

# GENERATIVE ADVERSARIAL NETWORKS

11785- Introduction to Deep Learning

AKSHAT GUPTA

“This (GANs), and the variations that are now being proposed is the most interesting idea in the last 10 years in ML, in my opinion”

–Yann LeCun

Video: <https://www.youtube.com/watch?v=QiiSAvKJIHo>



# WHAT ARE GANS?

Generative Adversarial Networks

# WHAT ARE GANS?

Generative Adversarial Networks

Generative Models

We try to learn the underlying the distribution from which our dataset comes from.

Eg: Variational AutoEncoders (VAE)

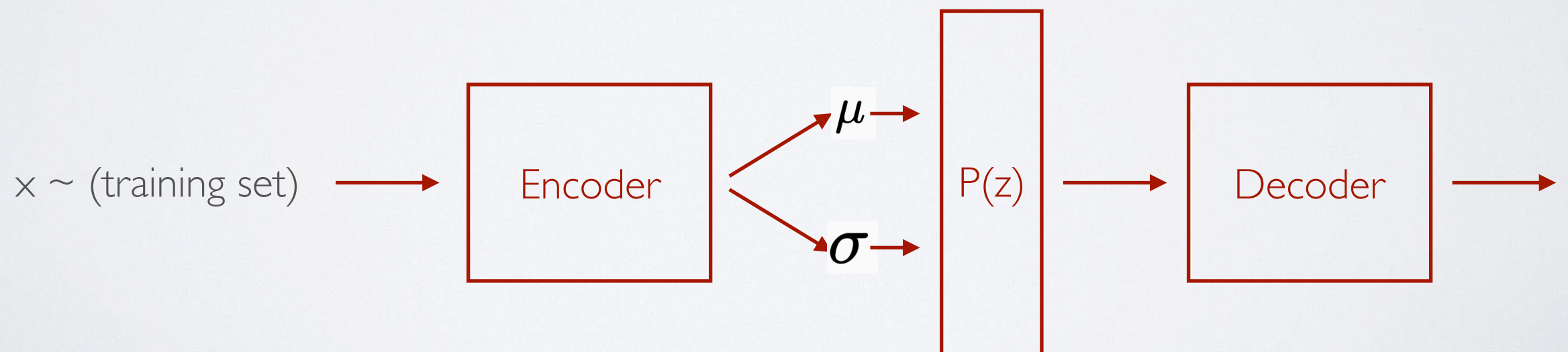
# WHAT ARE GANS?

## Generative Adversarial Networks

### Generative Models

We try to learn the underlying the distribution from which our dataset comes from.

Eg: Variational AutoEncoders (VAE)





# WHAT ARE GANS?

Generative Adversarial Networks



## Generative Models

We try to learn the underlying the distribution from which our dataset comes from.

Eg: Variational AutoEncoders (VAE)

## Adversarial Training

GANS are made up of two competing networks (adversaries) that are trying beat each other.

# WHAT ARE GANS?

Generative Adversarial Networks

## Generative Models

We try to learn the underlying the distribution from which our dataset comes from.  
Eg: Variational AutoEncoders (VAE)

