X-GAN: Latent Optimization by Convex Combinations for Generative Adversarial Network

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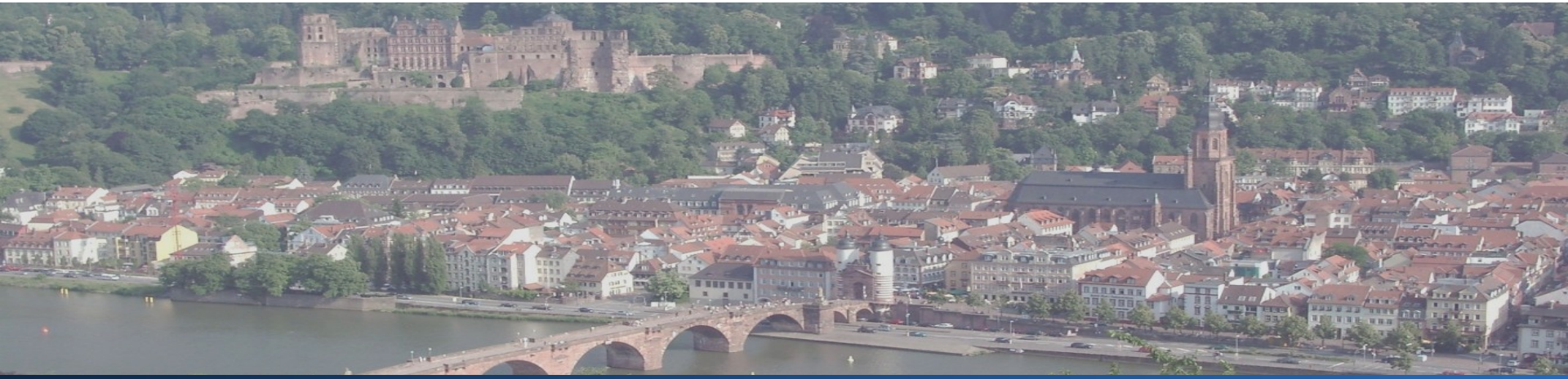

Motivation

Reconstruction of the continuous Image Manifold

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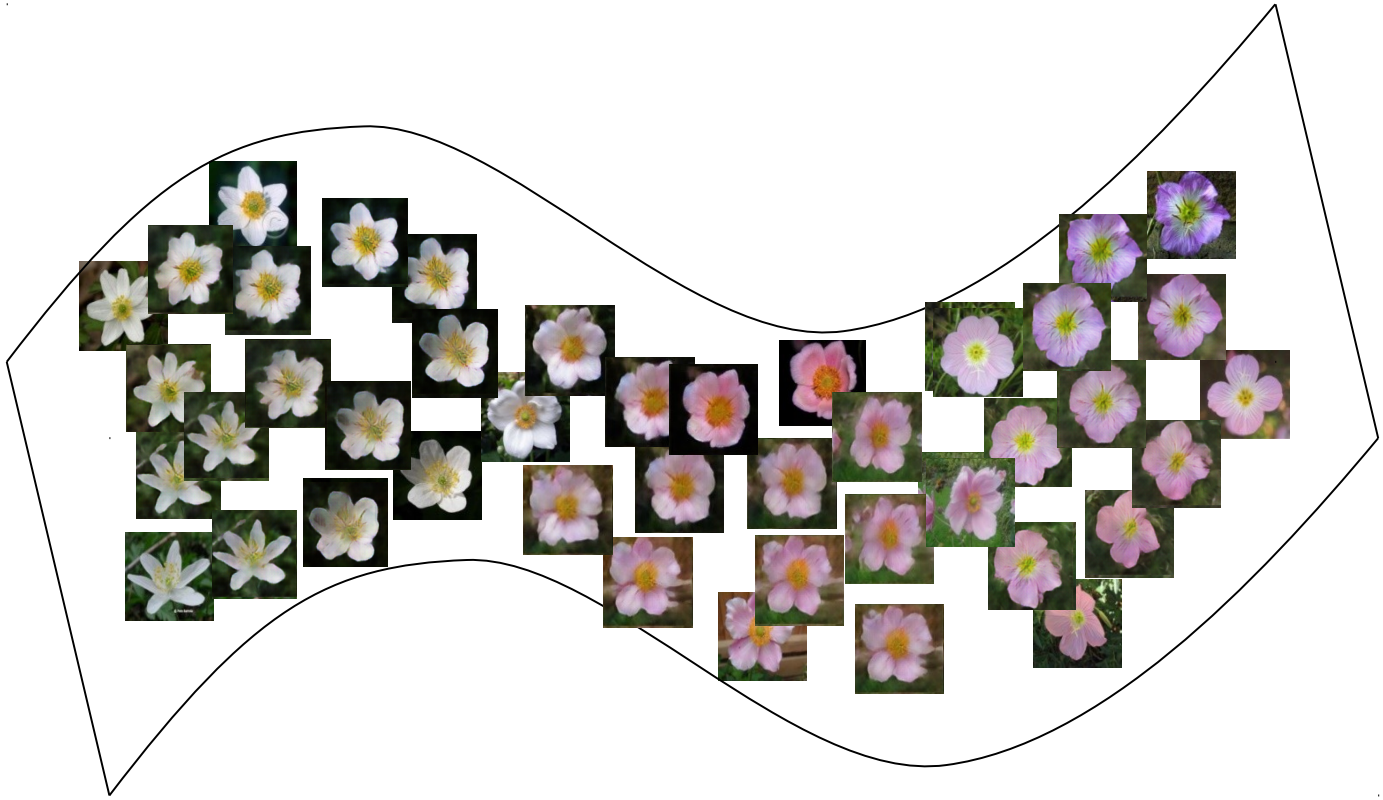
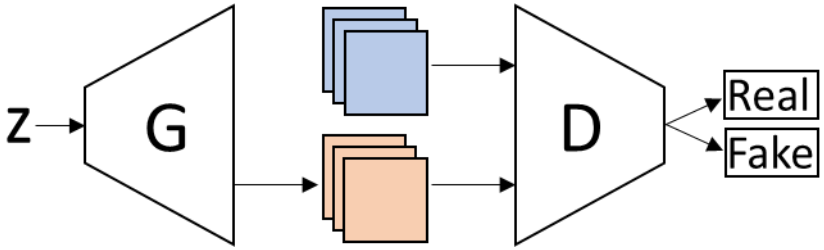


