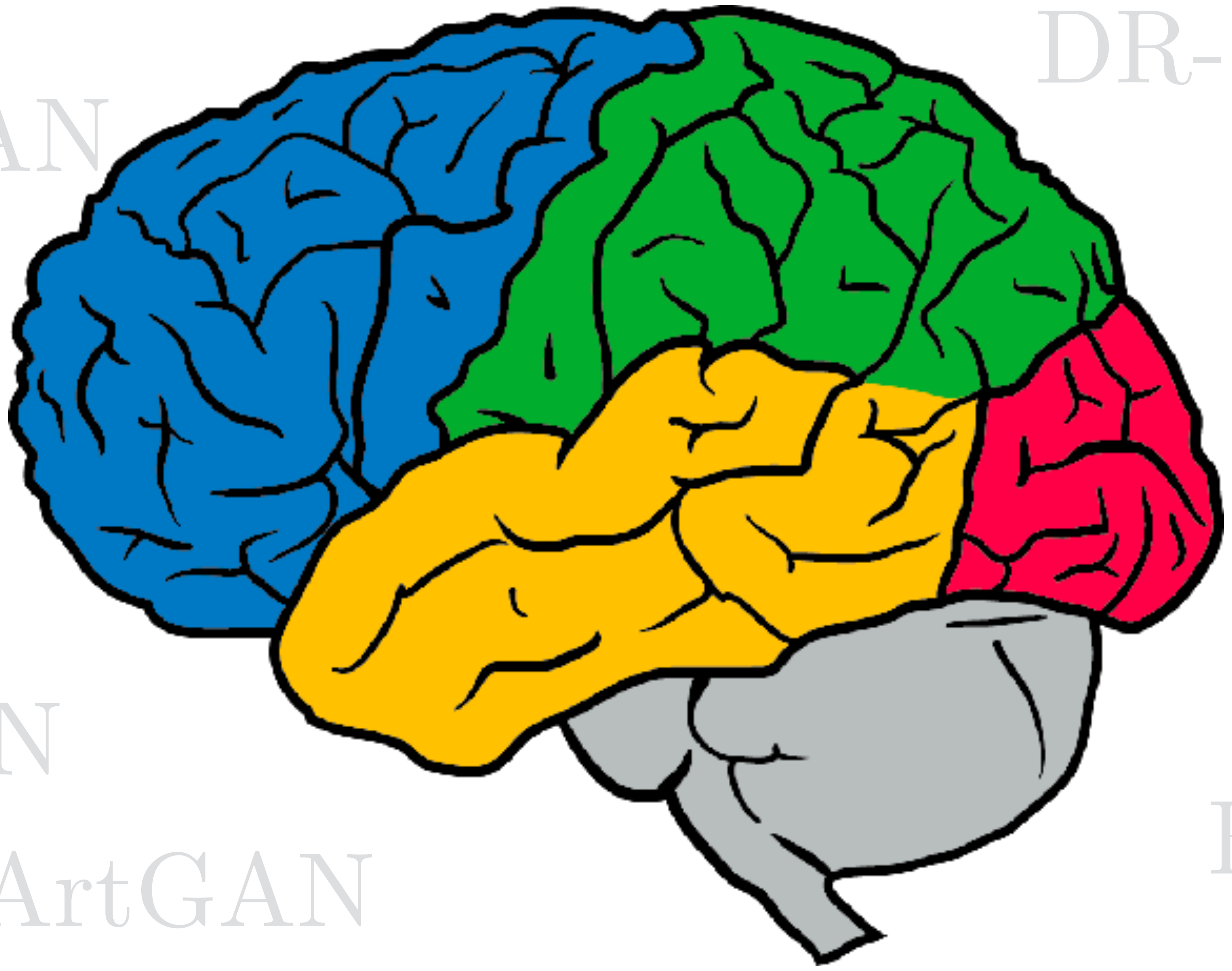
Generative Adversarial Networks

Ian Goodfellow, Staff Research Scientist, Google Brain

ICCV Tutorial on GANs

Venice, 2017-10-22



MedGAN ID-CGAN CoGAN LR-GAN CGAN IcGAN b-GAN LS-GAN AffGAN LAPGAN DiscoGAN MPM-GAN AdaGAN LSGAN InfoGAN CatGAN AMGAN iGAN IAN McGAN MIX+GAN alpha-GAN GMAN MGAN FF-GAN BS-GAN GoGAN C-VAE-GAN C-RNN-GAN DR-GAN DCGAN CCGAN AC-GAN MAGAN 3D-GAN BiGAN GAWWN DualGAN CycleGAN GP-GAN Bayesian GAN AnoGAN WGAN-GP EBGAN DTN MAD-GAN Context-RNN-GAN ALI BEGAN AL-CGAN f-GAN MARTA-GAN ArtGAN MalGAN