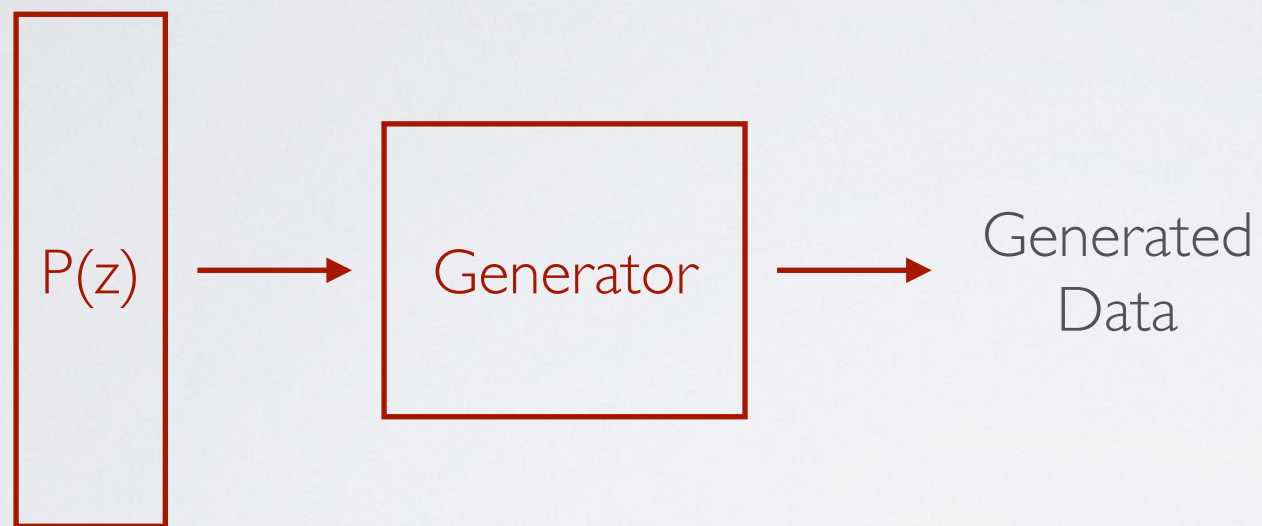
## Adversarial Training

GANs are made up of two competing networks (adversaries) that are trying beat each other.

