Introduction to Generative Adversarial Networks

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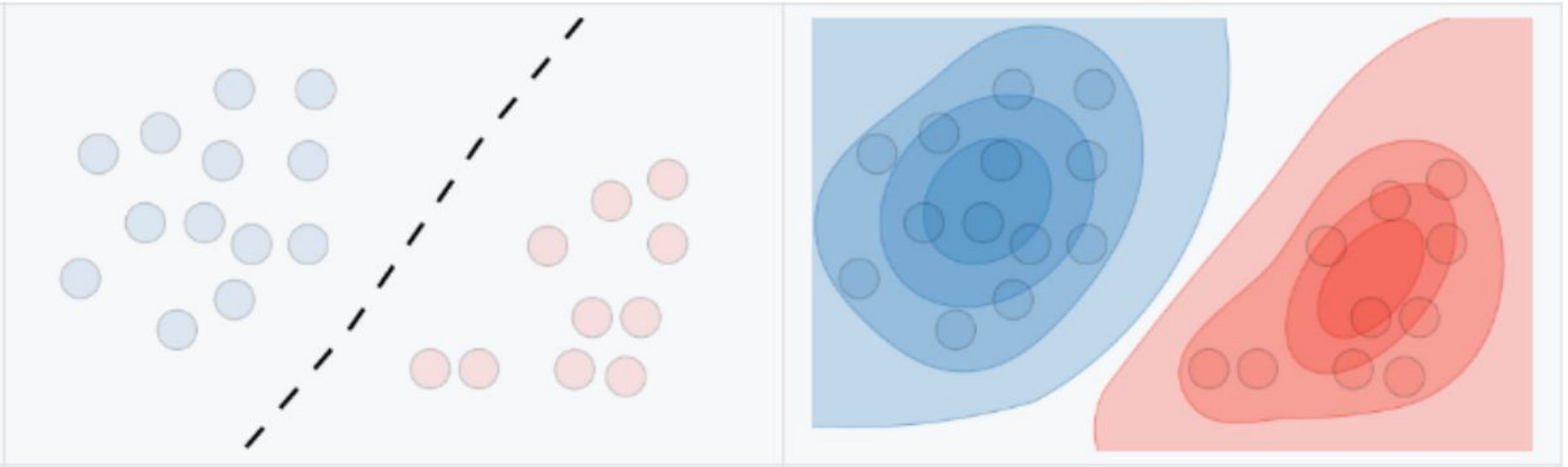
Generative and Discriminative Models

Generative modeling means building a model that can generate new examples that come from the same distribution as the training data.

Discriminative models learn the function mapping inputs and outputs.

Discriminative Models

Generative Models



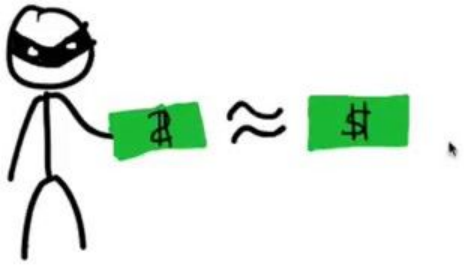
Generative Adversarial Networks

I do not exist!

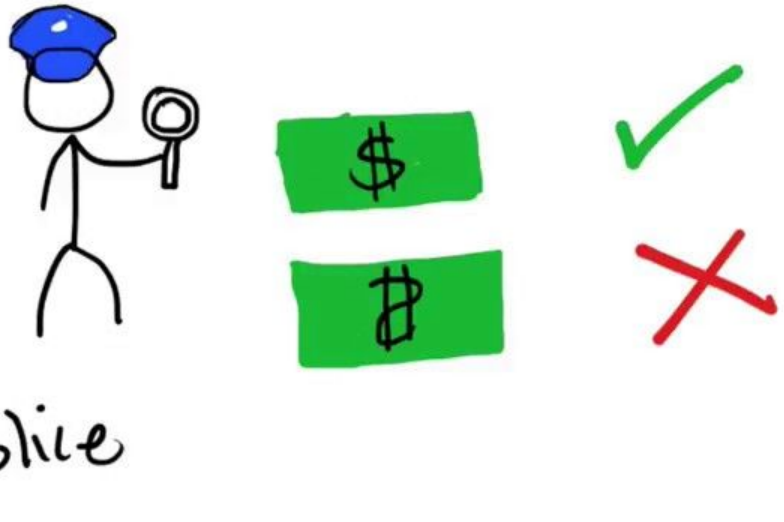
Produced by a GAN (generative adversarial network)
StyleGAN (Dec 2018) - Karras et al. and Nvidia
Original GAN (2014) - Goodfellow et al.
Don't panic. Learn about how it works.