Reconstruction of the continuous Image Manifold

Issues with Current Models

Gererative Adversarial Net



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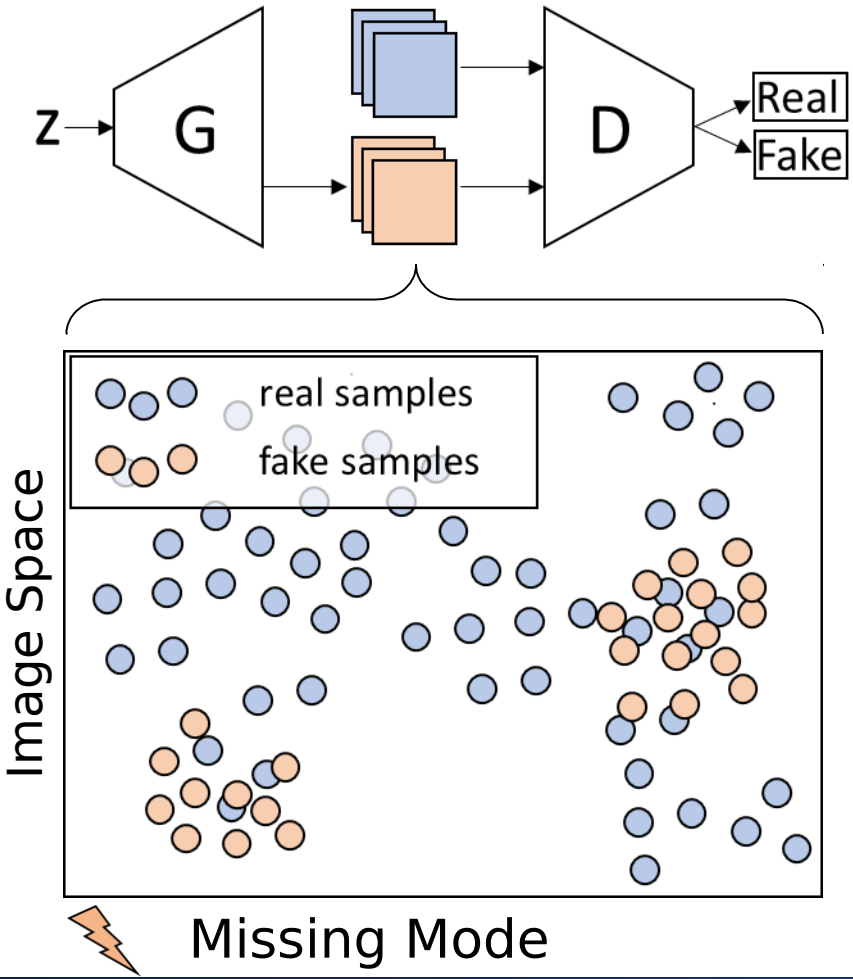

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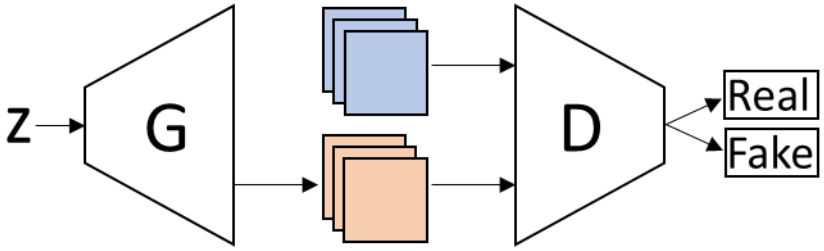
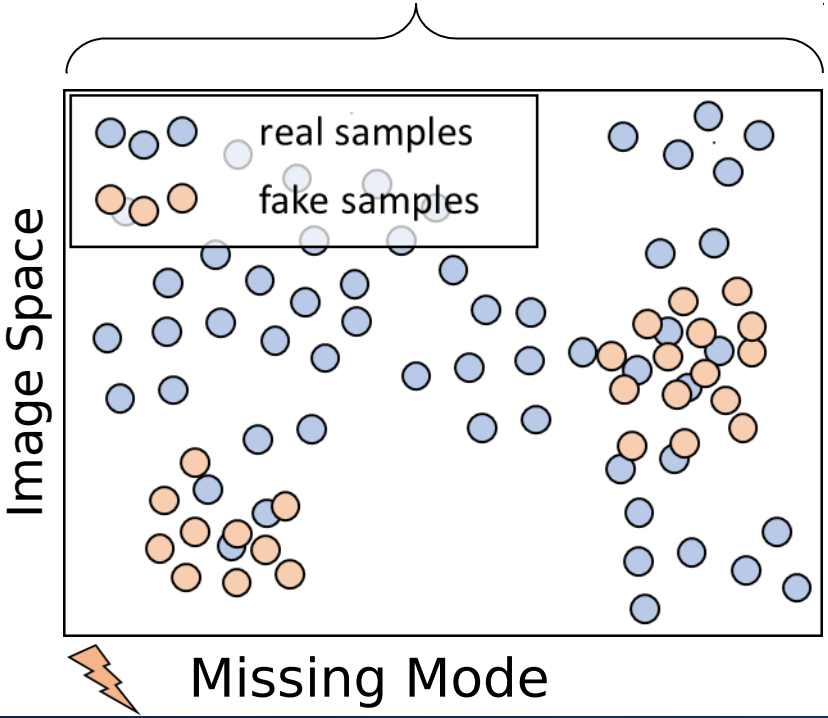
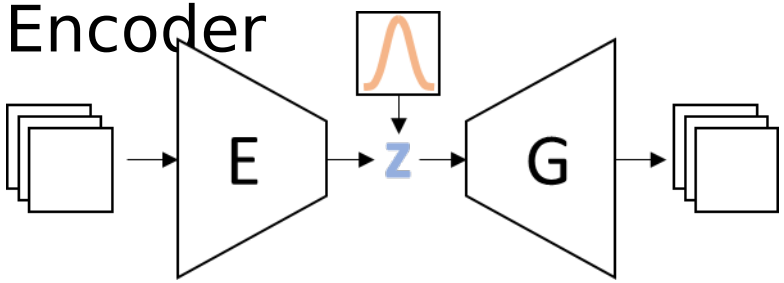




