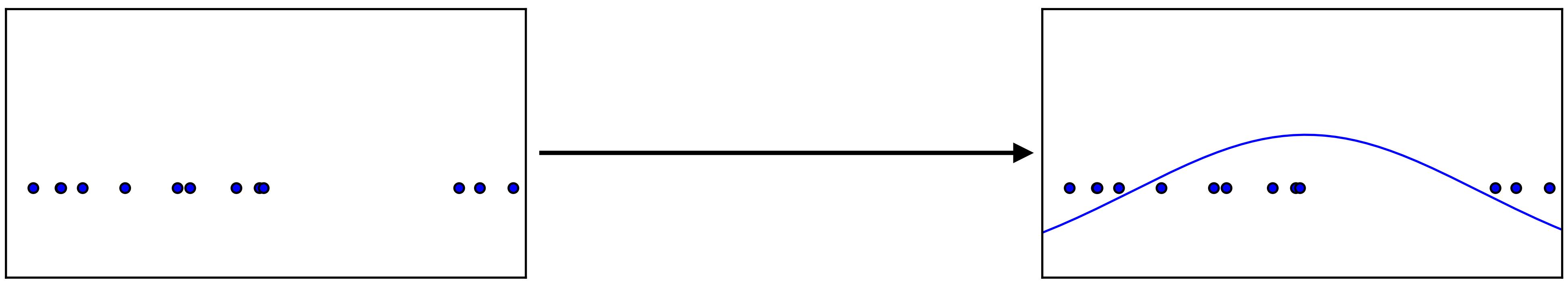
Generative Adversarial Networks (GANs)

Ian Goodfellow, OpenAI Research Scientist

Presentation at AI With the Best, 2016-09-24

Generative Modeling

- Density estimation

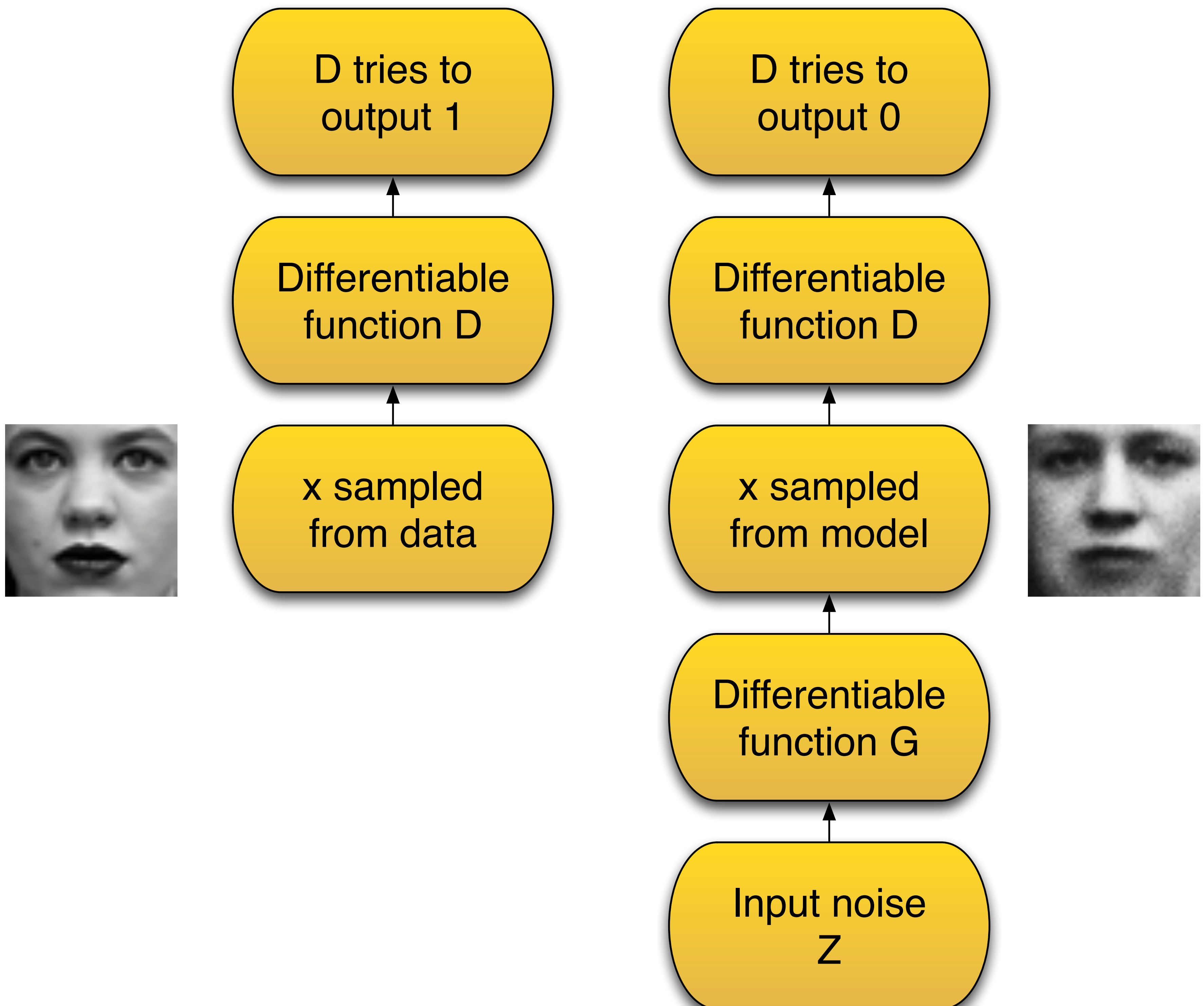


- Sample generation

Training examples　　　　Model samples

(Goodfellow 2016)

