

# Lecture 12 – Generative Adversarial Networks

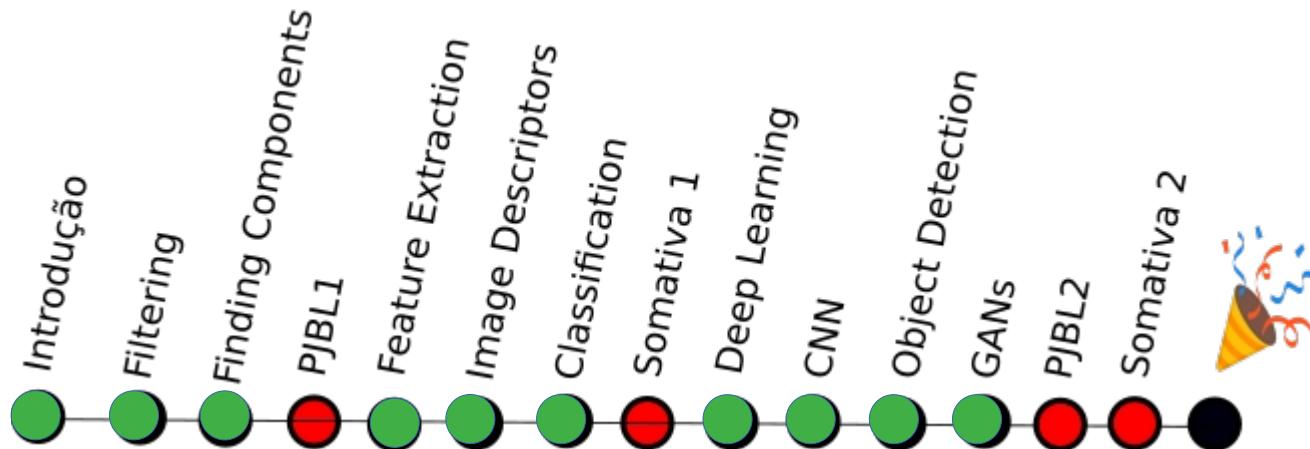
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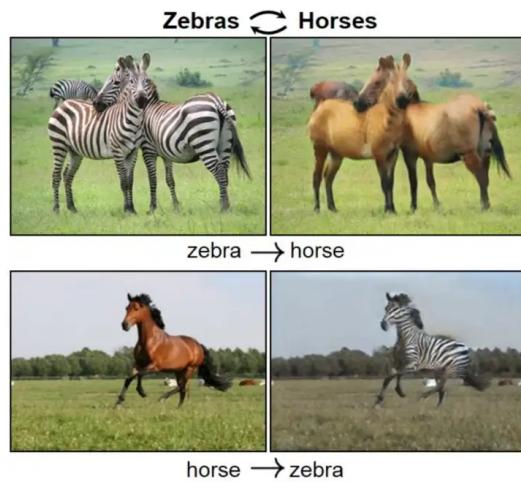
# Topics

- Review of Lecture 11 - Image Segmentation
  - Object Segmentation (Bounding Box Level)
  - Instance / Semantic Segmentation (Pixel Level)
  -
- Generative Adversarial Networks
  - DCGAN
  - PIX2PIX
  -
- Practice