Variational Auto Encoder



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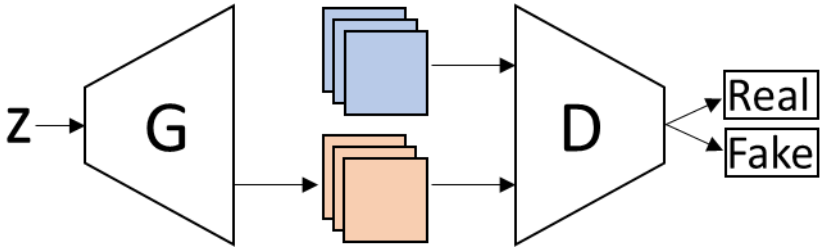
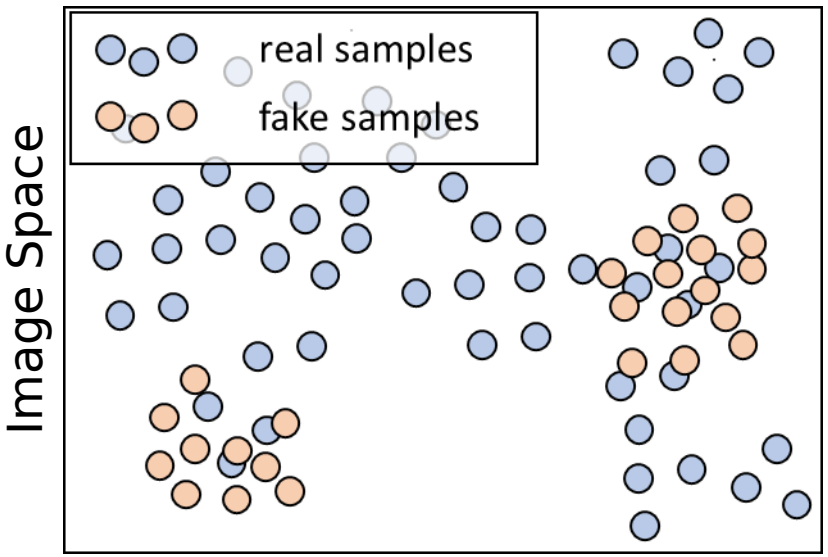
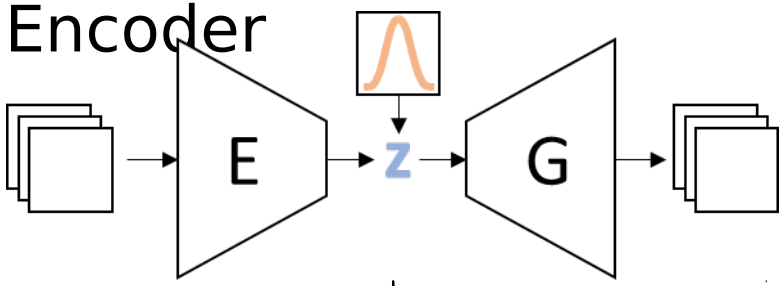
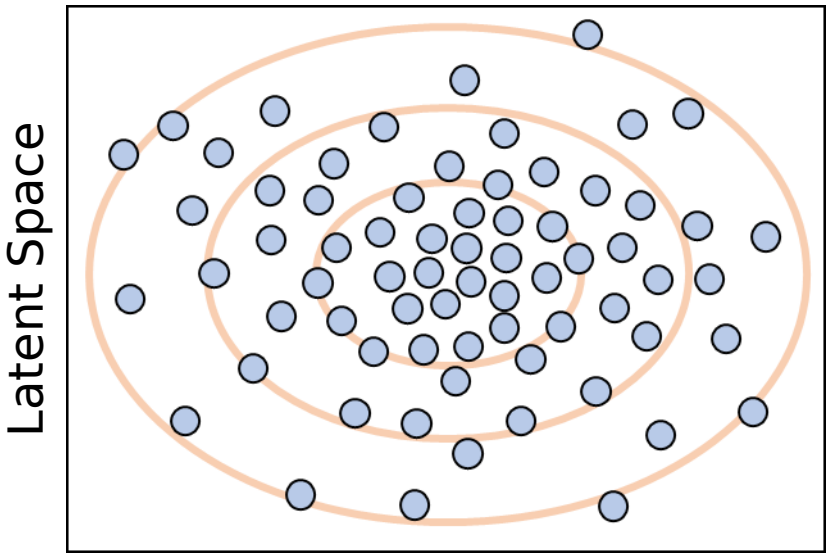




