# Generative Models

“What I cannot create, I do not understand.”

- Richard Feynman

# Most Common Example: Generating Images

https://thispersondoesnotexist.com/

# Three popular approaches

- **Generative Adversarial Networks (GANs)**

  *A gamified approach that pits two networks against each other*

- **Variational Autoencoders (VAEs)**

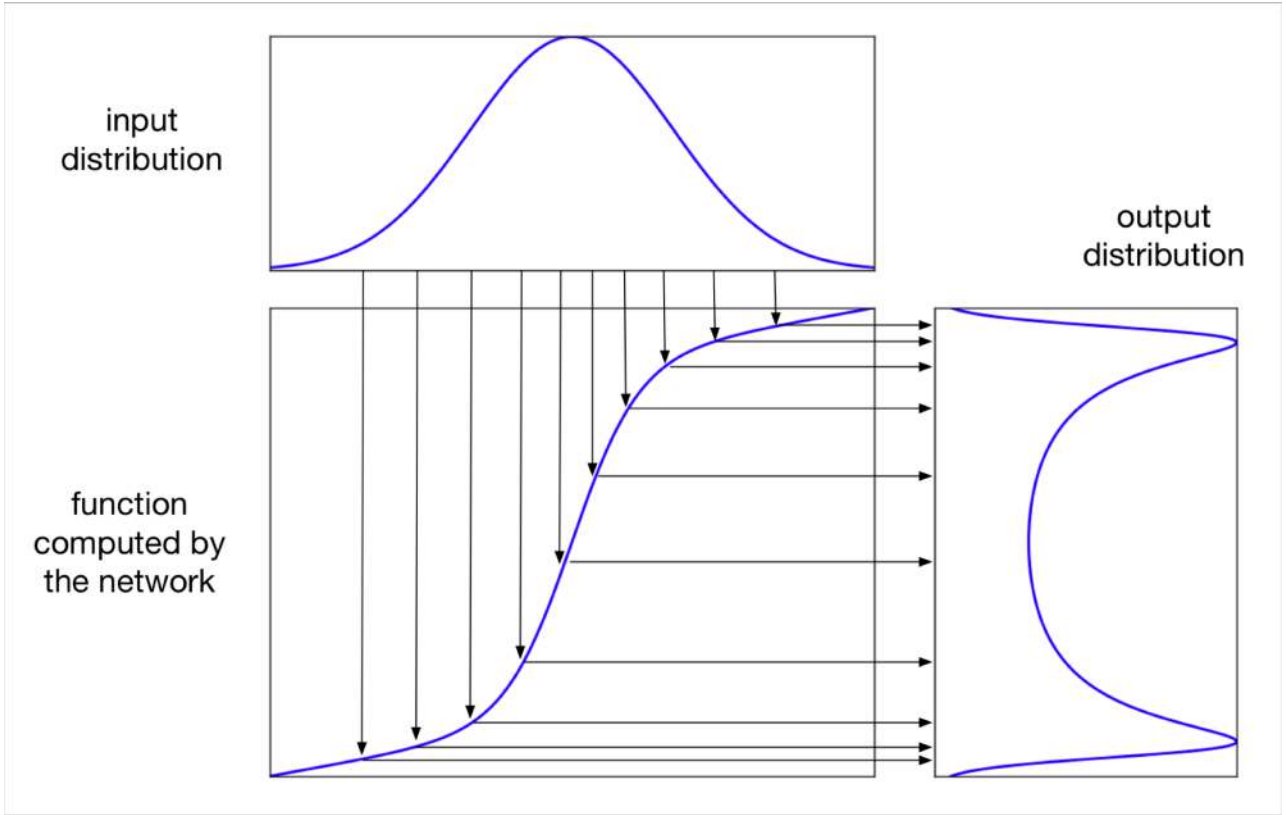
  *Based on probabilistic graphical models*