https://thispersondoesnotexist.com/

Generative Adversarial Networks (GANs)



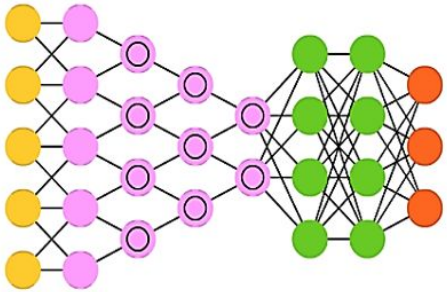
counterfeiters



police

Discriminator

Deep Convolutional Network (DCN)

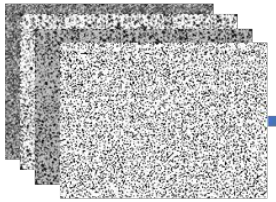


Fake

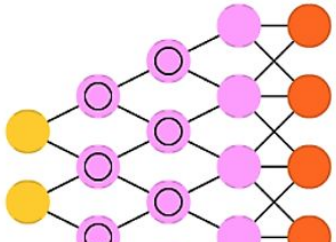
Real

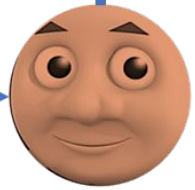
Generator

Random noise

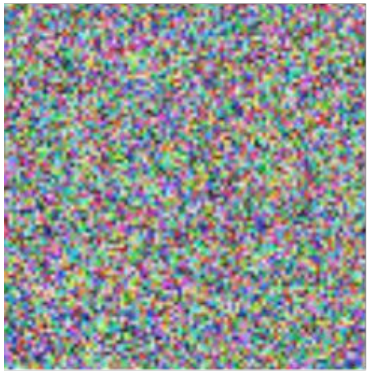


Deconvolutional Network (DN)





Noise ~ N(0,1)

