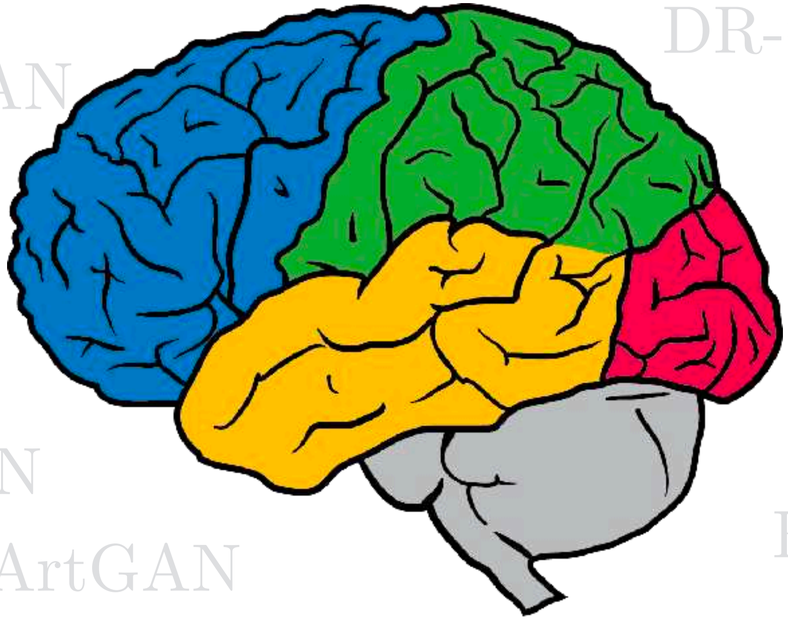
Generative Adversarial Networks

Ian Goodfellow, Staff Research Scientist, Google Brain

ICCV Tutorial on GANs

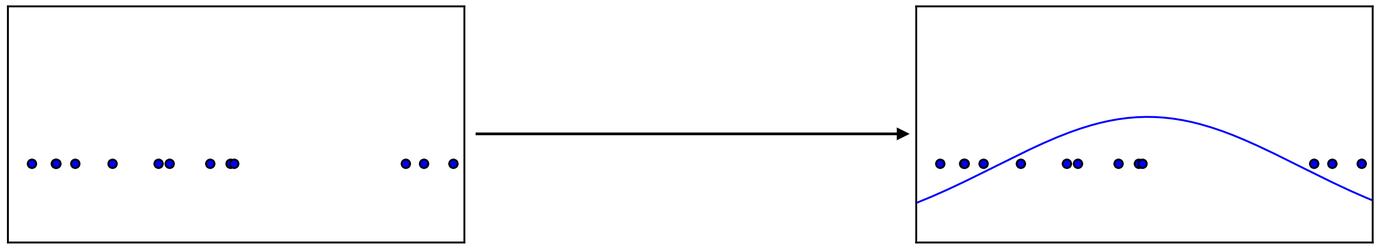
Venice, 2017-10-22



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 Bayesian GAN GP-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