Missing Mode

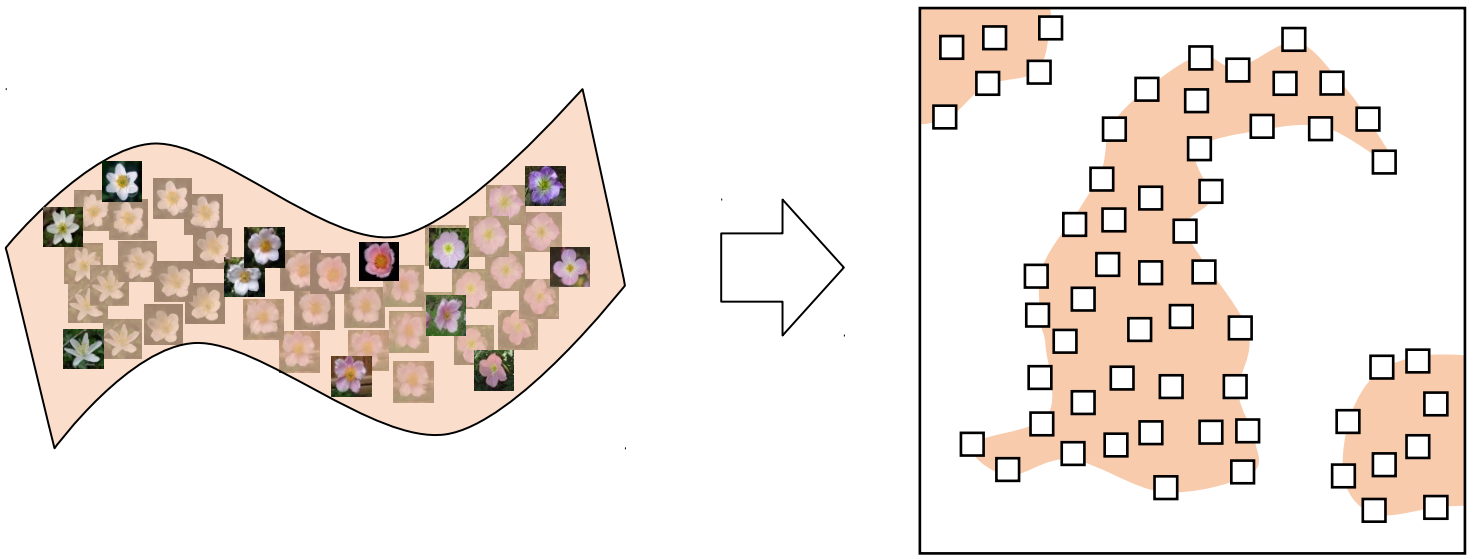
Variational Auto Encoder





Overpowering

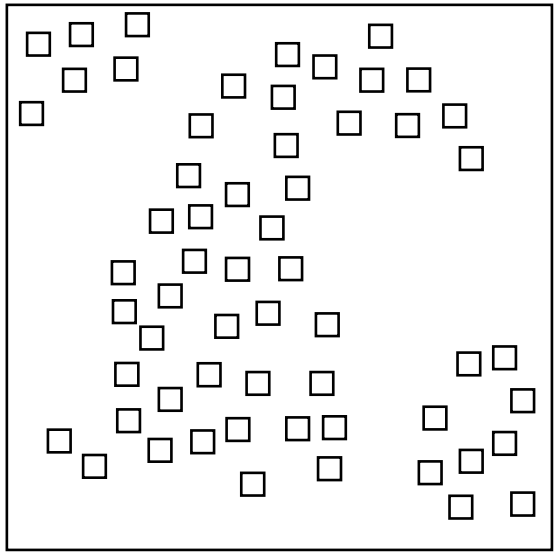
Convex Combination Strategy



Latent representations of training images (discrete)

Latent representation of all realistic images (continous)

Convex Combination Strategy



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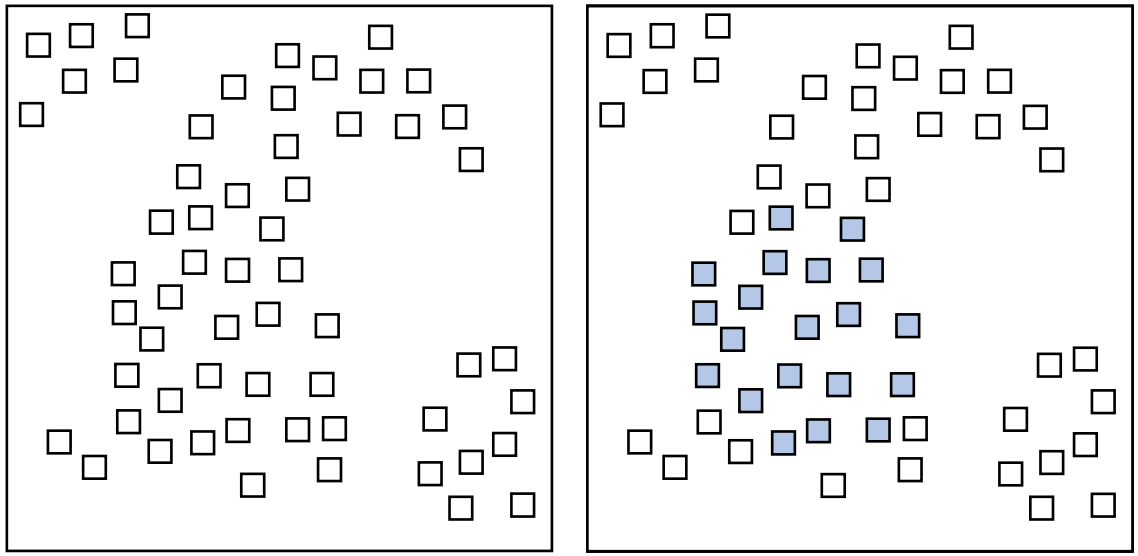

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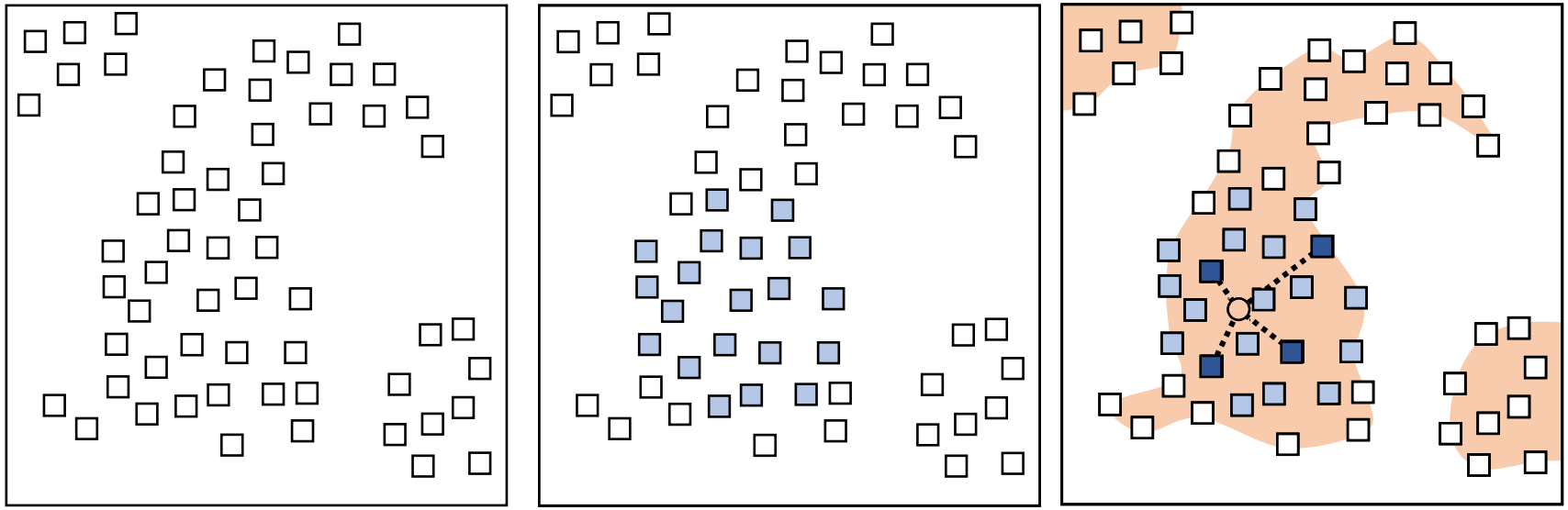