Generative Modeling

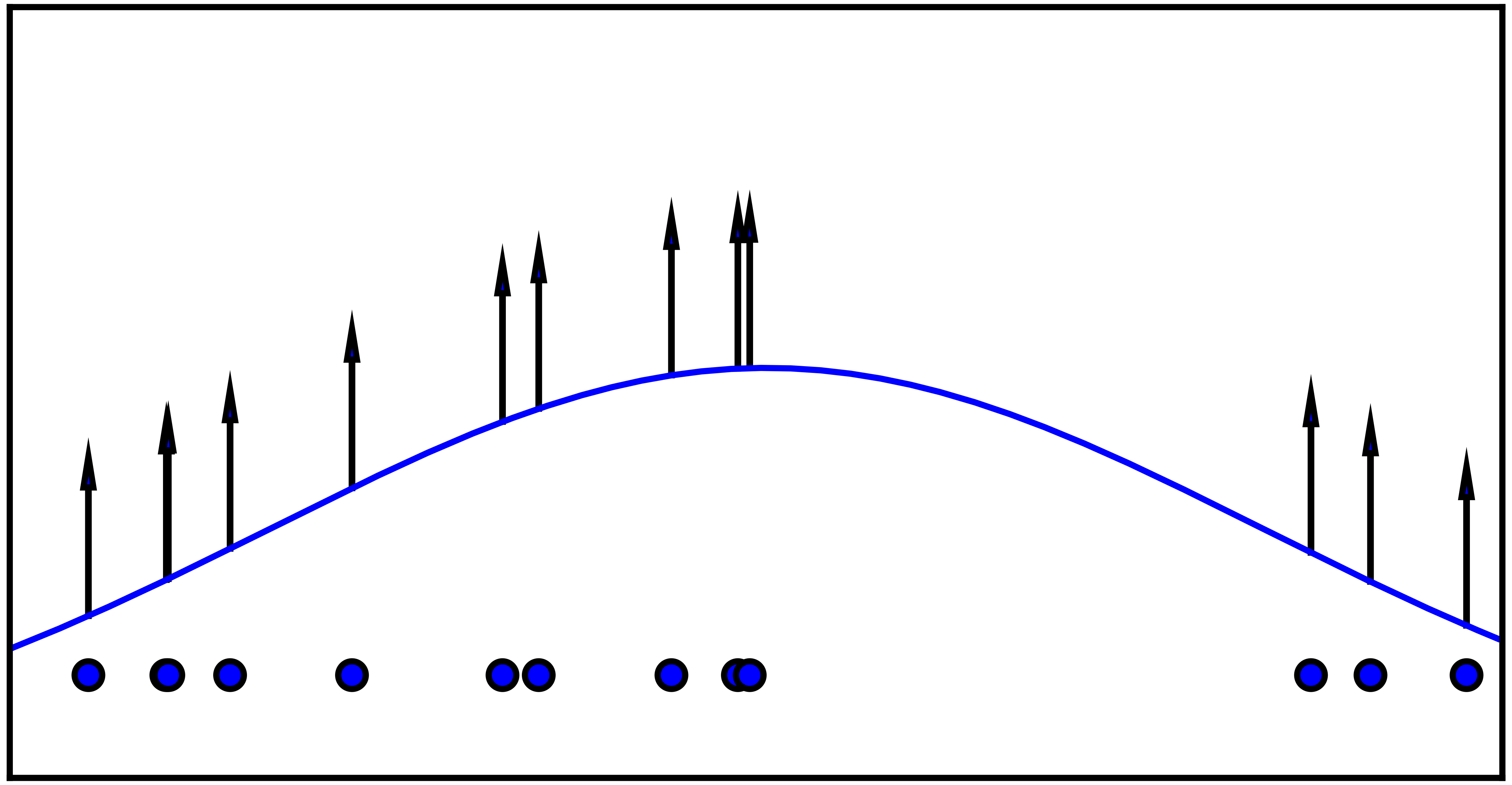
- Density estimation

- Sample generation

Training examples　　　Model samples

(Goodfellow 2017)

