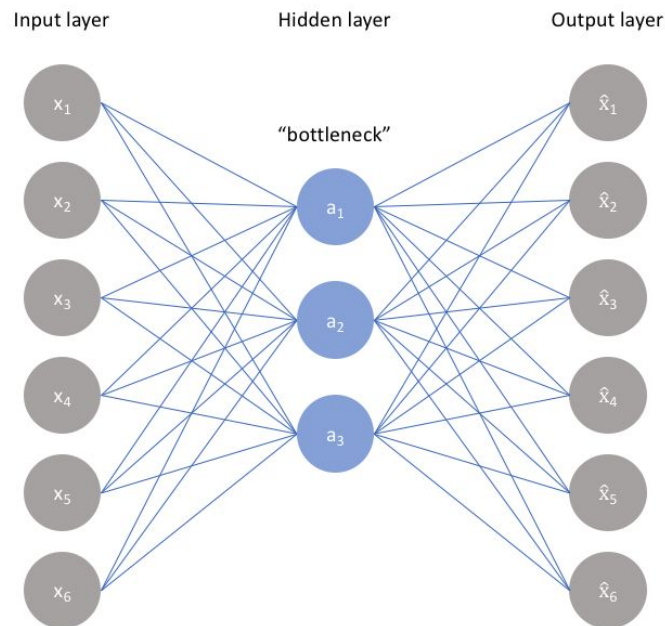# GANs

AutoEncoders

- Compression, noise removal
- Z space, Latent Space, Bottleneck

- data need not be labeled
- still used internally in complex GANS
- … and other neural networds

Input layer   Hidden layer   Output layer

"bottleneck"

x_1 x_2 x_3 x_4 x_5 x_6 a_1 a_2 a_3 $\hat{x}_1$ $\hat{x}_2$ $\hat{x}_3$ $\hat{x}_4$ $\hat{x}_5$ $\hat{x}_6$

Latent Space, Z space

Not continuous

Can be mapped onto data but

poorly grouped, can't create similar
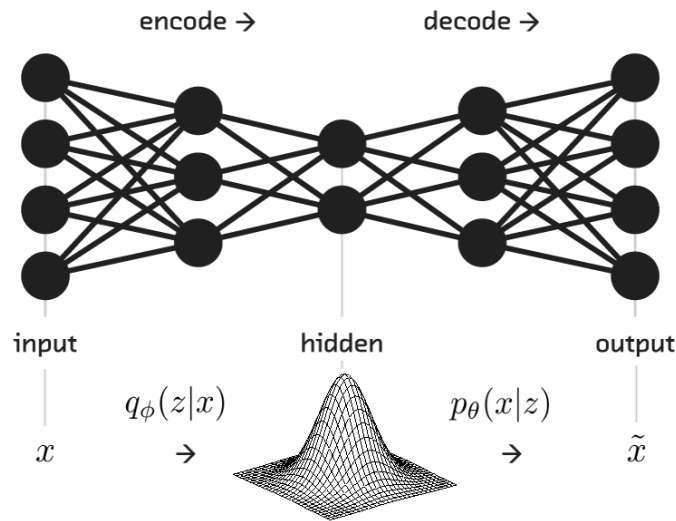
data

latent space representation
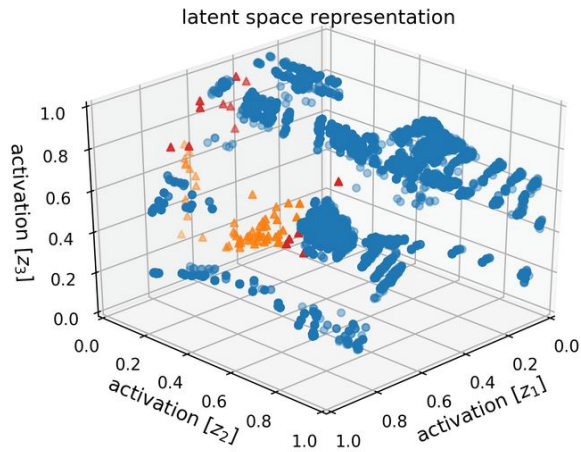
Variational Auto Encoders