- **Autoregressive models**

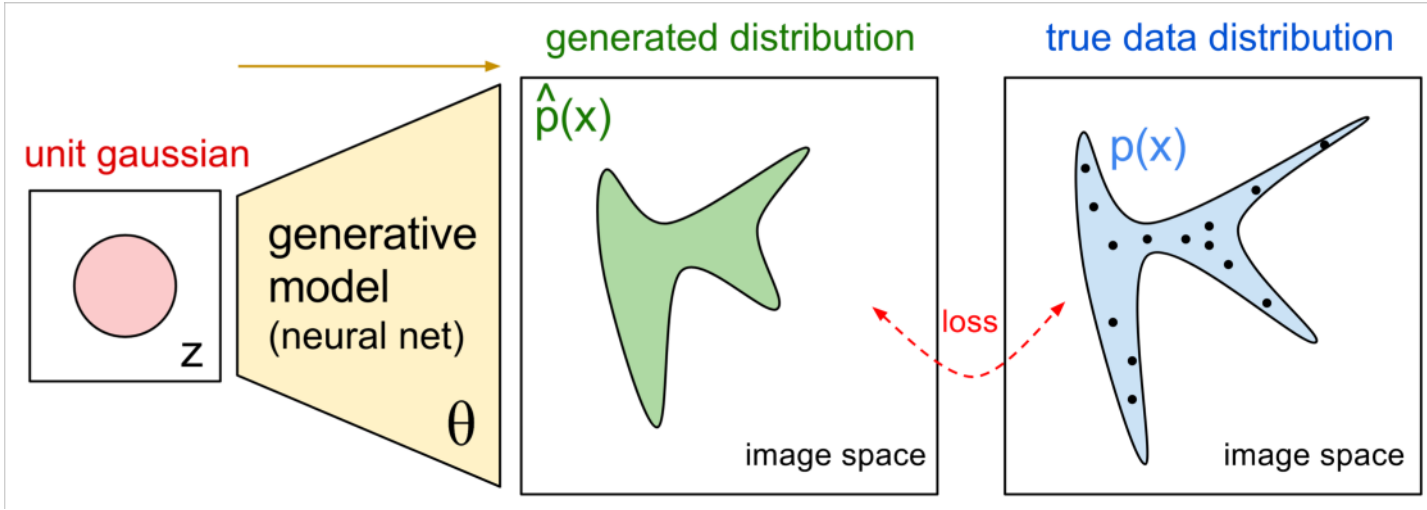
  *Model the conditional distribution of every individual pixel given previous pixels*

# Implicit Generative Models

- These models try to implicitly define a probability distribution.
- One starts by sampling a random code vector from some simple fixed distribution (e.g. a Gaussian); this is often called the latent space.
- Some generator then maps this input vector into a vector that is part of the desired target distribution.