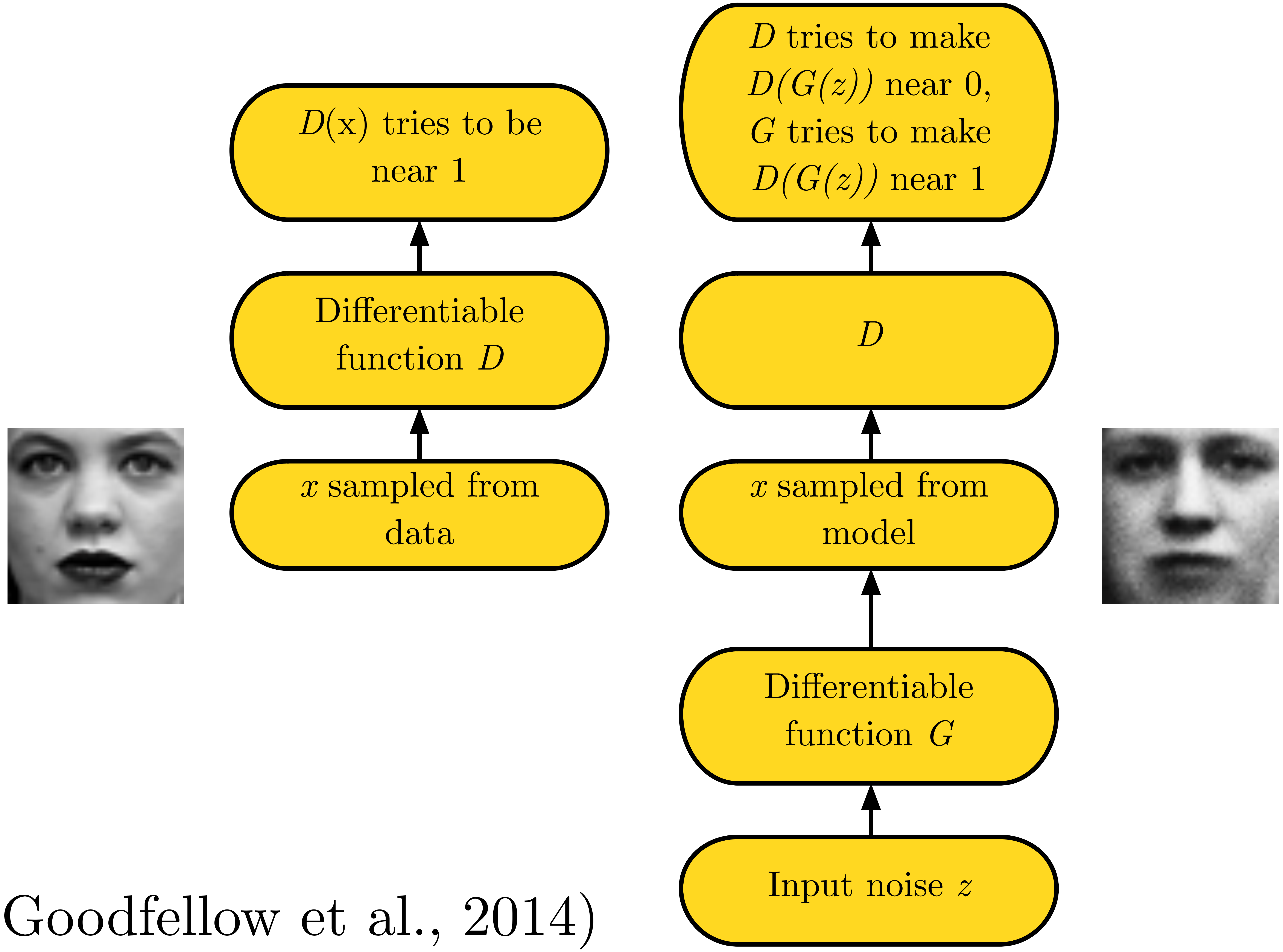
Maximum Likelihood



$$\boldsymbol{\theta}^* = \arg\max_{\boldsymbol{\theta}} \mathbb{E}_{x \sim p_{\text{data}}} \log p_{\text{model}}(\boldsymbol{x} \mid \boldsymbol{\theta})$$

(Goodfellow 2017)

Adversarial Nets Framework



(Goodfellow et al., 2014)

(Goodfellow 2017)

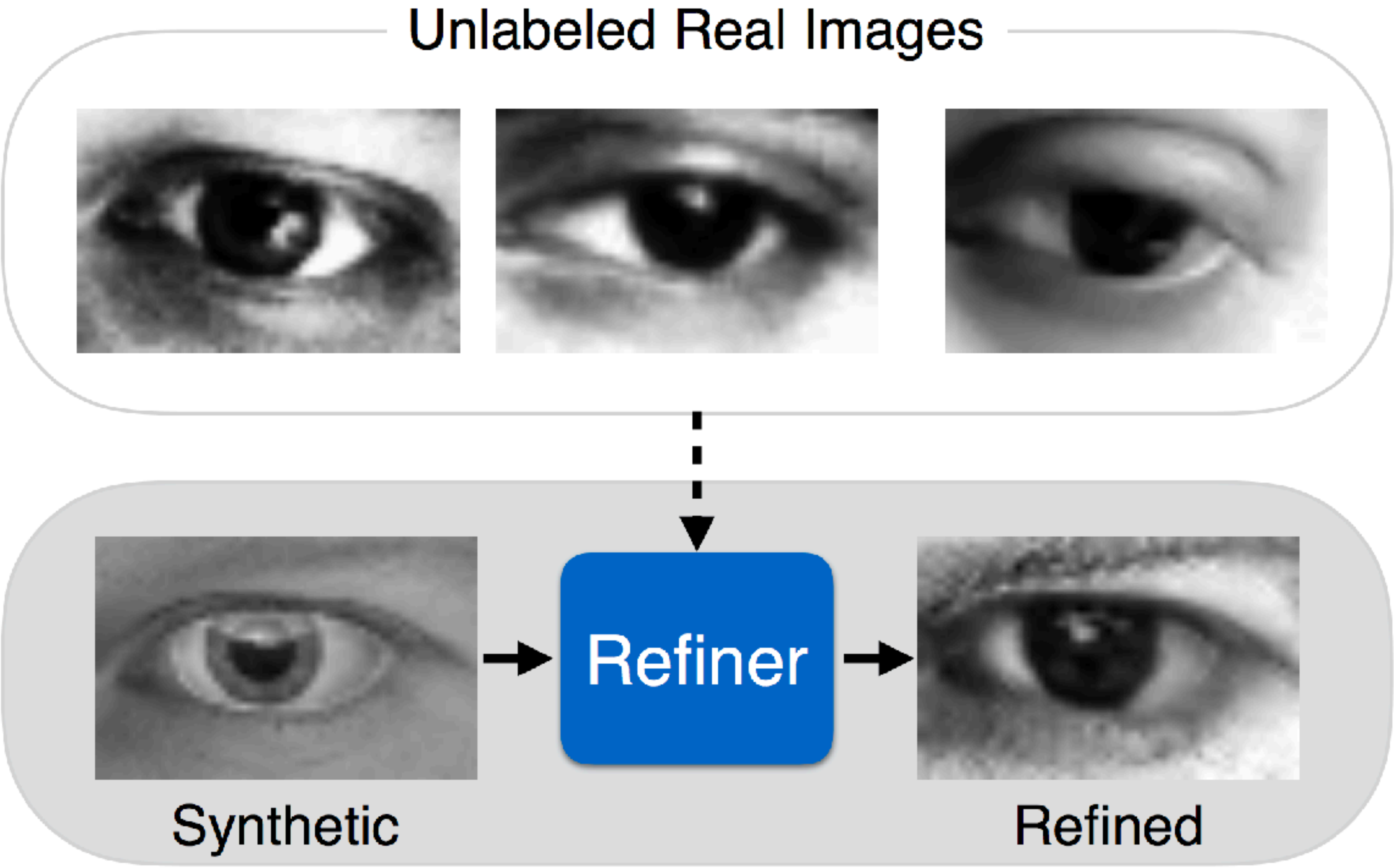
What can you do with GANs?

