

# Complete Crash Course On Artificial Intelligence (AI)



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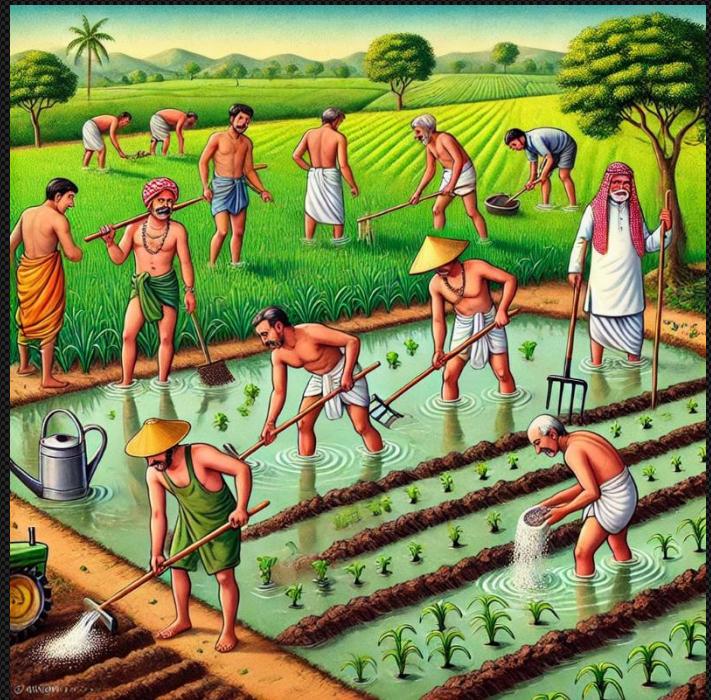
## GREEN REVOLUTION IN INDIA



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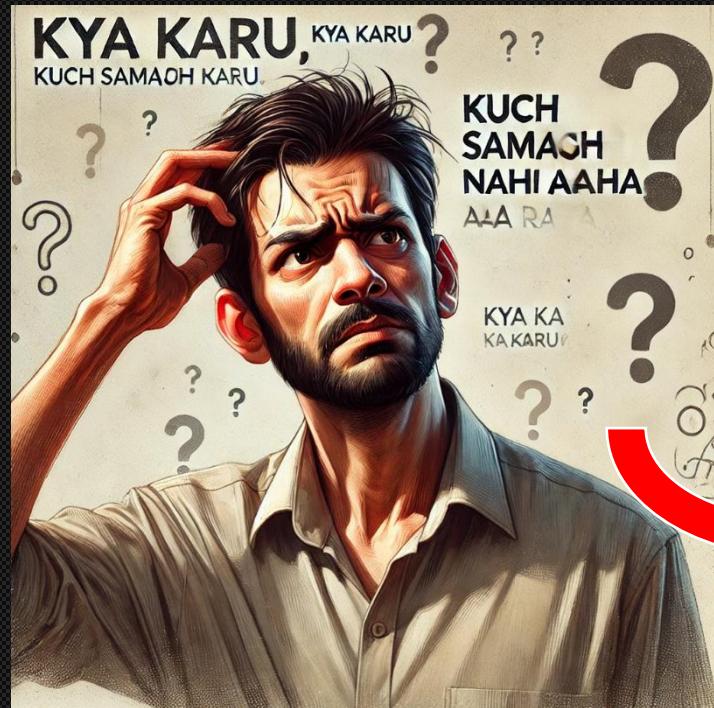


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- AI Infrastructure & Model Creators
- Company that uses AI Infrastructure
- Types of AI Tools
- What is Artificial Intelligence ?
- Evolution of AI
- Discriminative Model (Classifier & Predictor)
- Generative Model (Content & Data Creation)
- Agentic Model (AI with Decision-Making Abilities)
- Hybrid Models (Combination of Multiple Approaches)
- Structure of AI
- Machine Learning
- Supervised ML
- Unsupervised ML
- Reinforcement ML
- Deep learning
- Neurons and neural network
- Face detection
- Computer vision
- Evolution of CV
- Natural language Processing
- Evolution of NLP
- Companies using NLP
- Case works
- Architecture
- LLM
- Building of LLM
- Agentic AI
- Features of AI agents