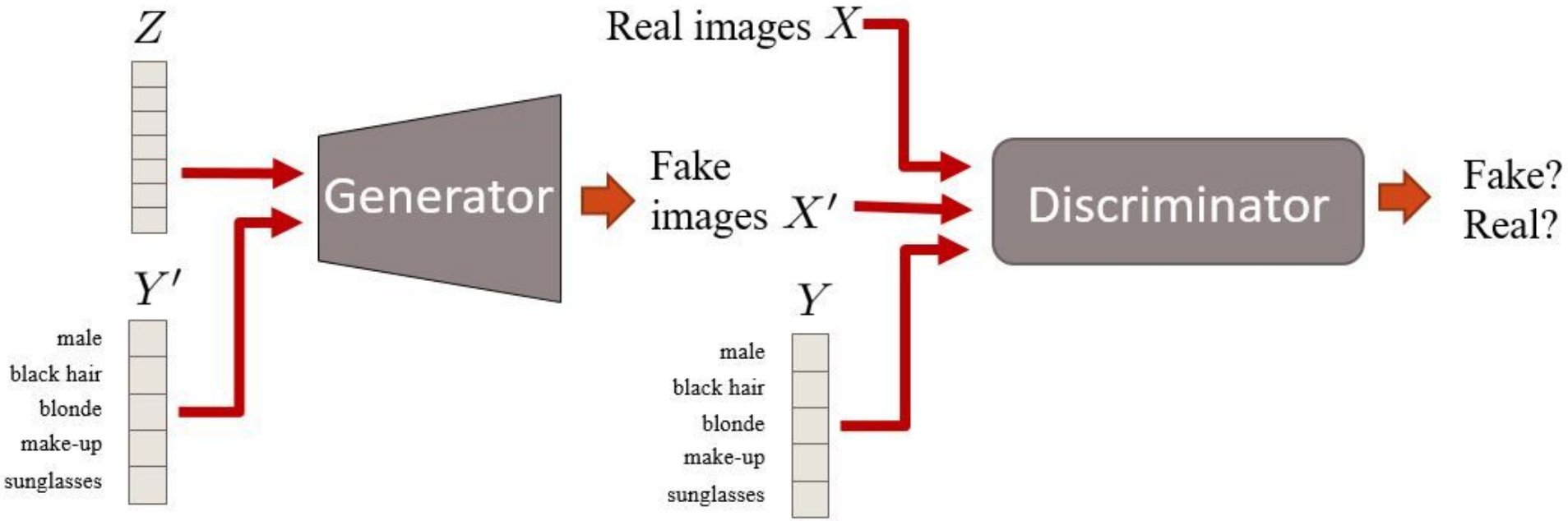


Generative Model

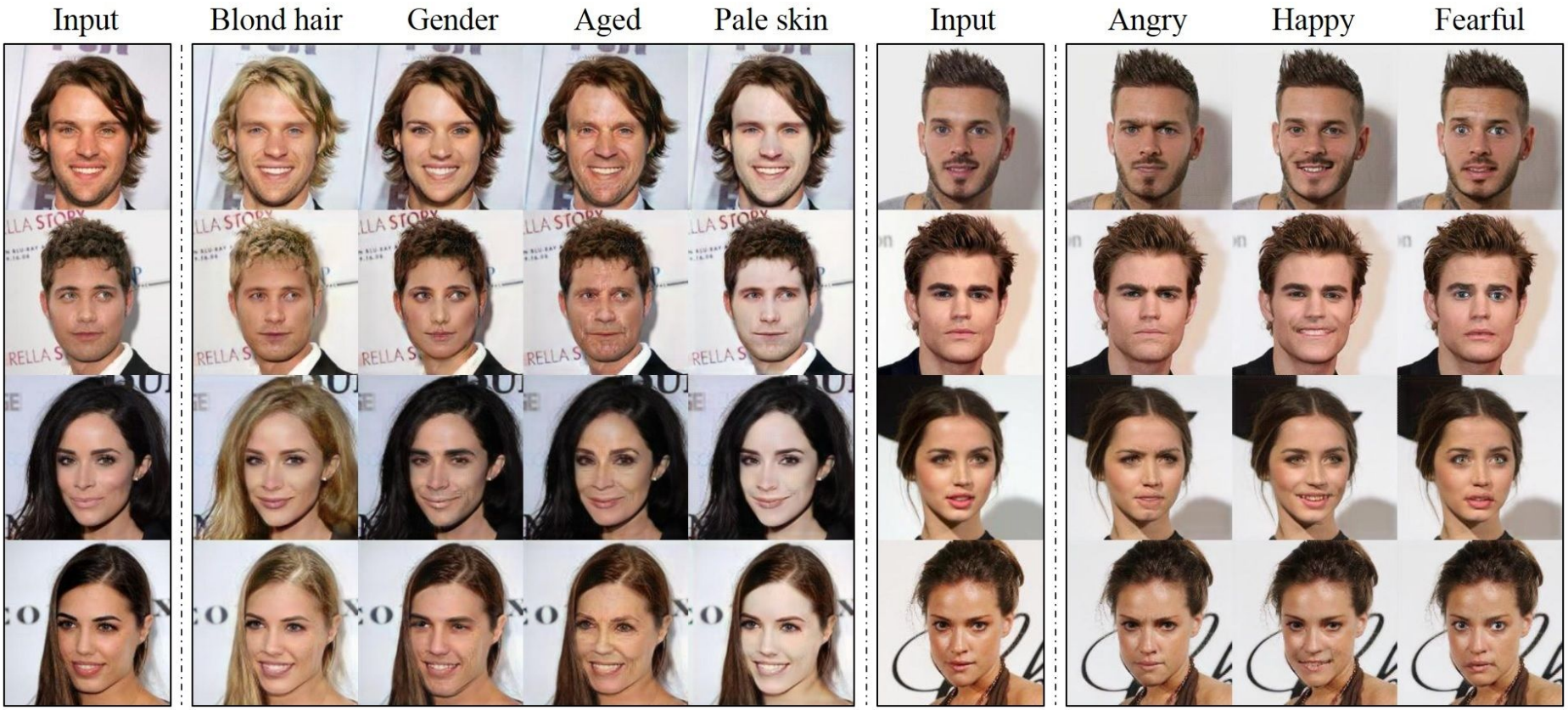
$$\min_{G}\max_{D} V(D,G) = \mathbb{E}_{x \sim p_{data}(x)}\left[logD(x)\right] + \mathbb{E}_{z \sim p_{z}(z)}\left[log(1 - D(G(z)))\right]$$