- Simulated environments and training data
- Missing data
  - Semi-supervised learning
- Multiple correct answers
- Realistic generation tasks
- Simulation by prediction
- Solve inference problems
- Learn useful embeddings

TEACHING AID

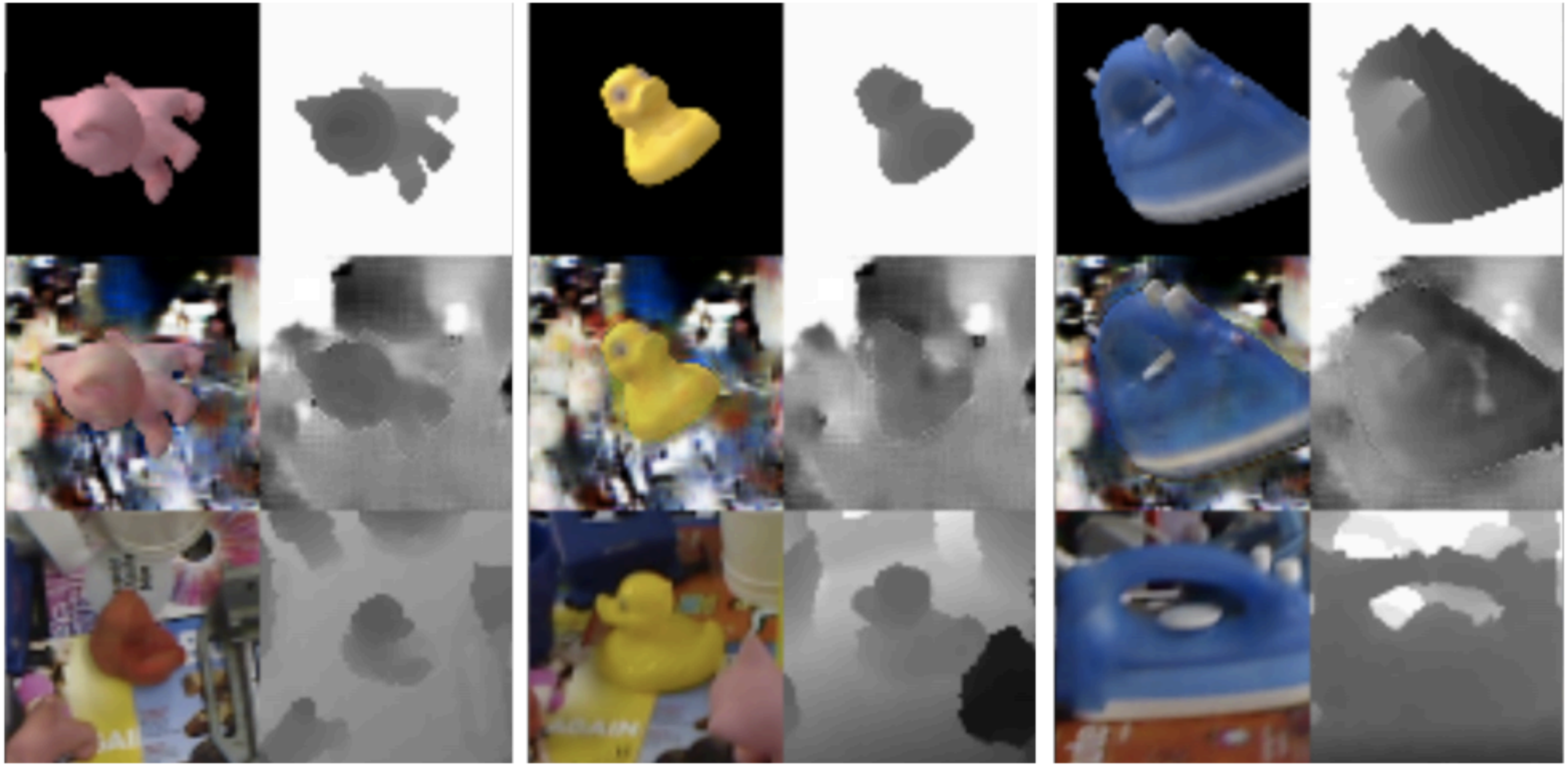
Apple's first research paper tries to solve a problem facing every company working on AI

GANs for simulated training data



(Shrivastava et al., 2016)

GANs for domain adaptation



(Bousmalis et al., 2016)

(Raffel, 2017)

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Generative modeling reveals a face

(Yeh et al., 2016)

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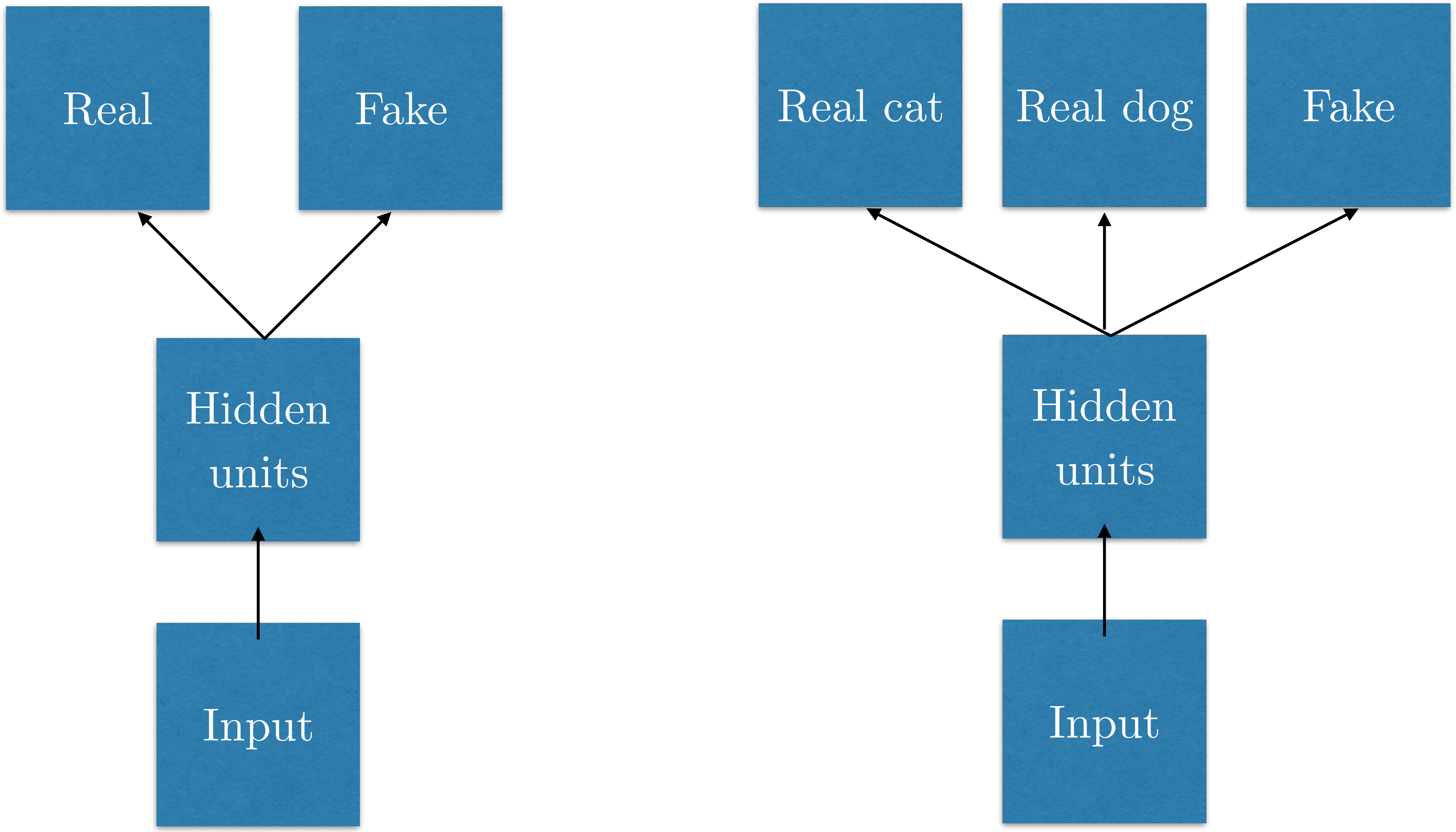
(Goodfellow 2017)