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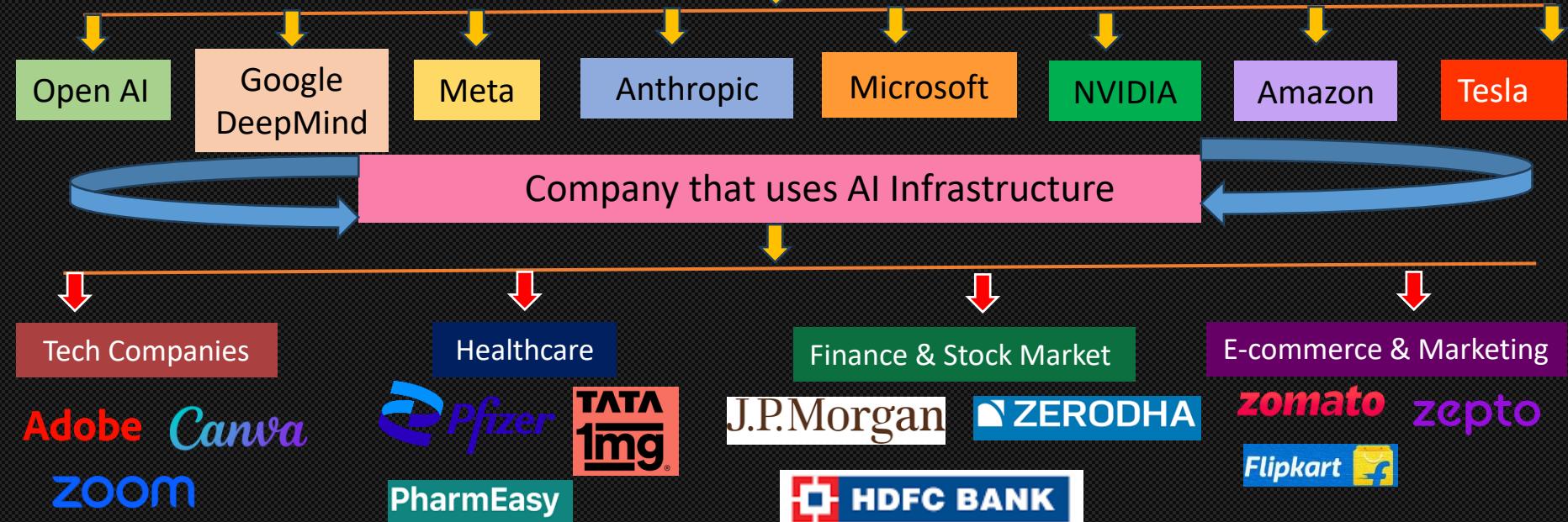
 **AIRBUS**  **VISTARA**



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## AI Infrastructure &amp; Model Creators



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## 3 types of AI Tools



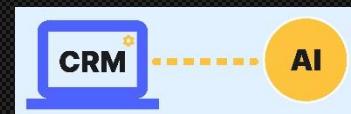
Standalone AI Tools



Integrated AI Tools



Customized AI Tools



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## What is Artificial Intelligence ?

Artificial Intelligence (AI) is a branch of computer science that focuses on creating machines that can perform tasks that typically require human intelligence. These tasks include:

- ✓ **Learning** – AI learns from data and improves its performance over time.
- ✓ **Reasoning** – AI can analyze information and make logical decisions.
- ✓ **Problem-Solving** – AI can find solutions to complex problems.
- ✓ **Understanding Language** – AI can process and generate human language (like ChatGPT!).
- ✓ **Perception** – AI can recognize images, sounds, and patterns.

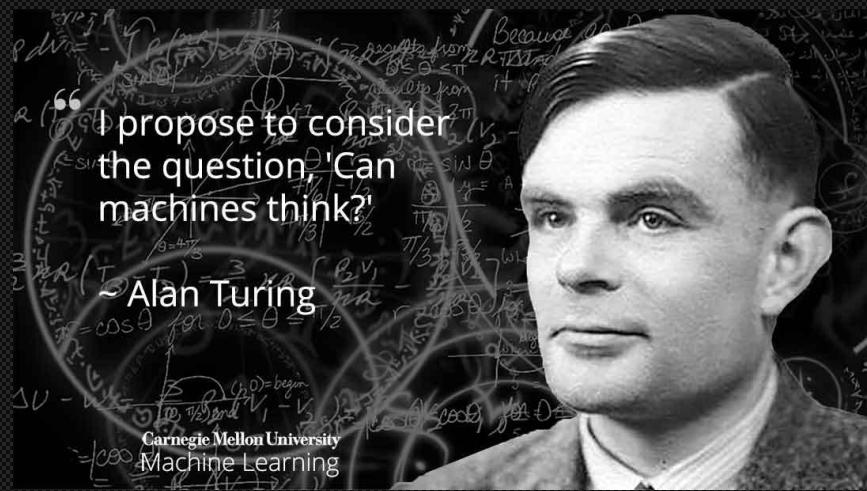


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1950s

Sabse pehle, AI ka concept Alan Turing ne introduce kiya tha. 1950 mein unhone ek paper likha tha, "Computing Machinery and Intelligence," jisme unhone Turing Test introduce kiya. Is test ka goal tha yeh dekhna ki kya ek machine soch sakti hai jaise insaan karta hai.