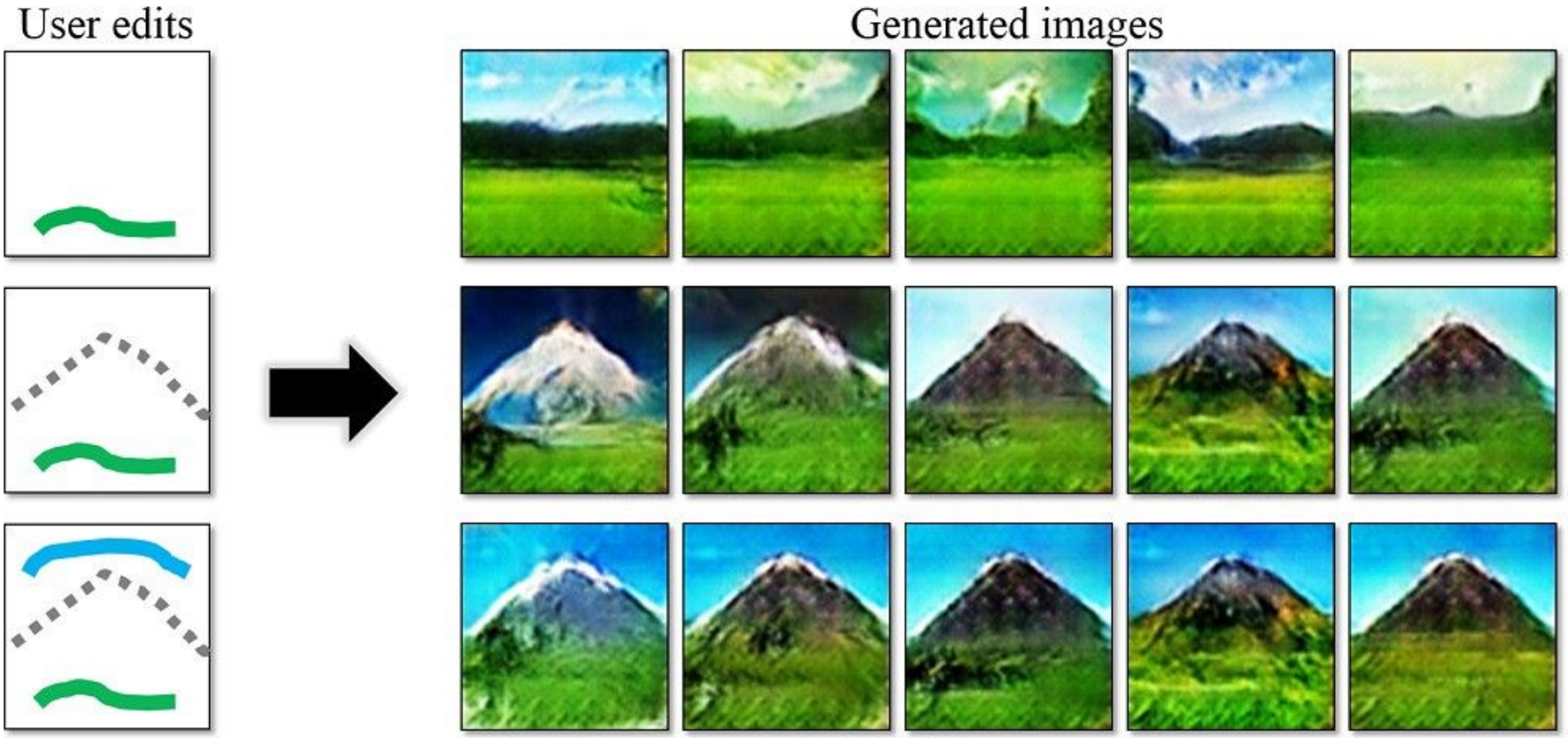
Different Types of GAN

Conditional GAN

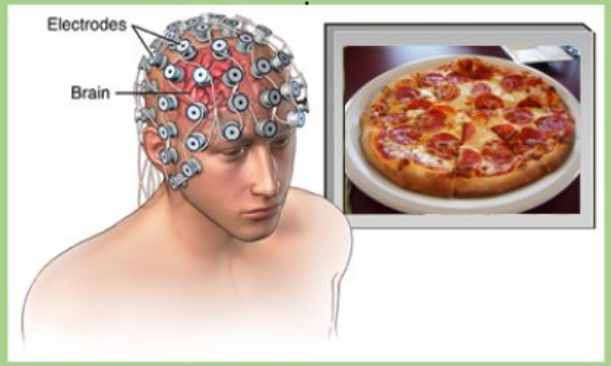


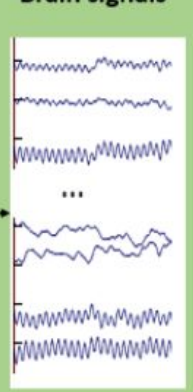
Applications


Input
Blond hair
Gender
Aged
Pale skin
Input
Angry
Happy
Fearful