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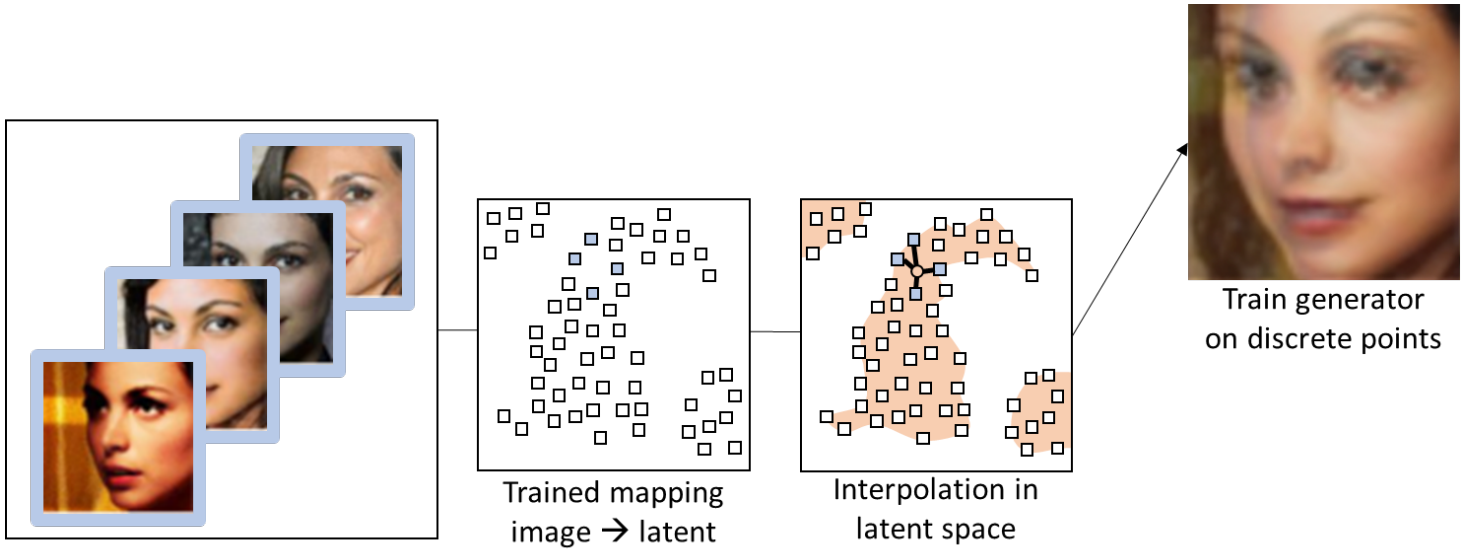
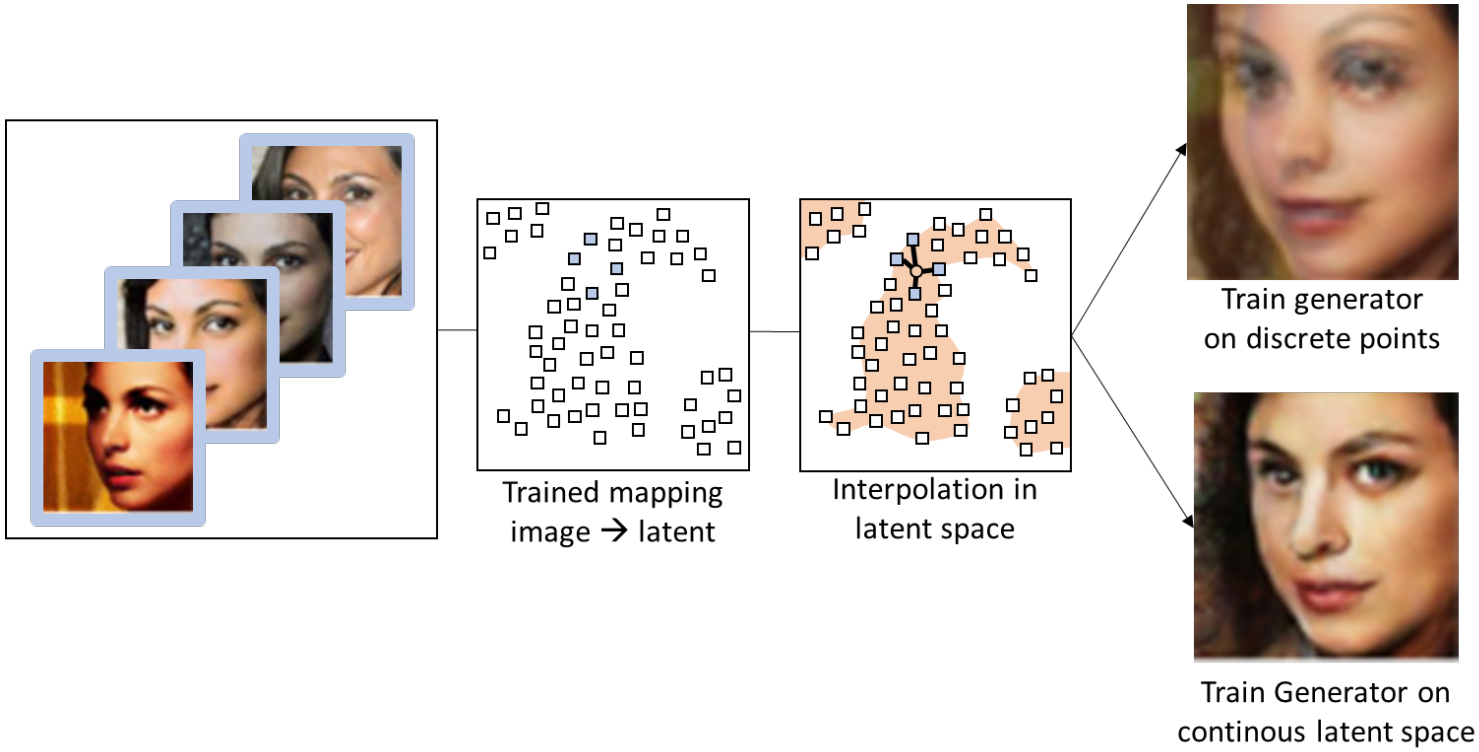


