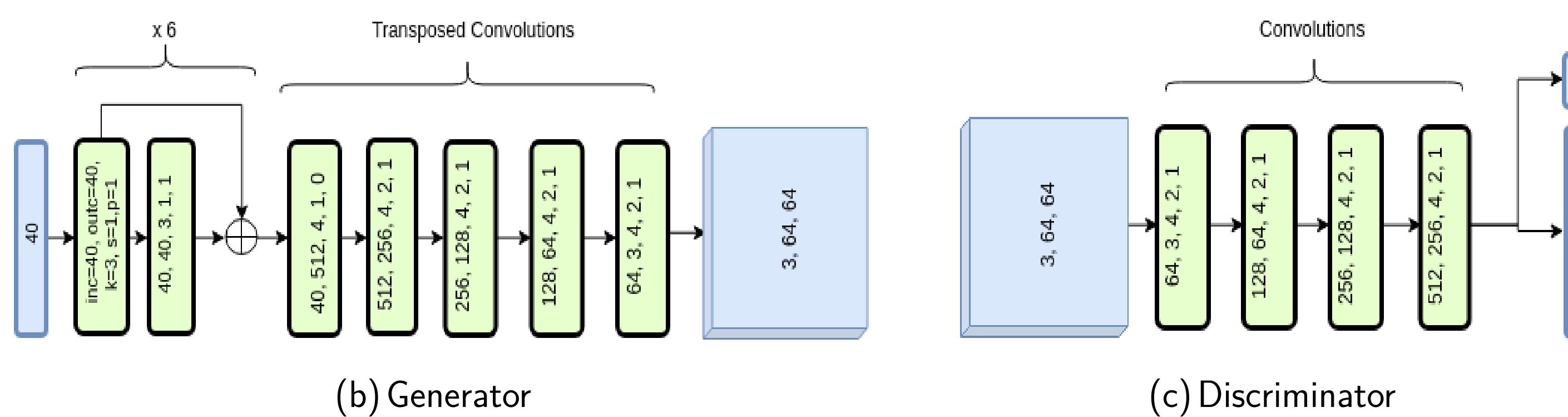
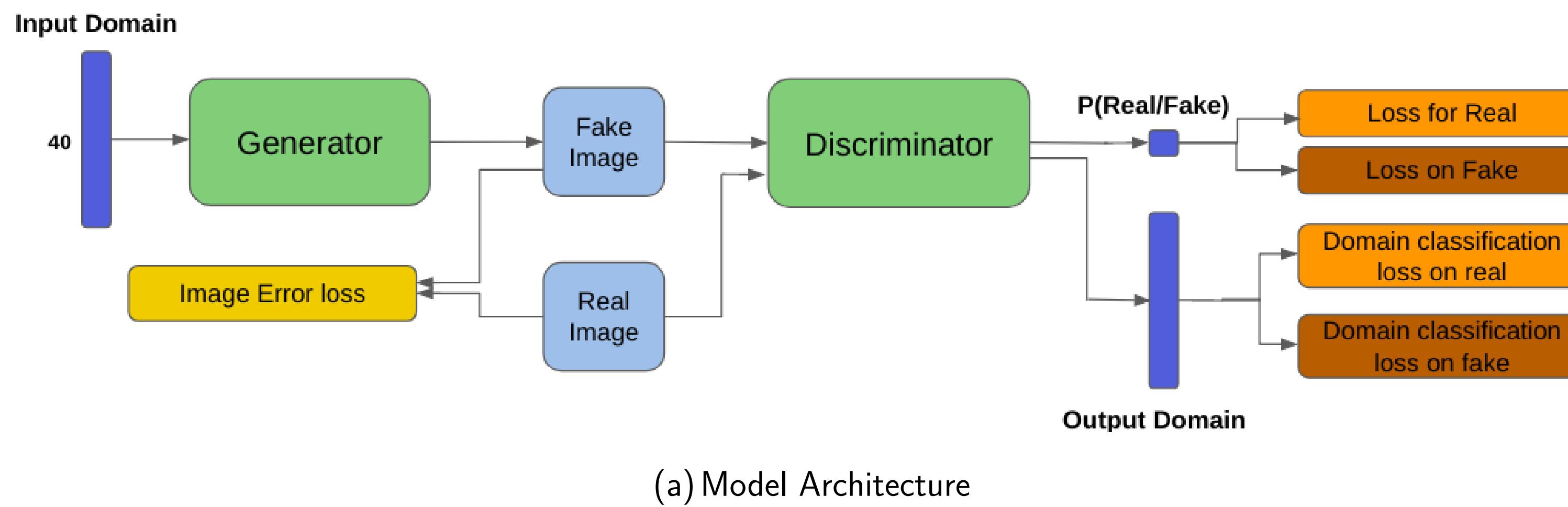
CelebFaces Attributes (CelebA) Dataset