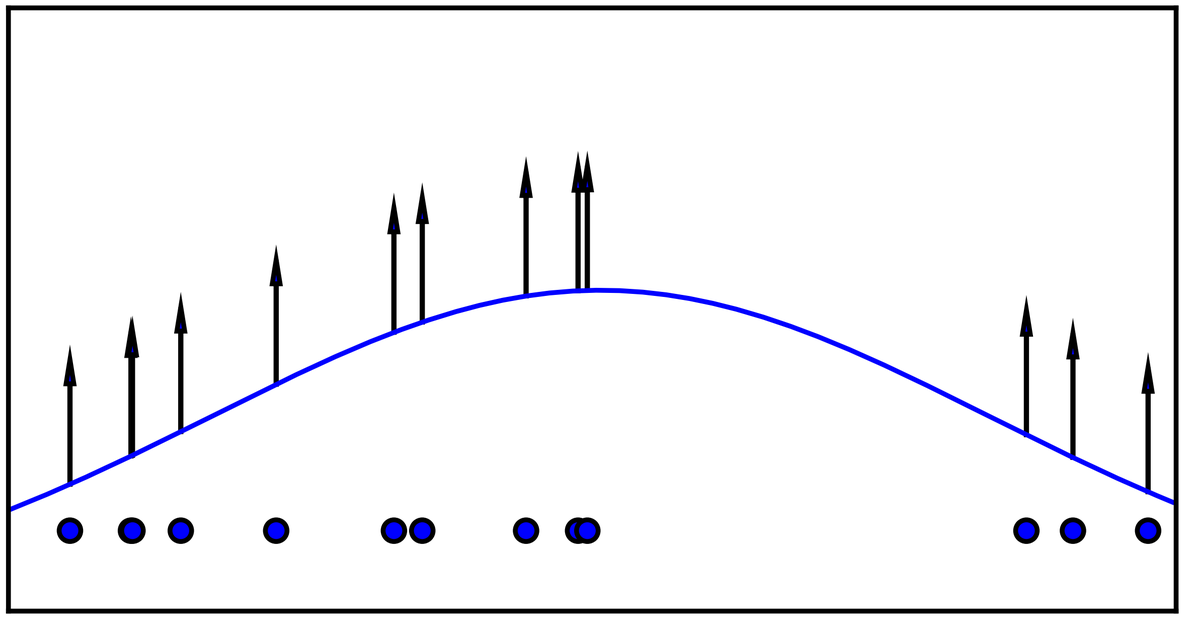


- Sample generation

Training examples

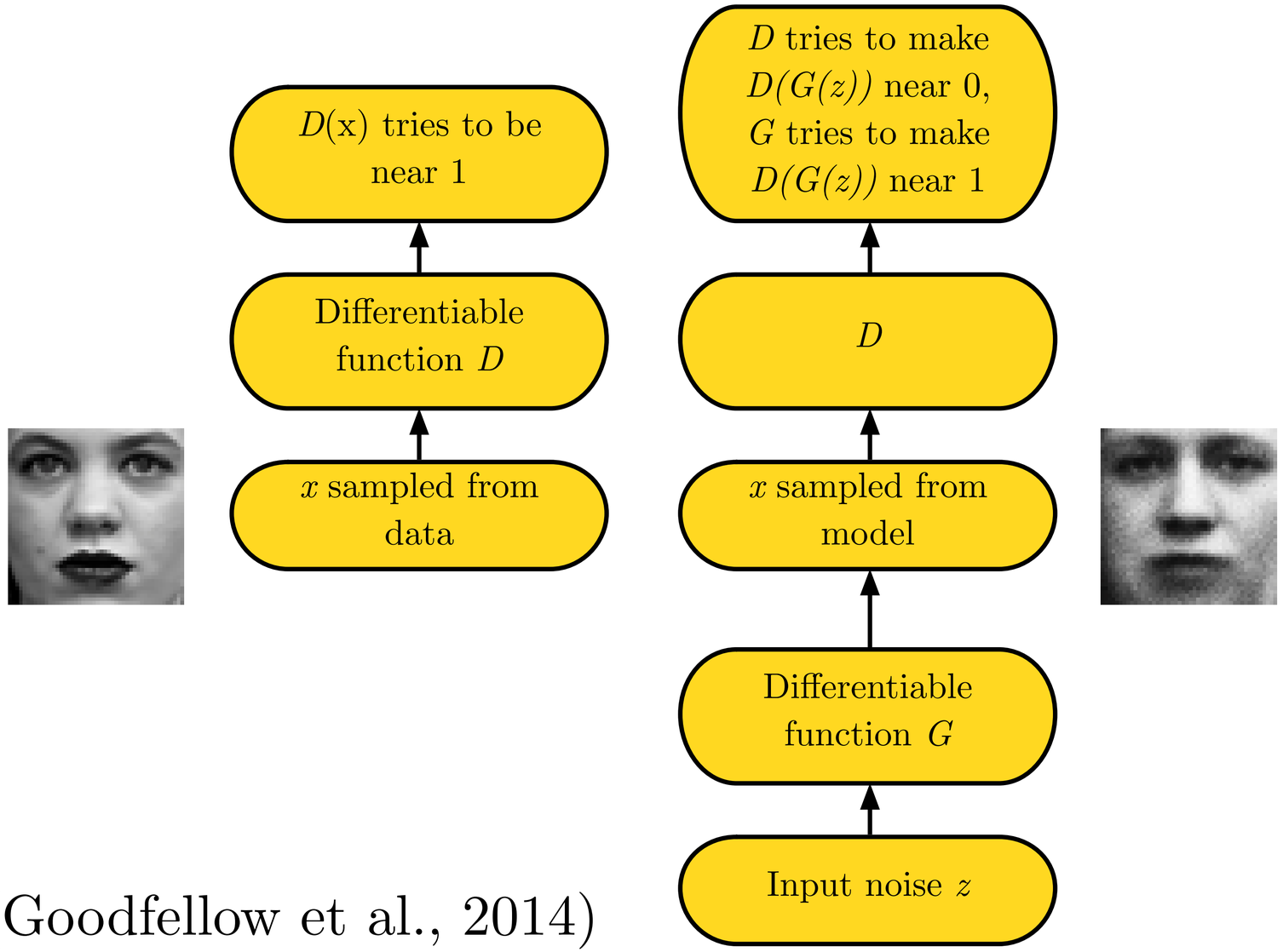
Model samples

Maximum Likelihood



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

Adversarial Nets Framework



(Goodfellow et al., 2014)

