



Fig. 1.1 Generated human faces by GAN

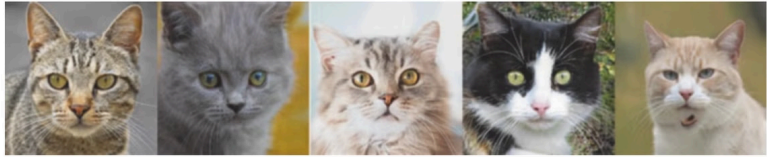


Fig. 1.2 Generated cats by GAN

# Generative Adversarial Networks (GANs)

Generative adversarial networks (GANs) are a type of neural network that can generate new data samples that resemble a given dataset.

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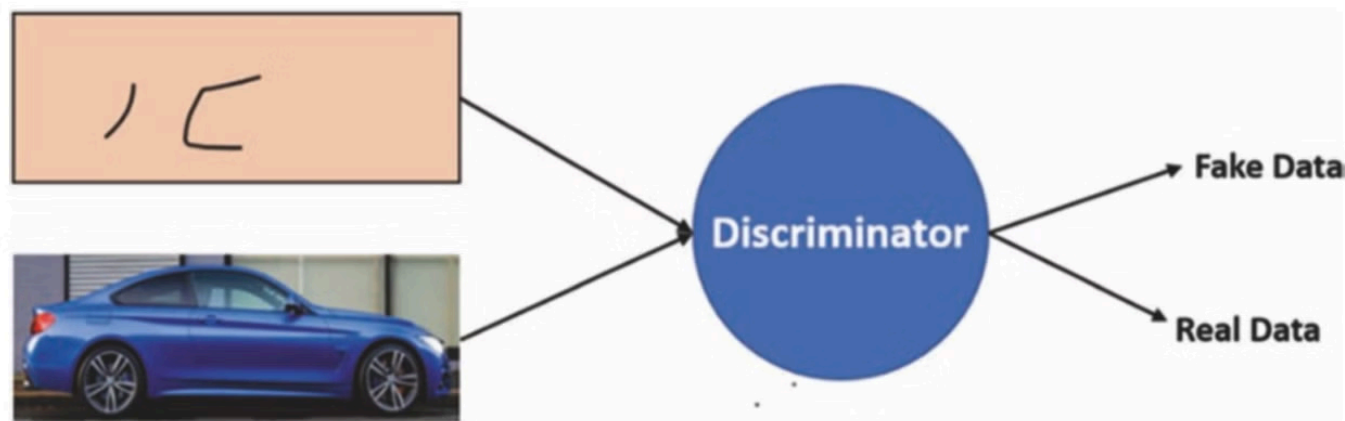
# Generative vs. Discriminative Models

## Generative Models

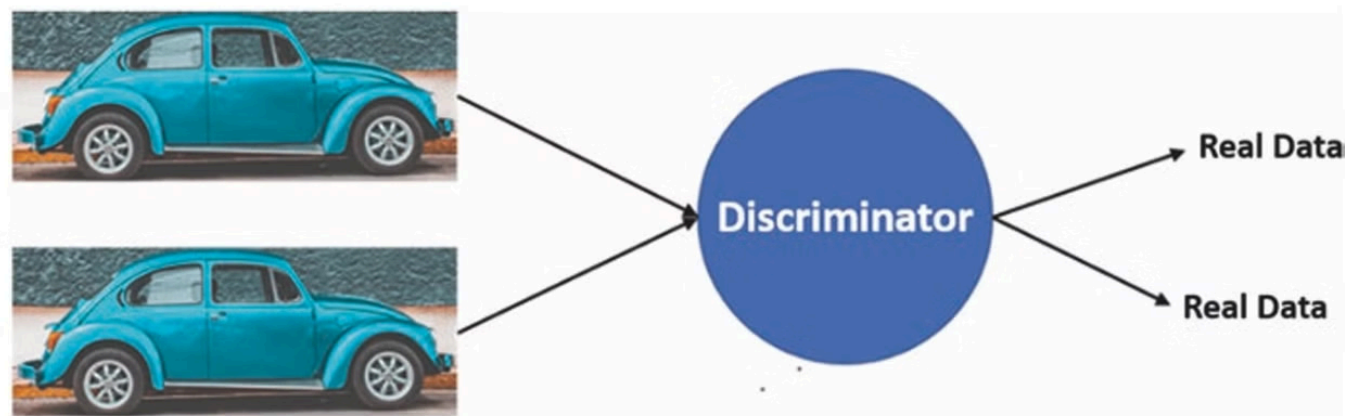
Generative models can generate new data. They learn the patterns in the input data to generate new data.

## Discriminative Models

Discriminative models are used for classification. They do not consider how the data was generated.

