5/1/24
Accenture

Generatine AI

M1. • This is the Creatine Wizard in Computers. it can create text, music, Picture etc.

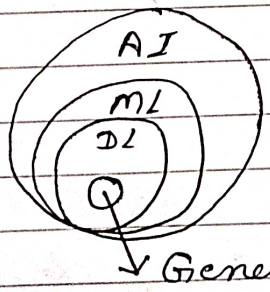
• Generatine AI in entertainment, Arts, Science Design and Medicine.

9+ can replace creatine artist, Story writer

• types of AI

• Artificial Narrow Intelligence
AI
• Artificial General Intelligence

ANI :- Specializes in one area and Solve one Problem. Self driving car, smart speakers.
AGI :- Anything a human can do.
Research in Progress (Evolving)



↓ Generatine AI Subset of DL

ex of real World :- 1. Face aging and De-aging
2. Content creation & language translat
3. music Generatine
4. Procedual content generation (video)
5. Fashion Design.
6. Interior Design, 7. Medical Imaging.
8. Enhancing Data set
9. virtual reality
10. Drug Discovery

CLASSMATE
Date :
Page :

Q Difference between Gen AI and other types of AI.

1. • Traditional AI focuses on rule-based systems and predefined patterns.
   • Generative AI creates new content based on patterns learned from data.

2. • Discriminative AI classifies input data into predefined categories.
   • Gen AI creates new data instance that resemble the training data.

3. • Predictive AI Forecasts outcomes based on historical data.
   • Gen AI creates new instance that fit the underlying distribution of the data.

Gen AI cereates something new that not exist.

Module : 2

• Machine learning

→ A subset of AI where computers learn from data without being explictly Program

input → Process → output (Prediction

- **Types of ML :-**

  i. SL :- Learn from labeled data.
  ii. USL :- Discover Patterns in Unlabeled data
  iii. Semi-S :- Utilizes both labeled & Unlabeled data.
  iv. Reinforcement L :- Learn by interacting with an environment.

- **ML applications :-**
  1. Ranking website
  2. Recommendation
  3. Classification
  4. Regression
  5. Clustering
  6. Anomaly Detection

- **How SL Works :-**

  Input LABELED DATA ⟹ [model] ⟹ output

  It works like small child how you train to identify People.

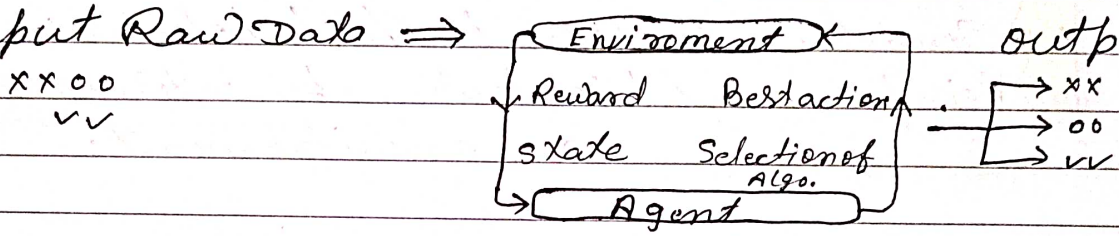
- **How USL Works :-**

  Unlabled data ⟹ [model] ⟹ Similar thing Group1
  cat & Dog ⟹ Group2.

  Sorting things, group them

- **How Reinforcement learning works:-**

training a machine to make a bounch of decision one after other.

Input Raw Data ⟹ 

S1: Formulate problem
2: Create Environment
3: Define Reward.
4: Create Agent and trained agent
5: Validate Agent
6: Deploy Policy

- Common ML algo

1. LR :- continuous value Predict
LOR :- binary outcomes estimated
DT : Ask question to decide
RF : Random forest use multiple tree for accuracy
SVM : find optimal boundiries between data.
Naive Bayes :- It uses Bayes theorem for class Predict
KNN :- It based on neighbours.
NN :- mimic the human brain to recognize Patterns
PCA :- reduce data dimensions
K-means clustring :-
GBM :- enhanced model accuracy.
DBSCAN :
Hierarchical clustering :- Form a tree of clusters
Ada Boost :- enhanced model accuracy