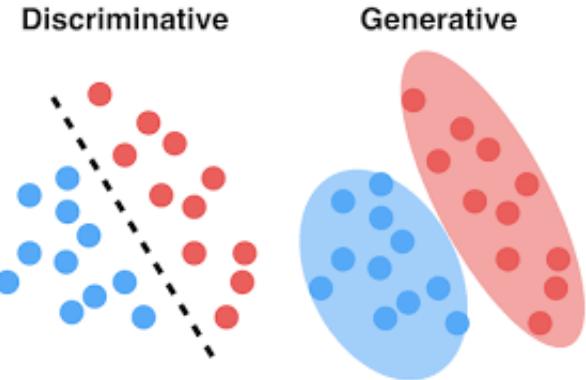
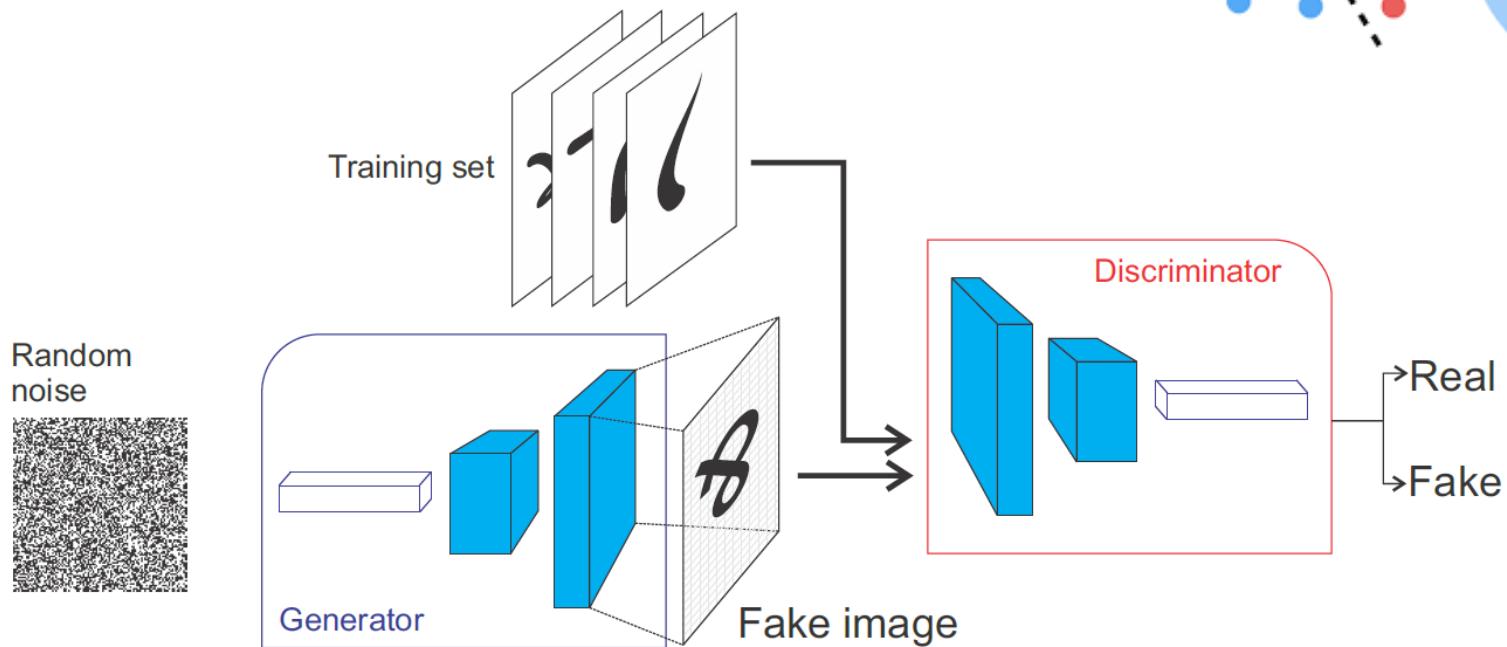
# Deep Fakes

- Generalization: Synthetic data produced from the learning of real data distribution
- Several Applications
  - Movies (Fake Scenes)
  - Photo Enhancement (Pose Estimation, Gray2Color, Noise Reduction)
  - Image Translation
  - .....



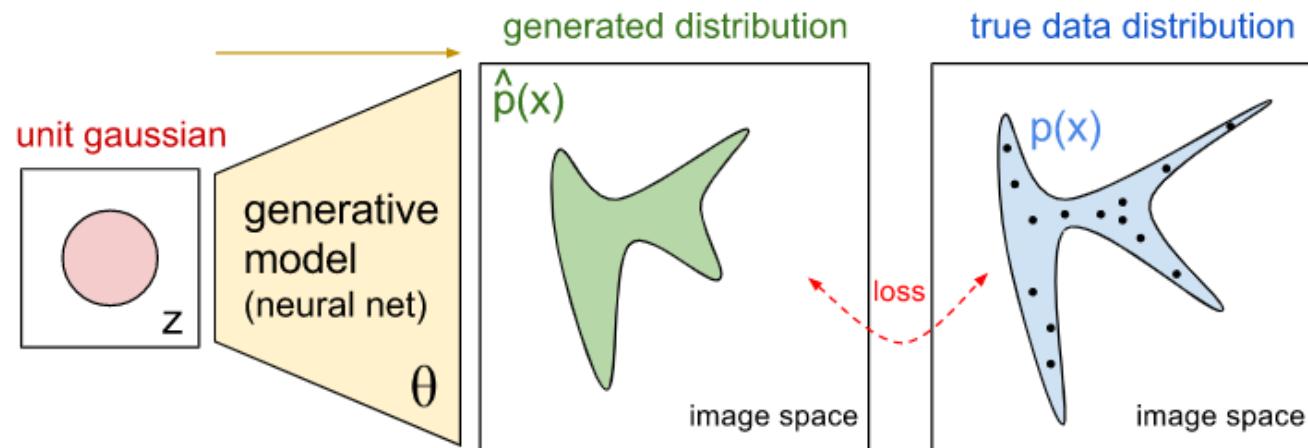
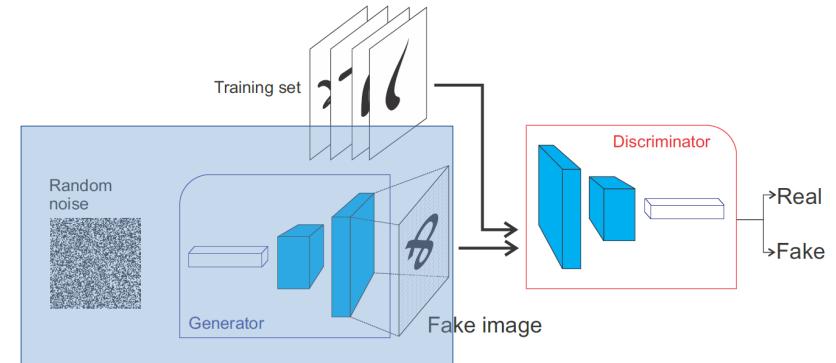
# Generative Adversarial Networks (GAN's)

