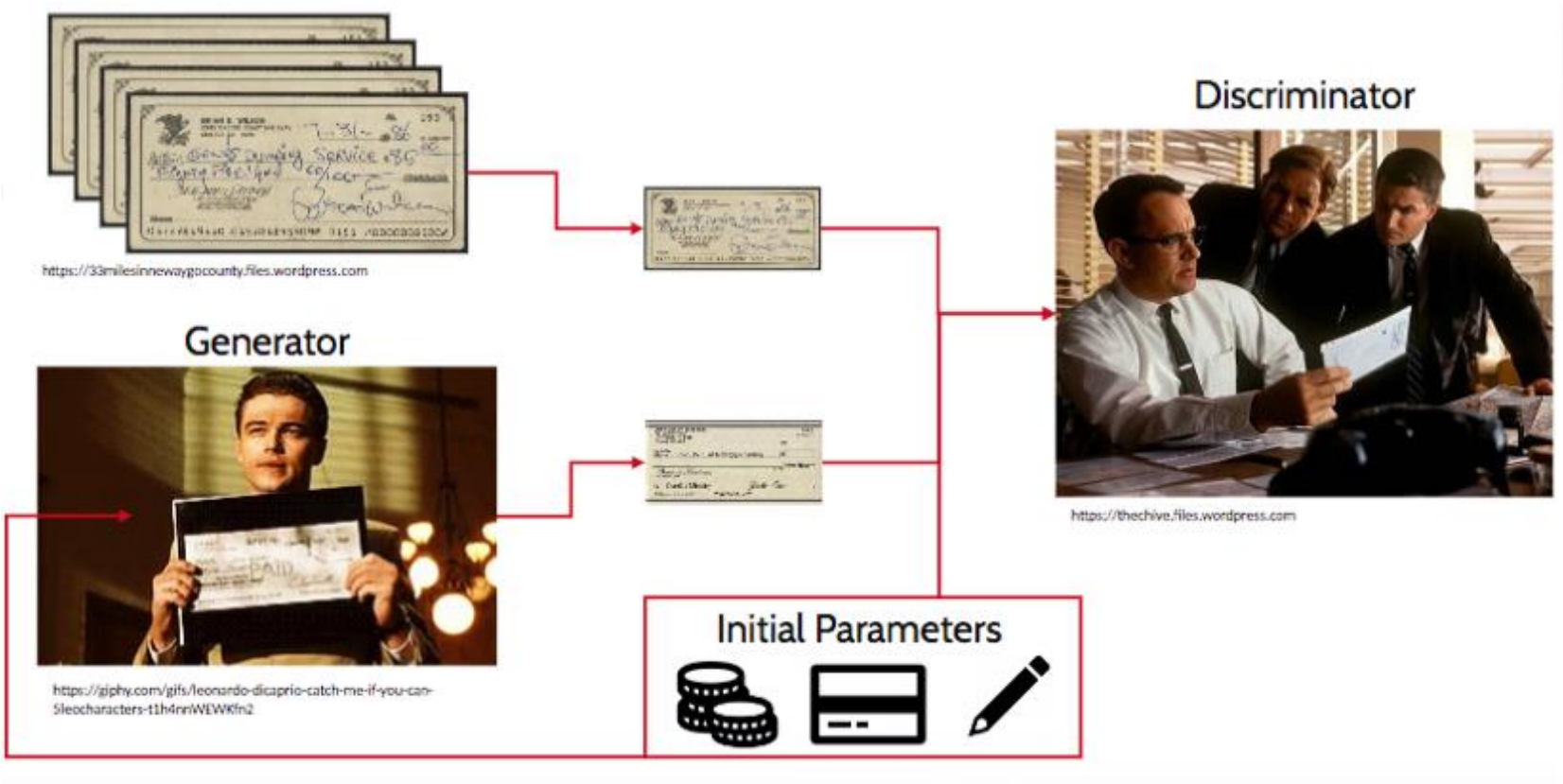
PH451, PH551

April 1, 2025

- **Generative Adversarial Networks**

GANS

Generative Adversarial Networks



GAN

Generative Adversarial Networks

- Goodfellow et al., 2014

Generator

- Produces and image out of random noise

Discriminator

- Guesses if image is fake or real