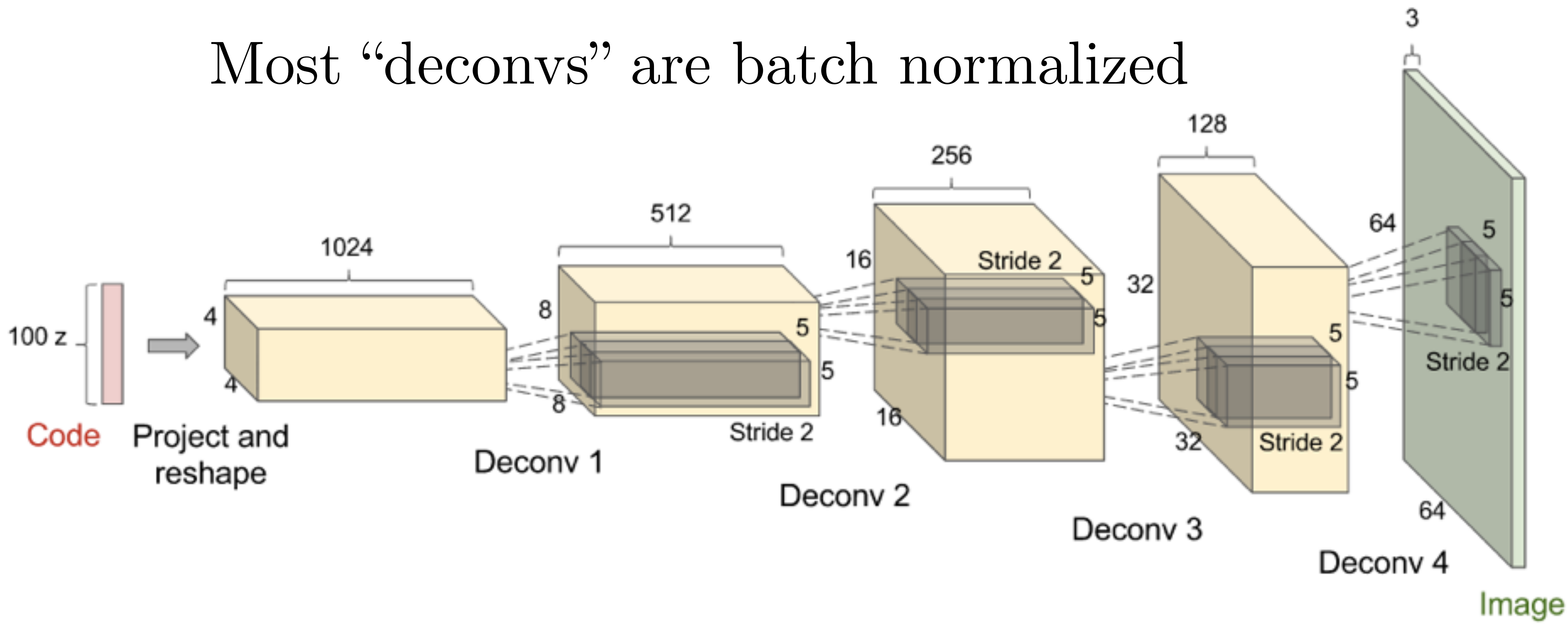
Adversarial Nets Framework



(Goodfellow 2016)

DCGAN Architecture

Most "deconvs" are batch normalized



(Radford et al 2015)

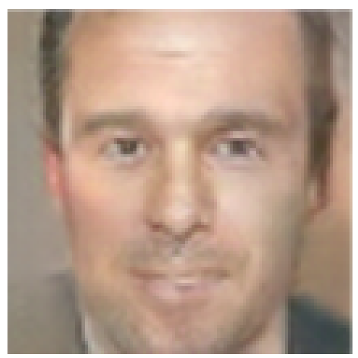
DCGANs for LSUN Bedrooms

(Radford et al 2015)