- ML Model Deployment:

i. Data Collection :- Extract data from various source.
ii. Data Storage :- Store data in reliable storage
iii. Data Preparation :- Organize data for reliable use and clean to make it usable.
iv. Data Analysis :- Uncover Patterns, identify trends distributions and segments.
v. Prototyping & testing ML :- experiment. → Interpretable simple model, A/B test
vi. ML in Production :- Deploy, monitor and update models in Production

- Deeplearning:

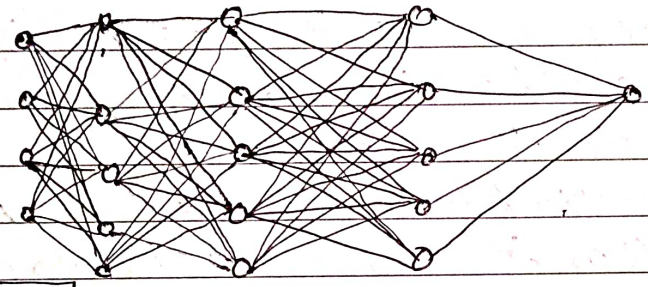
Deeplearning is a subset of machine learning in AI. that has network capable of learning unsupervised from data that is unstructured or unlabeled.

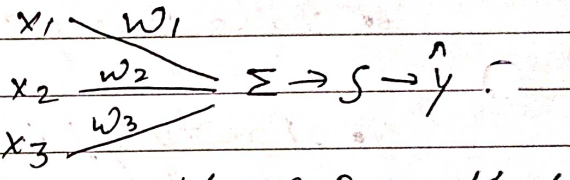
- It used in variety of complex task:

- ANN for Regression and classification.
- CNN for computer vision.
- RNN for time series Analysis.
- Self Organizing map for feature extraction
- Deep Boltzman machine for recommendation System.
- Auto encoders for Recommendation systems.

- **Neural Network:-**

→ A NN is a series of algorithm that attempts to recognize underlying relationship in a set of data through a process that mimic the human brain.





input | Hidden layers | output layer

- **How NN learn:-**

S1: Forward propagation
S2: Back Propagation
S3: Repeat until the loss function is minimized

- **Architecture of NN:**
  - Single-layer feed forward Network.
  - multilayer feed forward Network.
  - recurrent layer
  - mesh Networks

- **Challenges in Training:**
  - Overfitting:- Well Performing on training data but Not on new
  - vanishing / Exploding Gradients:-
  - Need for large Dataset:- NN require vast amount of data.
  - computational Requirements:-

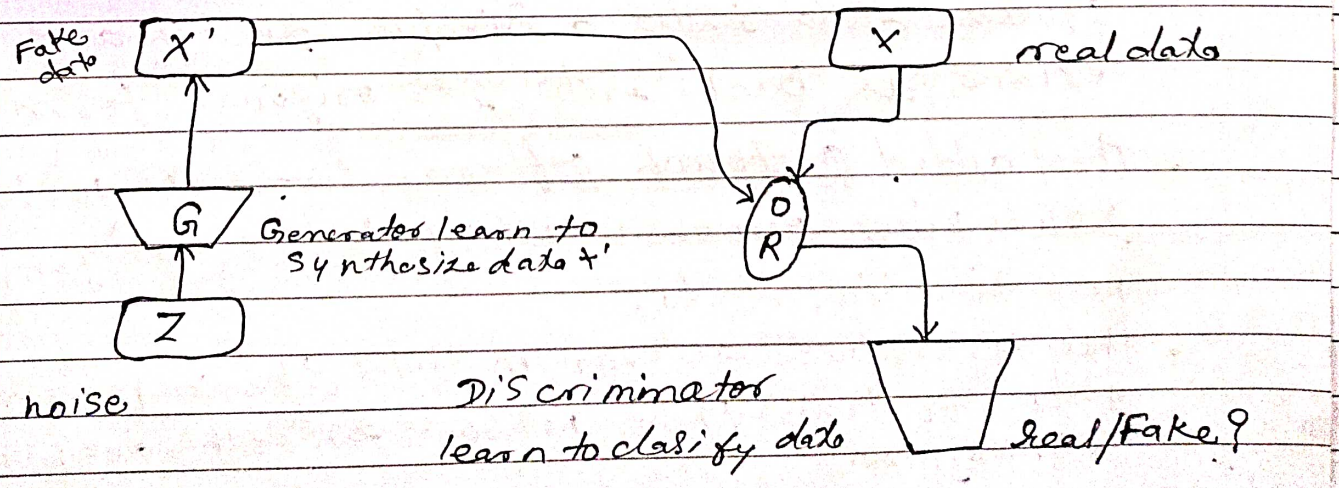
Generative AI

M3

GAN:- Generative Adversarial Network.