  - outputs probability that sample x is real

GAN

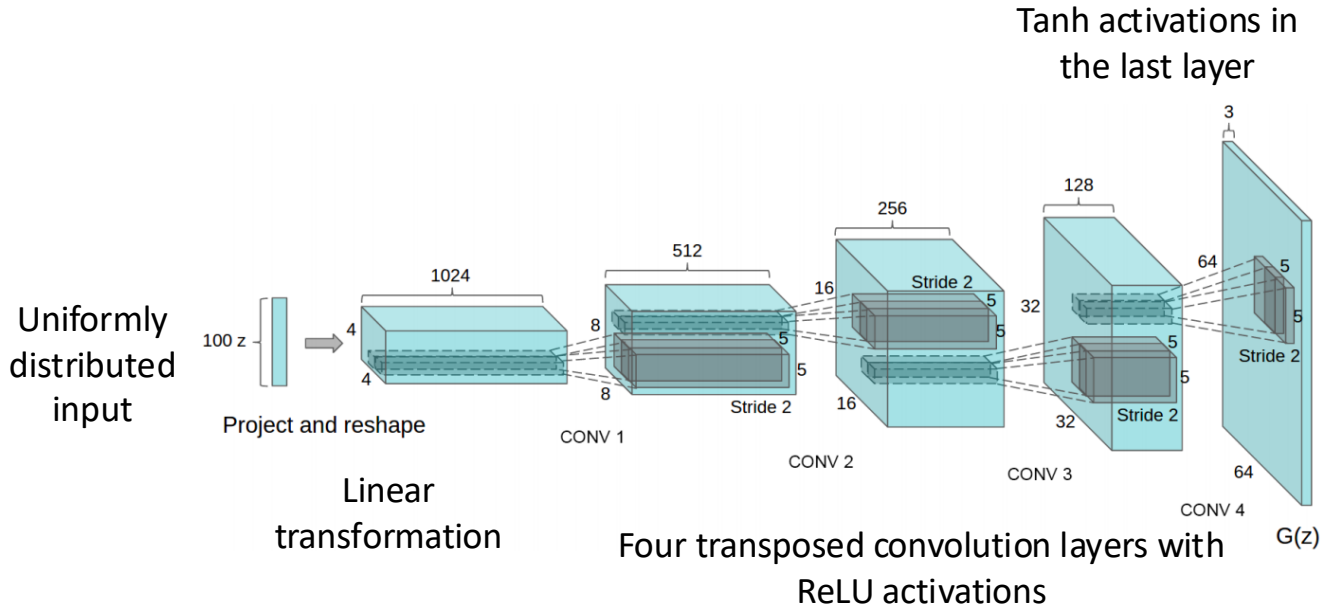
Generative Adversarial Networks

- Co-trained networks
  - first gradient **ascent** for **discriminator**
  - then gradient **descent** for **generator**
- **Game Theory:**
  - Nash Equilibrium, Minimax game
  - Watch out for “mode collapse”