Vector Space Arithmetic

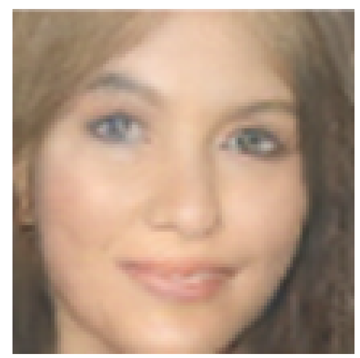
Man
with glasses

-



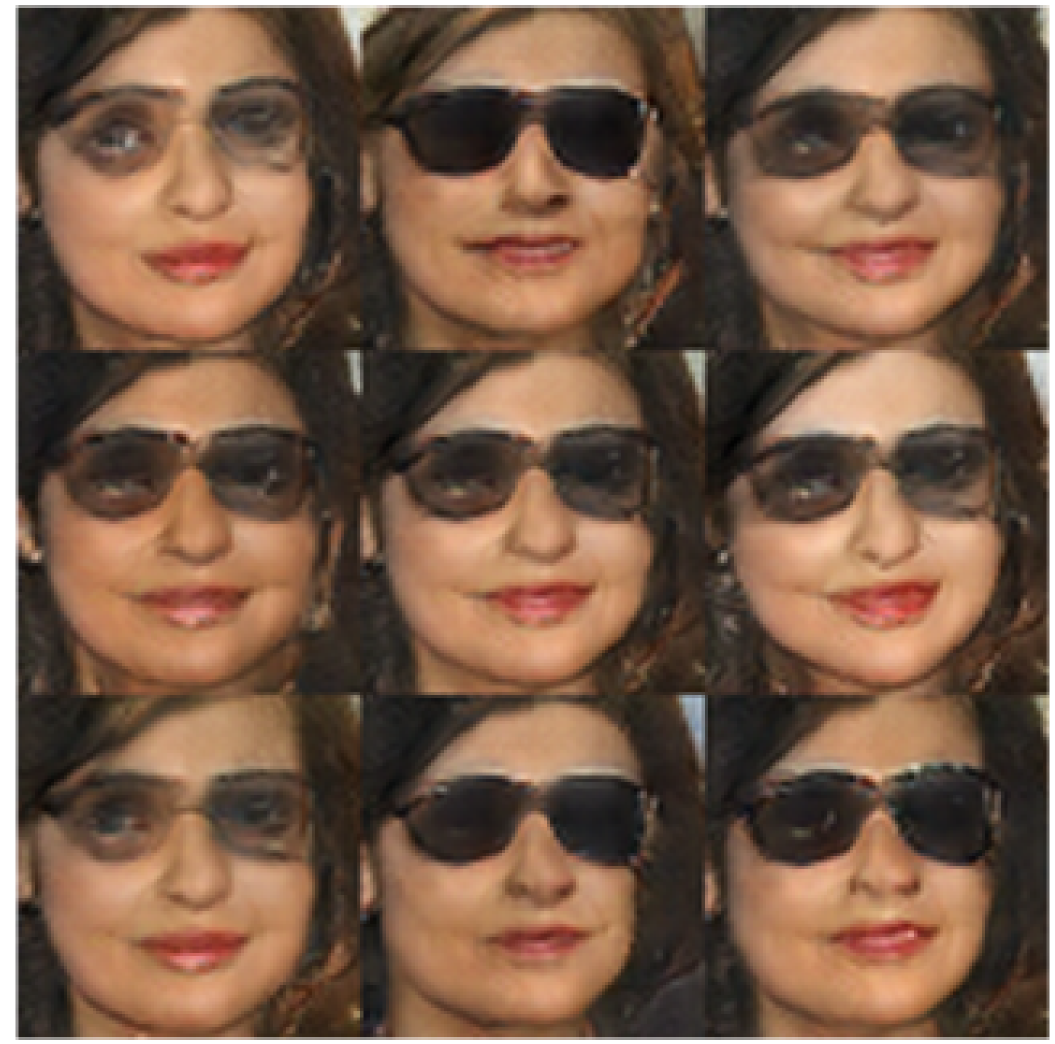
Man

+



Woman

=



Woman with Glasses

(Goodfellow 2016)