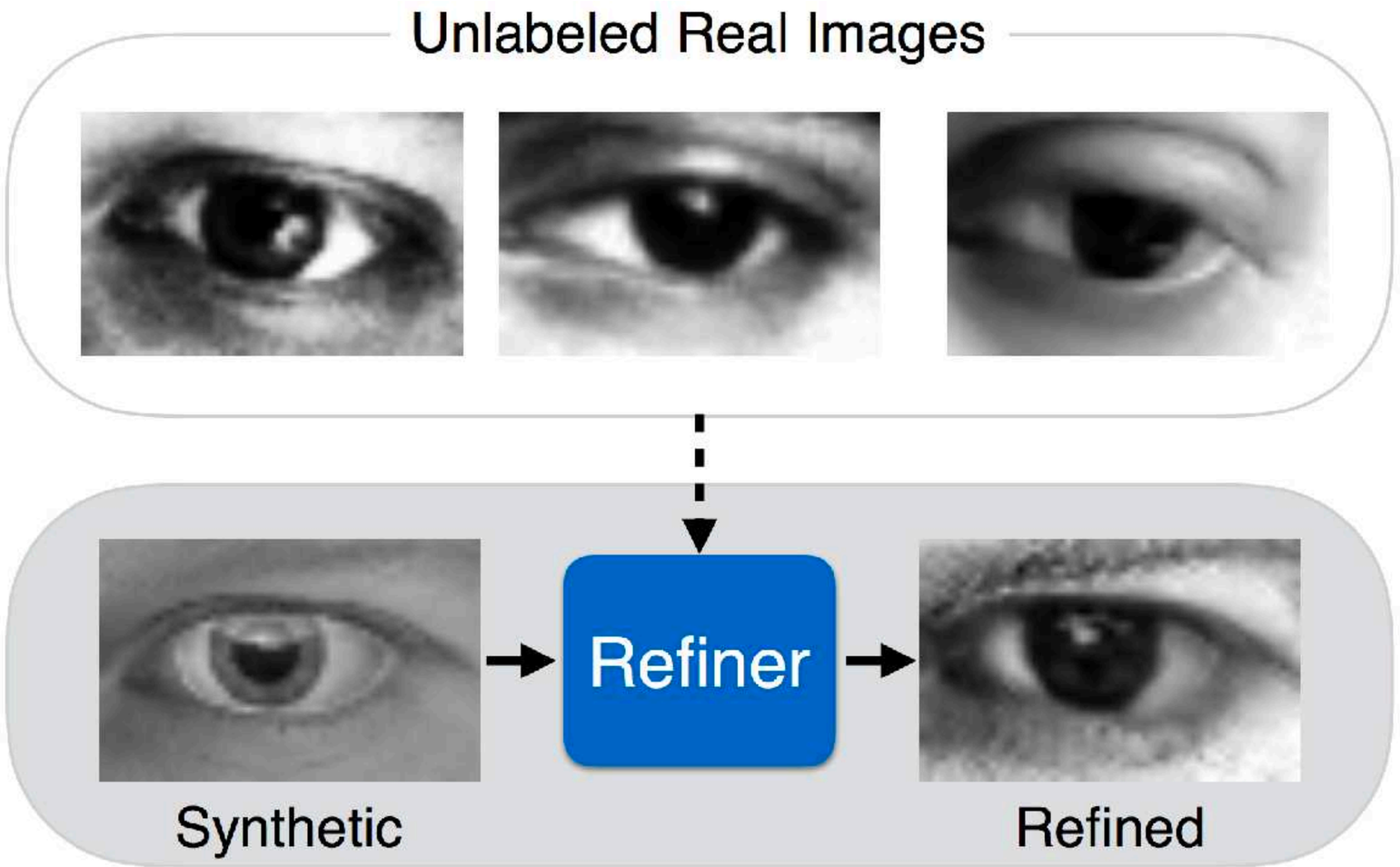
What can you do with GANs?

