Rajiv Gandhi Institute of Technology
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TECHNICAL SEMINAR (17CSS86)

ON "GENERATIVE ADVERSARIAL NETWORKS"

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ORIGIN OF GAN

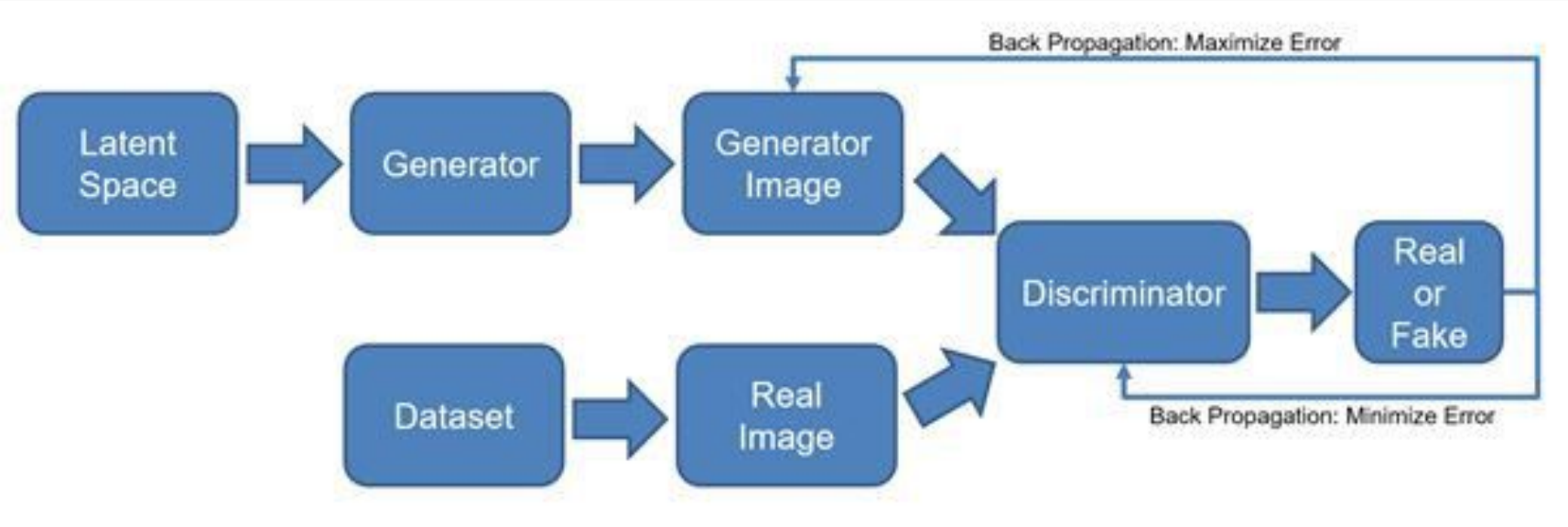
Can computers generate images on their own?

GAN

- A generative adversarial network (GAN) is a Machine Learning (ML) model in which two neural networks compete with each other to become more accurate in their predictions.
- Follows the zero - sum approach

TERMINOLOGIES OF GAN

- The **generator** learns to generate plausible data. The generated instances become negative training examples for the discriminator.
- The **discriminator** learns to distinguish the generator's fake data from real data. The discriminator penalizes the generator for producing implausible results.
- The **Loss Function** provides the stopping criteria for the **Generator** and **Discriminator** training processes.