Supervised Discriminator



(Odena 2016, Salimans et al 2016)

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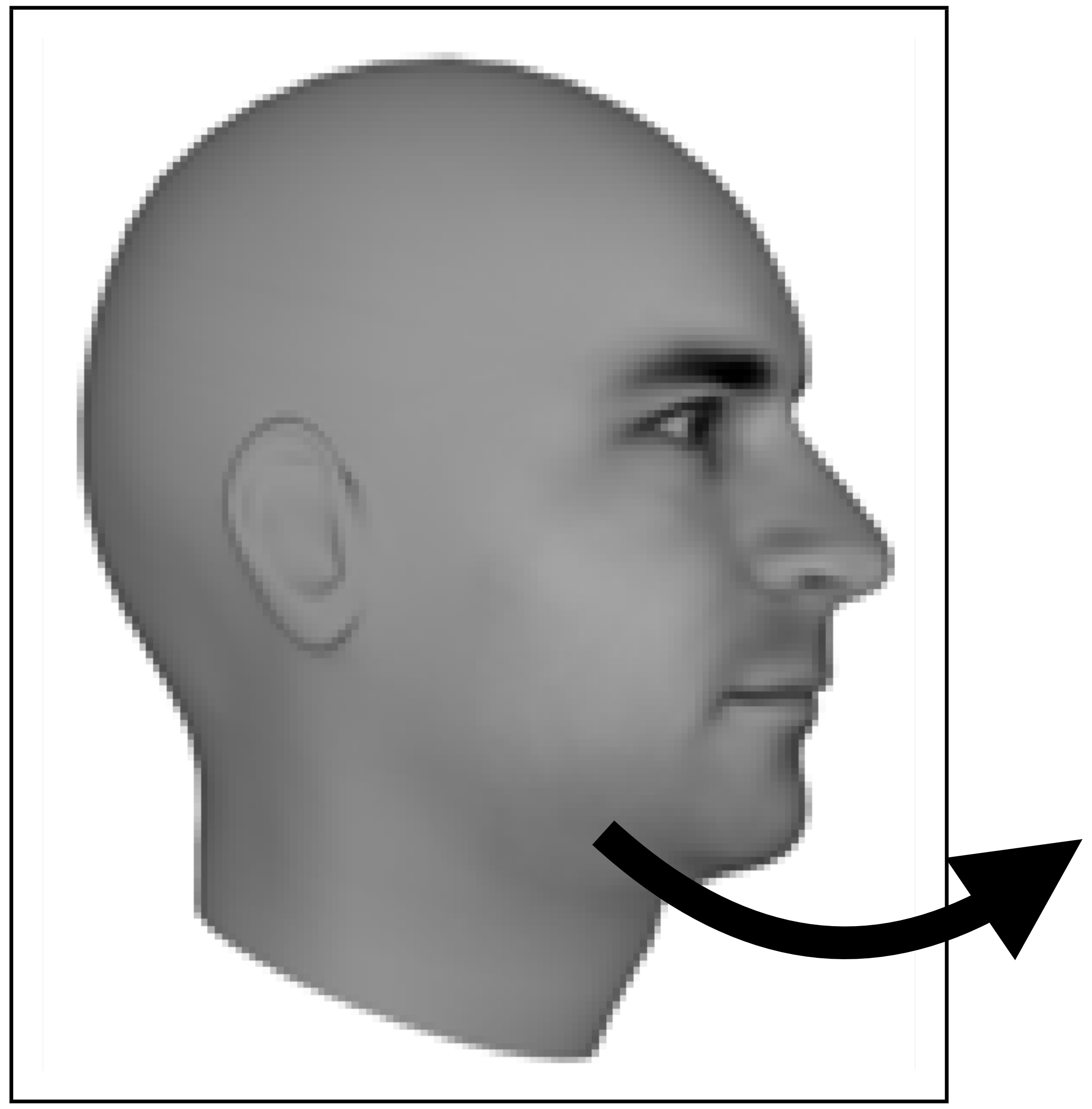
Next Video Frame Prediction