Mode Collapse

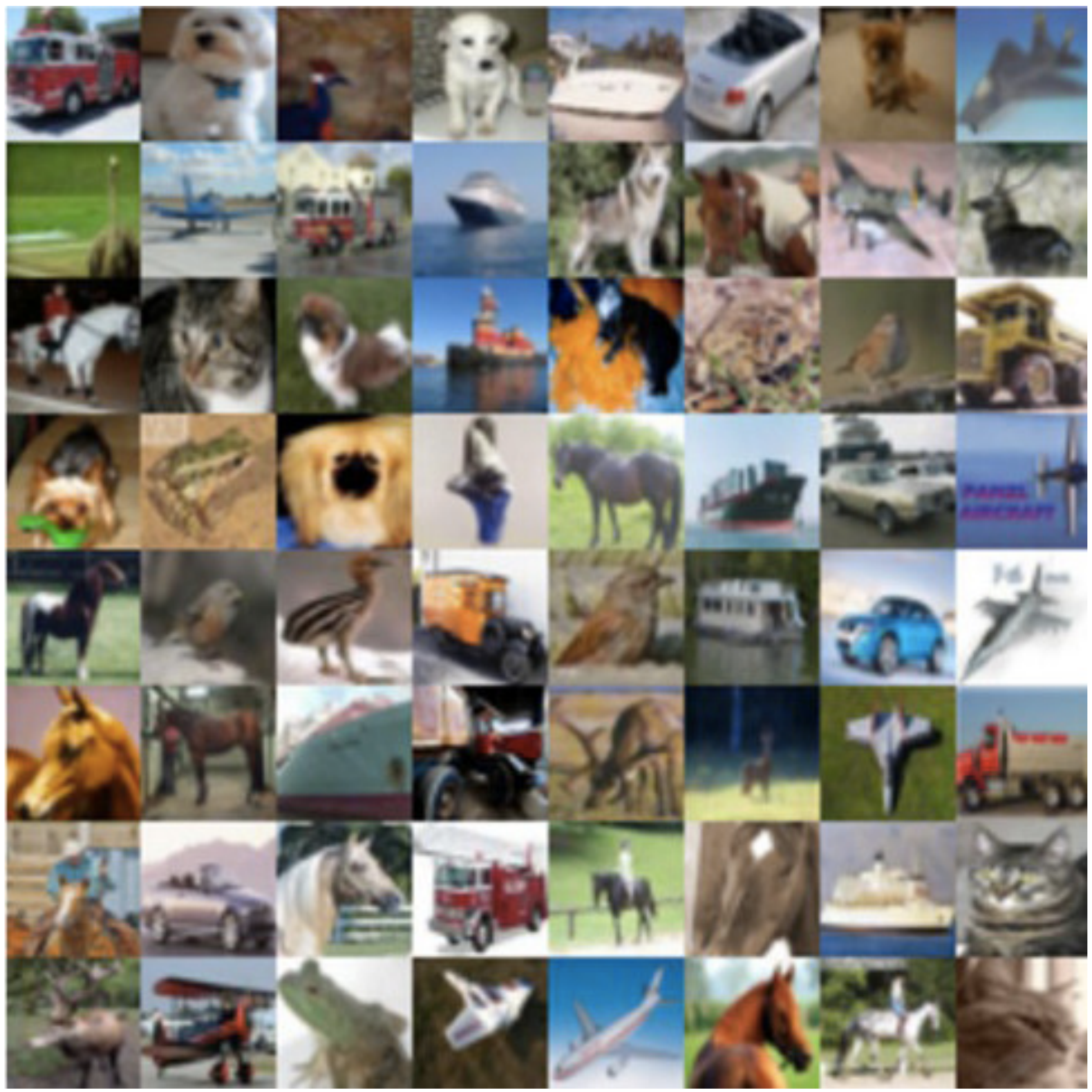
- Fully optimizing the discriminator with the generator held constant is safe

- Fully optimizing the generator with the discriminator held constant results in mapping all points to the argmax of the discriminator

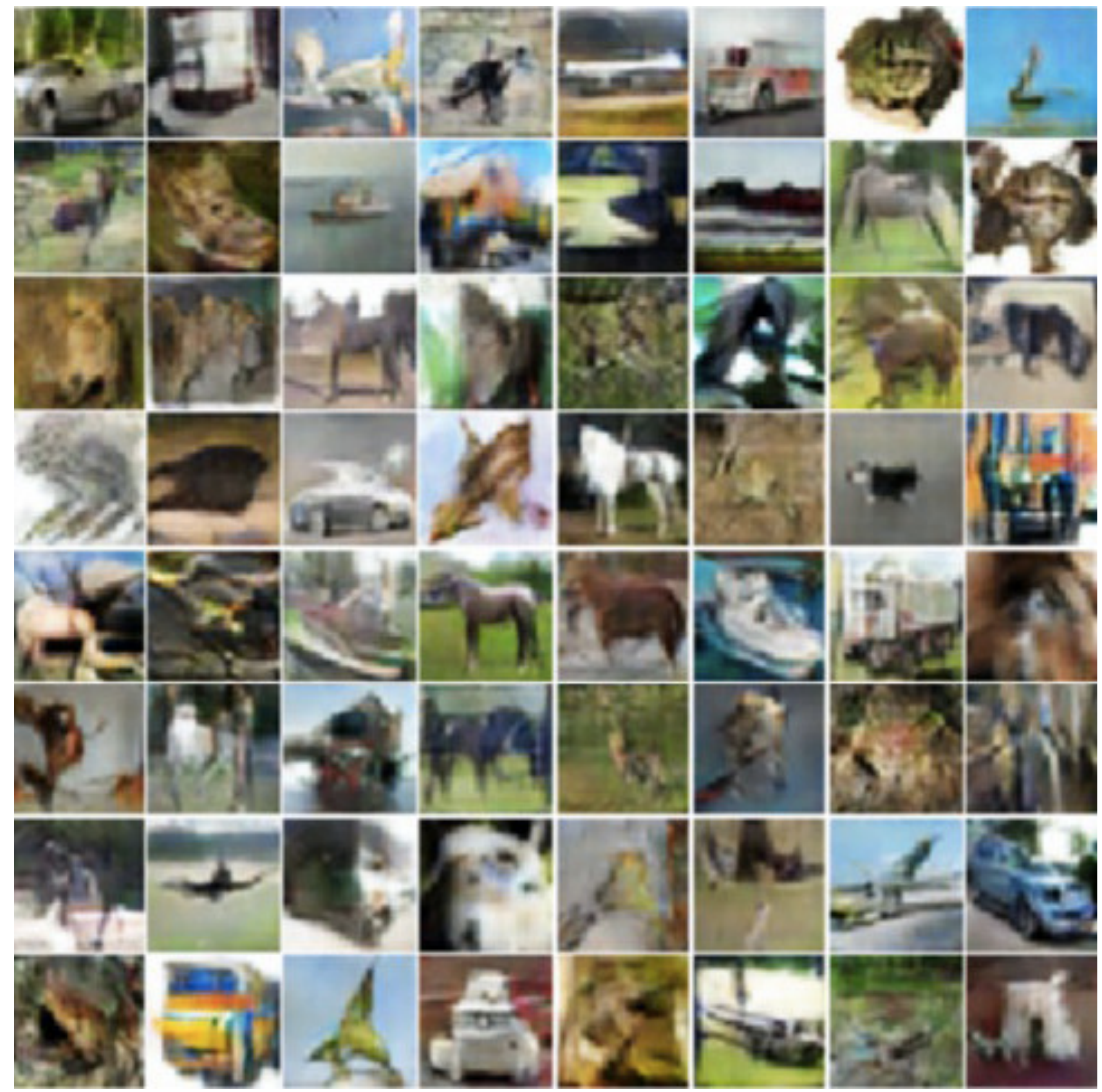
- Can partially fix this by adding nearest-neighbor features constructed from the current minibatch to the discriminator ("minibatch GAN")

