Investigating the performance of Generative Adversarial Networks on Fabric Pattern Generation

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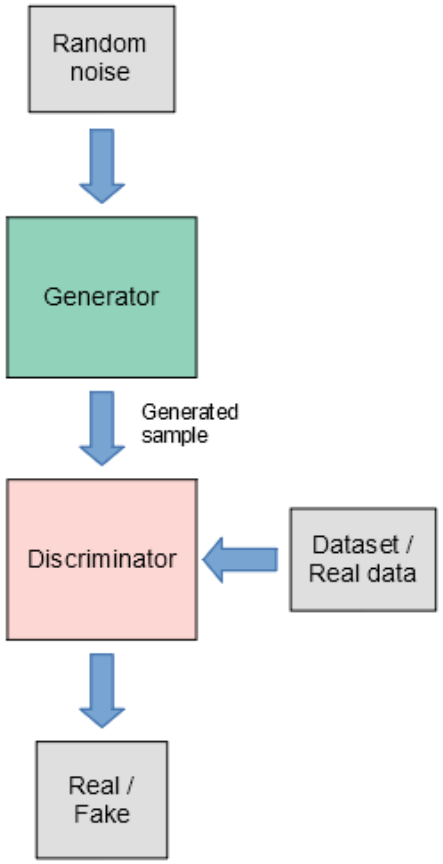
Background information

Generative Adversarial network[1] (GAN) is a model that consists of two neural networks that contest with each other in a game. One generator against one discriminator. The generator tries to generate images the discriminator will think are real. The discriminator tries to become better at distinguishing real and fake images. In the end, the generation should be able to generate images indistinguishable from the original dataset.



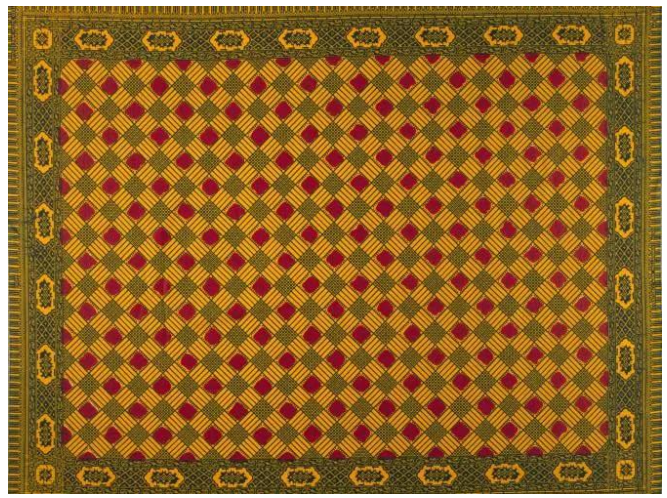
Research questions

- How do GANs perform on fabric pattern generation'?
- What are the differences between poorly performing GANs and GANs that perform well?
- How does the performance of GANs compare to Variational Autoencoders[2]?

Approach

1. Gather open source implementations of GANs
2. Use GANs on dataset
3. Evaluate results
4. Compare results to other models and variational autoencoders

Example fabric pattern



Source: Vlisco.com

Results GANs

FID Score

The Fréchet Inception Distance (FID) is a metric that measures the similarity between two sets of images. A lower FID score indicates a better performing model.

GAN Model	FID Score
GAN	297.5
DCGAN	202.1
ACGAN	157.5
WGAN-GP	231.5
Relativistic GAN	134.4
Relativistic Average GAN	165.8
StyleGAN2	69.0
Relativistic StyleGAN2	56.7

Conclusions

- The performance of GANs is promising, but not yet of the same quality that GANs have achieved on other domains.
- Convolutional layers attribute to sharper images.
- Relativistic discriminators seems to improve the results.
- The performance of most GANs is similar to that of Variational Autoencoders, but modern GANs perform better.
- The large variety of resolution and aspect ratios of images in the dataset likely had a large influence on the quality of images.

Recommendations

- Investigate using higher resolution samples
- Investigate influence of variance in dataset's resolution and aspect ratio
- Investigate further into performance of modern models

References

1. Ian J. Goodfellow et al.Generative Adversarial Networks. 2014
2. Diederik P Kingma and Max Welling.Auto-Encoding Variational Bayes. 2014.

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