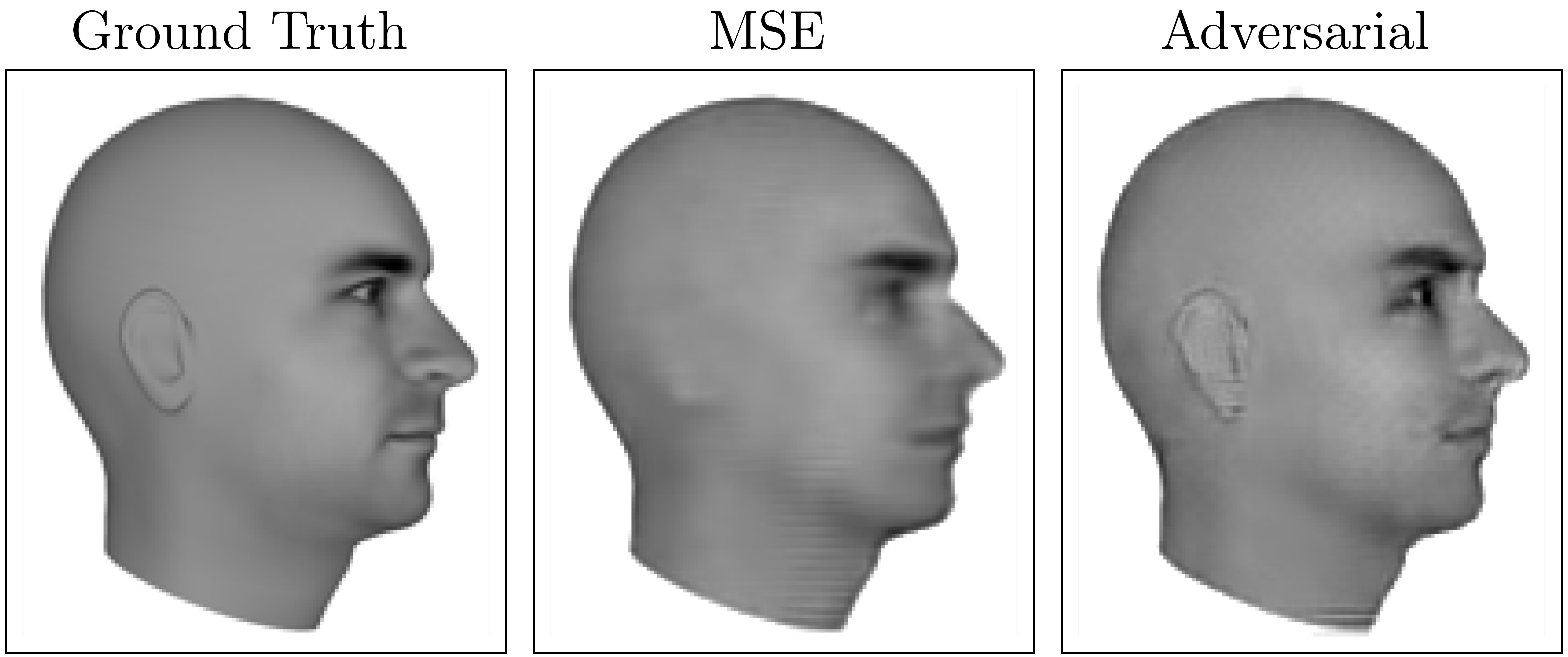
Ground Truth



What happens next?

(Lotter et al 2016)

Next Video Frame Prediction



(Lotter et al 2016)

Next Video Frame(s) Prediction

Mean Squared Error

Mean Absolute Error

Adversarial

(Mathieu et al. 2015)

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Which of these are real photos ?

(work by vue.ai covered by Quartz)

(Goodfellow 2017)

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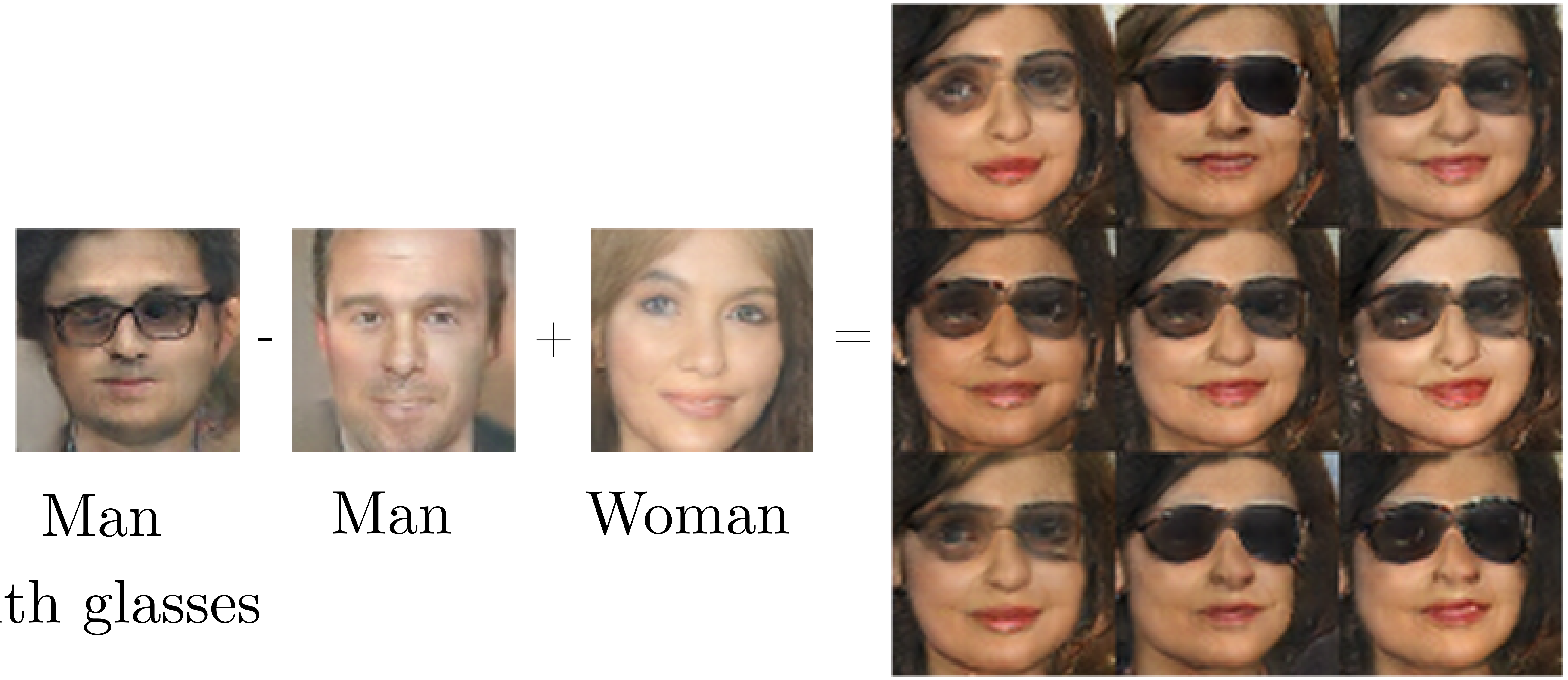
Vector Space Arithmetic