User edits
Generated images
Color
Sketch

Learning EEG Manifo



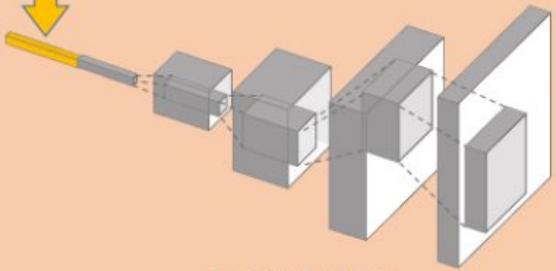


ENCODER

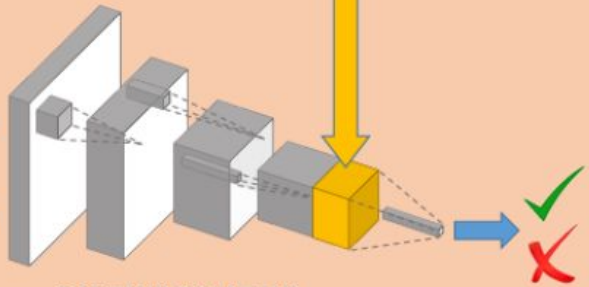
EEG features

Image Generation

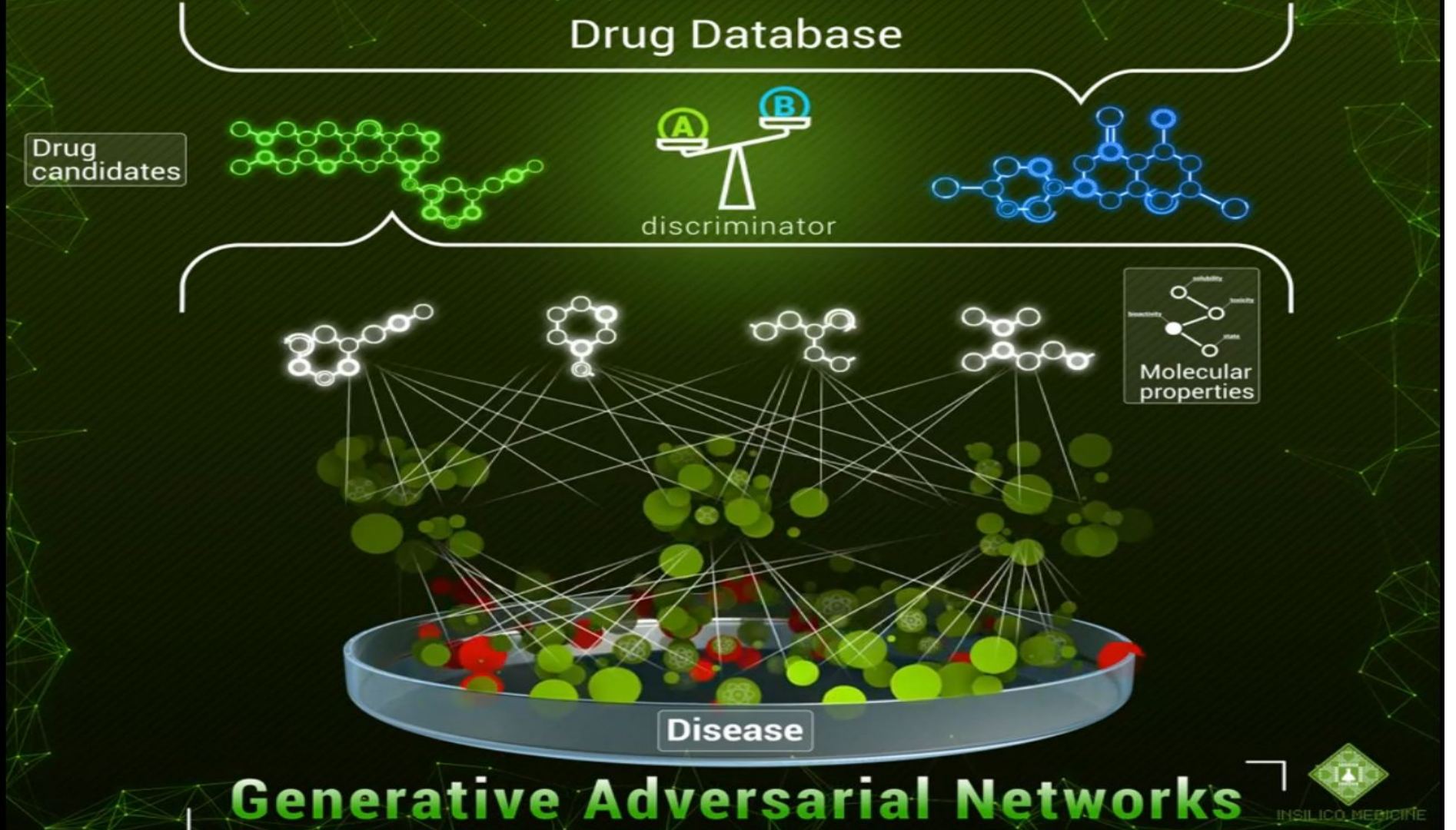
Generated Image

