1. **Roles of Generator and Discriminator in a GAN**

A **Generative Adversarial Network (GAN)** consists of two competing neural networks:

Generator

* Purpose: **Create synthetic (fake) data** that mimics the real data distribution.
* Input: **Random noise** (latent vector).
* Goal: **Fool the discriminator** into thinking generated images are real.

Discriminator

* Purpose: **Classify inputs** as **real** (from dataset) or **fake** (from generator).
* Input: **Image (either real or generated)**.
* Goal: **Correctly distinguish real vs. fake images**.

Adversarial Training

* The **generator** improves by producing more realistic data.
* The **discriminator** improves by becoming better at spotting fakes.
* Over time, **both models improve together** in a balanced "zero-sum game".

When trained successfully, the generator can create **extremely realistic** images that are **indistinguishable from real ones**.