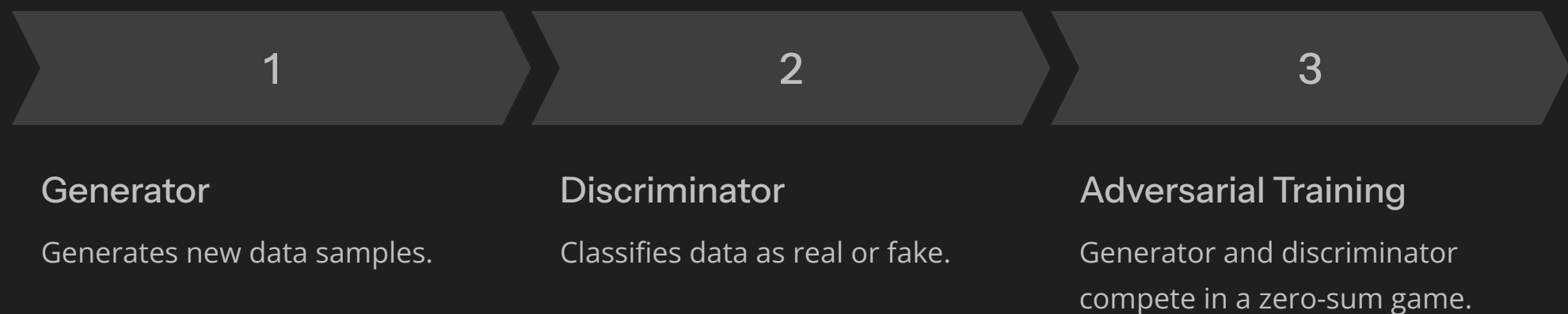


**Fig. 1.6** The beginning of the training process

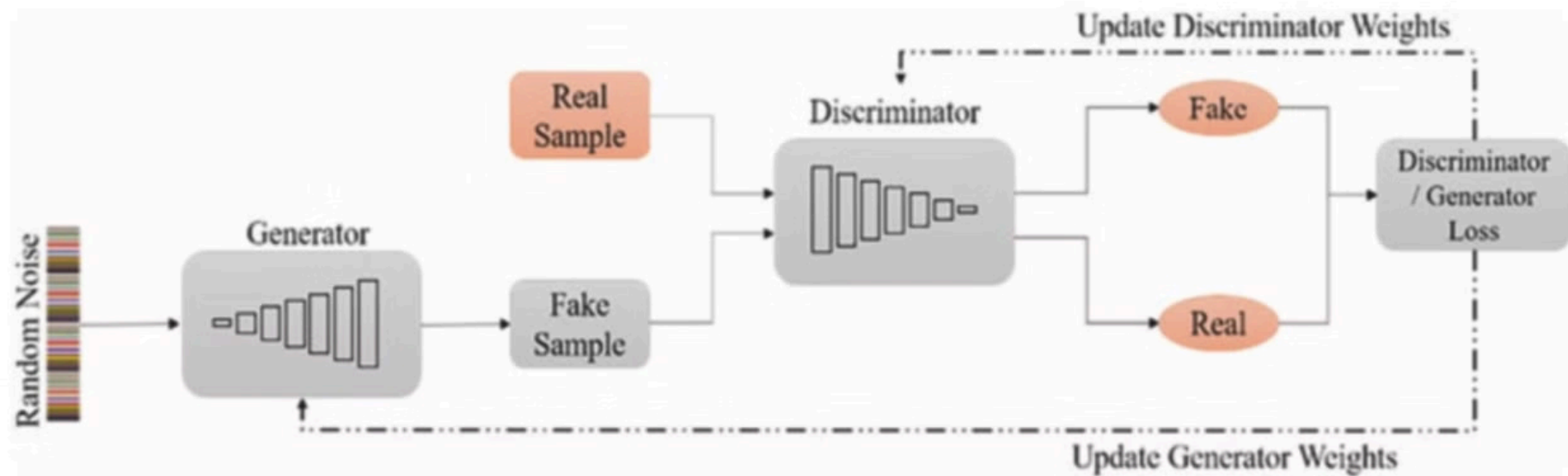
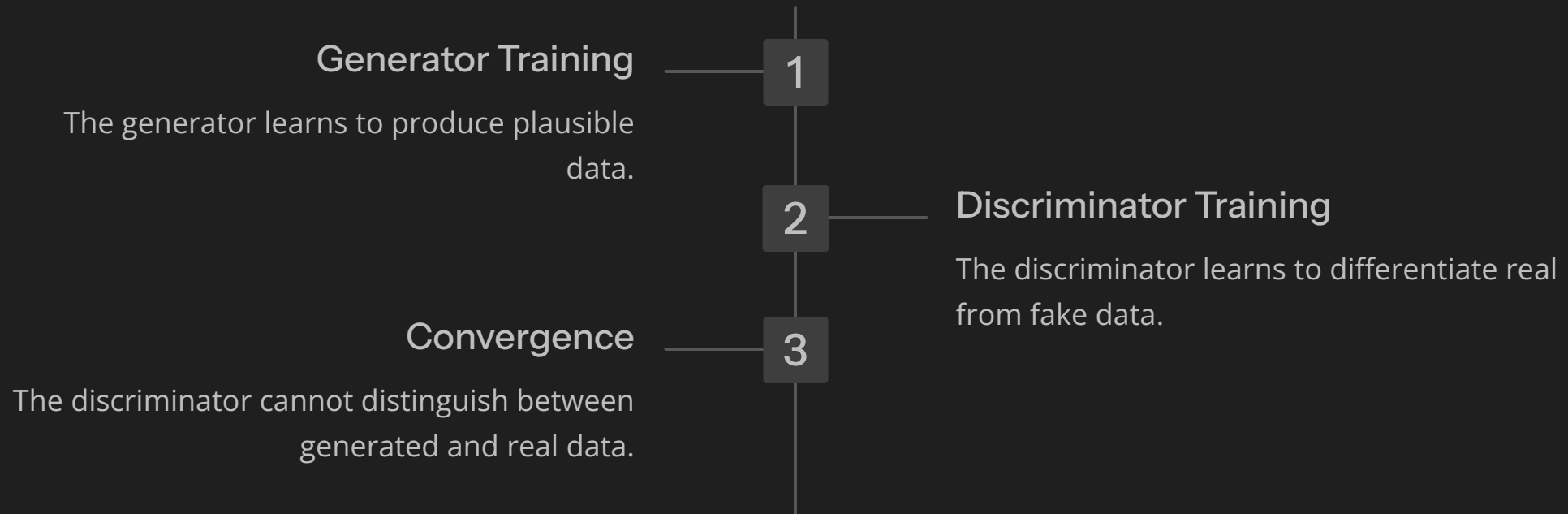