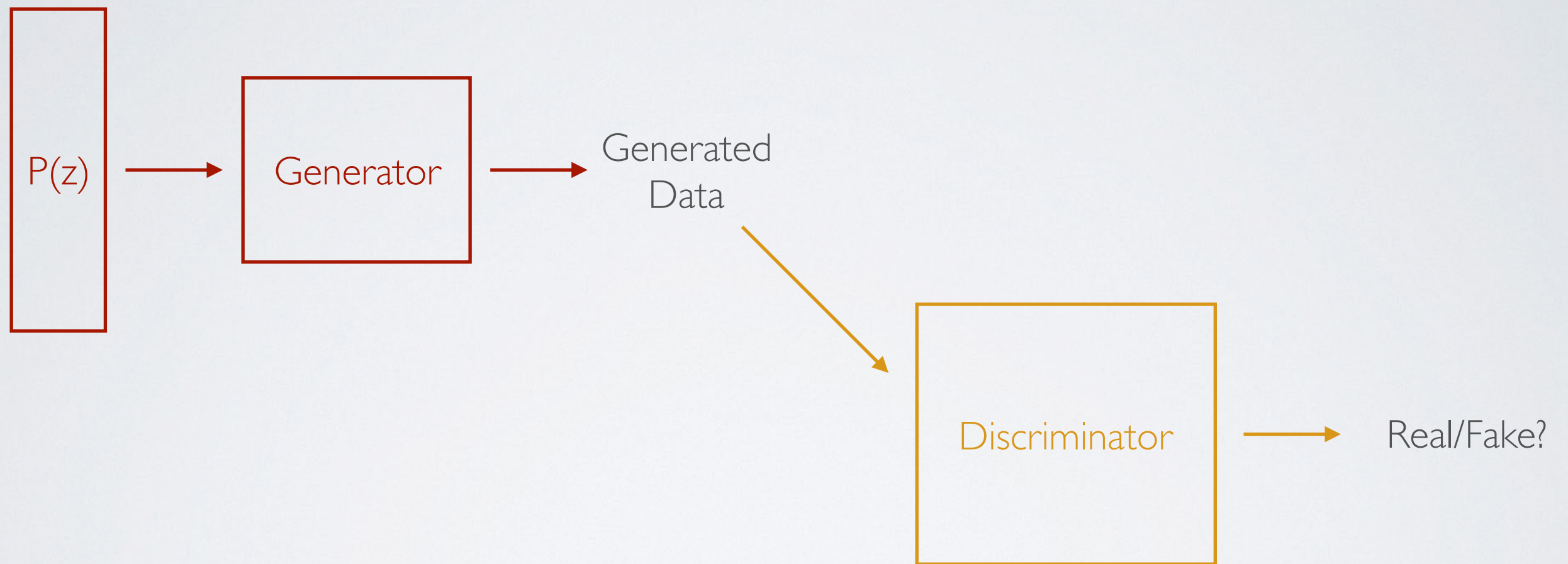
## Neural Networks



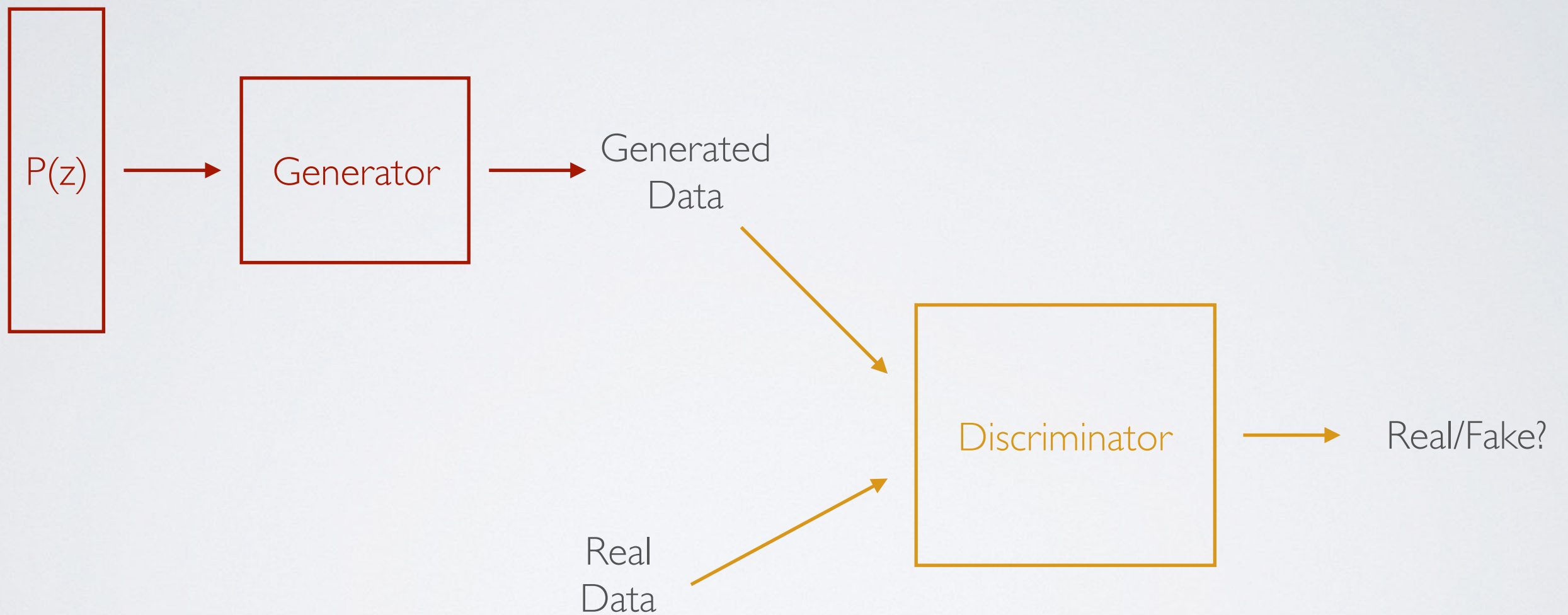
# WHAT ARE GANS?



