Hierarchical Mixtures of Generators for Adversarial Learning

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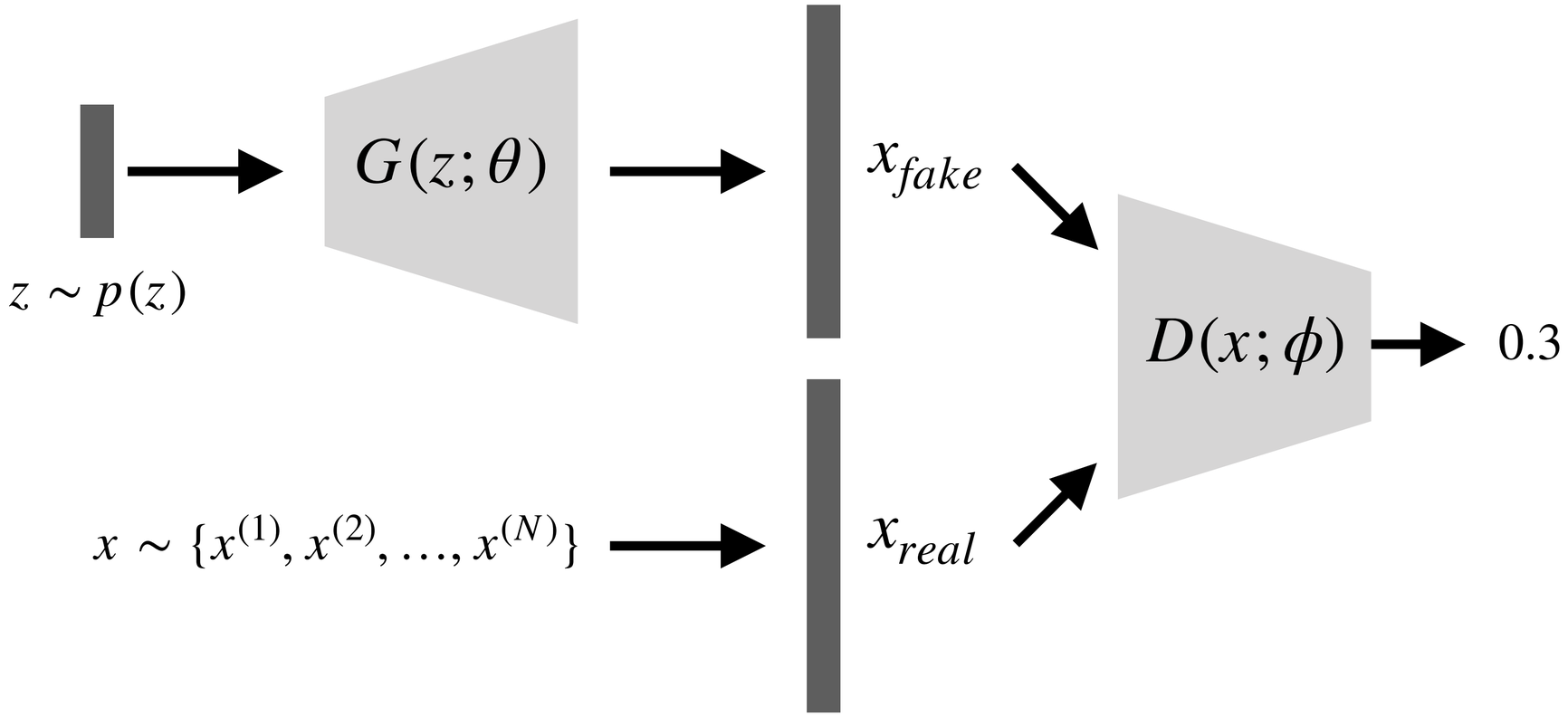
Generative Adversarial Networks



Problems with GANs

- Vanishing or exploding gradients: $\log(1 - D(G(z)))$ or $-\log D(G(z))$
- Mode Collapse