- Generator: Noise → Data
- Discriminator: Classification

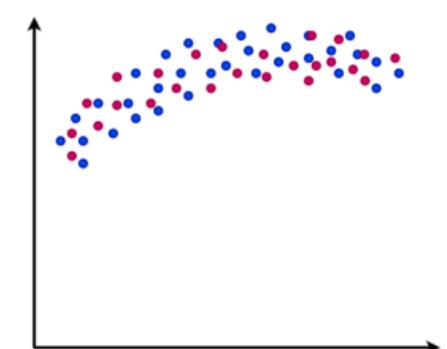
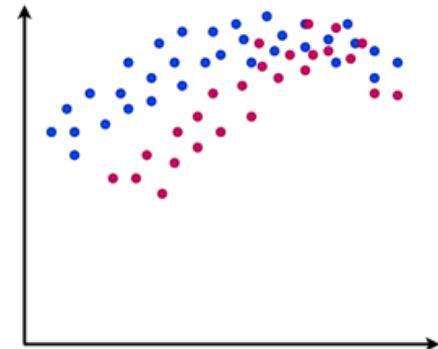
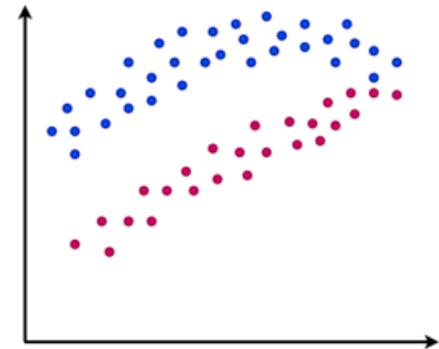
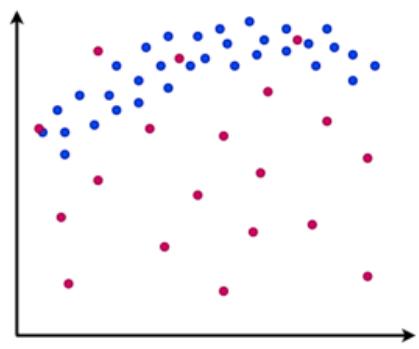
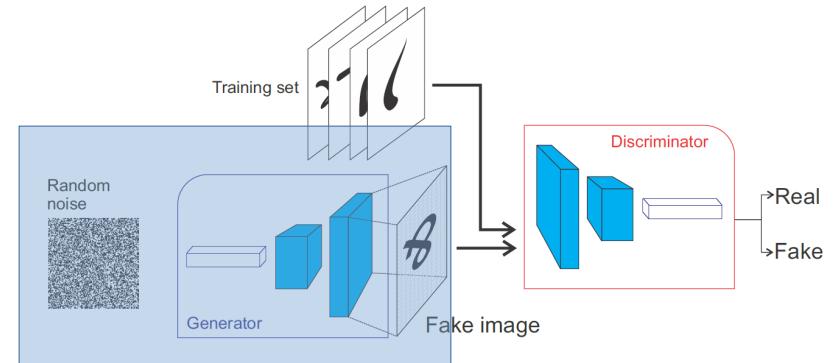
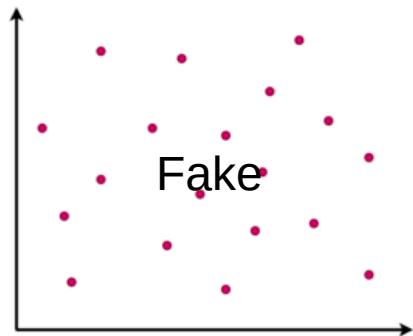
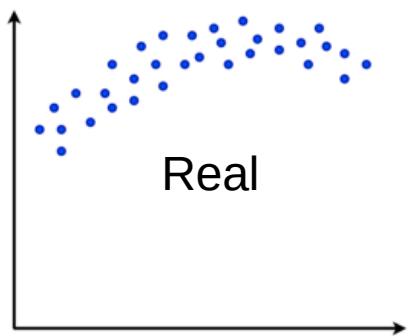