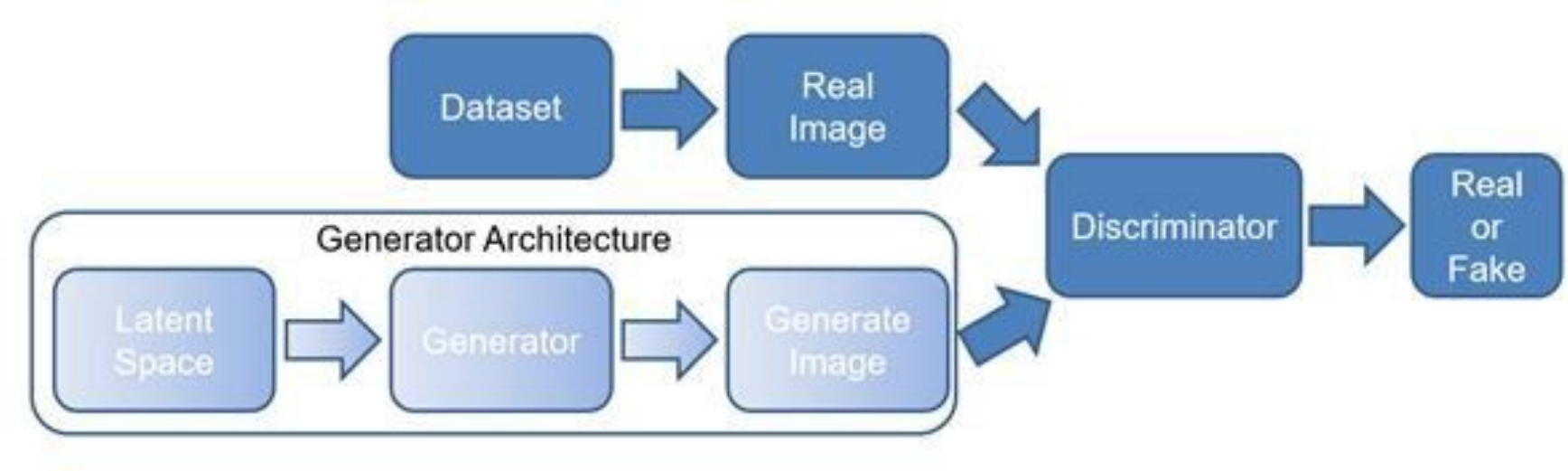


ARCHITECTURE OF GAN

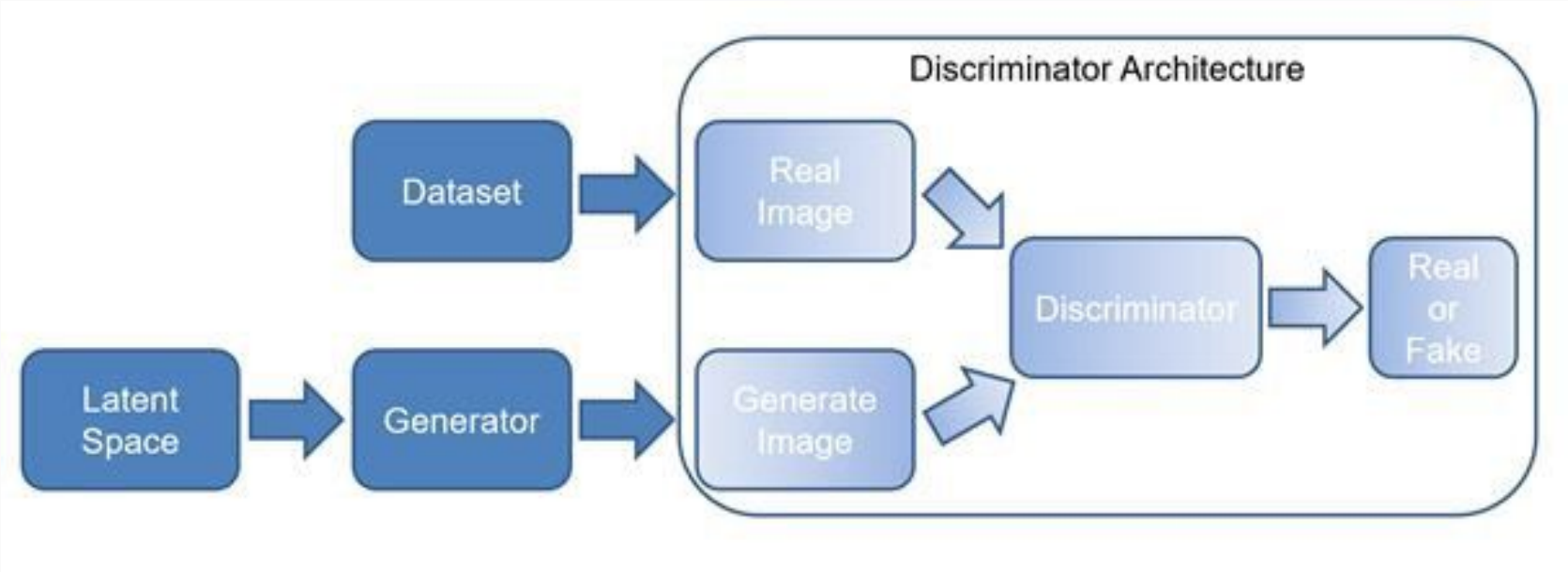
TRAINING PHASE IN GANs

GAN training proceeds in alternating periods:

1. The **discriminator** trains for one or more epochs.
2. The **generator** trains for one or more epochs.
3. Repeat steps 1 and 2 to continue to train the generator and discriminator networks.