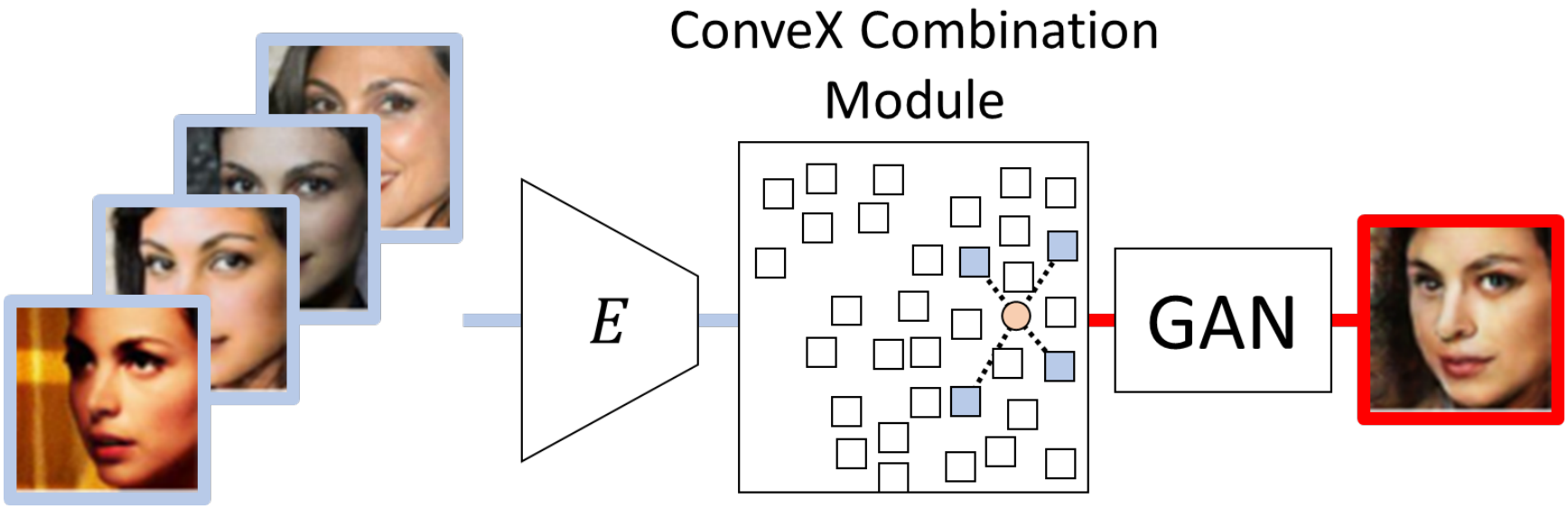
Taining with discrete latent vectors

Convex Combination Strategy



Taining with continous latent vectors

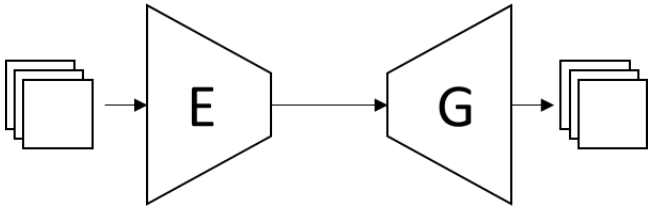
Convex Combination Strategy



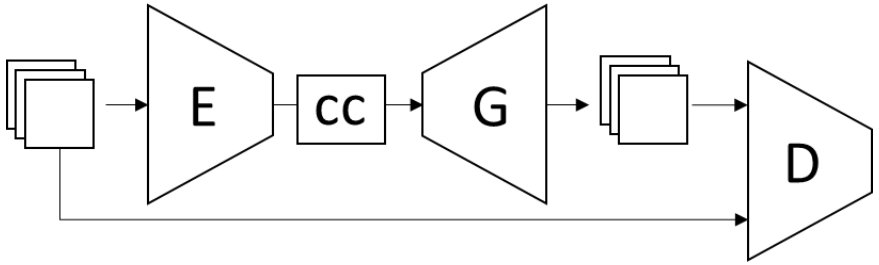
Convex Combinations to sample synthetic featur vectors in latent space