(Salimans et al 2016)

Minibatch GAN on CIFAR



Training Data

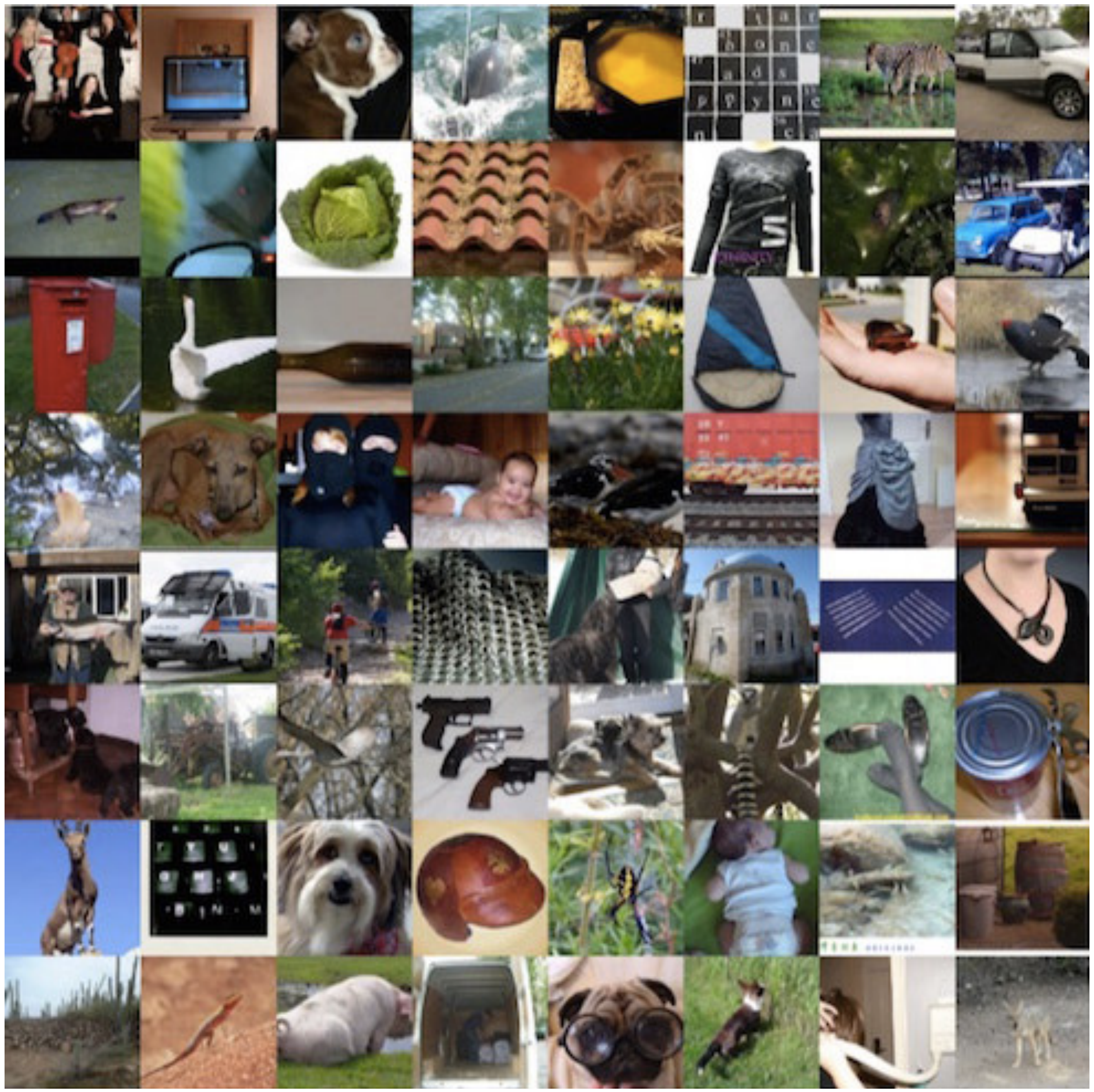


Samples

(Salimans et al 2016)