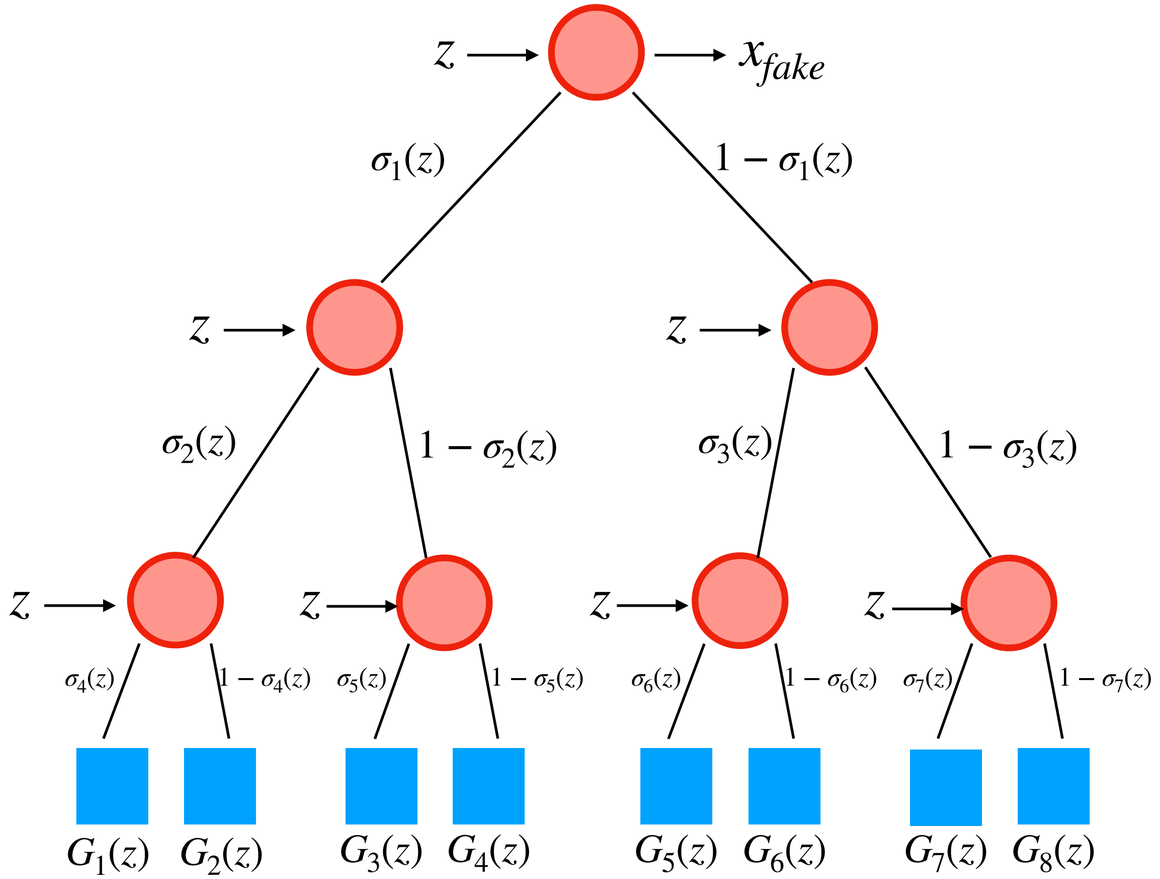
Solution Approaches

- Architecture change: DCGAN, ProgGAN
- Objective change: LSGAN, WGAN
- Regularization methods: Spectral normalization

Combining Multiple Generators in GANs

- Multi-agent diverse GAN (MADGAN, Ghosh et al. 2018)
- Mixture GAN (MGAN, Hoang et al. 2018)
- Mixture of experts GAN (MEGAN, Park et al. 2018)

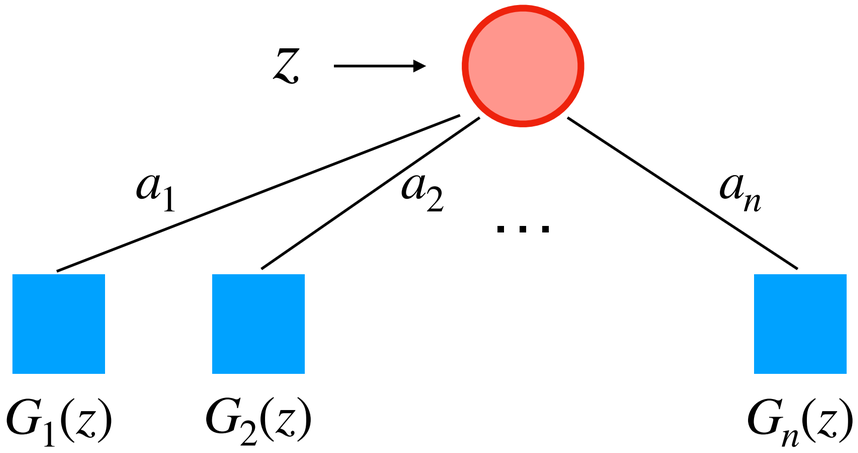
Hierarchical Mixture of Generators (HMoG)



$$\sigma_1(z) = \frac{1}{1+\exp[-(v_1 z + v_{10})]}$$

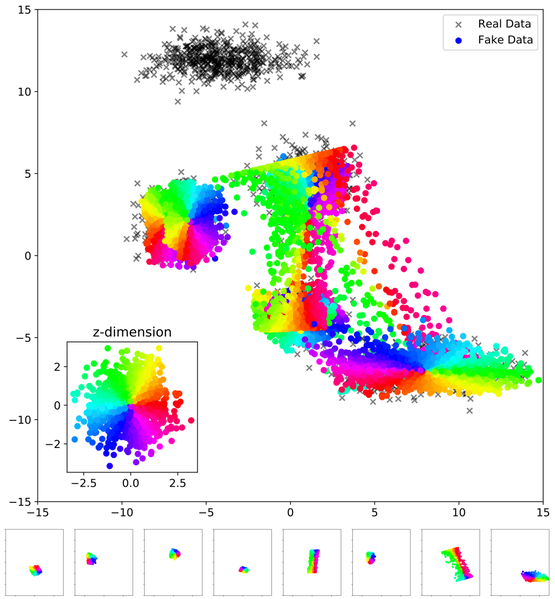
$$G_1(z) = W_1 z + w_{10}$$

Flat Mixture of Generators (MoG)