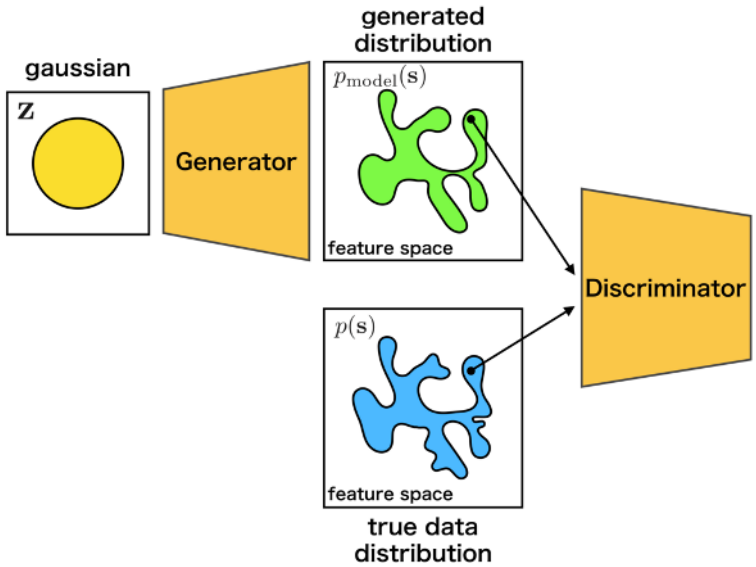



*https://www.cs.toronto.edu/~rgrosse/courses/csc321_2018/slides/lec19.pdf*



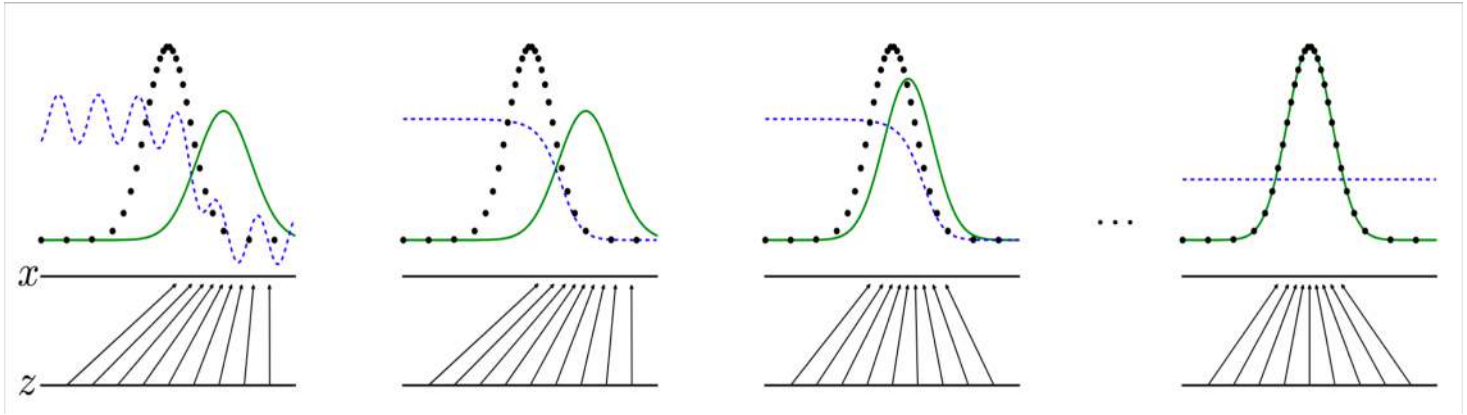

*https://blog.openai.com/generative-models/*

# Generative Adversarial Networks (GAN)




*https://medium.com/@keisukeumezawa/dcgan-generate-the-images-with-deep-convolutinal-gan-55edf947c34b*