# Generative Model

- Learns data distribution



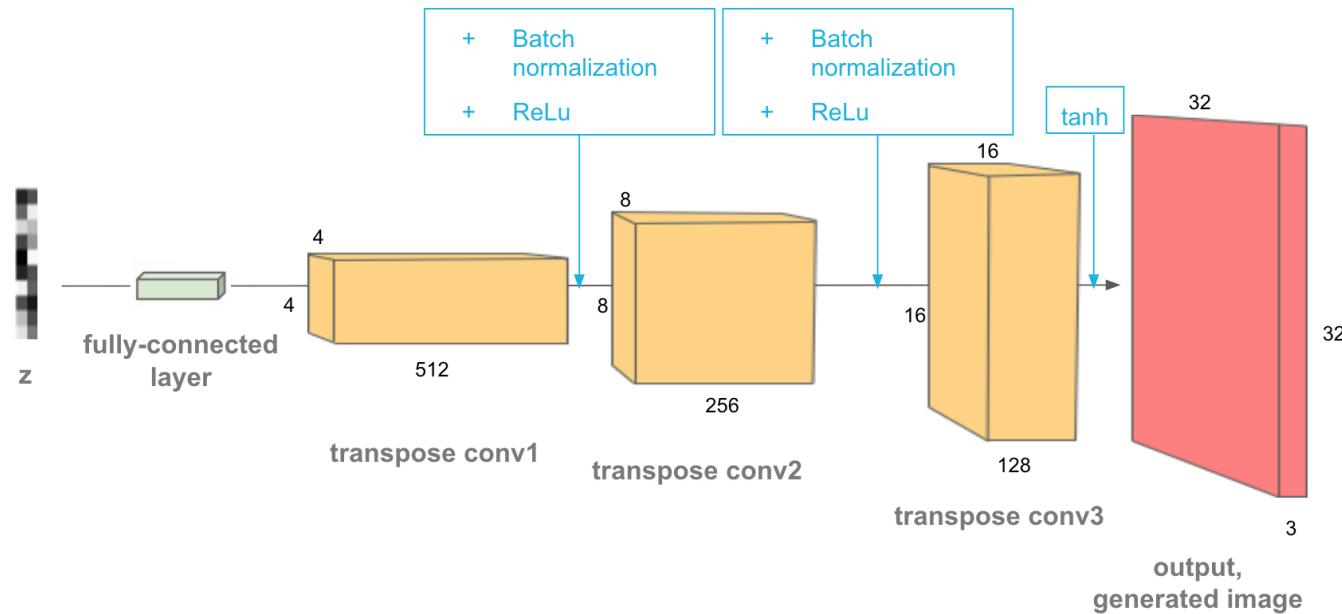
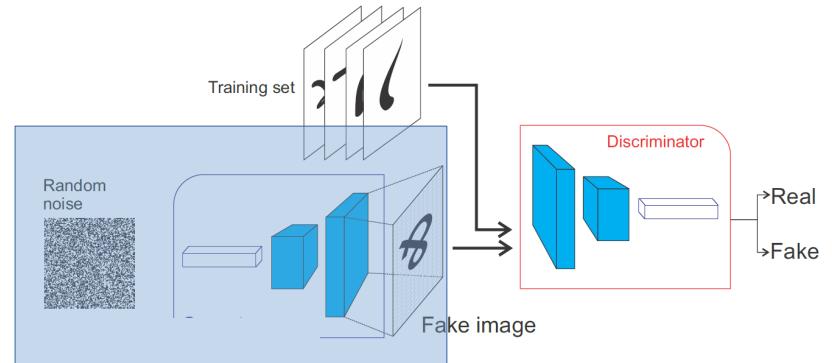
# Generative Model