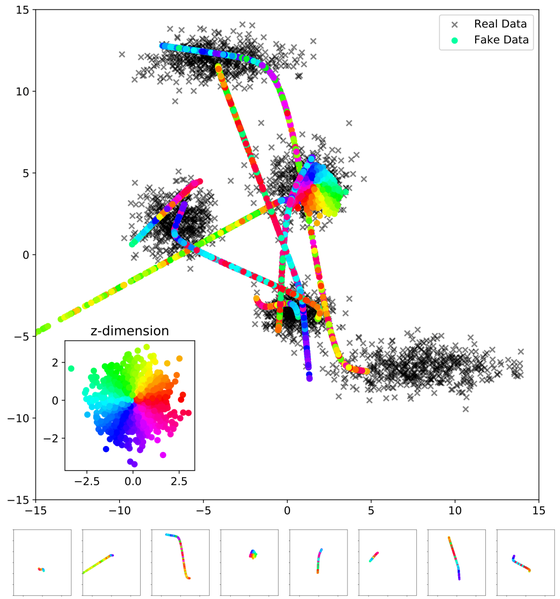


$$a(z) = \textbf{softmax}(vz + v_0)$$

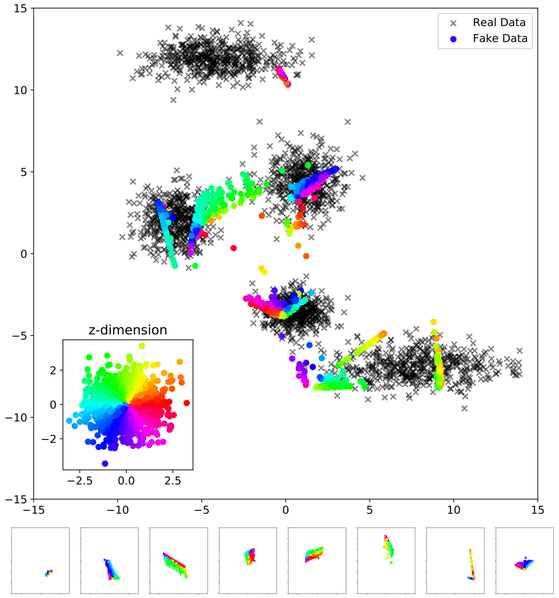
MADGAN



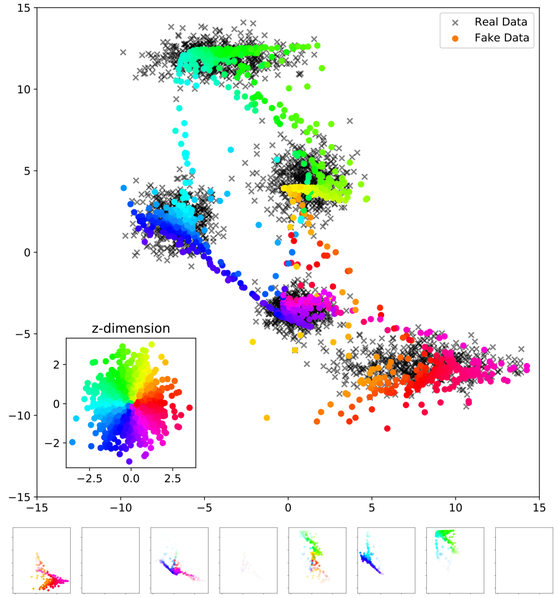
MGAN



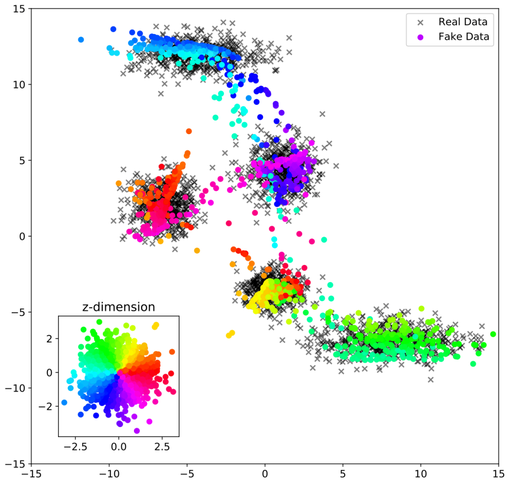
MEGAN

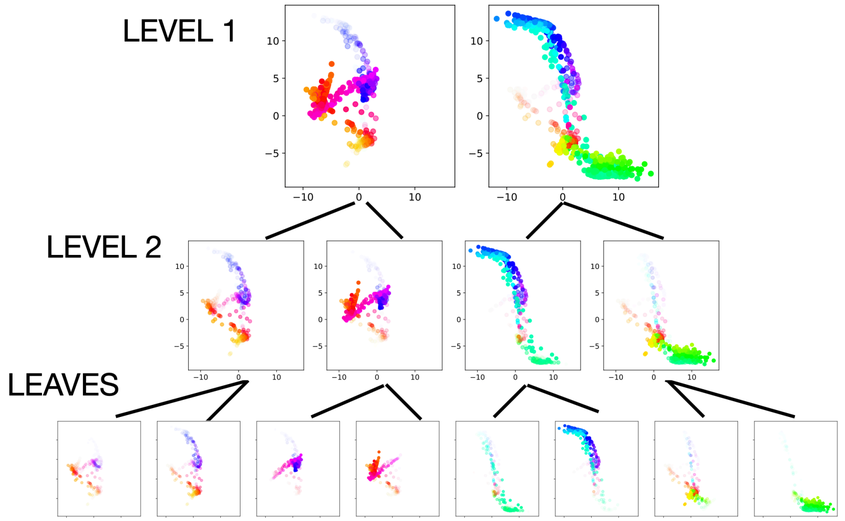


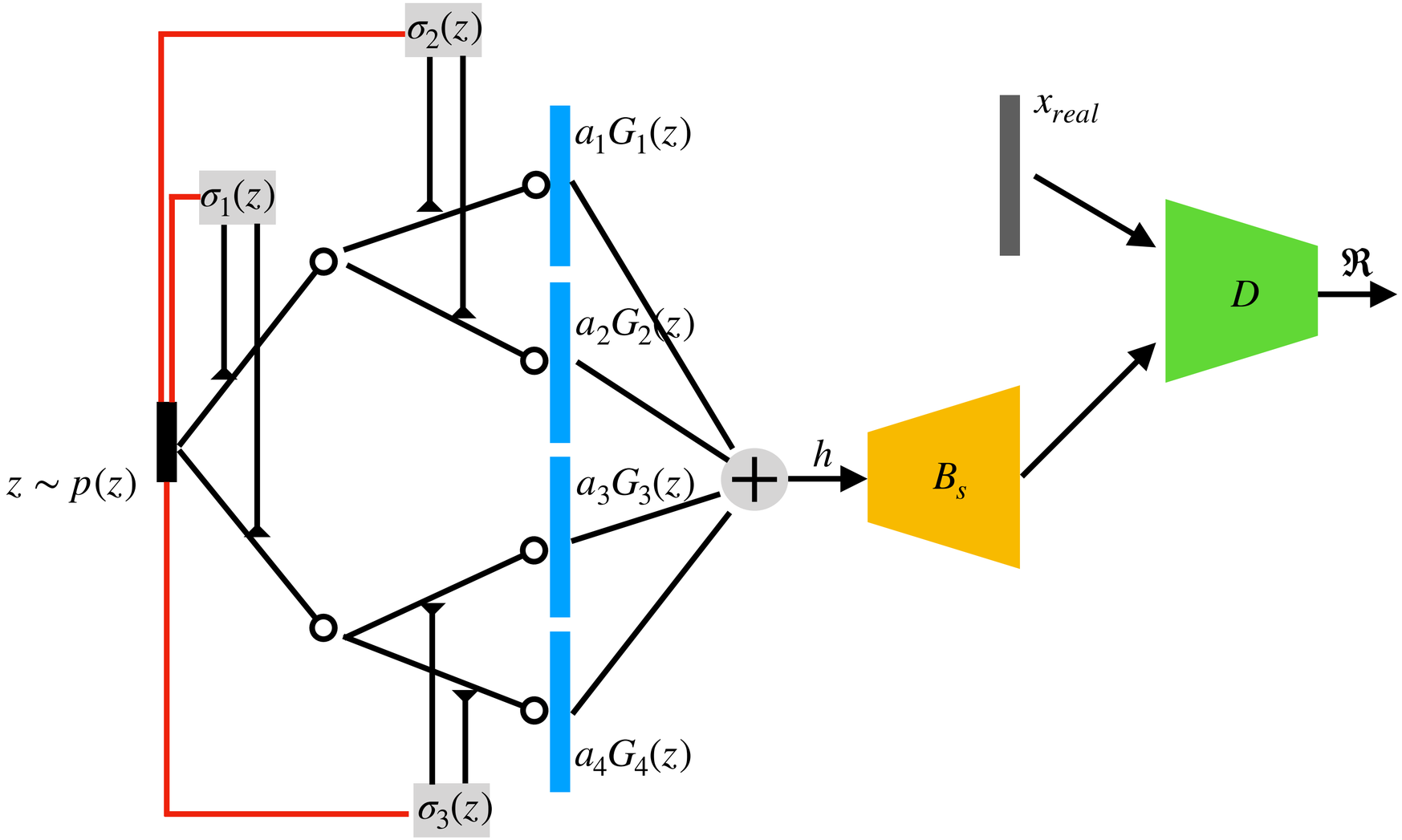