- **History:-**
  - The root of Gen AI can be traced back to the development of Neural Network. These network, inspired by Human brain were Design to recognise pattern.
  - The late 2000s and early 2010 saw the rise of generative model. These model aimed not just to recognize but to generate new unseen data
  - In 2014 Ian Goodfellow introduced Generative adversarial Network of GNS. This was game changer.
  - Genes consist of two network, the generator and the discriminator, cometing against each other, leading the highly realistic generated content.

- **GAN:** Two Networks → Generator and Discriminator

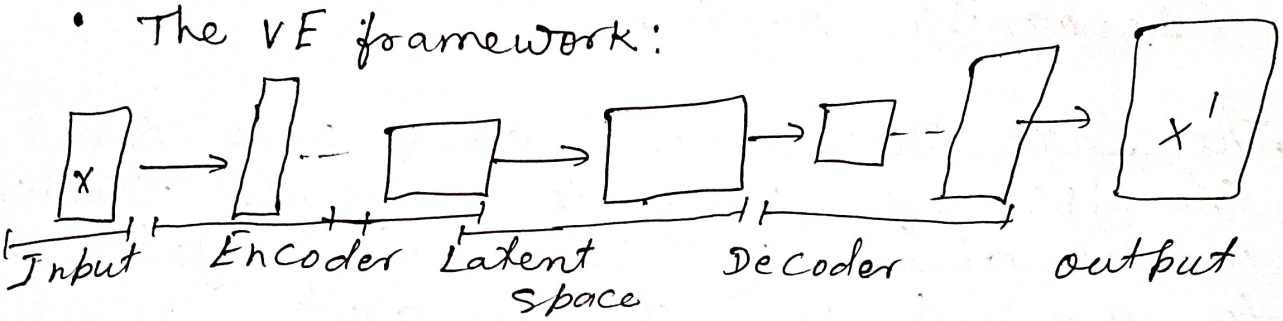


* VARIATIONAL AUTOENCODERS (VAEs)

→ • The Paper Auto encoding variational Bayes by Kingma and Welling introduced the VAE via EA Significant advancement in Generative modelling.

• The key Points in Paper:-

• The VE framework:



• It uses a Probabilistic approach to encode and decode data. Unlike traditional auto encoders.

• It introduced to Caustic layer that models the data in a latent Space allowing for continuous and Smooth representation.

• Variational Auto encoder values are like tools that Squeeze data into a Simple Sketch and then expand it back into its original form.

• They added a touch of randomness to the Squeezing Process which helps in generating new Similar data.

• They introduced a clever method, the reparametrization trick, to train these network Smoothly despite the randomness.

- **Progression & REFINEMENT**
  Model like DCGAN, CycleGAN, BigGAN

→ GAN's and V's were refined, leading to more realistic and diverse outputs. model like DCGAN, CycleGAN, BigGAN Pushed the boundaries.

- **DCGAN**:- better building rule for creating stable and effective AI Image makers using pattern and regularities. Smart learning showed that the AI can focus on specific part of an image like recognizing noses or trees.

- **CycleGAN** :- unpaired image to image translation using cycle-consistent adversarial Network.

→ **CycleGAN** magic transformation can change pictures, like turning horses photos into zebra photos without a direct comparison

- **BigGAN**:- Semi-supervised generative adversarial network for image synthesis and classification on sexual facial recognition.

9t showed big ai model makes better pictures Pick a categories can make high quality Picture based on specific category like birds or mountains.

*. Transformers and large scale models.

→ In late 2010 and early 2020 marked the rise of transformer architectures.

originally designed for natural language processing.
It introduced a new model structure, the transformer, which relies solely on attention mechanisms, eliminating the need for recurrent layers.