# WHAT ARE GANS?



# WHAT ARE GANS?

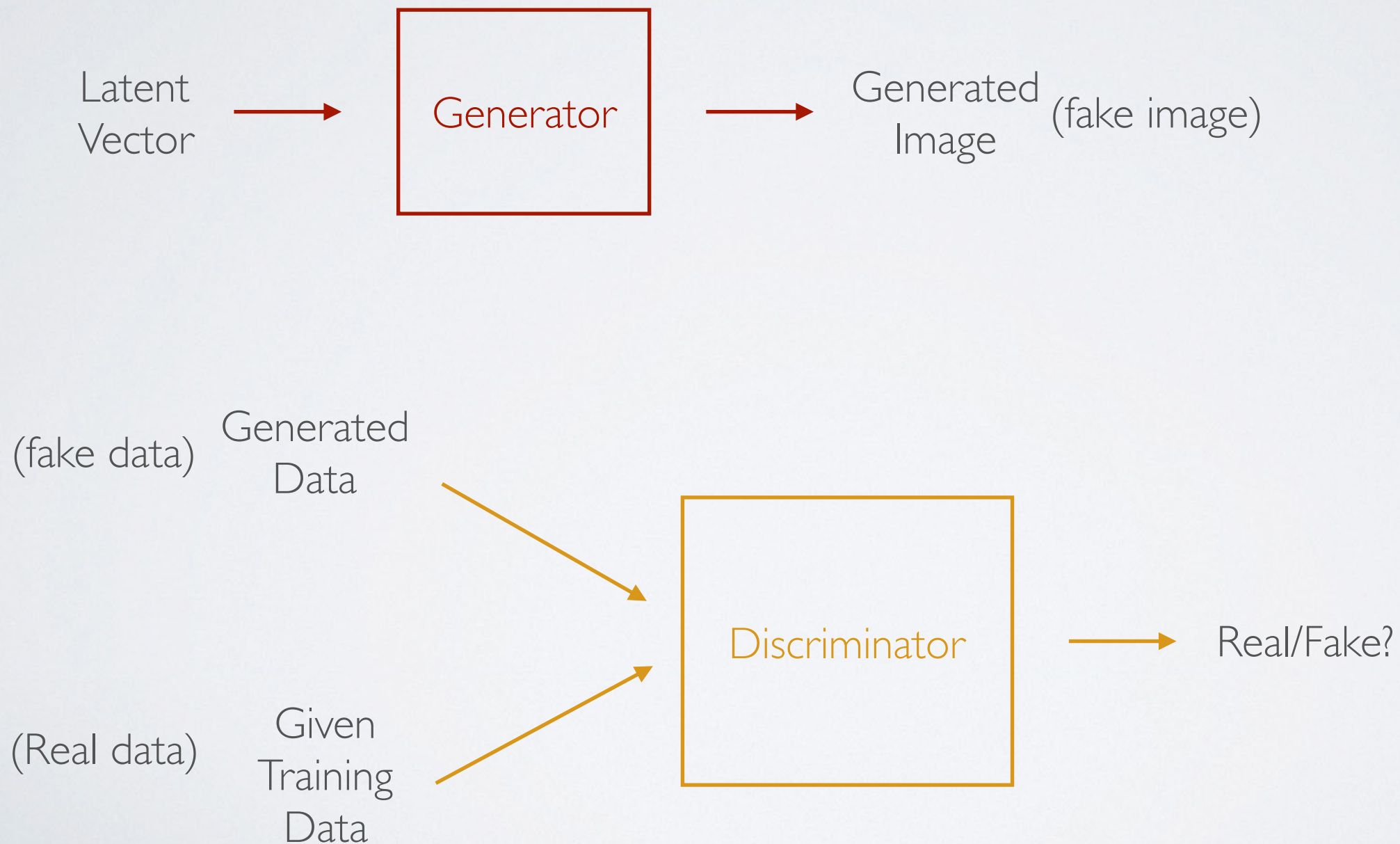




HOW TO TRAIN A GAN?