MoG (ours)



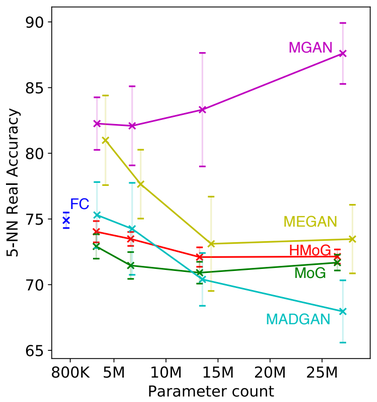
HMoG (ours)

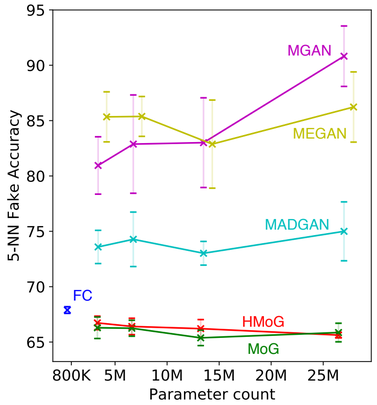


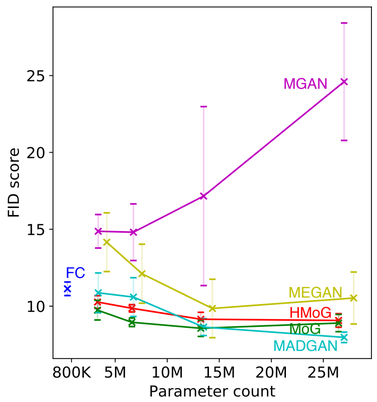



$\sigma_2(z)$
$\sigma_1(z)$
$a_1G_1(z)$
$a_2G_2(z)$
$a_3G_3(z)$
$a_4G_4(z)$
$\sigma_3(z)$
$z \sim p(z)$
h
B_s
x_{real}
D
$\Re$

