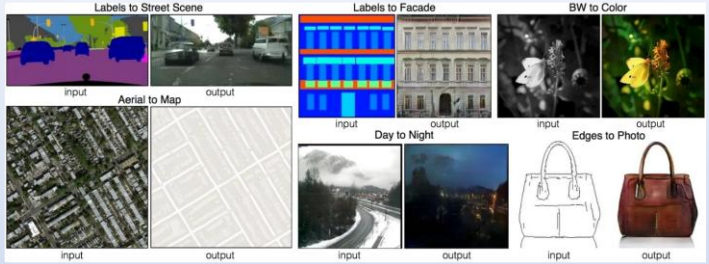
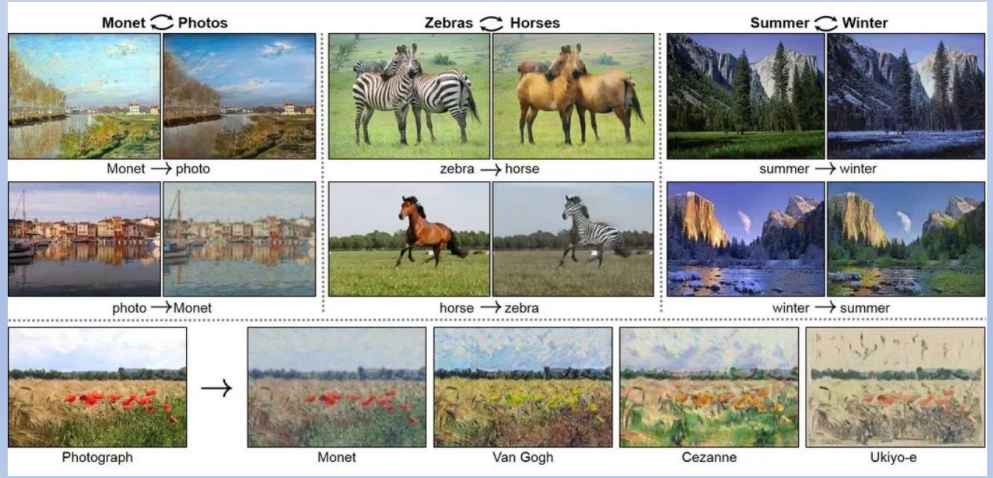
A03 Neural Network Zoo

Creating paired data for training other AI systems



Pix2Pix transforms sketches to photos, maps to satellite images, etc.

Transforming images from one style to another



CycleGAN transforms photos into Monet, Van Gogh, and other styles

Creating photorealistic faces of people who don't exist

Generated by StyleGAN

ThisPersonDoesNotExist.com

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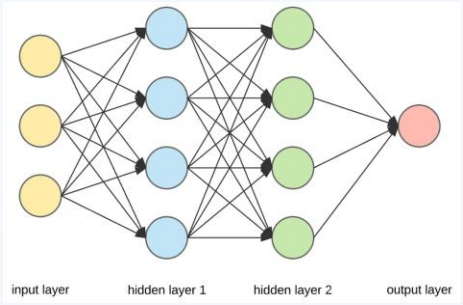
Class: ITAI 2376

Instructor: Sitaram Ayyagari

Introduction to Neural Networks



Input

Hidden

Output

Inspired by the brain 🧠

Mimics how our brains learn!

Input → Hidden → Output

Information flows through layers

Learns from examples

Recognizes patterns in data

Deep learning

Many layers for complex tasks

Neural networks power many applications: images, text, audio, and more!

Welcome to the Neural Network Zoo

Meet the GAN Butterfly

A special creature in our Neural Network Zoo that creates images that look real, even though they're fake!

Master of Disguise

The GAN Butterfly's superpower is creating **realistic** **fake images** that can fool even humans!

Mimics patterns in nature

Just like real butterflies mimic patterns for protection, the GAN Butterfly mimics visual patterns to create convincing images.