- 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

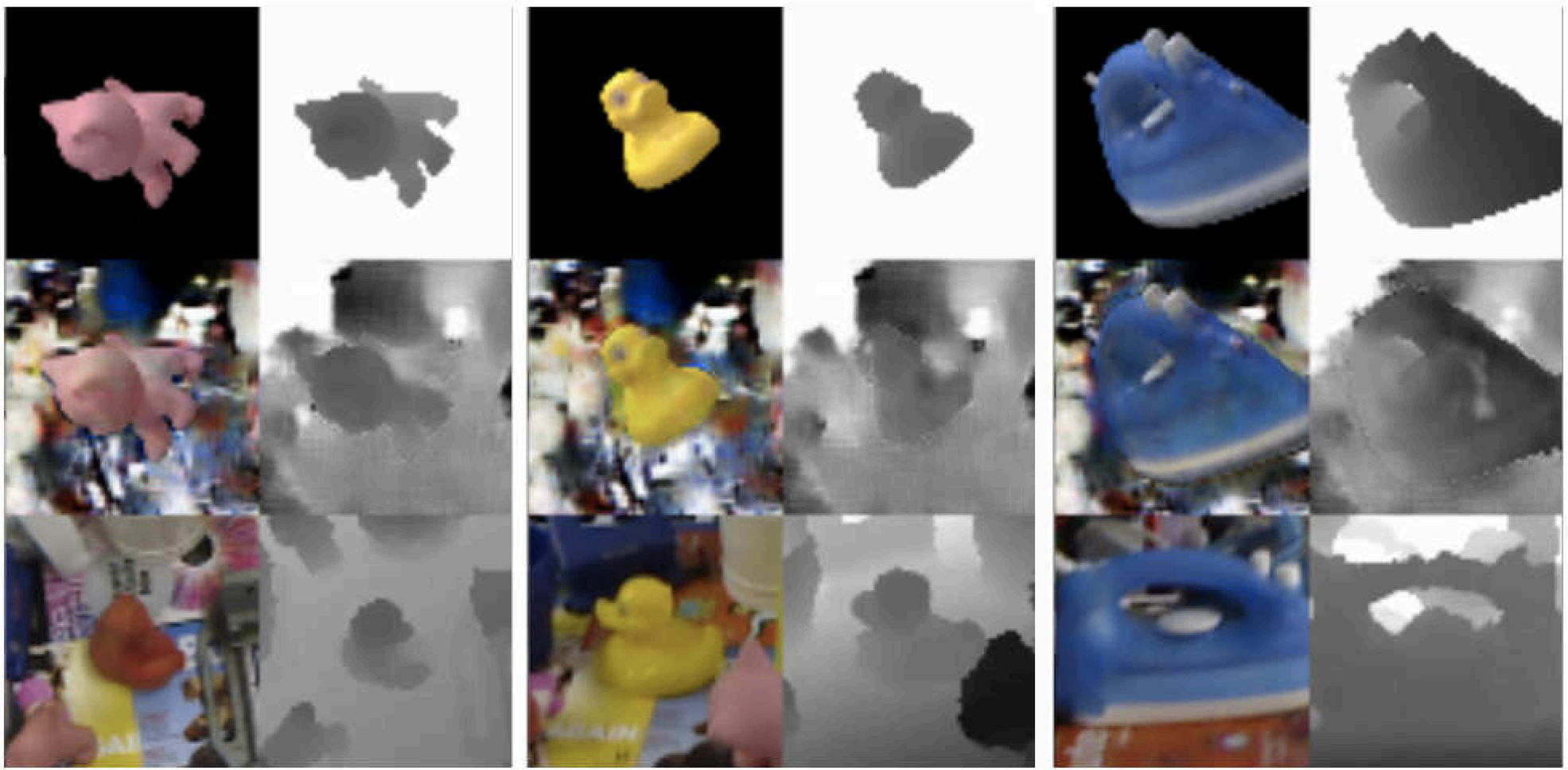
Apple's first research paper tries to solve a problem facing every company working on AI

GANs for simulated training data



(Shrivastava et al., 2016)

GANs for domain adaptation



(Bousmalis et al., 2016)

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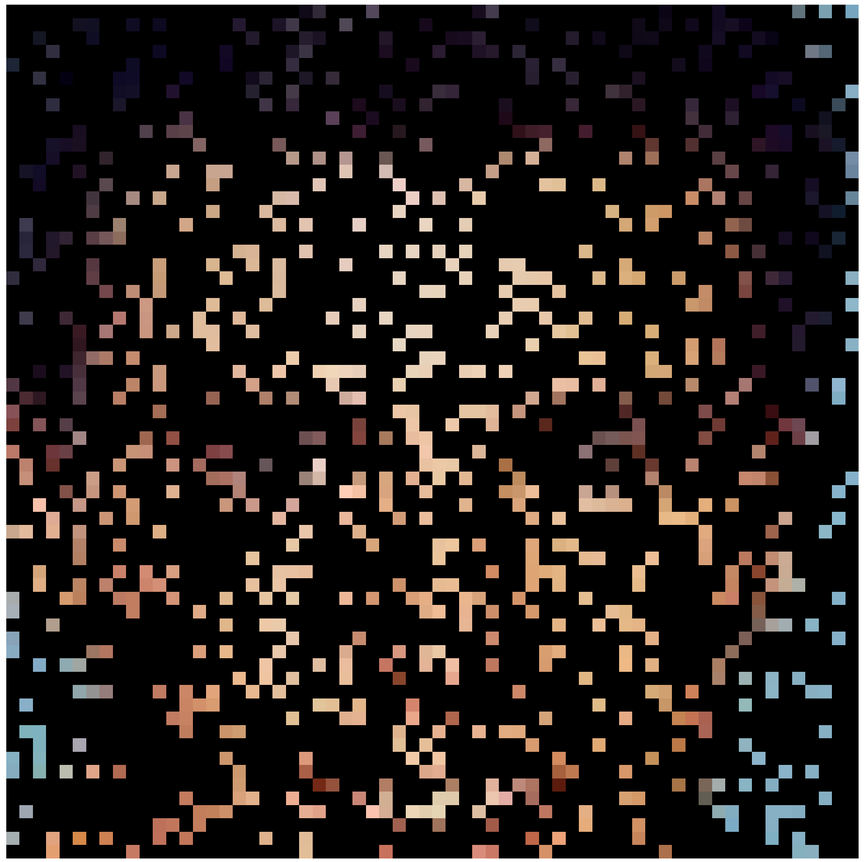
Generative modeling reveals a face