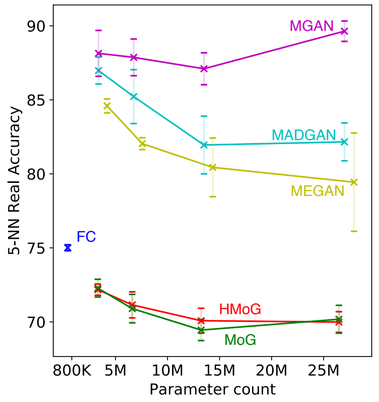
MNIST

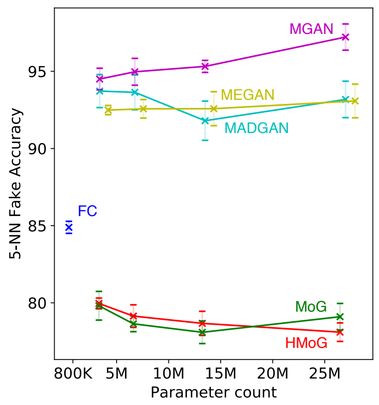


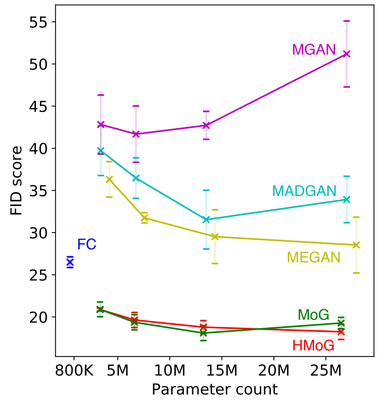




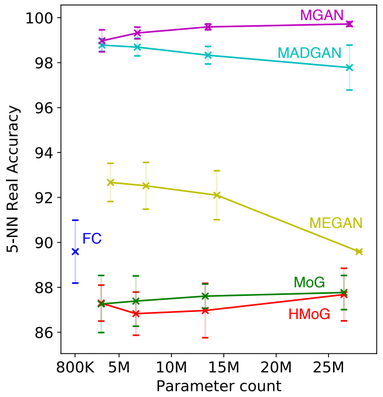
FashionMNIST

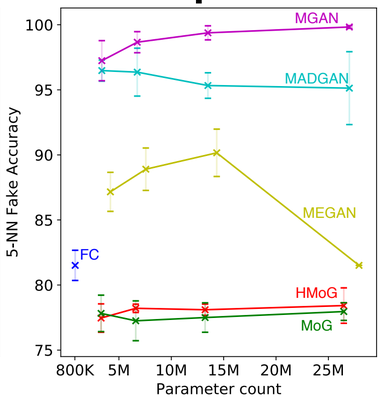


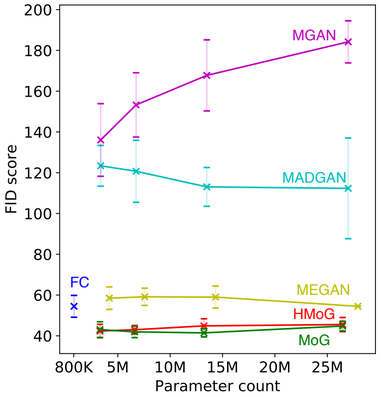




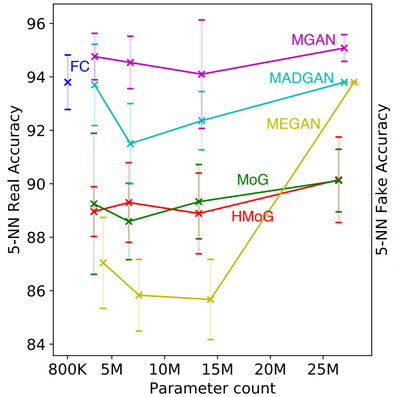
UTZap50K

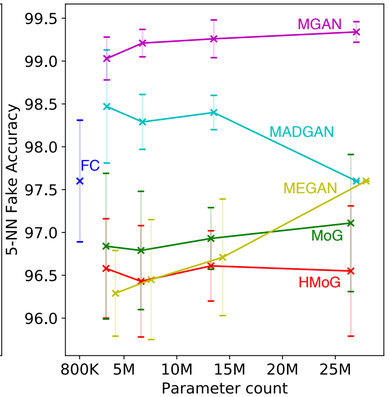