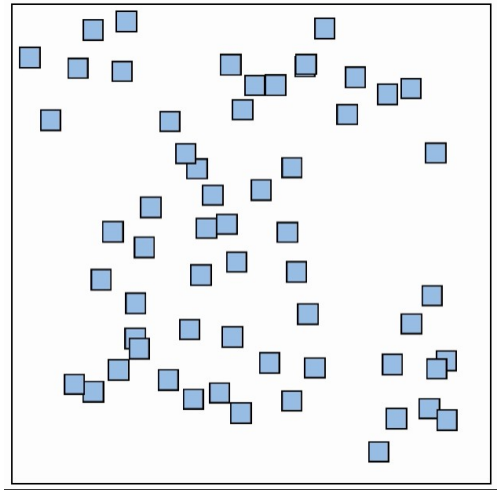
Implementation: Training

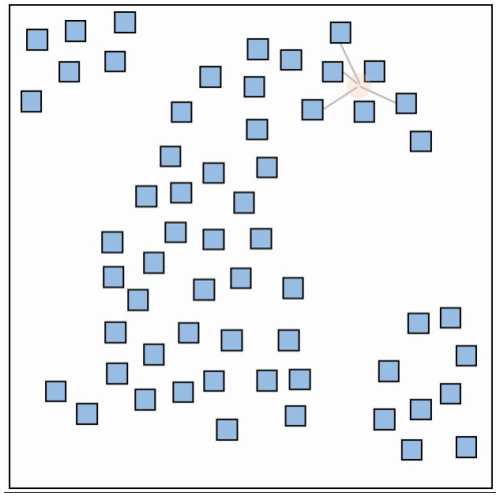
Auto-Encoder: Real data



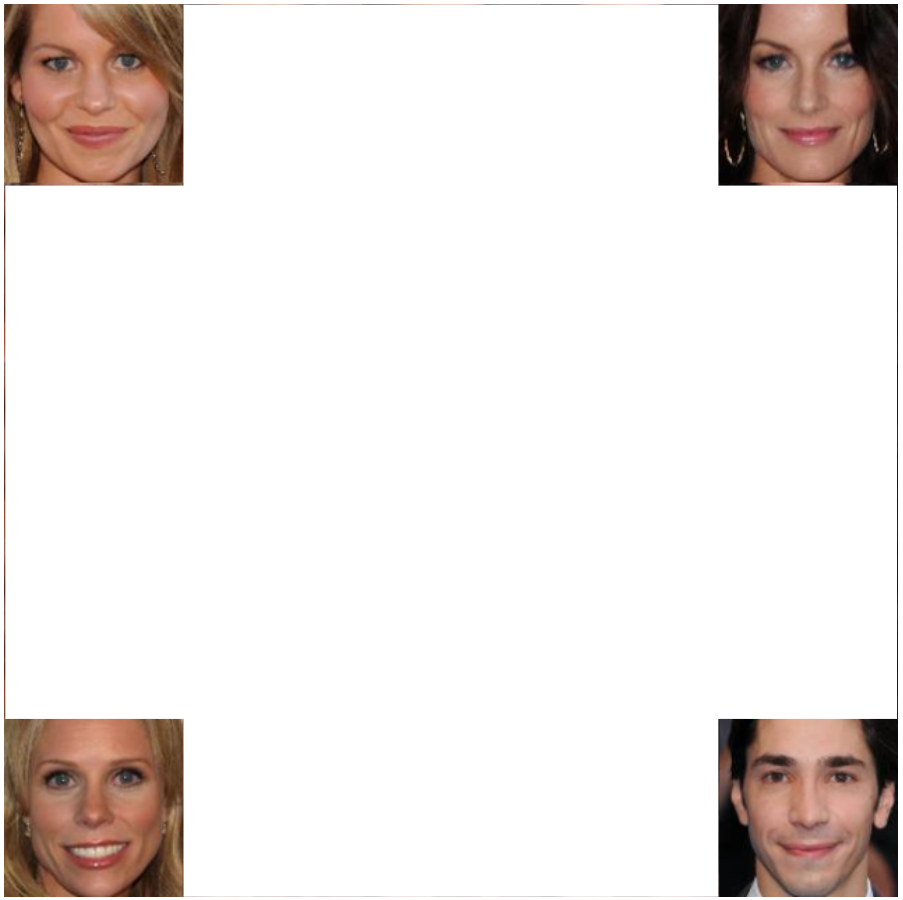
GAN: Sampled data

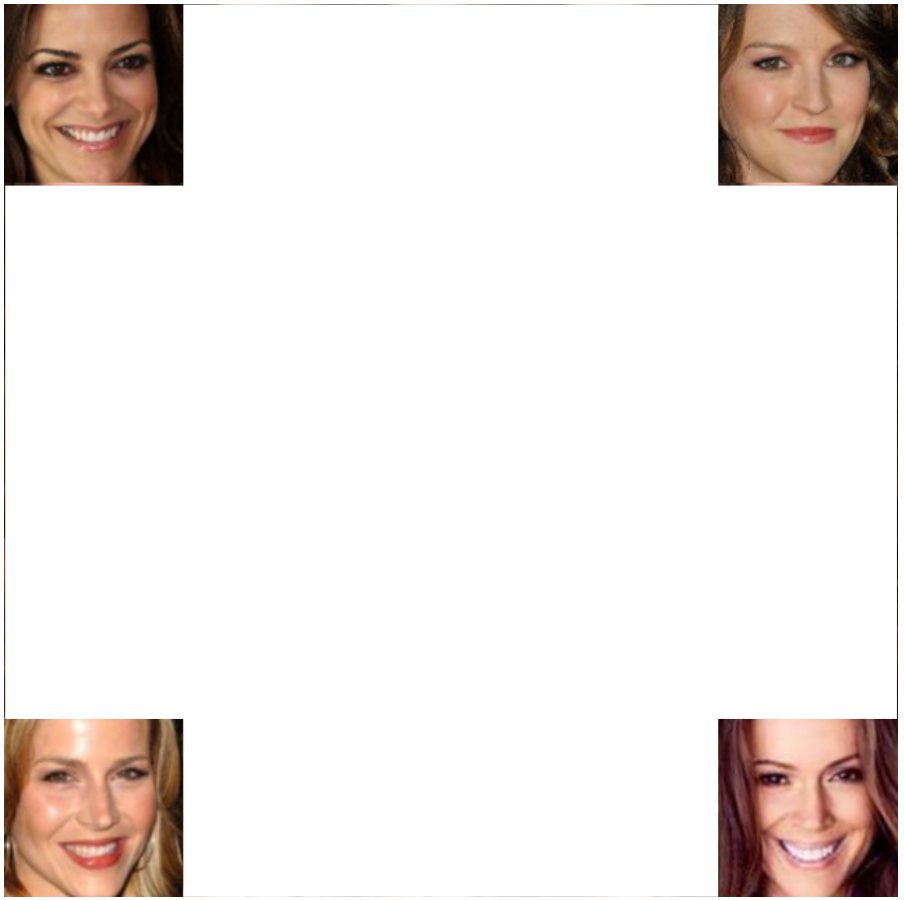






Results: Image morphing





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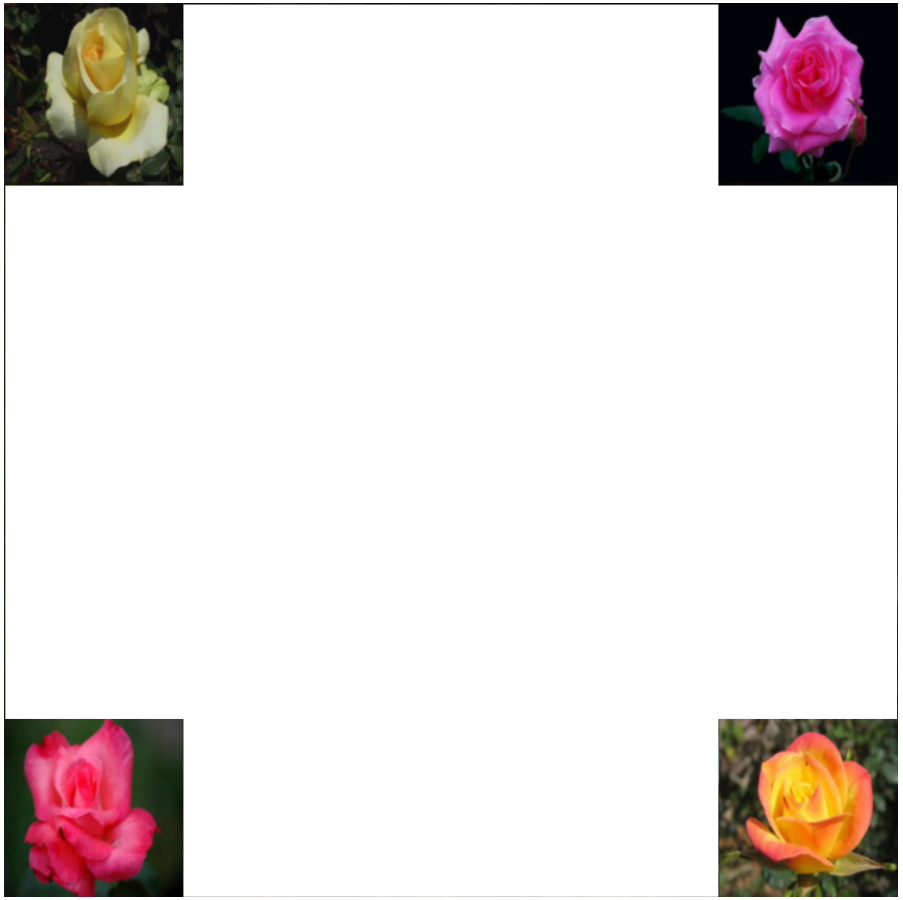
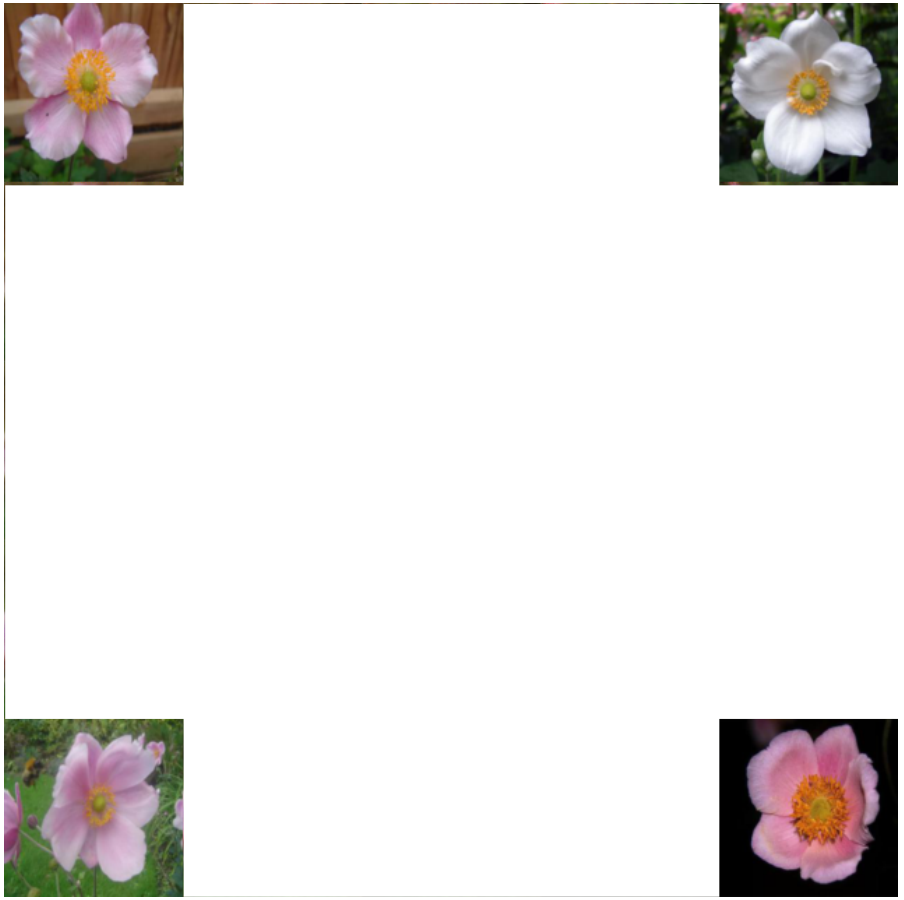




Results: Visual Comparison

Results: Inception Score

Score quantifying image realism

Model	Inception Score
CVAE-GAN	1.757
X-GAN	**1.831**
Real Data (upper bound)	2.372

Tim Salimans, Ian Goodfellow, Wojciech Zaremba, Vicki Cheung, Alec Radford, and Xi Chen. Improved techniques for training gans. In Advances in Neural Information Processing Systems, pages 22342242, 2016.