- Continuous Z Space, learns distribution
- Binary Cross Entropy + KL Divergence
- Similar data grouped together
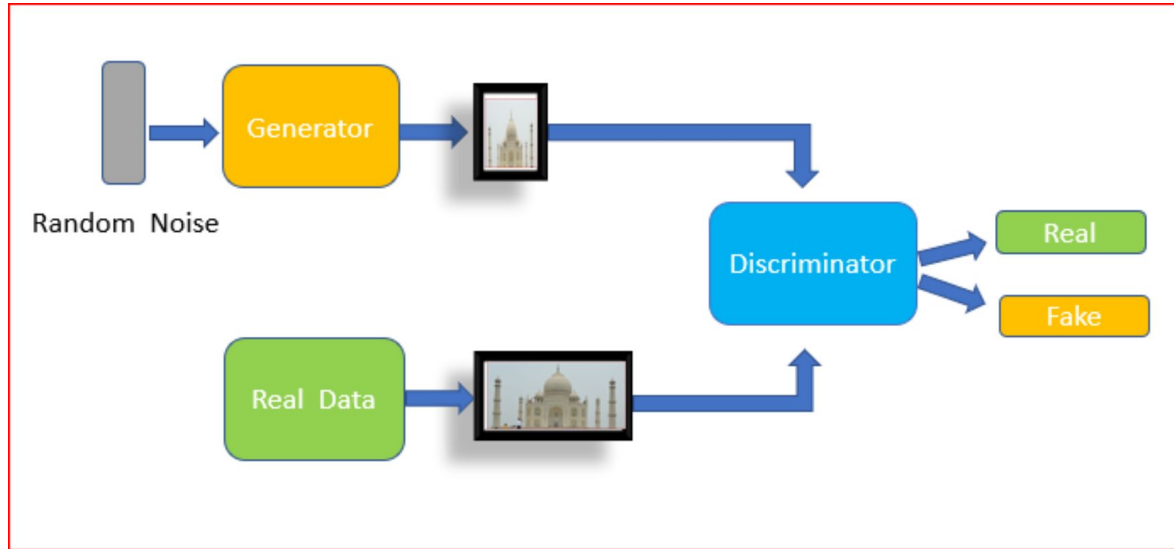- Can create similar data

How VanGogh is it?

How is this measured?

$$D(p||q) = \sum_{x \in X} p(x) \log \frac{p(x)}{q(x)}.$$

encode →   decode →

input   hidden   output

x $q_\phi(z|x)$ → $p_\theta(x|z)$ → $\tilde{x}$

GANs

- Discriminator (Critic) determines error
- Generator can be used to create new data (medical imaging)

Training GANs

for each batch:

    take a random real example, and generated fake and classify them
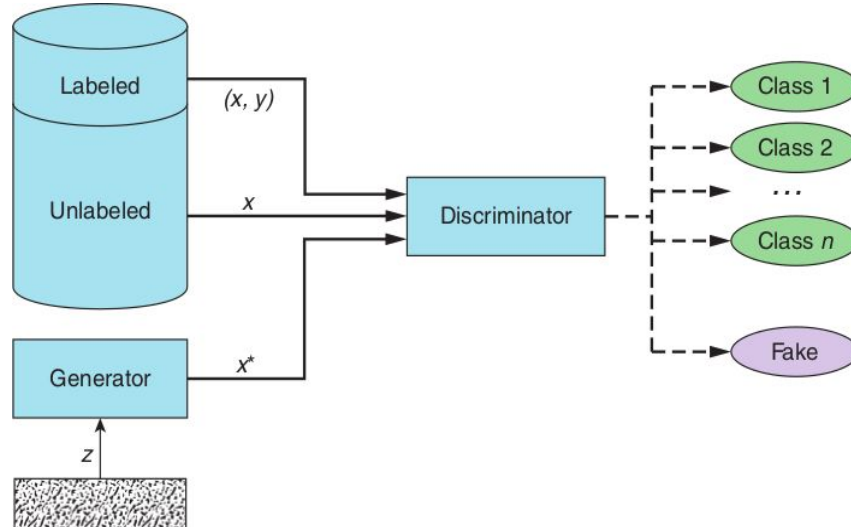
    compute error and update Discriminator

    take random noise and create fake example for Discriminator to classify

    compute error and update Generator

Semi Supervised GAN

Can be used with partially labeled data (Kannada/MNIST)

(different distribution btwn train/test/val data, used only 4k labeled images of 40k, 81% accuracy)

Code

Semi Supervised GAN Kannada code
https://github.com/timestocome/DeepLearning-Talks/tree/master/GAN%20Talk

- RL GANs   —- World Models https://worldmodels.github.io/
- Really Awesome GAN resources
  https://github.com/nightrome/really-awesome-gan
- Keras GANs https://github.com/eriklindernoren/Keras-GAN
- Numpy GAN https://github.com/shinseung428/gan_numpy

Resources

Paper

- Generative Adversarial Nets

  https://papers.nips.cc/paper/5423-generative-adversarial-nets.pdf

Books

- Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play (O'Reilly)
- GANs in Action (Manning)

Misc

Papers with Code: https://paperswithcode.com