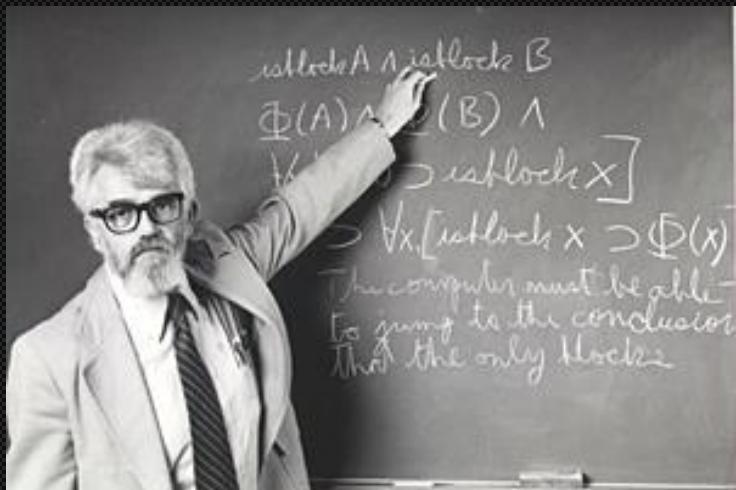


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1956 (Dartmouth Conference):

Yeh moment AI ki duniya ka turning point tha, jab John McCarthy aur unke colleagues ne "Artificial Intelligence" shabd ko define kiya aur officially is field ka shuruat ki. Yahaan se AI ka journey start hota hai.



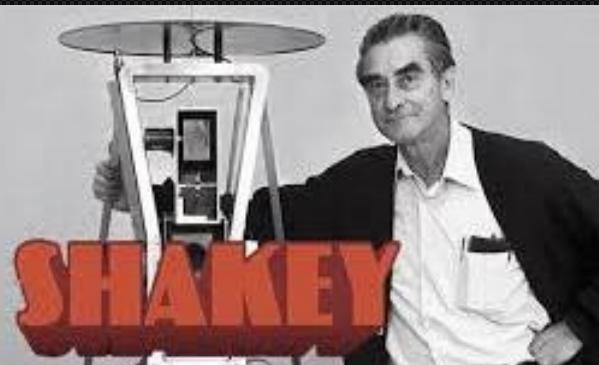
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1960s to 1970s

1960s se lekar 1970s tak, AI mein bohot basic systems aur programs banaye gaye.

- **ELIZA (1966)**: Yeh ek chatbot tha, jo Joseph Weizenbaum ne banaya tha. ELIZA ek simple script ke through logon se baat kar sakti thi. Yeh ek early AI conversational system tha.
- **Shakey the Robot (1969)**: Yeh ek robot tha, jise Stanford Research Institute ne develop kiya tha. Is robot mein decision-making aur problem-solving capabilities thi.



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## The Winter of AI - 1970s to 1980s

AI ka initial excitement zyada din tak nahi chal paya. 1970s aur 1980s mein AI mein bohot funding aur research kam ho gayi thi, isliye is period ko AI Winter kaha jata hai. Is time par logon ne socha tha ki AI utna promising nahi hai, jitna initially laga tha. Us waqt hardware aur resources kaafi limited the.



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1990s to Early 2000s

## Evolution of AI

1990s ke end tak, AI ka second boom start hota hai, jab machine learning aur neural networks ka development start hota hai.

**Deep Blue vs Garry Kasparov (1997)** : Yeh moment AI ki history mein bahut important tha, jab IBM ka Deep Blue chess world champion Garry Kasparov ko harata hai. Is se AI ke potential ko duniya ne seriously lena shuru kiya.

**Speech Recognition:** 1990s mein, speech recognition systems bhi kaafi improve hue, jisme Dragon NaturallySpeaking jese software aaye.



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## Evolution of AI

### AI Revolution - 2010s

2010 ke baad, AI ka real revolution dekhne ko milta hai, jab deep learning aur neural networks ka use improve hota hai. In technologies ke through, machines ko image recognition, speech recognition, natural language processing jaise complex tasks perform karne ke liye train kiya gaya.

#### Deep Learning and Neural Networks:

Google's DeepMind ne AlphaGo ko train kiya, jo 2016 mein Go game ke world champion ko harata hai.

