Bansilal Ramnath Agarwal Charitable Trust's
Vishwakarma Institute of Technology
(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

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'Predicting the future isn't magic, it's Artificial Intelligence'

HIGHLIGHTS

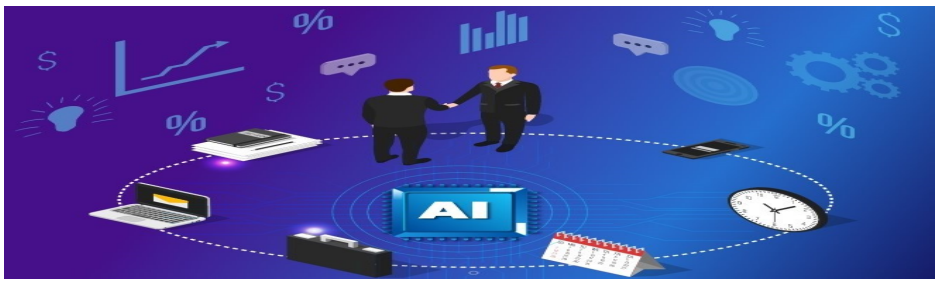
Generative Adversarial Networks (GAN's) and its impact

Generative Adversarial Networks (GANs) were developed in 2014 by Ian Goodfellow and his teammates. GANs are a unique type of deep neural network that can generate new data with similarities to the data it is trained on.

GANS helps in deep learning without extensively annotated training data. GANS are designed to solve the generative problems by using game theory instead of the optimization techniques like in other deep learning techniques.

Game theory is the study of mathematical models of strategic interactions among rational agent. Originally, it addressed two-person zero-sum games, in which each participant's gains or losses are exactly balanced by those of other participants. In game theory we use multiple players competing with other to solve the problem.

GANS are achieved by training two neural networks together in competition with one another. GANs are used for image samples for wide range of application like image style transfer, image editing, classification, and image synthesis



'Generative Adversarial Networks (GAN's) and its impact'

GAN is like a writer and an editor, or an artist and a critic who always interact with each other, improving their skills, as well as generative and discriminative models during training

GAN is growing it's importance because of its ability to offer significantly improved performance across a wide range of applications while reducing the energy and the physical space needed to deliver that performance when compared with conventional silicon technologies.

The main aim of GANS is to create new data samples by estimating potential distributions from training data. GANS applications ranges from image-vision computing, speech-language processing. Major advantage of GANS is that it can generate infinite new samples.

Generative Adversarial Networks (GANs) can be broken down into three parts:

- Generative: To learn a generative model, which describes how data is generated in terms of a probabilistic model.
- Adversarial: The training of a model is done in an adversarial setting.
- Networks: Use deep neural networks as the artificial intelligence (AI) algorithms for training purpose.

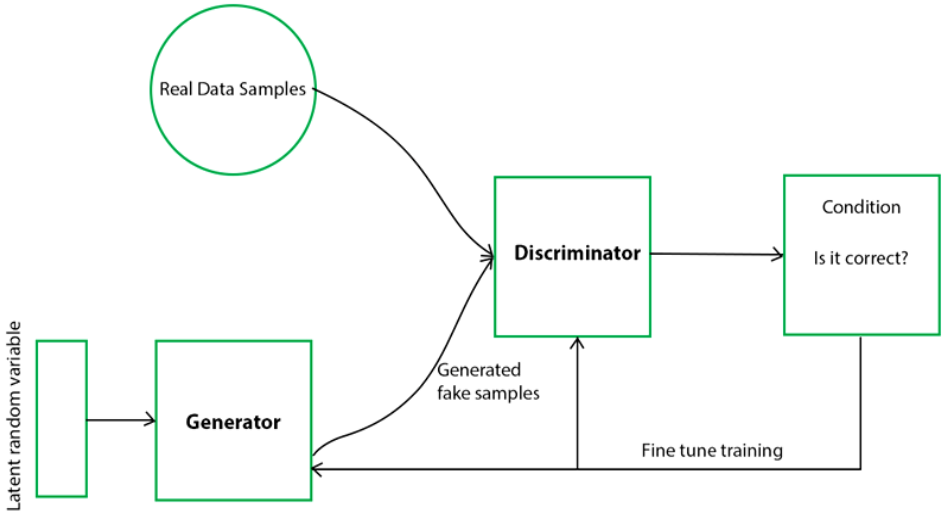
In GANs, there is a **generator** and a **discriminator**. The Generator generates fake samples of data (be it an image, audio, etc.) and tries to fool the Discriminator. The Discriminator, on the other hand, tries to distinguish between the real and fake samples. The Generator and the Discriminator are both Neural Networks and they both run in competition with each other in the training phase. The steps are repeated several times and in this, the Generator and Discriminator get better and better in their respective jobs after each repetition.