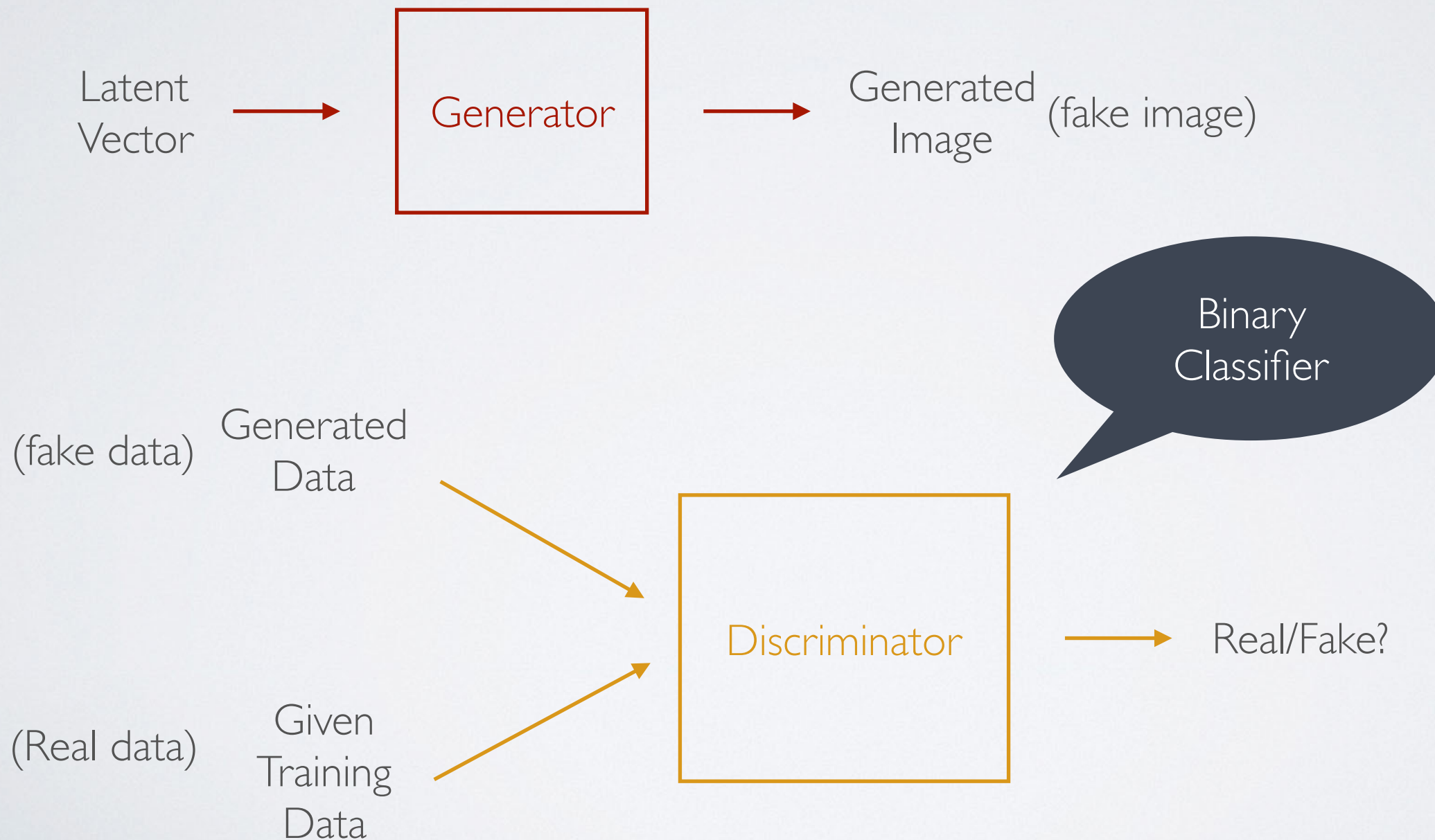
# HOW TO TRAIN A GAN?