The transformers can be trained more efficiently and achieve state-of-the-art result on translation task, outperforming existing RNN and CNN models.

Unlike RNNs, which process sequences step-by-step transformers handle entire sequence simultaneously enabling faster computation.

- GPT and state-of-the-art models:-

- Open ai GPT series based on the transformer architecture set new benchmarks. GPT 3 and GPT 4 with their billions of parameters. can generate highly coherent and contextually relevant content across domains.

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Date :
Page :

* Generative Model:

→ Algorithm that can generate new data sample from the same distribution as the training data.

(GAN) Generative adversarial Network is used

Image of dogs → Generator → Dog / New image not in Dset → Discriminator

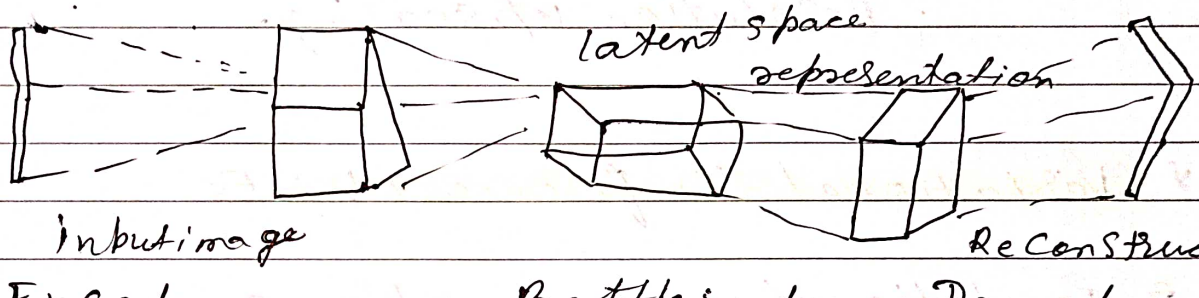
- Roles of generative model:-
  - Deep fakes, Generating Art, Drug Discovery

- While Generative model 'Create' Discri-mitive model 'classify' or 'Predict'.

• Generative model	• Discriminative
• • aim to generate new sample from learned data distribution.	• Focus on distinguishing data Pattern and making Prediction.
• GANs, VAEs, BayesianNets	SVM, LR, DT
• image generation, data augmentation, drug discovery	Image classification, Spam detection. Regression task.

* Variational Auto-Encoders (VAEs)

- Introduction:-
Auto encoders are type of Neural Network, Excel and data compression and noise reduction. They function in two parts, an encoder and a decoder.



- The encoder compress data into a compact form which may look scrambled. The
- decoder then tries to restore this data, but with slight imperfections.

- Auto encoder don't just dubicate data. They compress, then reconstruct, offering a fresh Perspective on the original data.

- They work unsupervised and can manage varied data, from speech and text to image and videos. Training is a crucial stage where the auto encoder learns from the given data.

Speech and text to image and videos.

Purpose & Mechanism → Training Phase → Testing Phase → Specificity

The Bottleneck Philosophy ← EoC

- **Uses:-**
  - Image reconstruction.
  - Color Enhancement.
  - Data compression.
  - Grayscale To color Conversion.
  - Resolution upscaling.

* Variational Inference & VAEs

⇒ Traditional auto-encoders can generate data similar to what they have been trained on. They are not optimized for generating entirely new, unseen data sample.

- Bayesian approach to modeling → Estimates Posterior

VAE Provide an approximation

- variational interface is a Bayesian method to approximate complex Posterior distributions. VAEs used this technique to generate new data points that are similar to the input data.

GAN

M6

- GAN:- Generative adversarial network.

→ This powerful models have taken the machine learning community by storm. Producing image like the never before.

→ It works on minimax Concept.

→ Mode Collapse:- Sometimes the generator finds a shortcut Producing similar images again and again. this is mode collapse.

- Lack of diversity
- evaluating quality and Authenticity
- Anoideing Overfitting.

→ Progressive GANs:- Generating high-resolution and diverse synthetic image-efficiency.

Real World example:-

- Art and Design
- Video Games and VR
- Medical Imaging and Research.