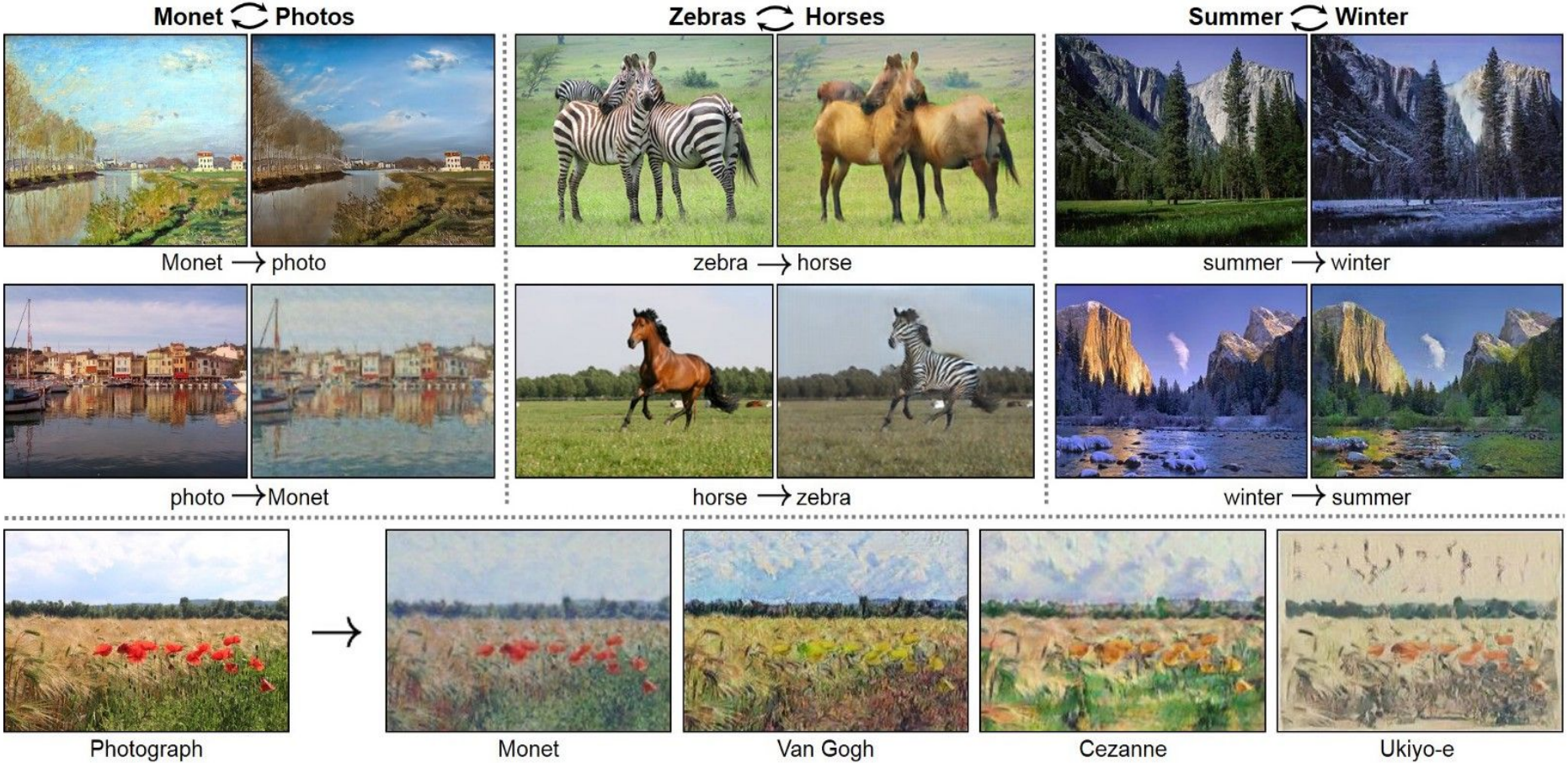


GENERATOR



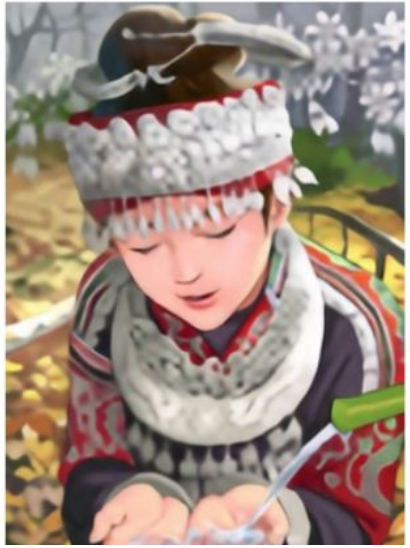
DISCRIMINATOR


Drug Database
Drug candidates
A
B
discriminator
Molecular properties
Disease
Generative Adversarial Networks
INSILICO MEDICINE


Monet ⇄ Photos
Zebras ⇄ Horses
Summer ⇄ Winter
Monet → photo
zebra → horse
summer → winter
photo → Monet
horse → zebra
winter → summer
Photograph
Monet
Van Gogh
Cezanne
Ukiyo-e

bicubic
(21.59dB/0.6423)

SRResNet
(23.53dB/0.7832)



SRGAN
(21.15dB/0.6868)

original