*GAN = **G** enerative **A** dversarial **N** etwork*

Anatomy (Structure)

Two wings:

Generator (Artist)

Creates images from random noise

Gets better by learning from feedback

Discriminator (Critic)

Judges whether images are real or fake

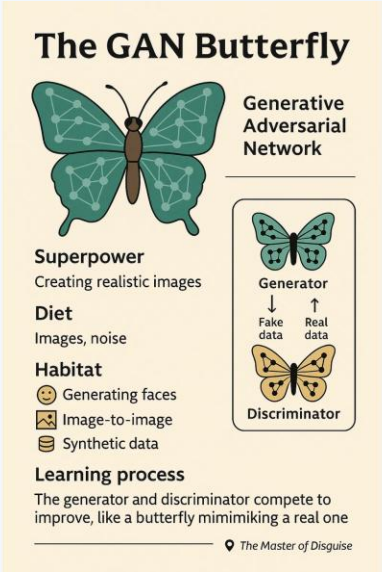
Gets better at spotting fakes

They compete + improve together

Like a game where both players get better over time!

The Generator tries to fool the Discriminator, while the Discriminator tries not to be fooled!

Behavior (Function)



1 Generator → blurry fakes

The Generator wing starts by creating blurry, unrealistic images from random noise.

2 Discriminator → checks real/fake

The Discriminator wing examines images and tries to determine if they're real or fake.

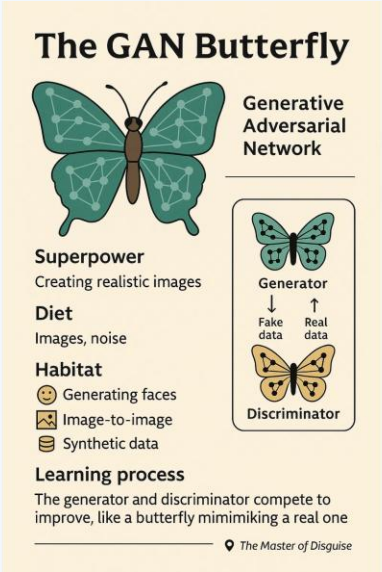
3 Both learn, improve

Both wings receive feedback on their performance and adjust to get better.

4 Generator → realistic images

Over time, the Generator creates increasingly realistic images that can fool the Discriminator.

Metamorphosis



Caterpillar → Random Noise

The GAN starts with random static - no structure, just chaos!

Chrysalis → Learning Patterns

Inside the chrysalis, basic patterns begin to form as the GAN learns.

Early Butterfly → Flawed Images

First recognizable images emerge, but with obvious flaws.

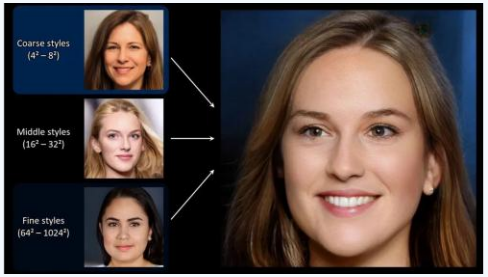
Mature Butterfly → Realistic Images

Finally, the GAN creates detailed, convincing images!

Just like real butterflies evolve through distinct stages, GANs transform from producing random noise to creating realistic images!

Natural Habitats (Applications)

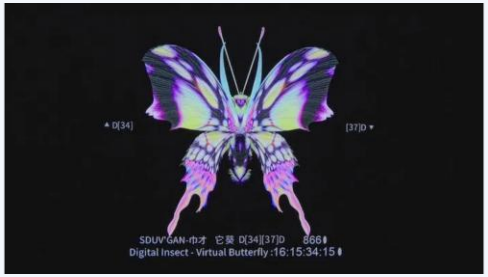
Face Generation Forest



Creates photorealistic faces of people who don't exist in real life

Example: ThisPersonDoesNotExist.com

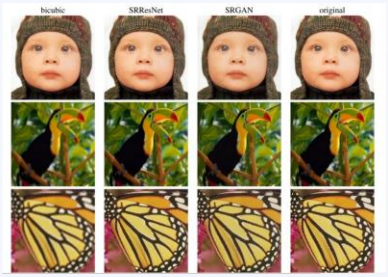
Style Transfer Garden



Transforms photos into artistic styles like Van Gogh or Monet paintings

Example: Converting photos to look like famous paintings

Data Synthesis Lake



Creates paired data like sketches→photos or maps→satellite images

Example: Converting simple sketches into detailed images

GANs are used in art, fashion, gaming, medicine, and many other fields!

Summary (Zoo Card Style)

The GAN Butterfly

Truly the Master of Disguise 🎭

Species Information

Superpower
Creates realistic fake images

Diet
Noise + image data

Habitat
Art, faces, style transfer, data science

Structure
Two wings: Generator and Discriminator

Learning Style
Competitive training between wings