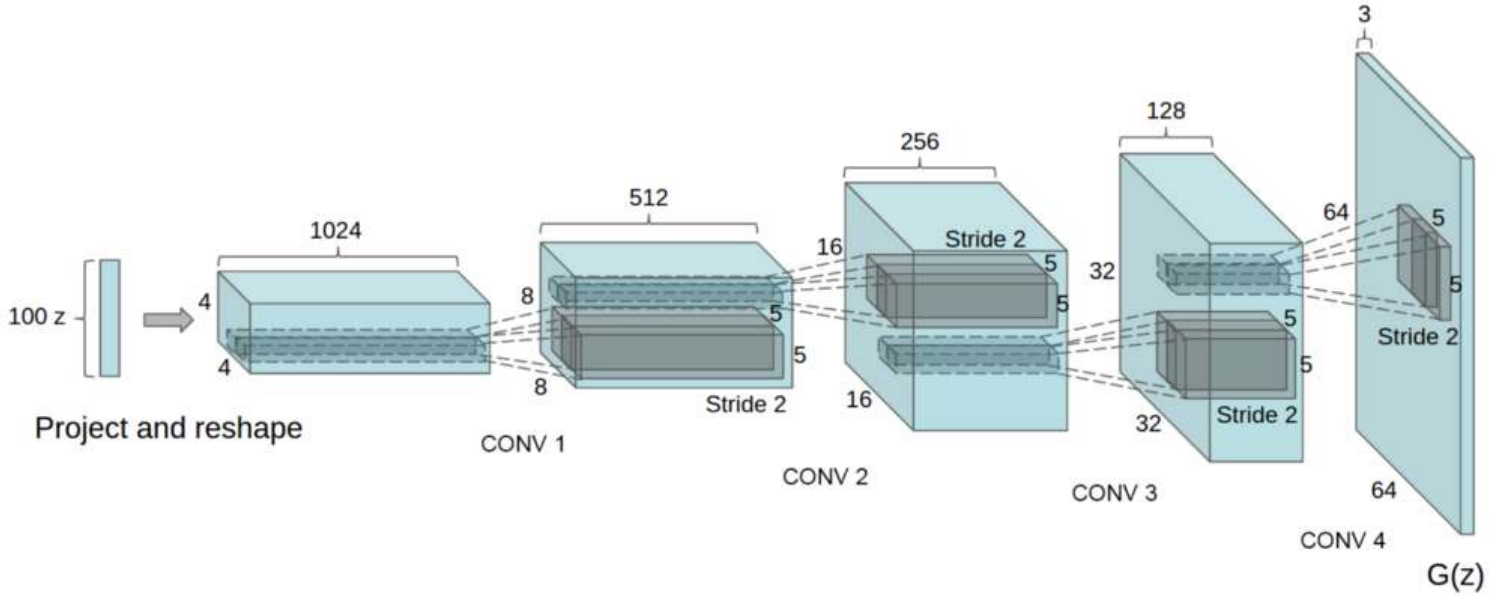
# Loss Function



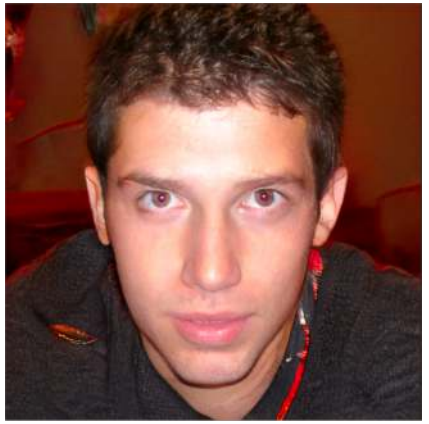

That particular network architectures results in the KL-divergence as the loss function.
This is a measure of how well one probability distribution is different from a second one.

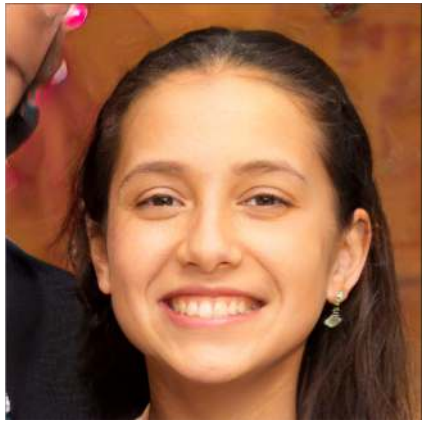
*Goodfellow et al., 2014, Generative Adverserial Networks*

# Generative Adversarial Networks (GAN)




*Radford et al, 2016, Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks*





https://thispersondoesnotexist.com/

# StyleGAN

*https://github.com/NVlabs/stylegan*

# True Images

*Find in latent space*

# True Images

*Less smile* *More smile*

# GAN Zoo

- 3D-ED-GAN - Shape Inpainting using 3D Generative Adversarial Network and Recurrent Convolutional Networks
- 3D-GAN - Learning a Probabilistic Latent Space of Object Shapes via 3D Generative-Adversarial Modeling (github)
- 3D-IWGAN - Improved Adversarial Systems for 3D Object Generation and Reconstruction (github)
- 3D-PhysNet - 3D-PhysNet: Learning the Intuitive Physics of Non-Rigid Object Deformations
- 3D-RecGAN - 3D Object Reconstruction from a Single Depth View with Adversarial Learning (github)
- ABC-GAN - ABC-GAN: Adaptive Blur and Control for improved training stability of Generative Adversarial Networks (github)
- ABC-GAN - GANs for LIFE: Generative Adversarial Networks for Likelihood Free Inference
- AC-GAN - Conditional Image Synthesis With Auxiliary Classifier GANs

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