TRAINING PHASE IN GENERATOR



TRAINING PHASE IN DISCRIMINATOR

OBJECTIVE FUNCTION

MINIMAX PROBLEM

$$\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x}\sim p_{\text{data}}(\boldsymbol{x})}[\log D(\boldsymbol{x})] + \mathbb{E}_{\boldsymbol{z}\sim p_{\boldsymbol{z}}(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z})))].$$

APPLICATION OF GANs

- Using GANs for Security
- Text to Image generation
- GANs for 3D Object Generation
- Enhancing the resolution of the image
- Long text Generation

REFERENCE PAPER

Efficient text generation of user - defined topic using Generative Adversarial Networks

Proposal of User - Defined GAN (UD - GAN) to generate a paragraph from user - defined topic

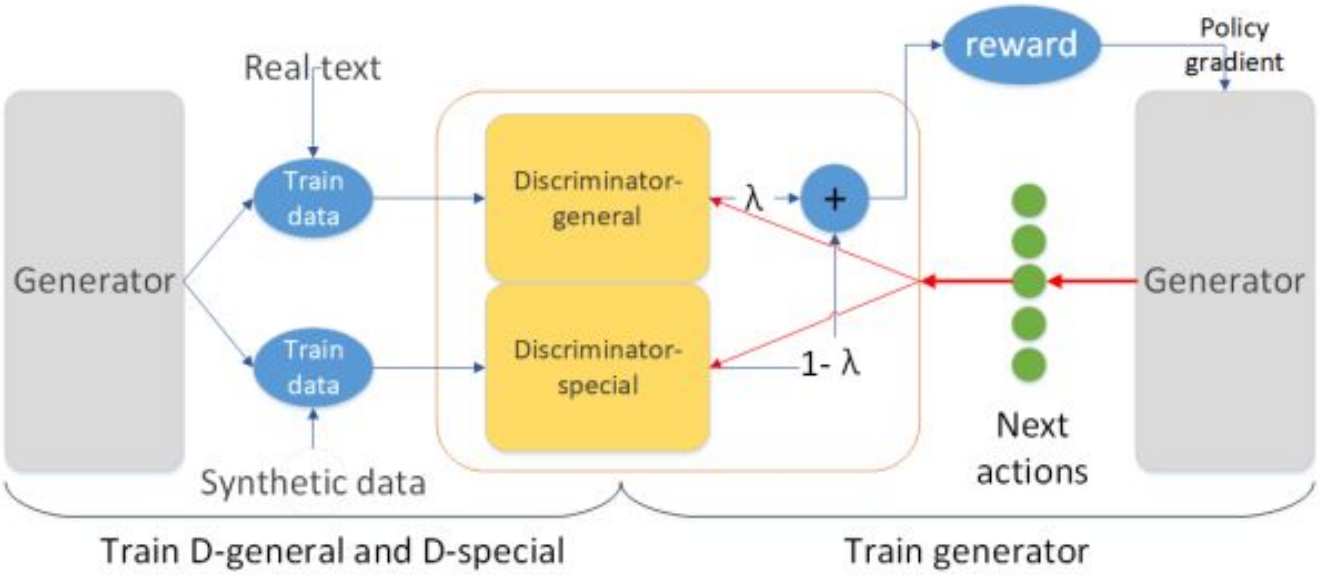


Figure 1: The framework of the proposed UD-GAN

FRAMEWORK OF THE PROPOSED UD - GAN

D-SPECIAL AND D-GENERAL

- Takes a vector of 5 elements as input
- Based on the TF-IDF values for each word, the cosine similarity is calculated.
- Larger the value of cosine similarity, the more the generated sentence is related to the user - defined topic

- Processes the sequence data and context information to generate paragraph level texts
- Use of a hierarchical - multiple LSTM neural network
- A weight is set manually to the discriminator general for generating sentences with better syntactic structure
- Bidirectional LSTMs used to take the feature matrices belonging to the same paragraph

RELEVANCE OF TOPIC

GAN-based models	ROUGE-L
UD-GAN(GS)	364.73
UD-GAN(S)	**370.54**
UD-GAN(G)	340.19
SeqGAN	342.27
LeakGAN	345.03

- ROUGE method is adopted to evaluate whether the generated sentences is related to user - defined topics
- ROUGE - L score is a score related to recall rate

RELEVANCE OF SENTIMENTAL TENDENCY

	Positive	Negative	Neutral
UD-GAN(GS)	0.39	0.05	0.56
UD-GAN(S)	**0.41**	**0.04**	**0.55**
UD-GAN(G)	0.10	0.08	0.82
SeqGAN	0.09	0.08	0.83
LeakGAN	0.08	0.07	0.85

- Use of VADER Algorithm to calculate the sentimental tendency of the generated sentences
- It can be positive, neutral or negative

ADVANTAGES

- GAN has infinite modeling power and can fit all distributions.
- The design of GAN model is simple
- GAN provides a powerful method for unsupervised deep learning models, and it subverts traditional artificial intelligence (AI) algorithms which are limited by human thinking.
- GAN uses machines to interact with machines after adequate data training.

FUTURE SCOPE

- Creating Infographics from text
- Generating website designs
- Drug discovery and development
- Training of Self Driving cars

CONCLUSION

GANs has gained significant attention for generating realistic images and has become important in modern world applications, such as image generation, domain adaptation, etc. Generative Adversarial Networks are a recent development and have shown huge promises already. It is an active area of research and new variants of GANs are coming up frequently.

THANK YOU