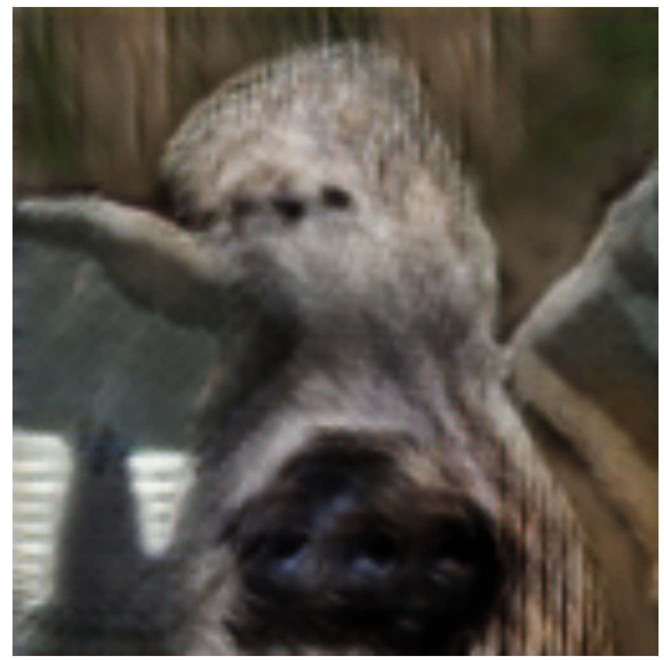
(Goodfellow 2016)

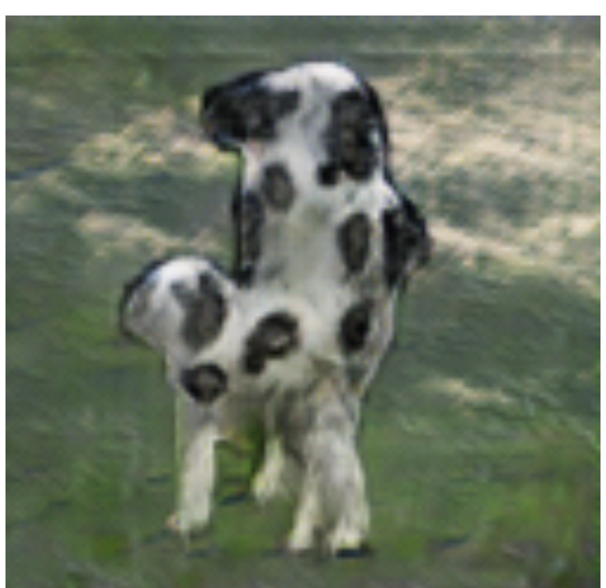
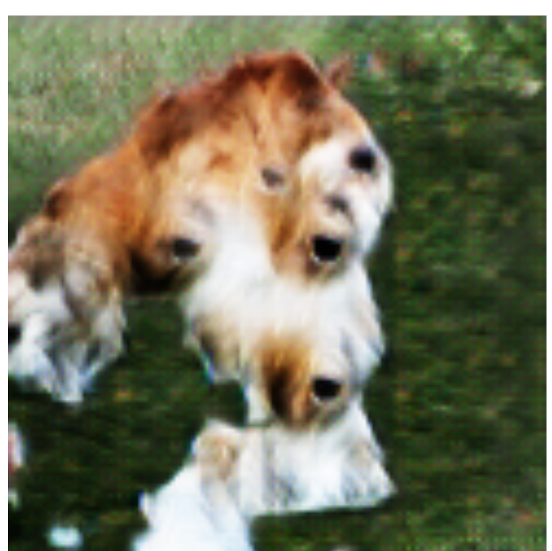
Minibatch GAN on ImageNet



(Salimans et al 2016)

Cherry-Picked Results

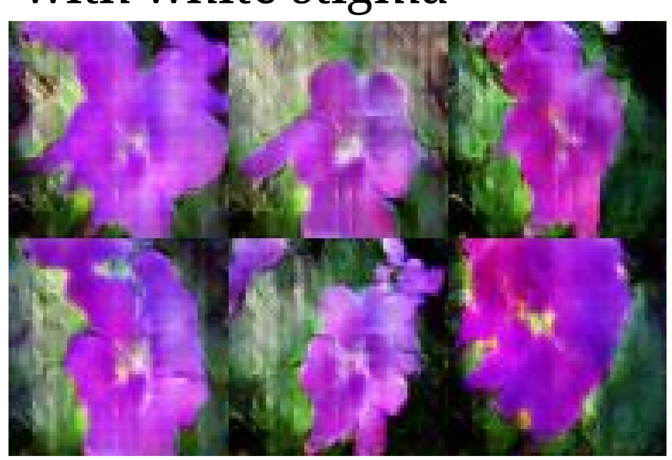
(Goodfellow 2016)