Training

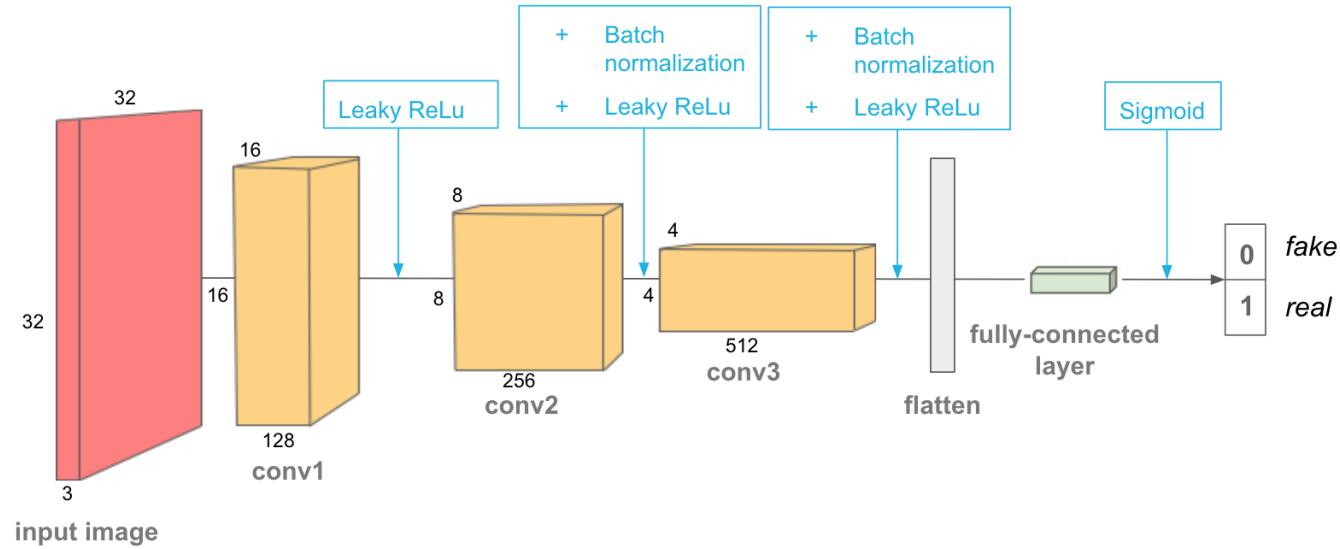
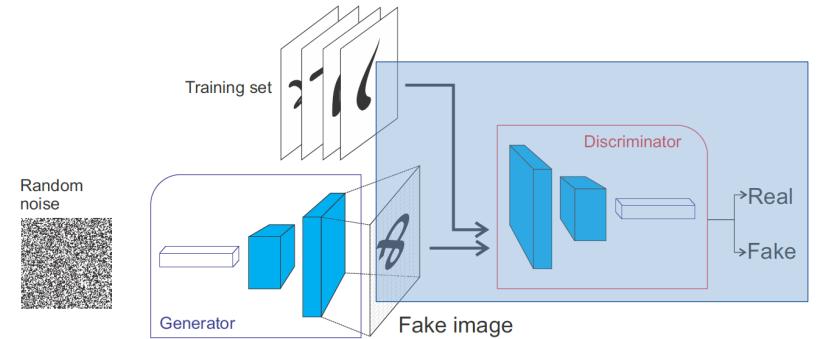
# Deep Generative Model