At  $t = 0$ ,



# HOW TO TRAIN A GAN?

At  $t = 0$ ,





# HOW TO TRAIN A GAN?

Which network should I train first?

# HOW TO TRAIN A GAN?

Which network should I train first?

Discriminator!

# HOW TO TRAIN A GAN?

Which network should I train first?

Discriminator!

But with what training data?



# HOW TO TRAIN A GAN?

Which network should I train first?

Discriminator!

But with what training data?

The Discriminator is a Binary classifier.

The Discriminator has two class - Real and Fake.

The data for Real class is already given: THE TRAINING DATA

The data for Fake class? -> generate from the Generator

# HOW TO TRAIN A GAN?

What's next? -> Train the Generator

But how? What's our training objective?

# HOW TO TRAIN A GAN?

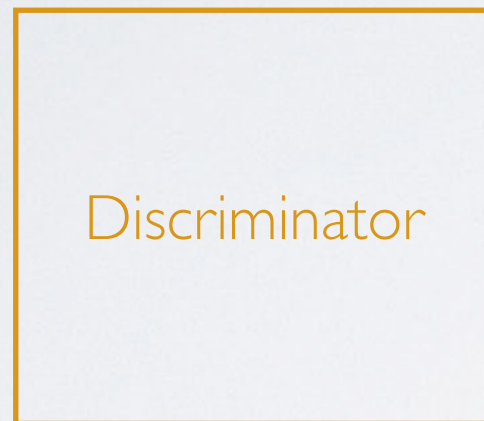
What's next? -> Train the Generator

But how? What's our training objective?

**Generate images from the Generator  
such that they are classified incorrectly by the Discriminator!**

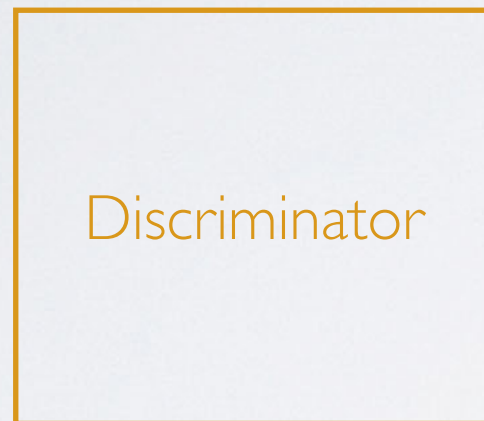


# HOW TO TRAIN A GAN?



Step 1:  
Train the Discriminator  
using the current ability  
of the Generator.

# HOW TO TRAIN A GAN?

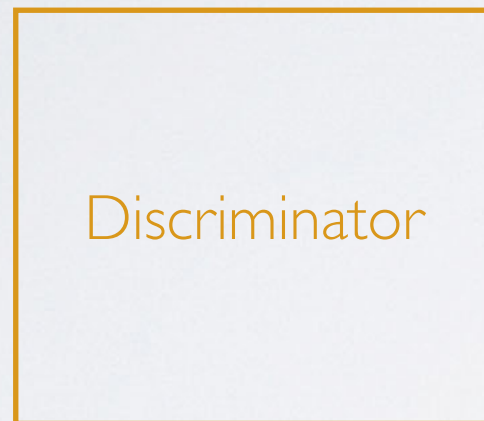


Step 1:  
Train the Discriminator  
*using the current ability*  
of the Generator.



Step 2:  
Train the Generator  
to beat  
the Discriminator.

# HOW TO TRAIN A GAN?



Step 1:  
Train the Discriminator  
*using the current ability*  
of the Generator.