Text to Image with GANs

this small bird has a pink breast and crown, and black primaries and secondaries.

this magnificent fellow is almost all black with a red crest, and white cheek patch.

the flower has petals that are bright pinkish purple with white stigma



this white and yellow flower have thin white petals and a round yellow stamen

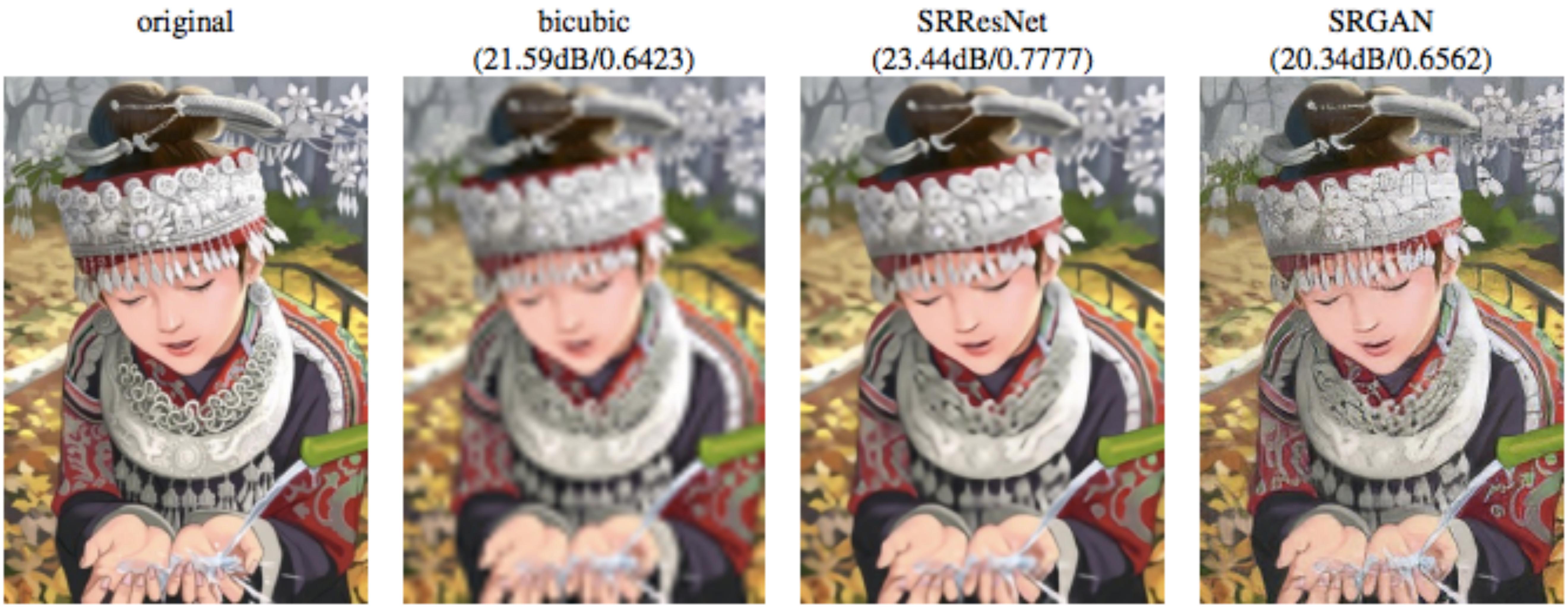
(Reed et al 2016)