Number of identities	10177
Number of face images	202599
Number of features	40

Methods

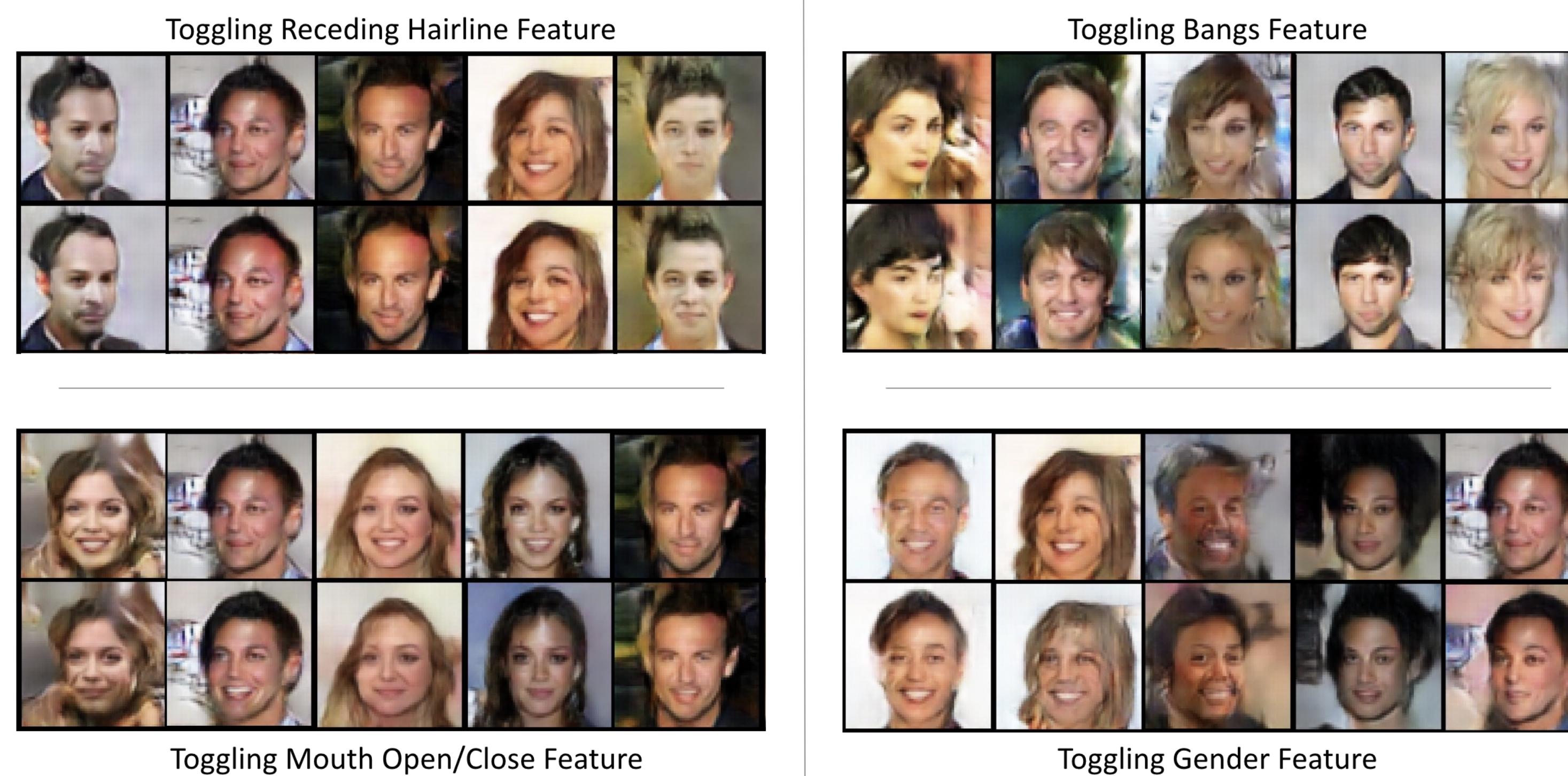
Baseline	DC-GAN
Our Model	Modified DC-GAN + deep residual blocks + domain classification + image loss
G Input	40×1 feature vector
G Output	$3 \times 64 \times 64$ fake image
D Input	Real and fake images
D Output	$P(\text{real}/\text{fake})$, 40×1 feat.
Adversarial Loss	For fake/real images
Domain Classification Loss	Binary cross entropy between input and predicted domain
Image Loss	$L1$ loss: $ \text{real} - \text{fake} $

Model Architecture



Results

Some of the faces demonstrating our GAN's control over certain features by individually toggling them.



Related Work

- ✓ StarGAN and Transparent Latent (TL) GAN can appropriately control facial features, but do not bode well for use cases we are targeting.
- ✗ StarGAN does not support generating features only from descriptive facial features.
- ✗ In contrast to our approach, TL GAN is not an end-to-end trainable model.

Conclusions

Strengths:

- + Control over certain features:
 - Bangs: ✓
 - Eye-glasses: ✓
 - Smiling: ✓
 - Open mouth: ✓
 - Receding hairline: ✓
- + Simple architecture: Only **2m** parameters, compared to $> 7m$ parameters in related works.
- + End-to-end trainable.

Limitations and Future Scope:

- Reduce correlation between related features.
Example: Beard \longleftrightarrow Male
- Gender-specific GAN might help too.
- Support longitudinal/sliding control over features (compared to binary).
- Scope of improvement in image quality.

References

- Alec Radford et al., DC-GANs, ICLR, 2015
- Yunjey Choi et al., StarGAN, CVPR, 2018
- Shaobo GUAN, TL-GAN, 2018