**Fig. 1.8** Advanced generator training stage

# GAN Architecture



# GAN Training



**Fig. 1.11** GAN training

# GAN Loss Functions

1

## Generator Loss

Measures the quality of generated data.

Minimize.

2

## Discriminator Loss

Measures the model's ability to discriminate between real and fake data.

Maximize.

3

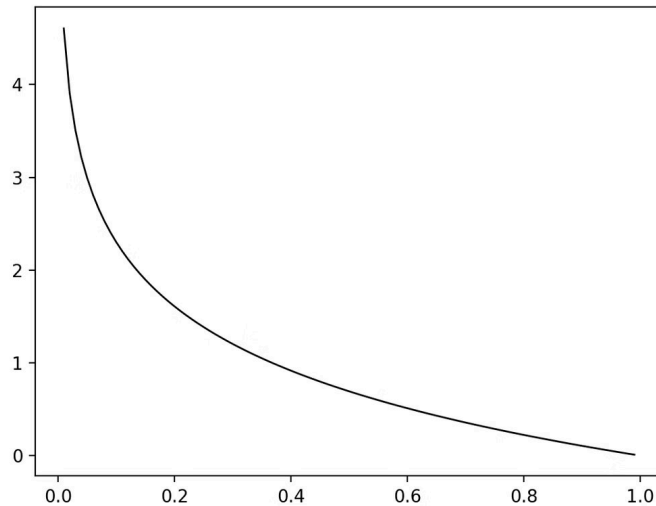
## Binary Cross-Entropy Loss

Measures the difference between the discriminator output and the actual label.

4

## Mean Squared Error

Measures the difference between generated and real data samples.





# GAN Weaknesses

## Stability

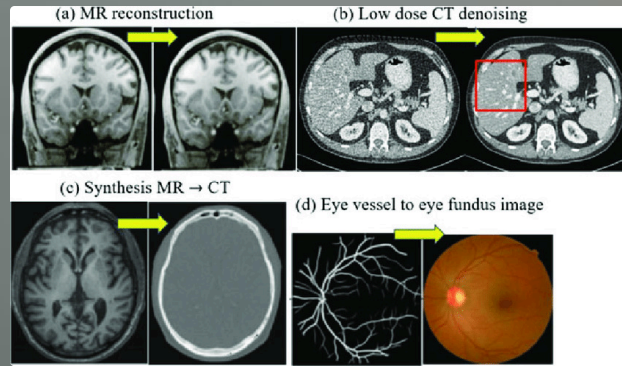
GANs can be difficult to train.

## Diversity

GANs can produce only a limited set of outputs.

## Interpretability

It is difficult to understand how GANs work.



# GAN Applications



Human Faces  
Generation



Deep Fake



Image-to-Image  
Translation



Enhancing Image  
Resolution



# Summary

What you have accomplished?

- GANs
- MRI