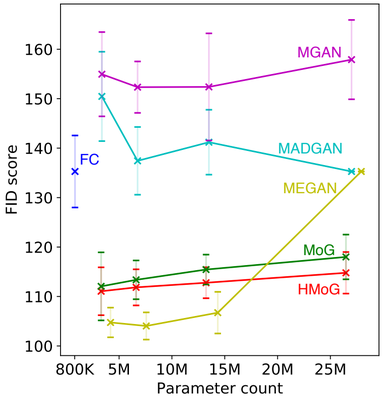




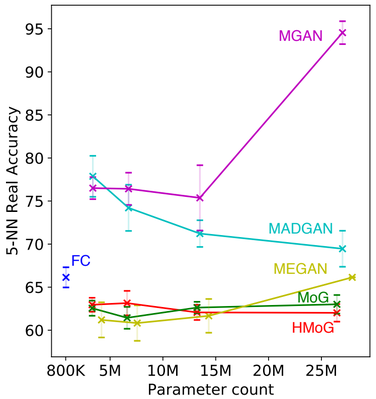
Oxford Flowers

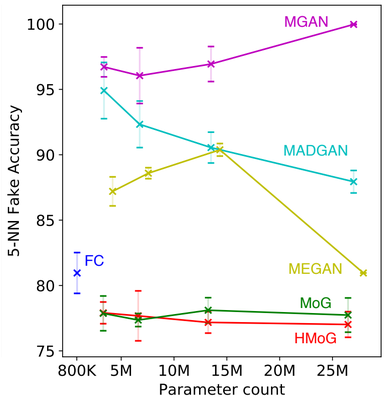


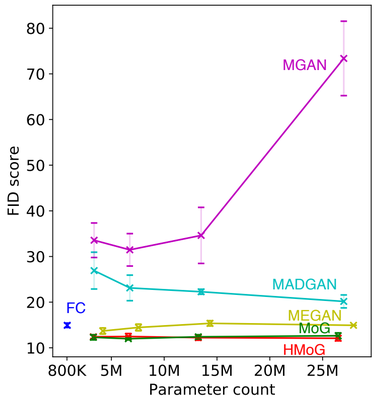




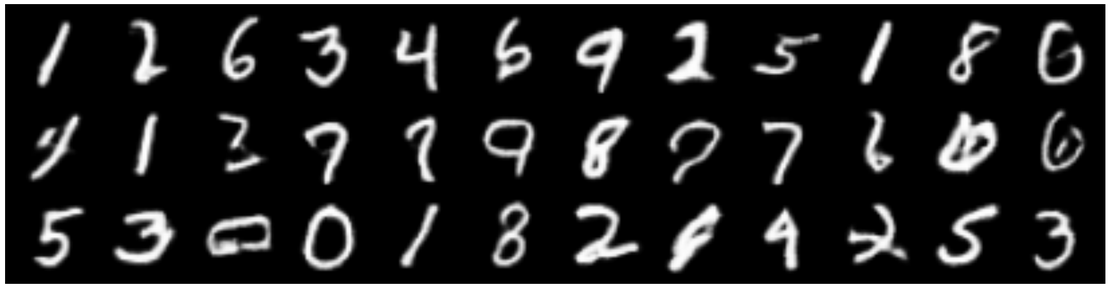
CelebA







MNIST



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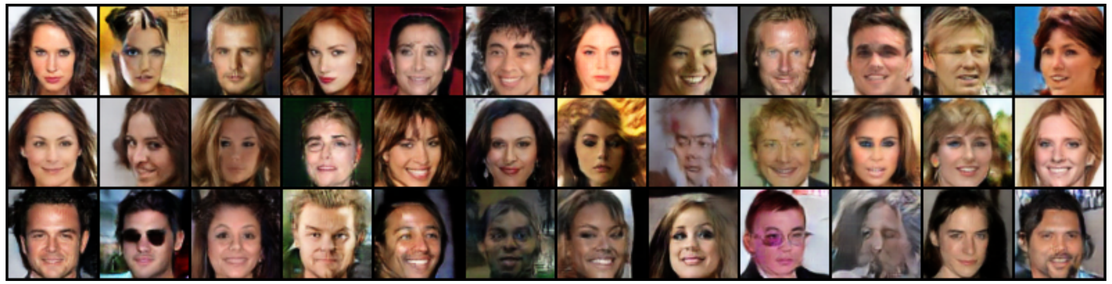