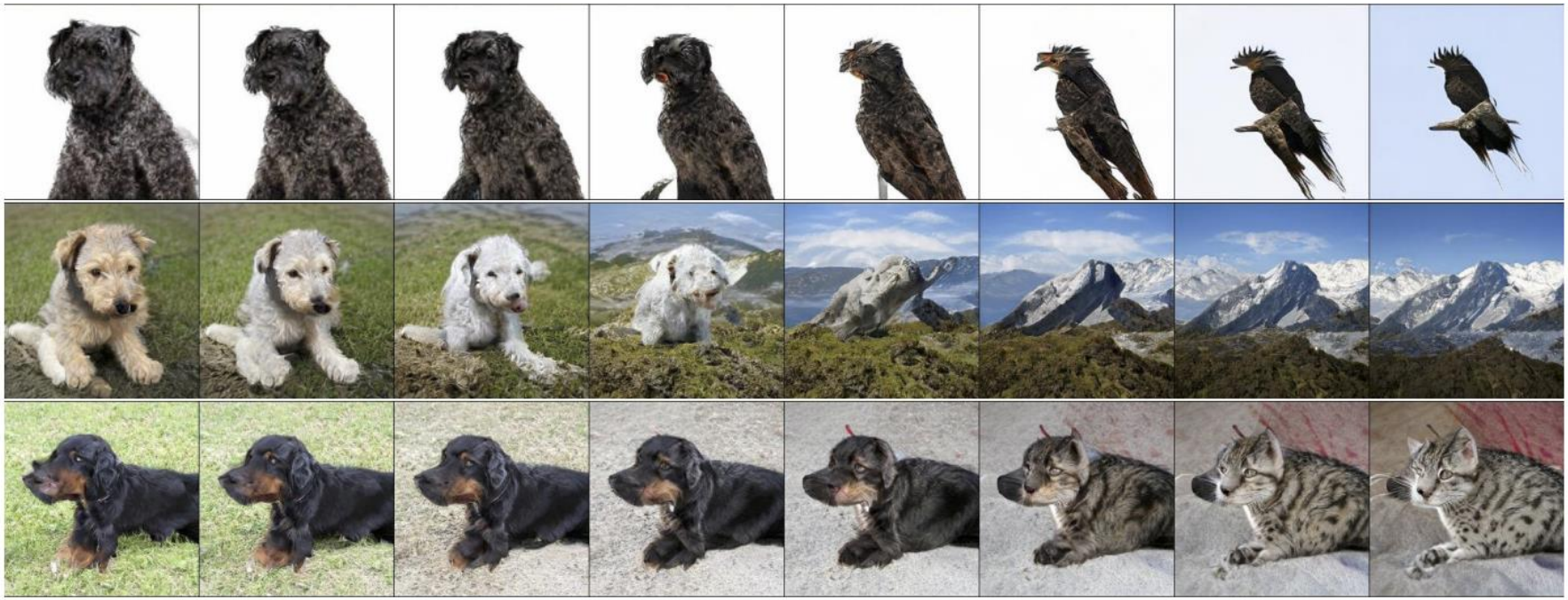
DCGAN

Deep Convolutional GAN

- Radford et al (2015)
- Early GAN success with CNN layers



GAN Examples



BigGan, 2018

GAN Examples

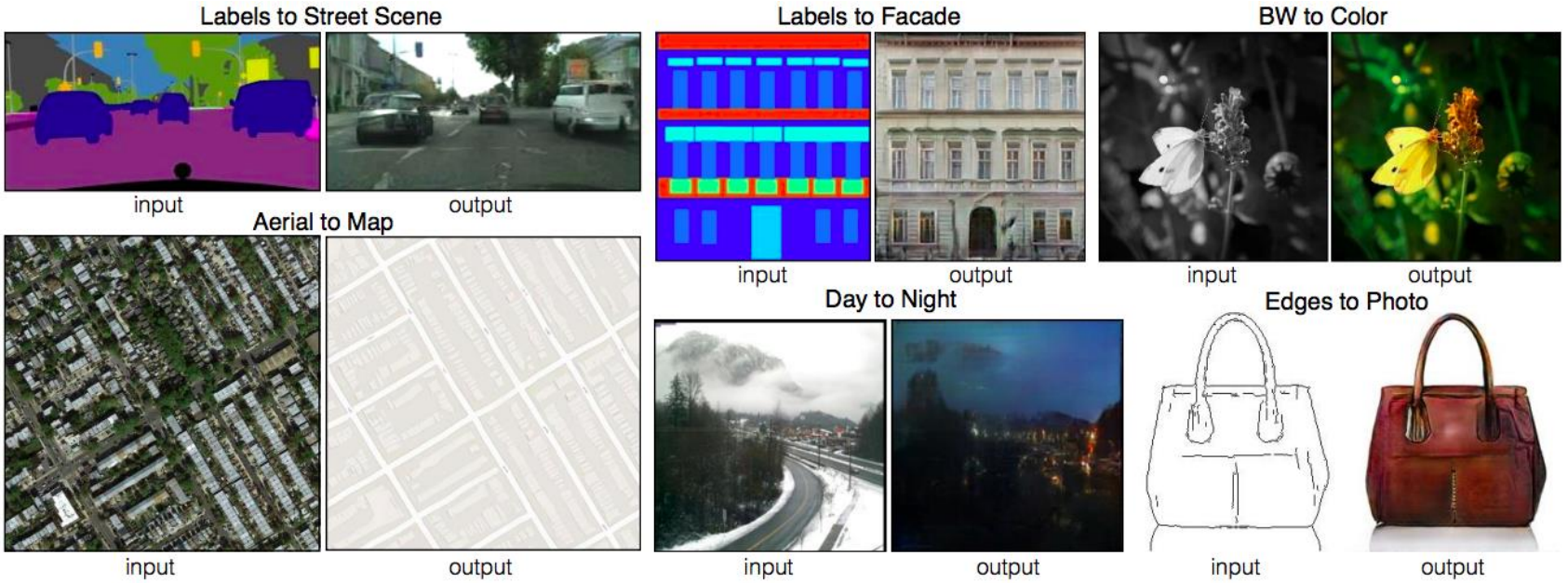
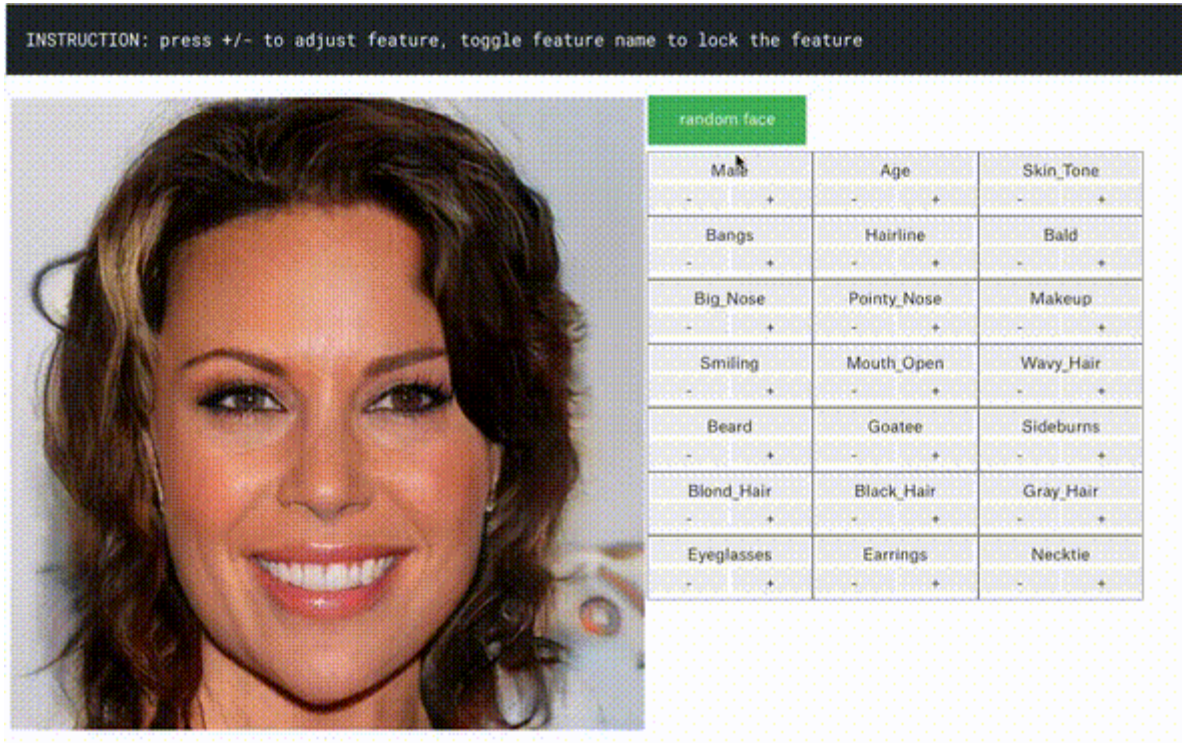


Image to image translation

Isola et al. (2017)

GANS


INSTRUCTION: press +/- to adjust feature, toggle feature name to lock the feature
random face
Male
Age
Skin_Tone
Bangs
Hairline
Bald
Big_Nose
Pointy_Nose
Makeup
Smiling
Mouth_Open
Wavy_Hair
Beard
Goatee
Sideburns
Blond_Hair
Black_Hair
Gray_Hair
Eyeglasses
Earrings
Necktie

GANS

StyleGAN, Karras et al. (2019)

StyleGAN

StyleGAN

- Karras et al. (Nvidia, 2019)
- **Style transfer in generator**
  - Similar local structure as training images
- **Mapping Network**
  - 8-layer NN, maps latent encodings to a vector
  - Dense layers control the style
  - ”hair color”
- **SynthesisNet**
  - Convolution + upsampling + noise at input (introduces randomness)