Man with glasses

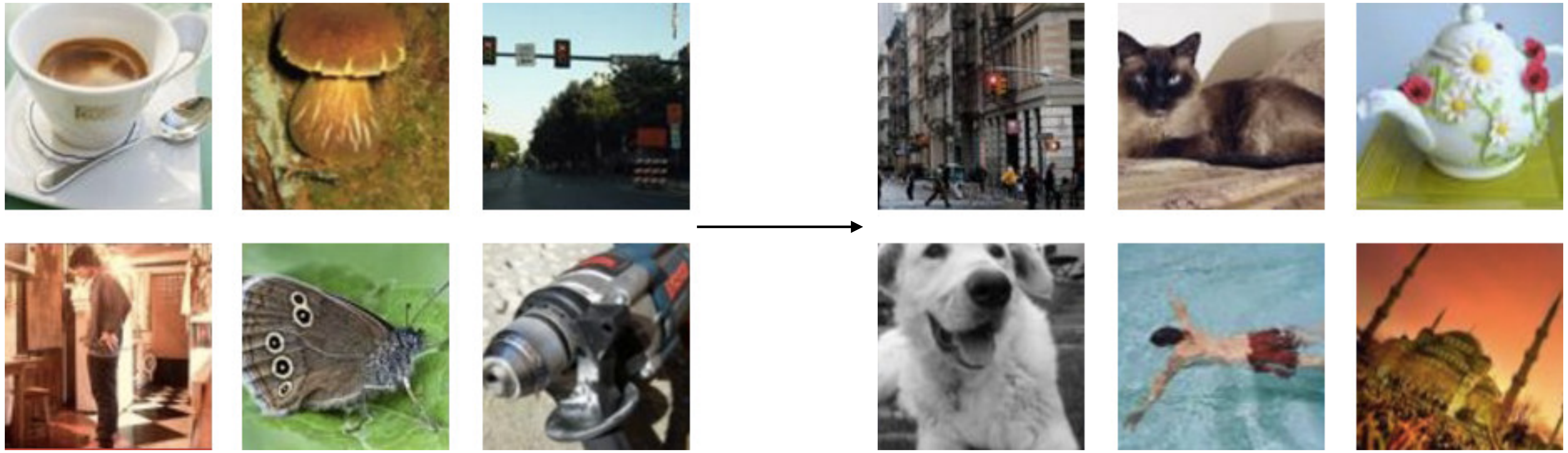
Man

Woman

Woman with Glasses

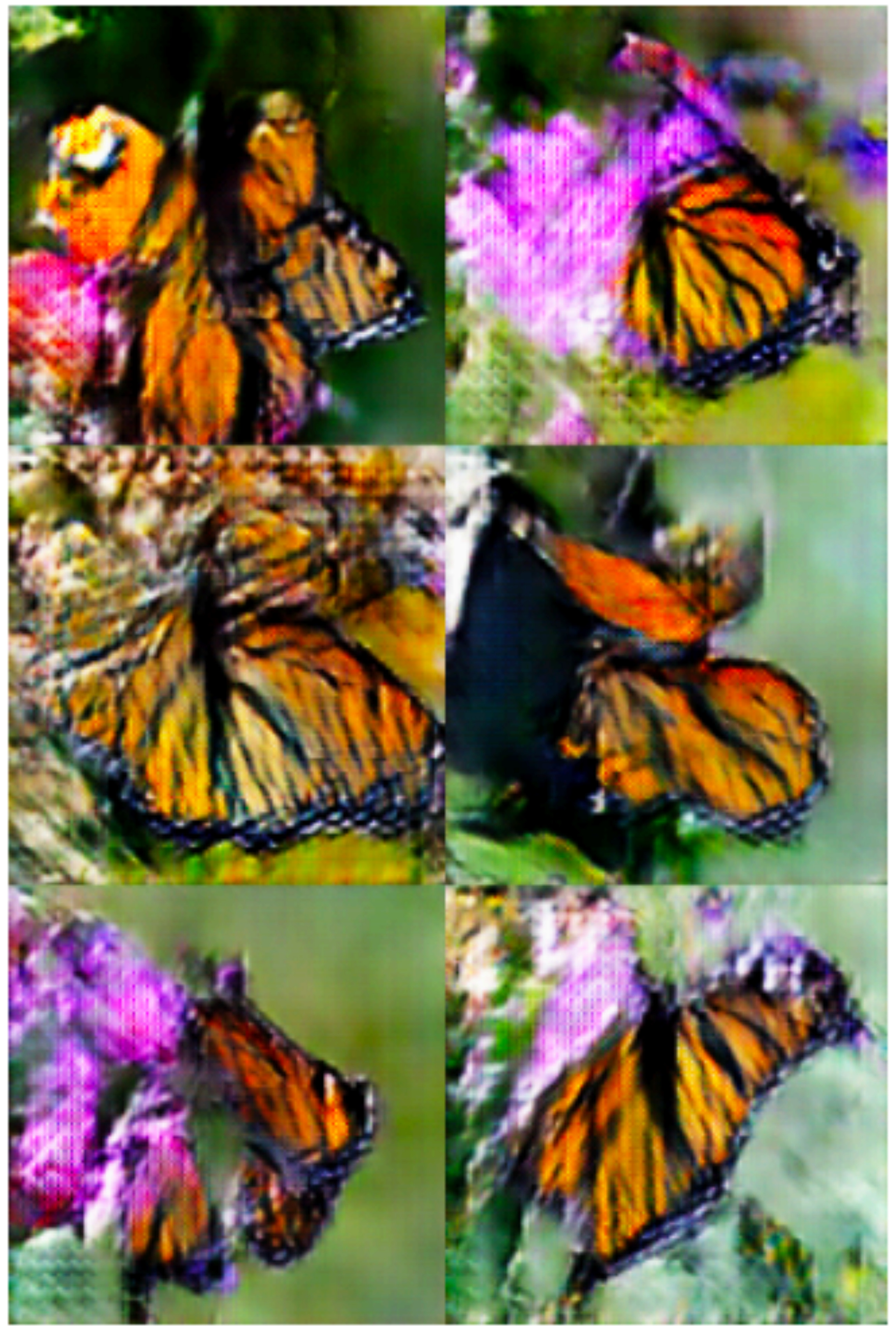
(Radford et al, 2015)