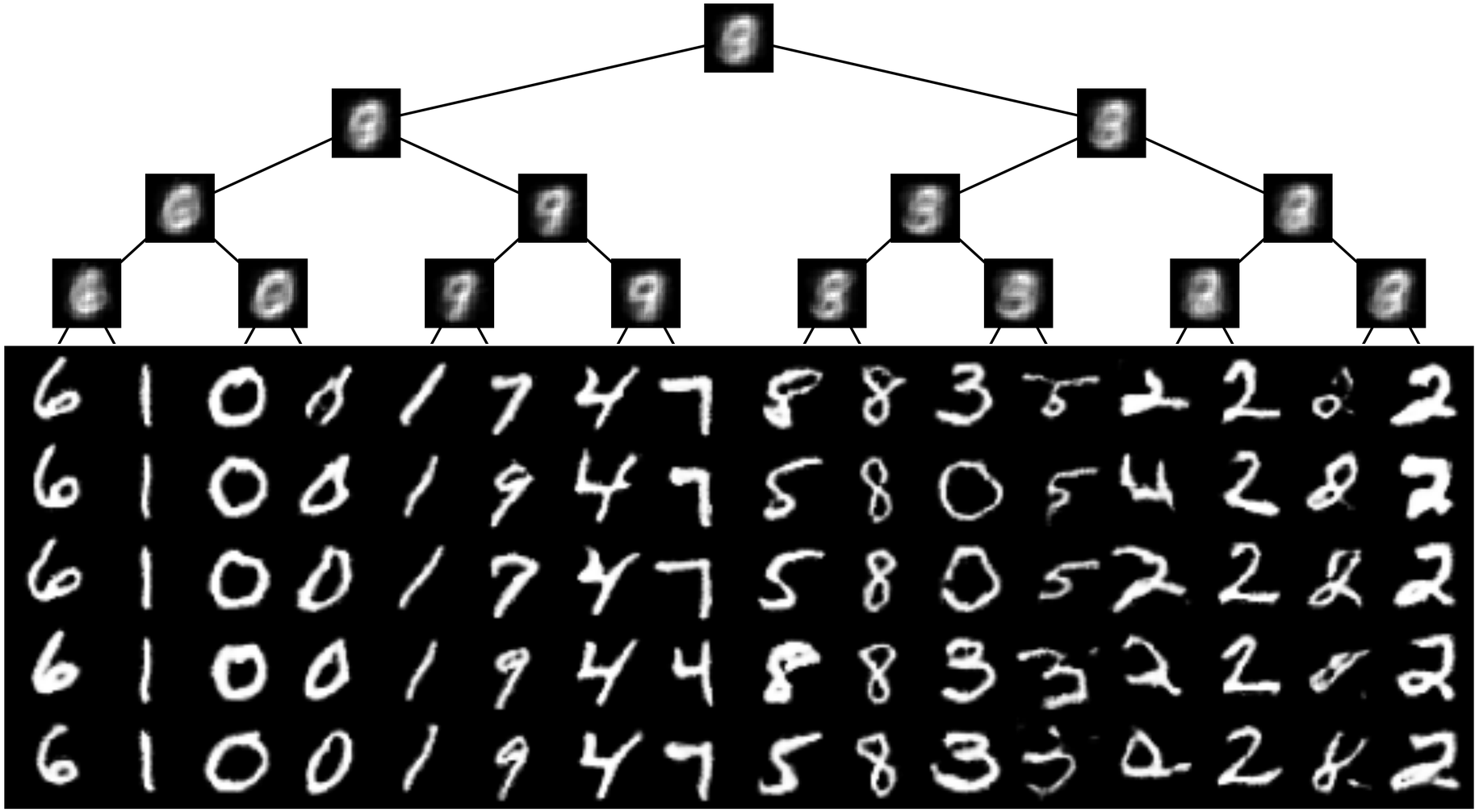

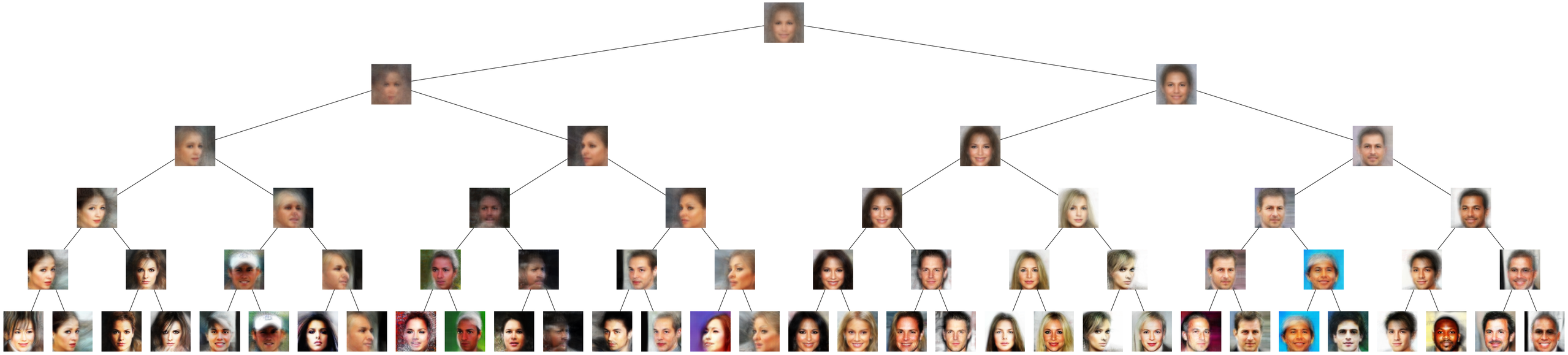

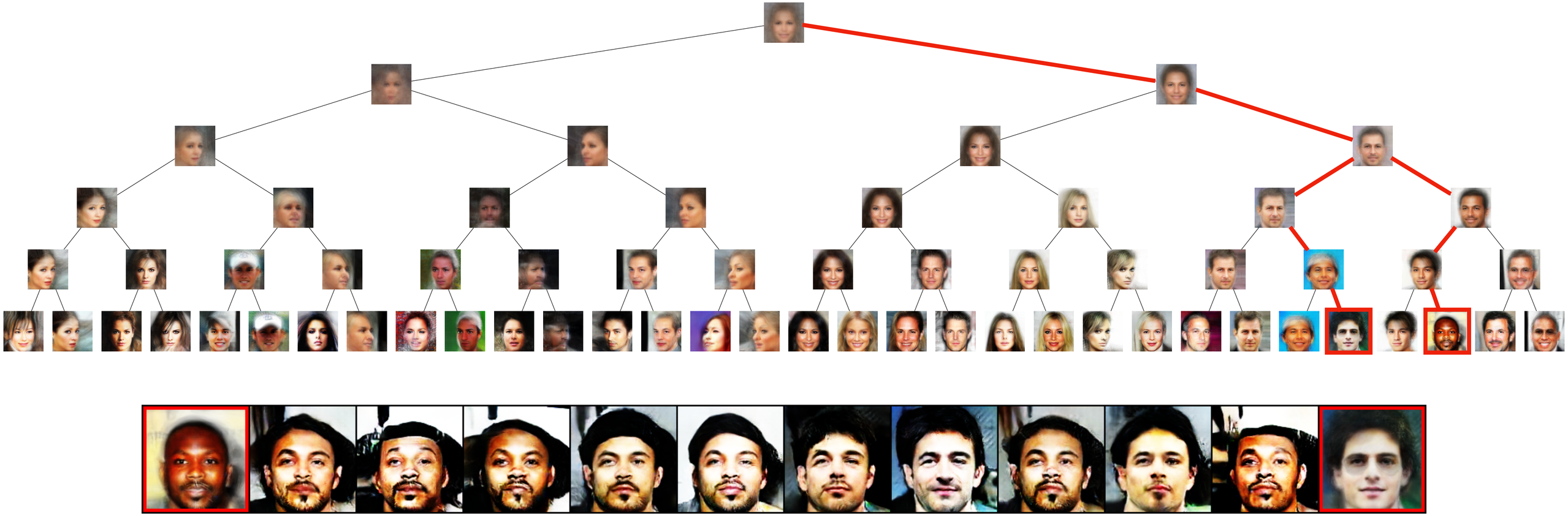

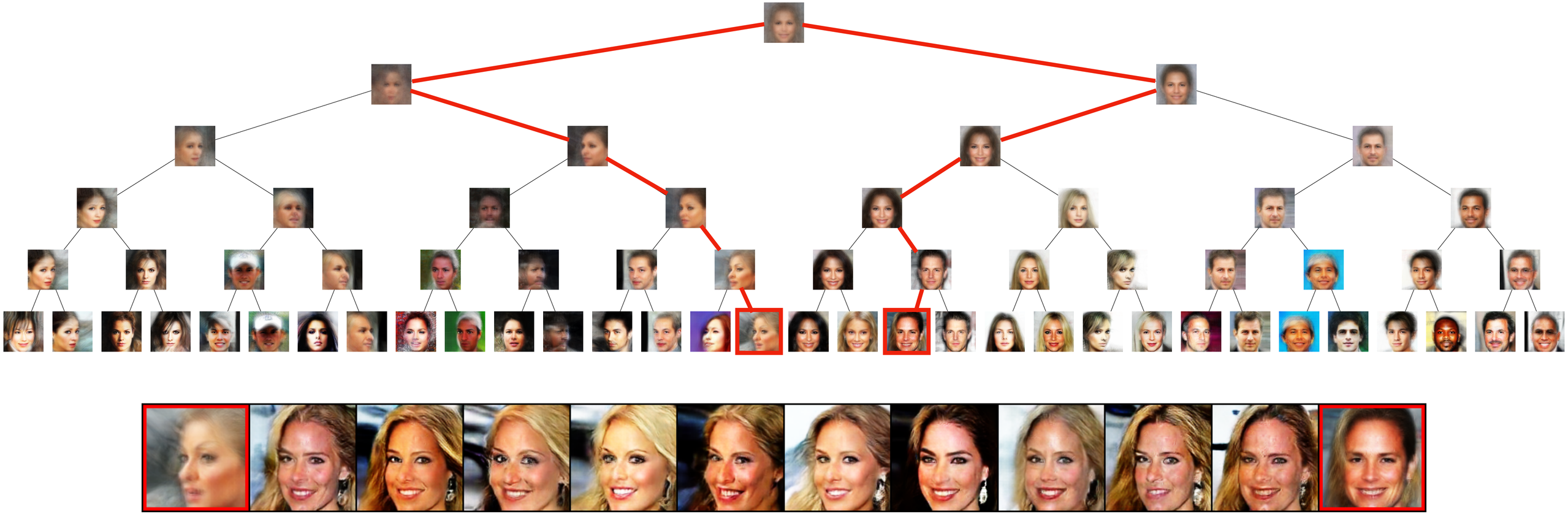

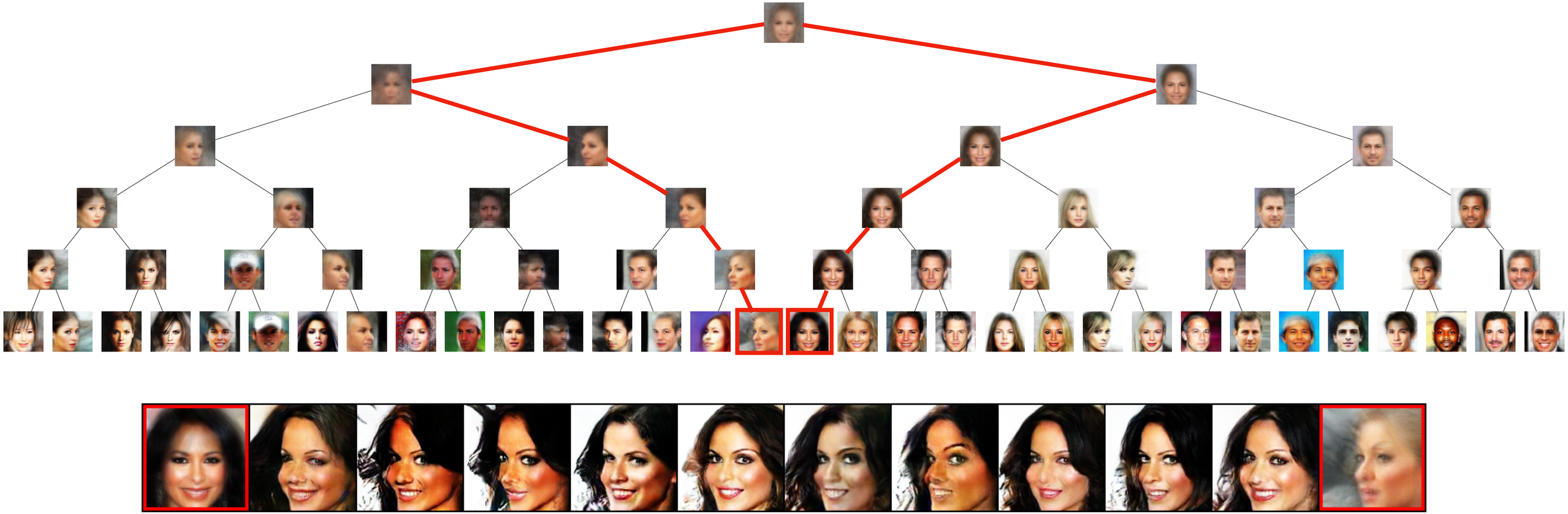

Conclusion

- We propose hierarchical mixtures of generators (HMoG).
- HMoG performs better than other multiple generator frameworks based on FID and 5-NN classifier tests.
- HMoG can be easily integrated with other GAN architectures.
- HMoG is interpretable to some extent.

`alpera.xyz/hmog`

Thank you for your time.

Questions and comments are welcome!