- De-Convolutional Layers (upsampling)
- Noise to Fake Image



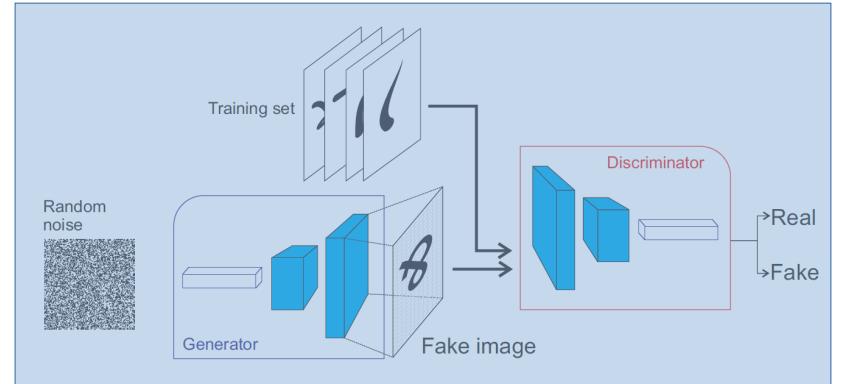
# Discriminator Model

- Classification: Fake or Real
- CNN

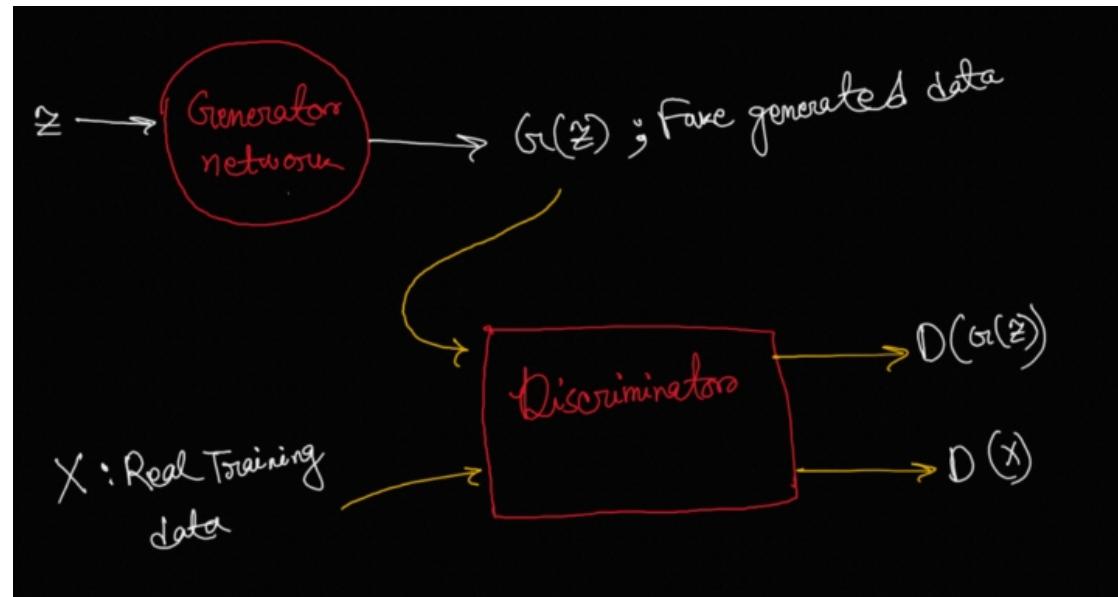


# Adversarial Training

- Adversarial Loss (Min-Max)
  - Minimize Generator
  - Maximize Discriminator

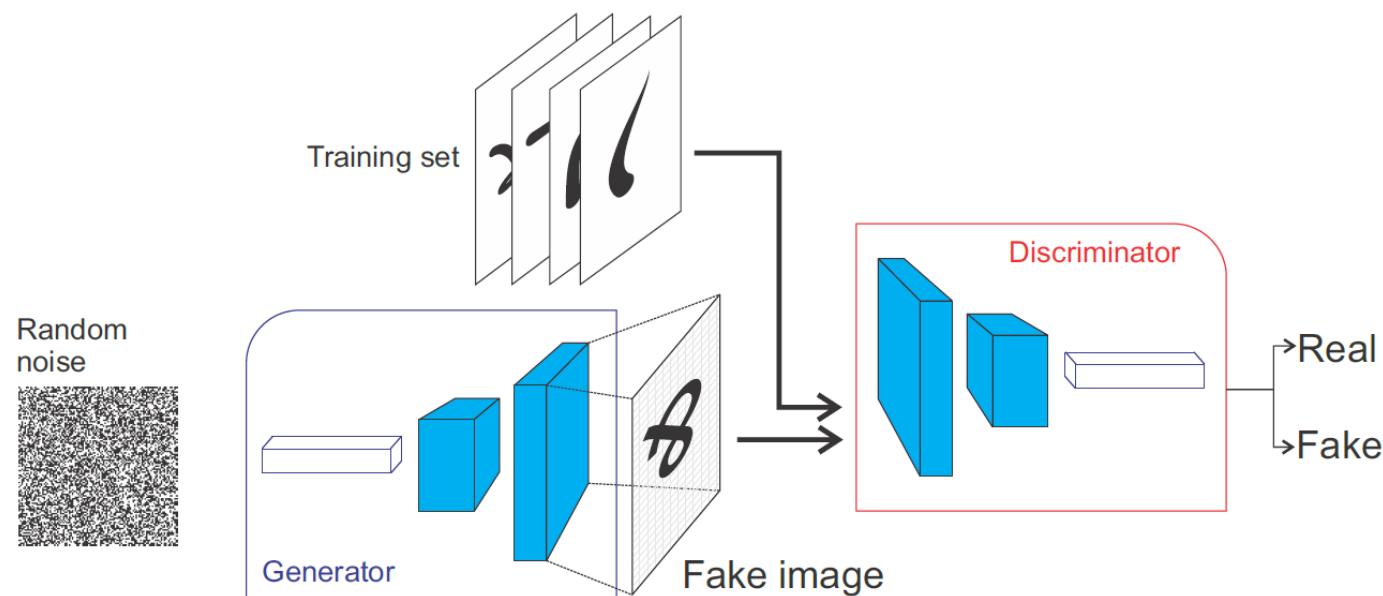


$$\min_G \max_D V(D, G) = \mathbb{E}_{x \sim p_{data}} [\log D(x)] + \mathbb{E}_{z \sim p_z(z)} [\log(1 - D(G(z)))]$$



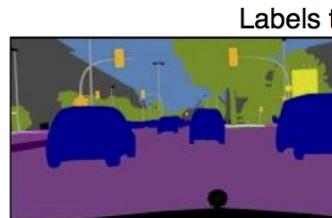
# Let's Code

- [LINK: Lecture\\_12-DCGAN.ipynb](#)



