Name :- P.Sumanth
Reg.No:- 9922005061

ASSIGNMENT - 1 :-

Summary of "Generative Adversarial Nets" (NIPS 2014)

This paper introduces Generative Adversarial Networks (GANs), a novel framework for estimating generative models using an adversarial process. It proposes training two neural networks simultaneously:-

1) Generator (G) :- Generates synthetic data that aims to resemble real data.

2) Discriminator (D) :- Evaluates whether a given data sample is real (from the dataset) or fake (from the generator).

Key Concepts:-

* The training process is modeled as a minimax game: The generator tries to complete realistic data to fool the discriminator, while the discriminator tries to distinguish between real and fake samples.
* The competition between two networks improves their performance until the generated samples become indistinguishable real data.
* Unlike previous generative models, GANs do not require Markov chains or approximate inference methods.

Theoretical insights:-

* The paper proves that, in the ideal case where both G and D have infinite capacity and training time, the generator will converge to the true data distribution.

* The loss function is derived from a "Jensen-Shannon divergence" minimization between the real and generated distributions.

Experiments:-

* The authors evaluate GANs on MNIST, Toronto face Database (TFD), and CIFAR 10 datasets.
* They demonstrate that GANs generate high-quality samples that are competitive with existing generative models.
* The paper acknowledges the challenge of evaluating generative models and estimates livelihood using Parzen window-based methods.

Advantages and challenges:-

Advantages:-

* No need for Markov chains.
* uses only backpropagation for optimization.
* Can generate sharp, high-dimensional images.

Challenges:-

* Training instability:- The generator and discriminator must be carefully synchronized.
* No explicit probability density estimation for generated data.

Future Directions:-

* Conditional GANs (for generating data conditioned on specific inputs).
* Semi-supervised learning applications.
* Improving training stability and efficiency.

This foundational work laid the groundwork for numerous advancements in generative modelling, leading to applications in image synthesis, style transfer, and AI-generated media.