"Our Intelligence is what makes us human, AI is an extension of that Quality" —

Elon Musk

'Generative Adversarial Networks (GAN's) and its impact'

The working can be visualized by the diagram given below :



GANs are capable of solving different problems while working with images, for example:

Generating novel data samples such as images of non-existent people, animals, objects, etc. Not only images, but other types of media can be generated in this way as well (audio, text).

Image inpainting — restoring missing parts of images.
Image super-resolution — upscaling low-res images to high-res without noticeable upscaling artefacts.

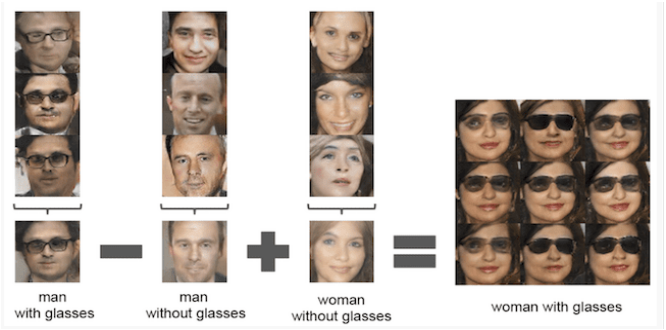
Domain adaptation — making data from one domain resemble the data from the other domain (making a normal photo look like an oil painting while retaining the originally depicted content).

Denoising — removal of all kinds of noise from the data. For example, removing statistical noise from x-ray images fits medical needs, which will be described in our use cases.

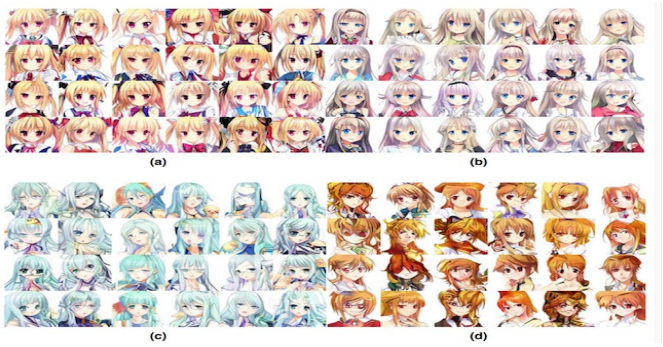
‘Generative Adversarial Networks (GAN’s) and its impact’

GANs applications are able to solve different tasks:

Generate examples for Image Datasets



Generate Photographs of Human Faces



Generate Cartoon Characteristics

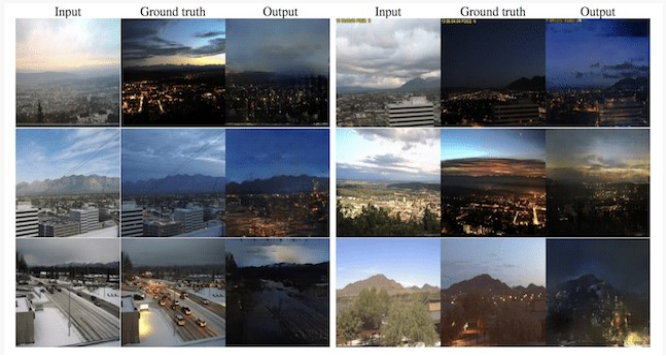


Image-to-Image Translation

‘Generative Adversarial Networks (GAN’s) and its impact’

GAN Use Cases and Project Ideas

GANs already produce photorealistic images, for example, for industrial design elements, interior design, clothing, bags, briefcases, computer games scenes, etc.

Also, GANs have been used to train film or animation personnel. They are able to recreate a three-dimensional model of an object using fragmentary images and improve photos obtained from astronomical observations.

GAN as a Service

Instead of finding a specific niche application for the models, some companies offer access to GANs and all the infrastructure and interfaces to handle the data, train the models, and obtain the final results.

Runway AI is one of such companies, positioning itself as a platform for Machine Learning and enabling novel content creation techniques. Generative media features, as the company calls them, are part of a web interface that supports training a GAN model on your own dataset and collecting the results in the form of images or even videos – it can be very useful for content creators and other interested parties as it helps bing the capabilities of GANs to the masses (working with GANs without graphical UI may prove too inconvenient for most of the non-programmer users).

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