(Yeh et al., 2016)

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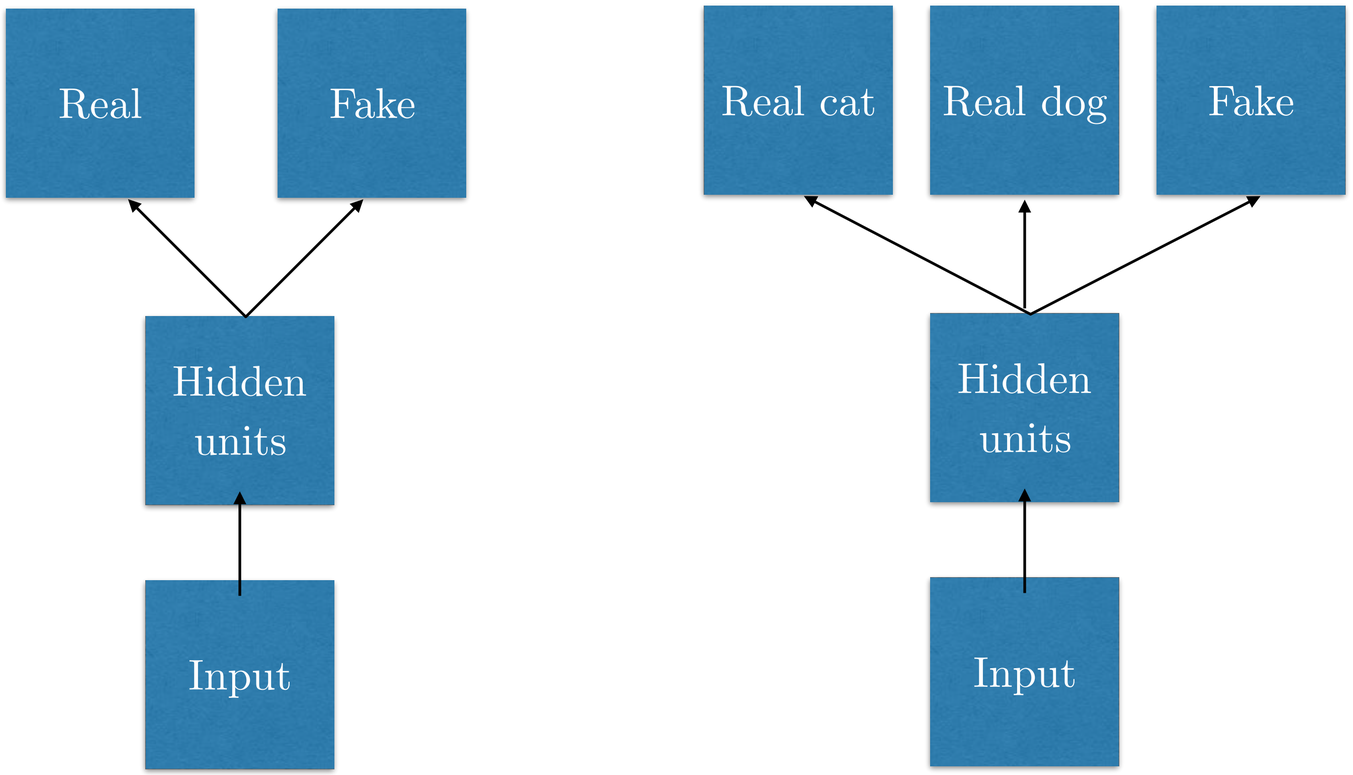
Supervised Discriminator



(Odena 2016, Salimans et al 2016)

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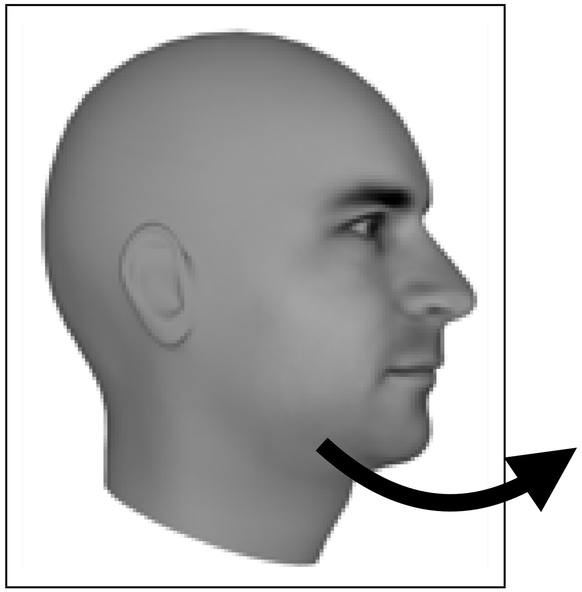
Next Video Frame Prediction