Results: D* - Score

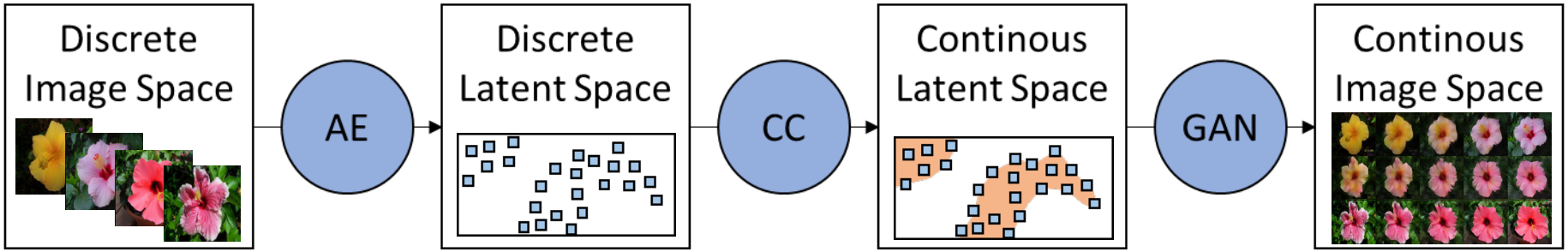
Estimate number of test images that clearly belong to a missing mode

Model	D* - Score
MD-GAN	2299 / 4412
CVAE-GAN	87 / 4412
X-GAN	**15 / 4412**

Tong Che, Yanran Li, Athul Paul Jacob, Yoshua Bengio, and Wenjie Li. Mode regularized generative adversarial networks. arXiv preprint arXiv:1612.02136, 2016.

Conclusion

- Novel convex combination strategy:



- X-GAN overcomes current issues
  - No latent space prior => No overpowering
  - Sample from entire manifold => mitigate missing mode

- X-GAN outperforms state of the art approaches