# Pix2Pix

- Image-Translation

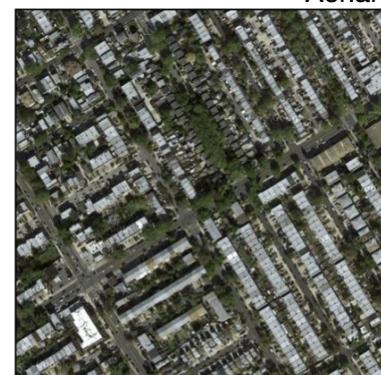


input

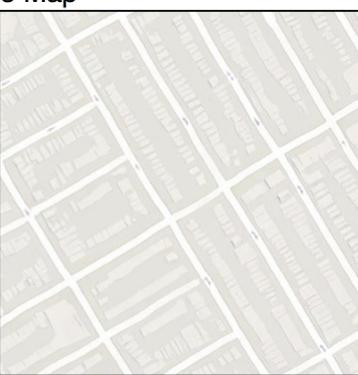


output

Labels to Street Scene

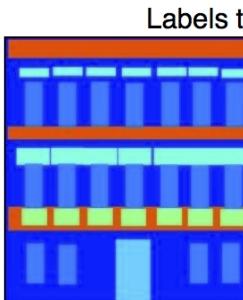


input



output

Aerial to Map



input



output

Labels to Facade



input



output

BW to Color



input



output

Day to Night



input

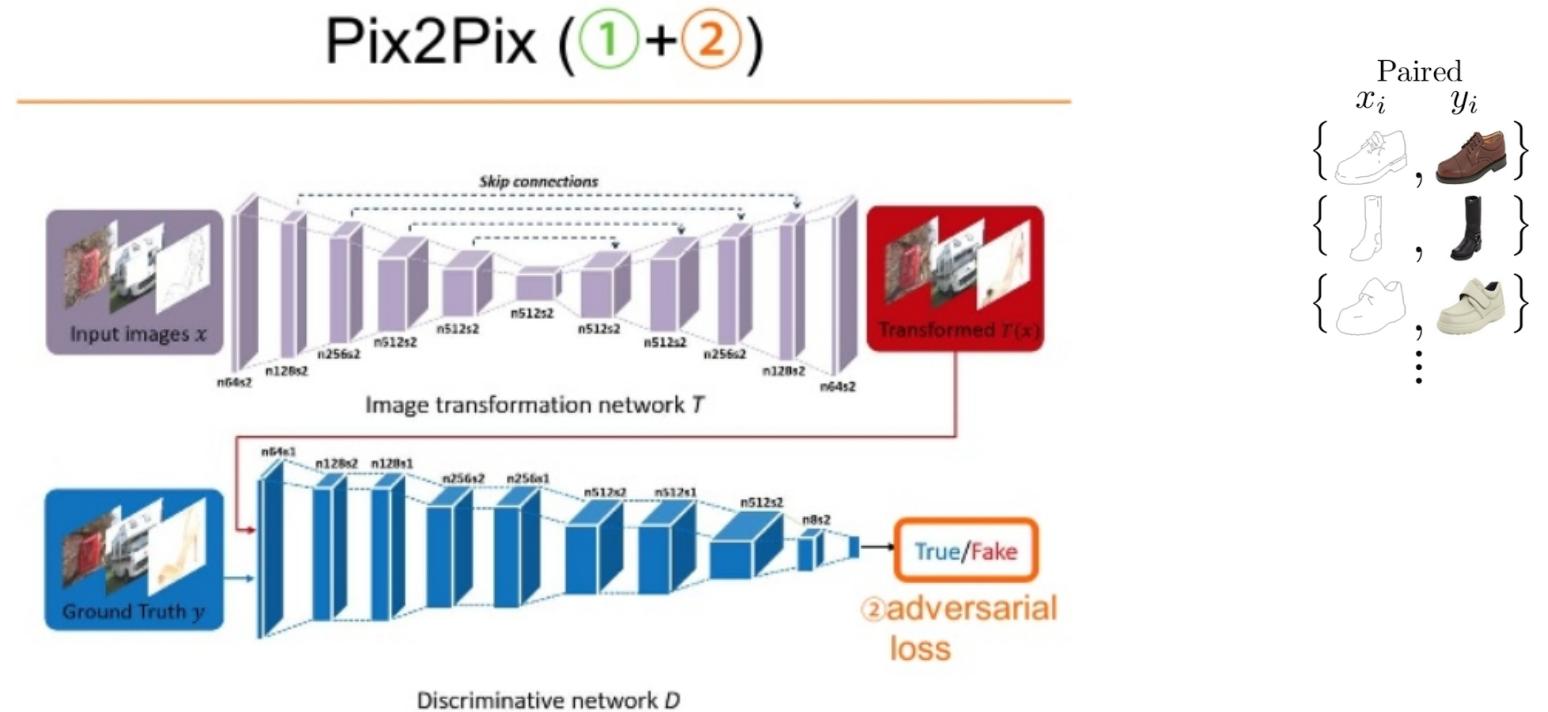


output

Edges to Photo

# Pix2Pix

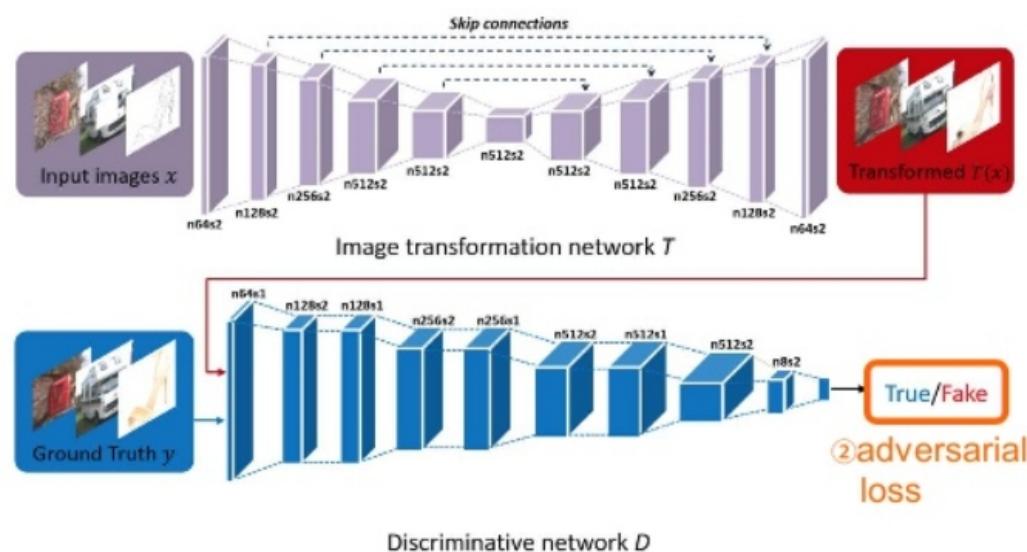
- Generative Model: Encoder-Decoder Architecture (i.e U-Net)
- Paired Annotated Dataset



# Let's Code

- [LINK: Lecture\\_12-pix2pix.ipynb](#)

## Pix2Pix (①+②)



# Course Final Remarks

- 12 Lectures / Topics
  - Image Processing
  - Image Segmentation
  - Image Classification
    - Feature Extraction
    - Shallow Classification
  - Deep Learning
    - Classification
    - Segmentation
    - GANs
- 04 assessment tasks
  - Coin Segmentation (Mask)
  - Coins Classification (Shallow Based Models)
  - Coins Classification (UNET + CNN Based)
  - Individual Assessment (Deep Learning)