Ground Truth

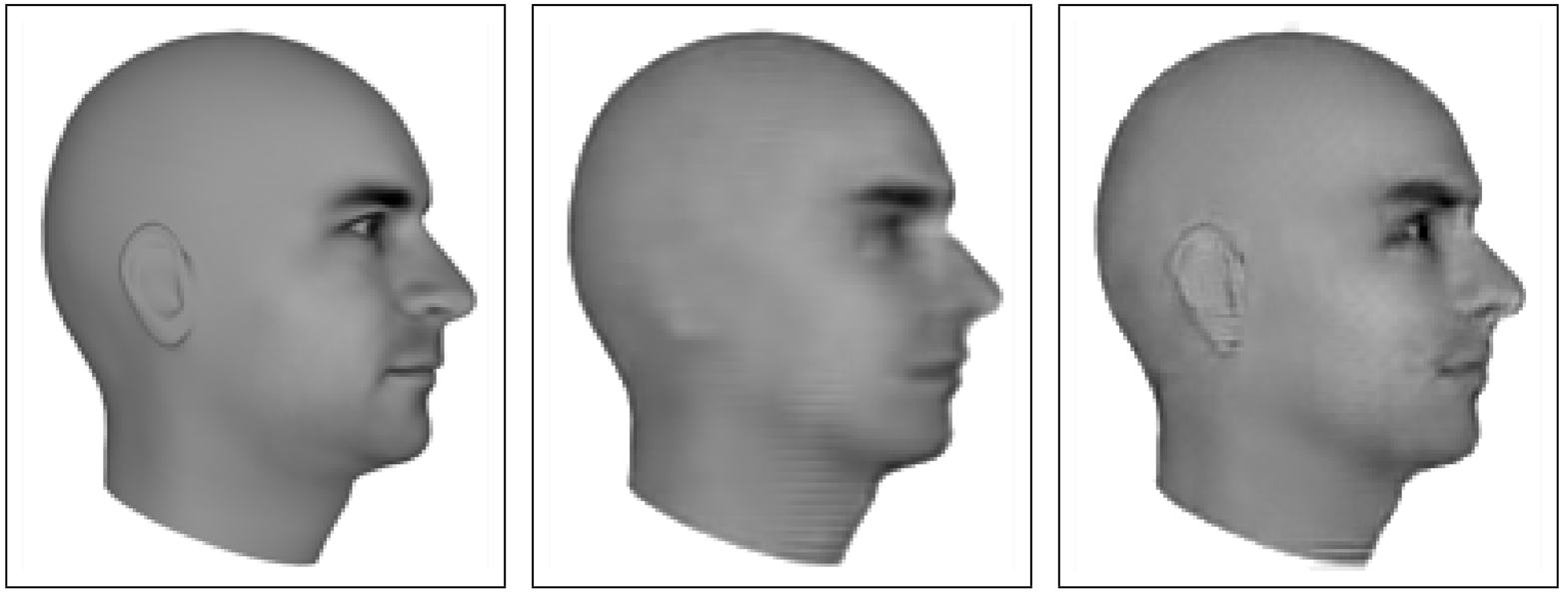


What happens next?

(Lotter et al 2016)

Next Video Frame Prediction

Ground Truth | MSE | Adversarial



(Lotter et al 2016)

Next Video Frame(s) Prediction

Mean Squared Error

Mean Absolute Error

Adversarial

(Mathieu et al. 2015)

(Raffel, 2017)

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Which of these are real photos ?

(work by vue.ai covered by Quartz)

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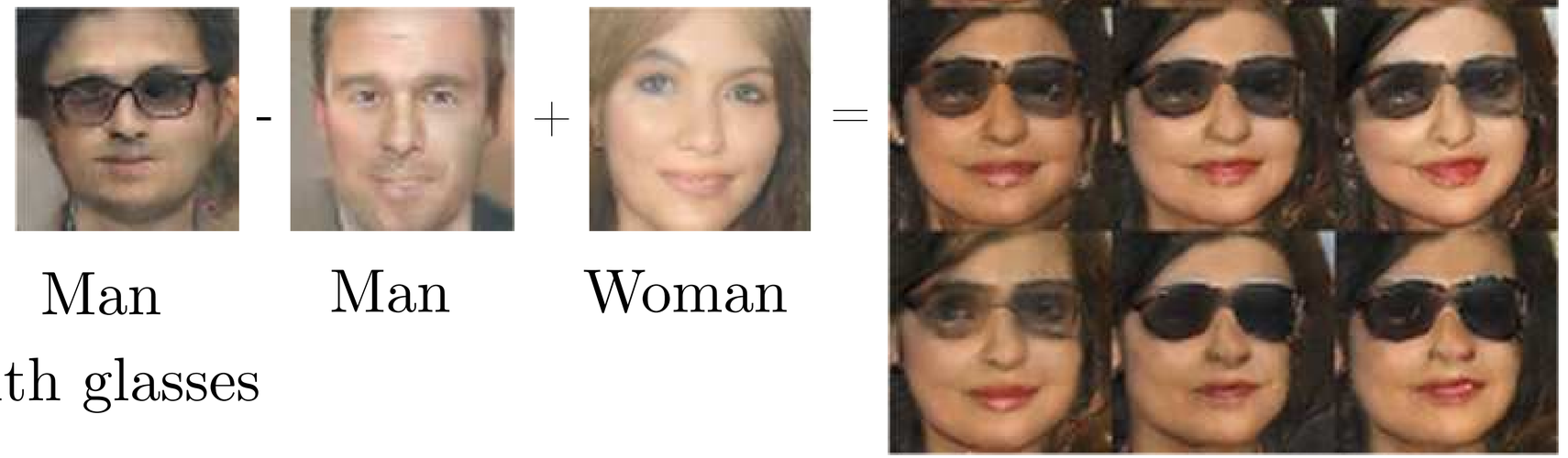
Vector Space Arithmetic