How long until GANs can do this?



Training examples Model samples

AC-GANs



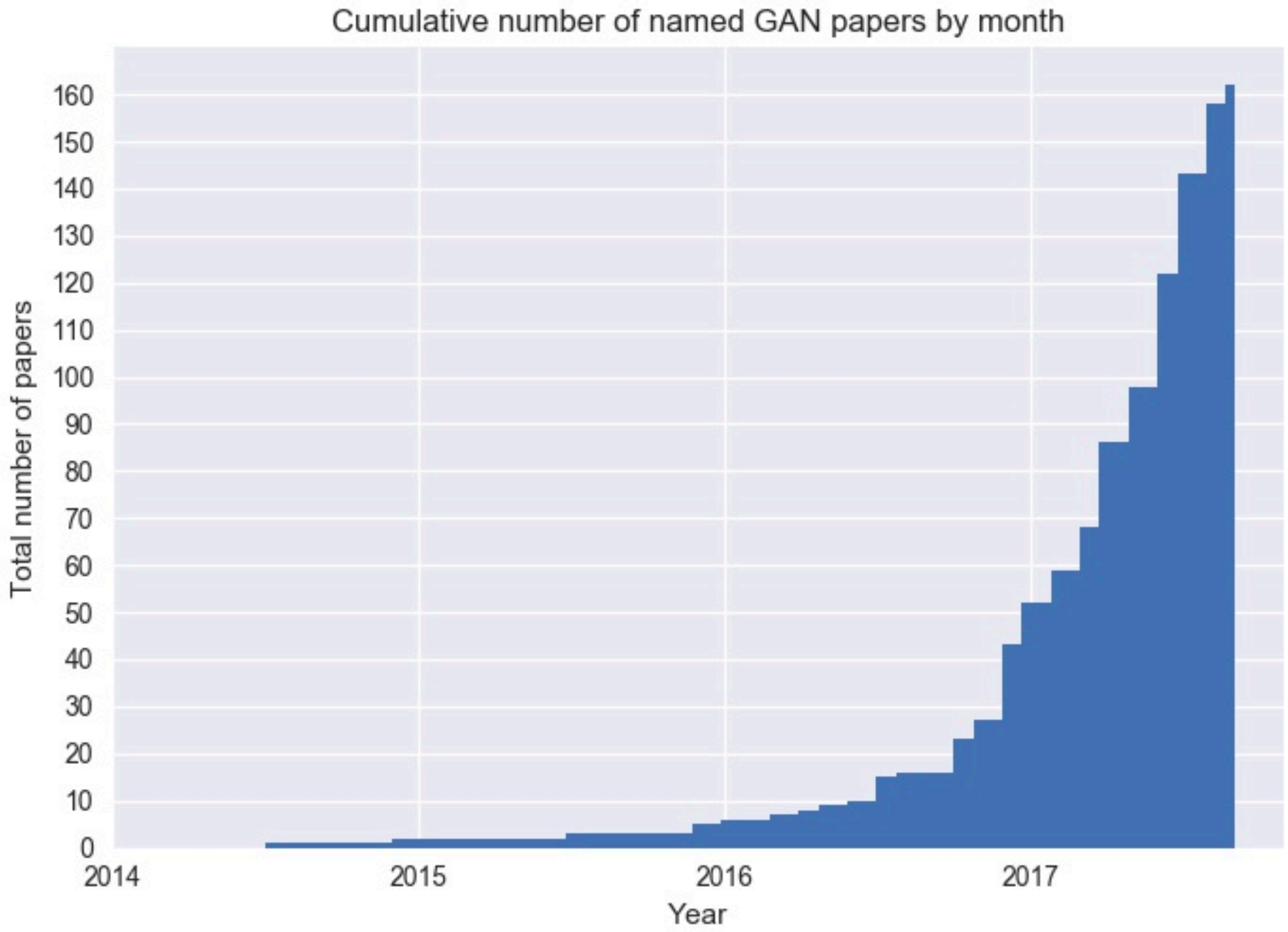
monarch butterfly

goldfinch

daisy

(Odena et al., 2016)

Track updates at the GAN Zoo



https://github.com/hindupuravinash/the-gan-zoo

Questions?