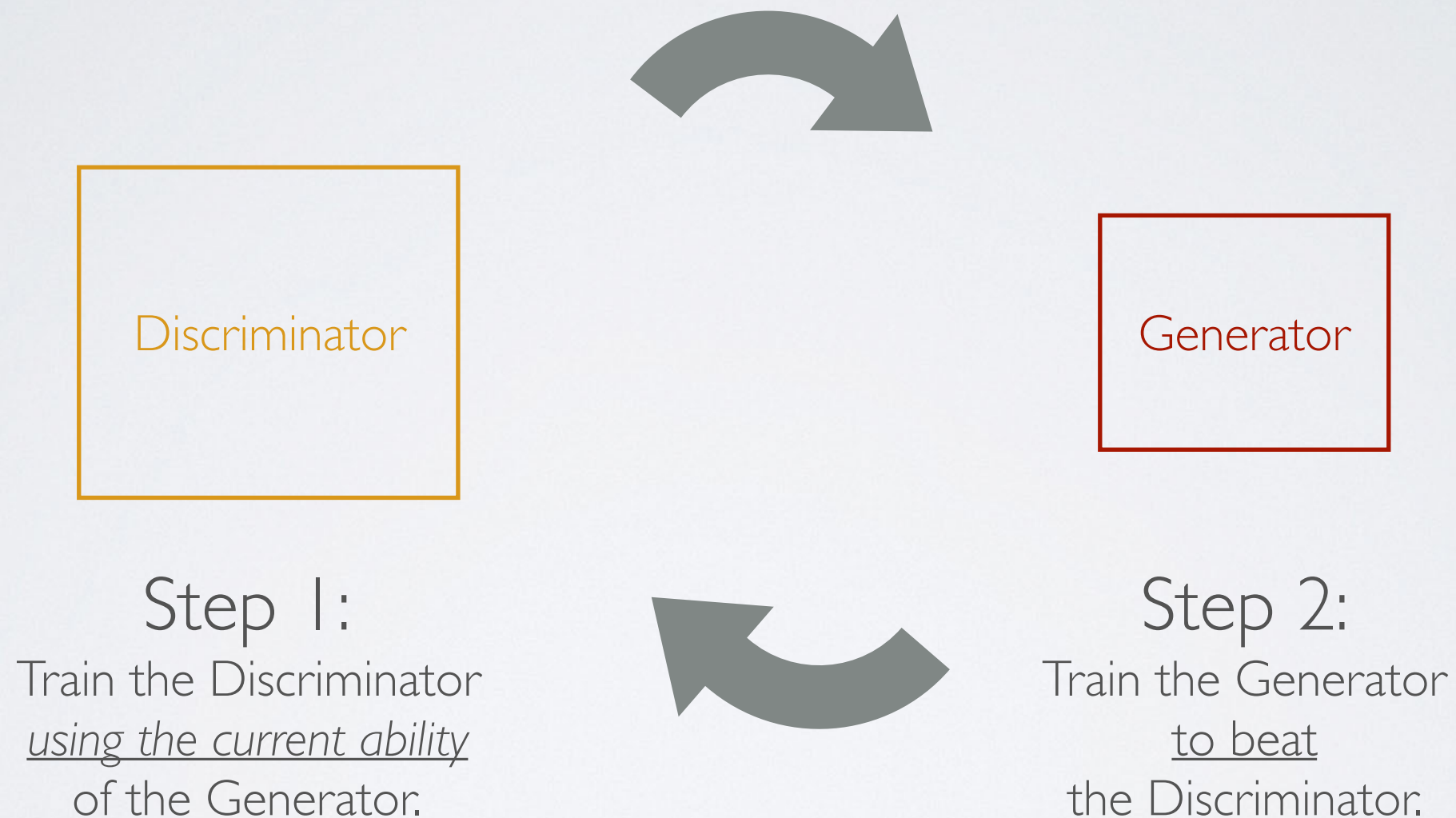


Step 2:  
Train the Generator  
to beat  
the Discriminator.

**Generate images from the Generator  
such that they are classified incorrectly by the Discriminator!**



# HOW TO TRAIN A GAN?



# MNIST AND FASHION-MNIST