Man with glasses — Man — Woman — Woman with Glasses

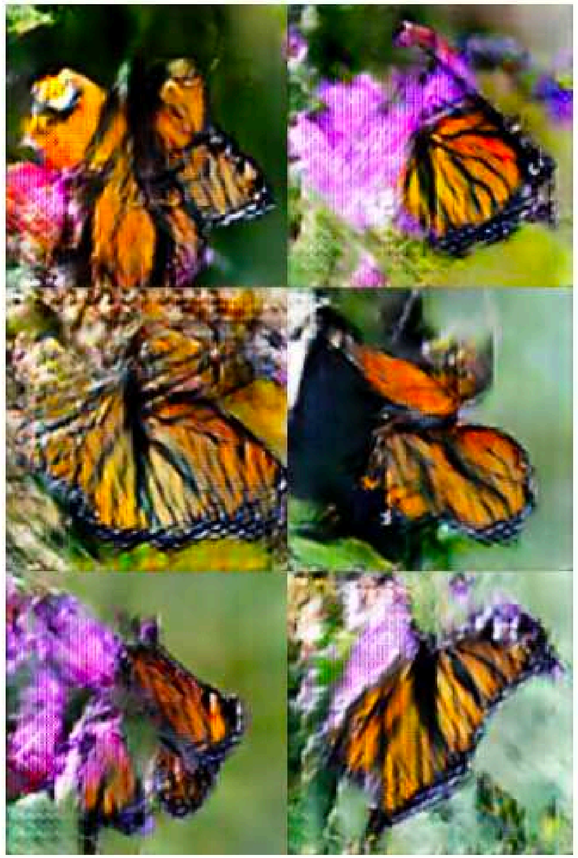
(Radford et al, 2015)

How long until GANs can do this?