Generating Pokémon

youtube

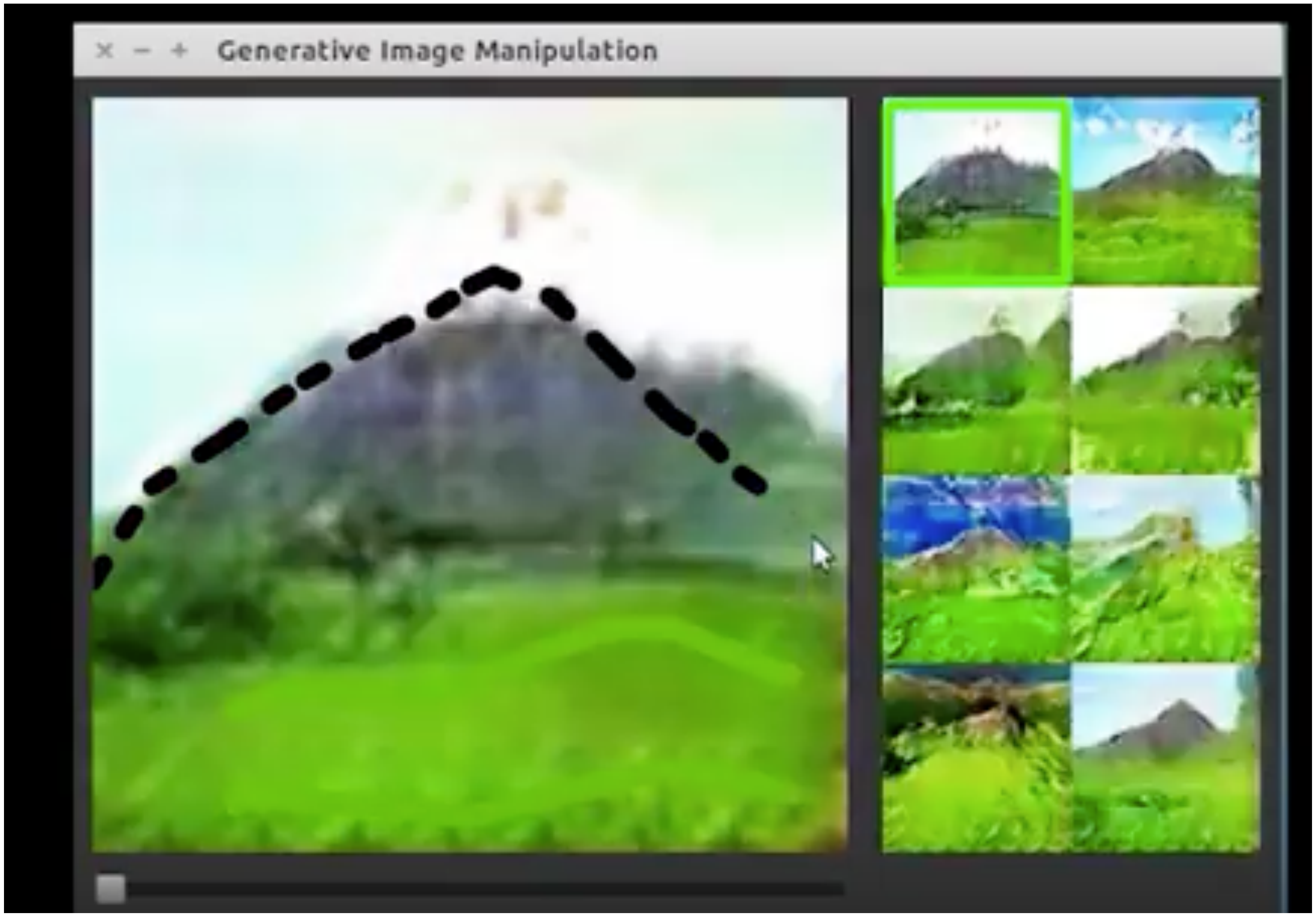
(Yota Ishida)

Single Image Super-Resolution



(Ledig et al 2016)

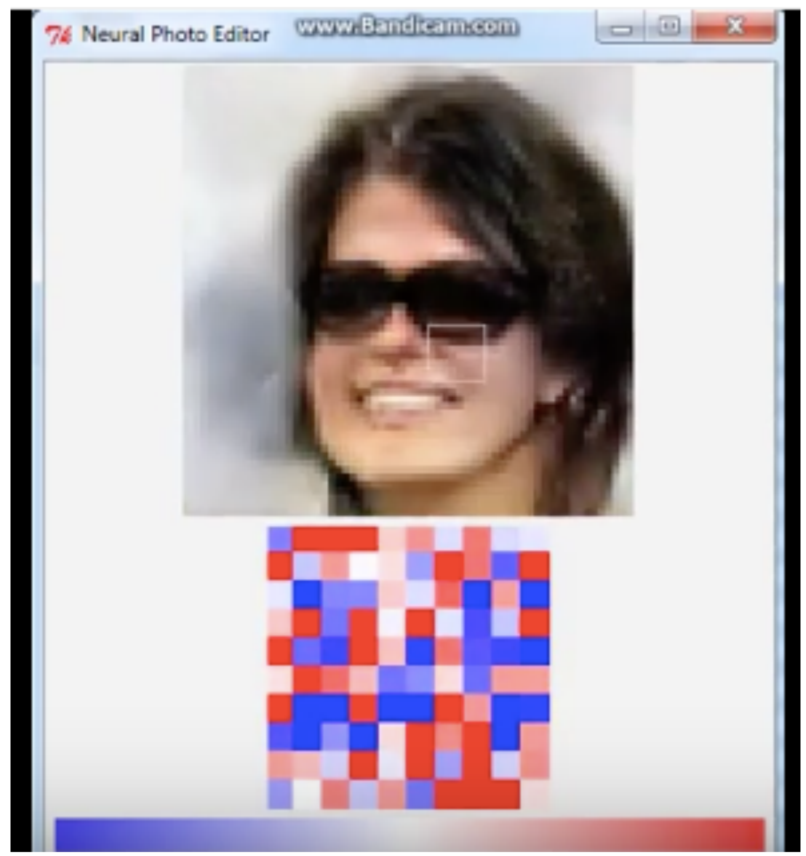
iGAN



youtube

(Zhu et al 2016)

Introspective Adversarial Networks



youtube

Conclusion

- GANs are generative models based on supervised learning and game theory
- GANs learn to generate realistic samples
- Like other generative models, GANs still need a lot of improvement