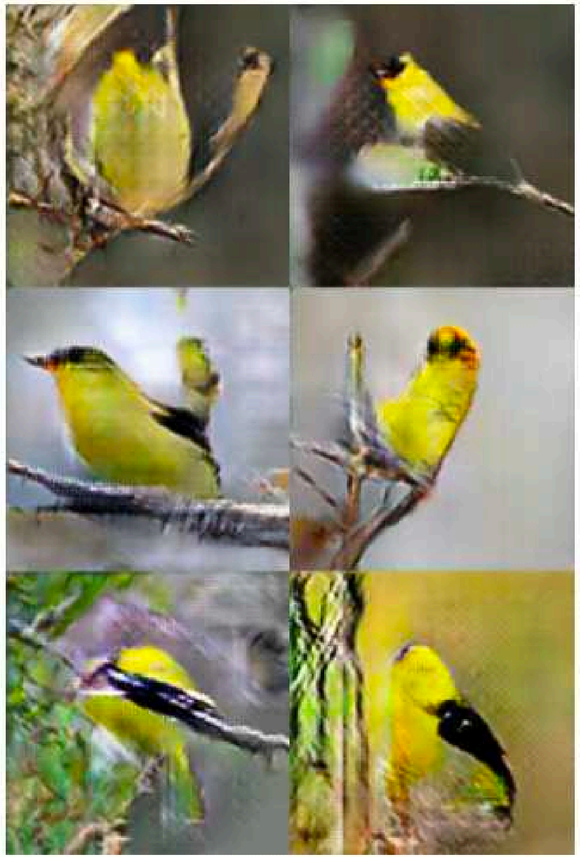
Training examples

Model samples

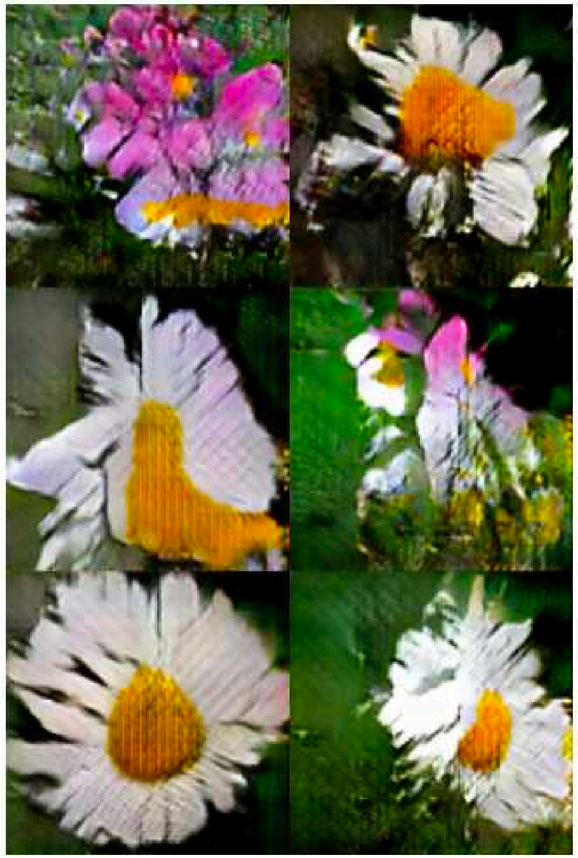
AC-GANs



monarch butterfly



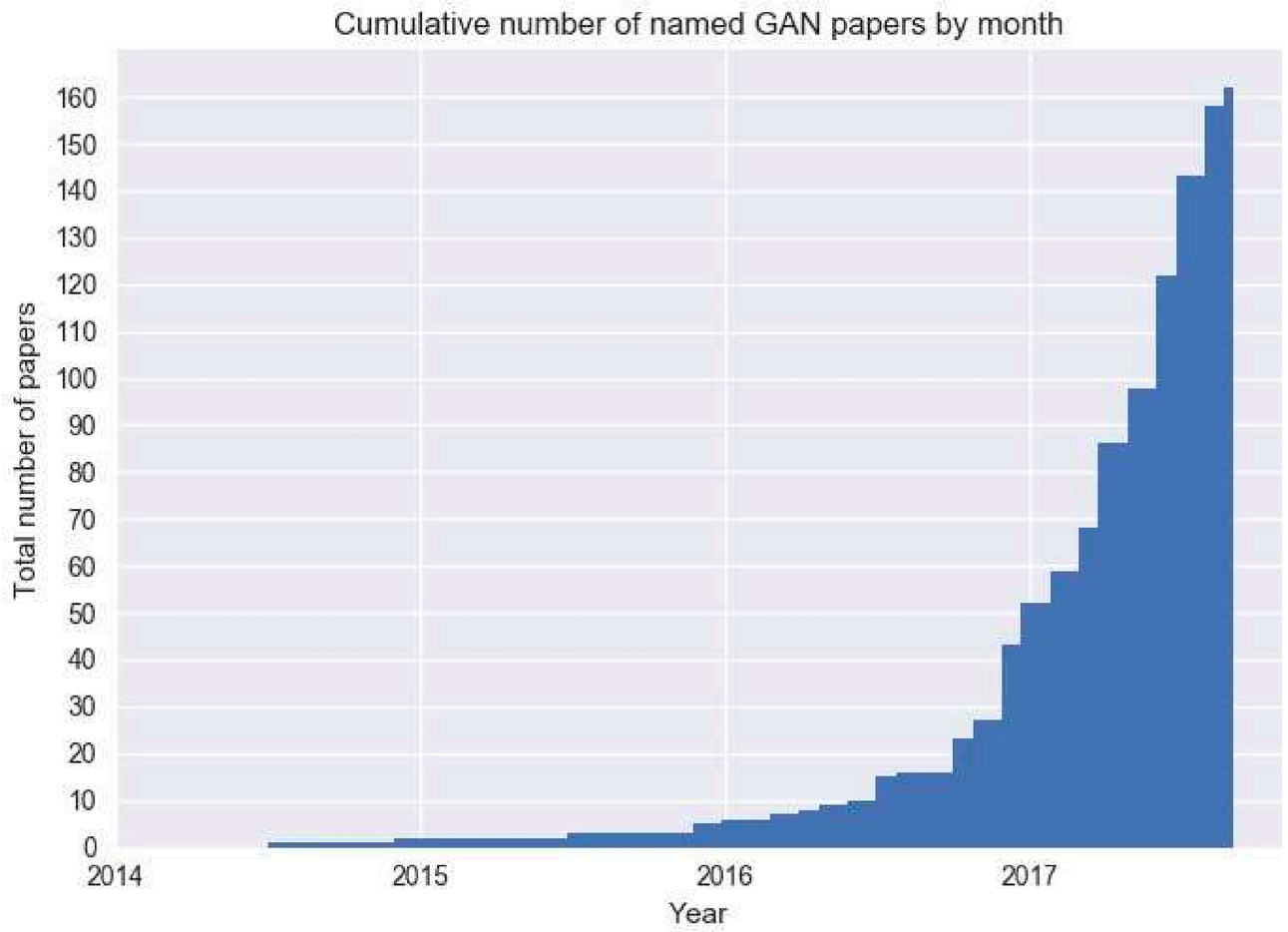
goldfinch



daisy

(Odena et al., 2016)

Track updates at the GAN Zoo



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

Questions?