#### Chatbots and Personal Assistants:

2010s mein, AI-powered chatbots aur personal assistants jese Siri, Alexa, Google Assistant market mein aaye, jo daily tasks ko automate karte hain.



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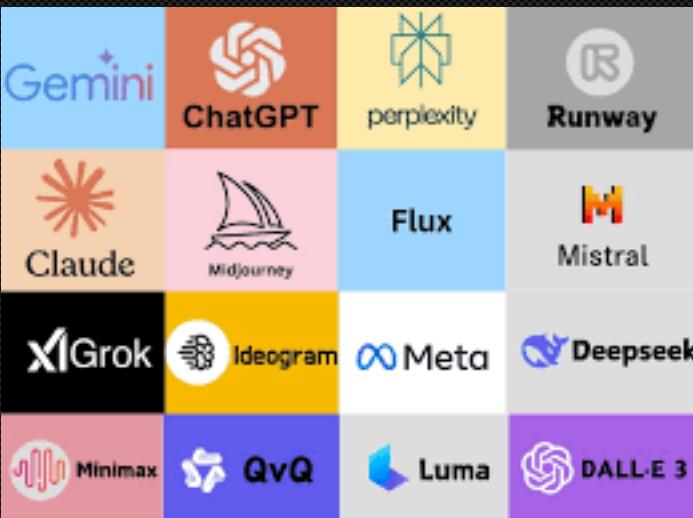
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## Evolution of AI

AI ka Future (2020s and Beyond)

Aaj ke time mein, AI bahut rapidly evolve ho raha hai, aur generative AI (jese ChatGPT aur DALL-E), self-driving cars, agentic AI, aur AI ethics jaise concepts ki taraf hum move kar rahe hain.

- **Generative AI:** Jaise ki ChatGPT, DALL-E, MidJourney, jo new content generate karte hain (text, images, etc.).
- **Agentic AI:** Jaise AutoGPT, jo independent tasks perform karne mein capable hote hain.



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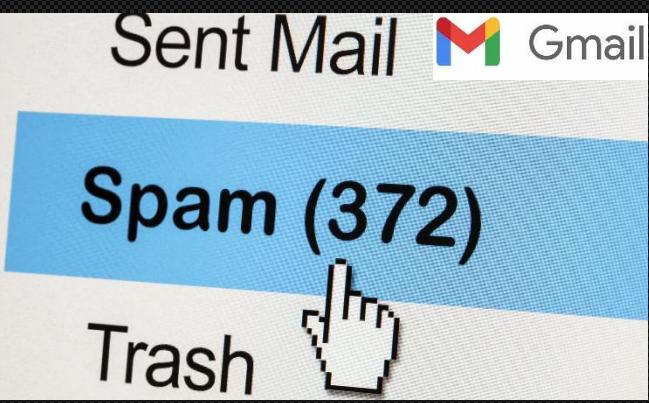
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## Discriminative Model (Classifier & Predictor)

Discriminative models are used for **classification and prediction**.

### Examples in AI:

- Spam detection (Spam or Not Spam)
- Face recognition (Is this face John's or not?)
- Fraud detection in banking



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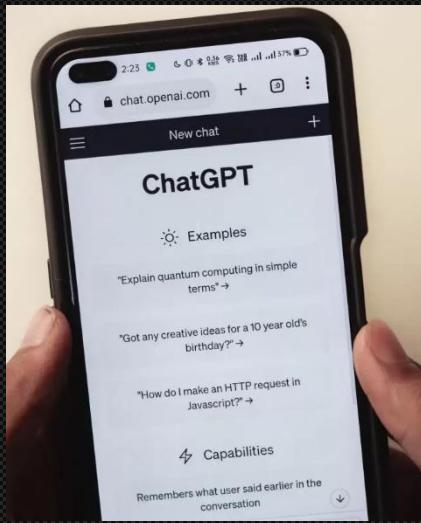
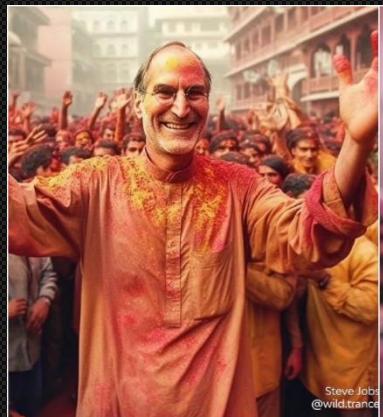
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## Generative Model (Content & Data Creation)

Generative models **create new data** based on training data.

### 📌 Examples in AI:

- ChatGPT, GPT-4, BERT (Text generation)
- Stable Diffusion, DALL·E (Image generation)
- WaveNet (Speech synthesis)



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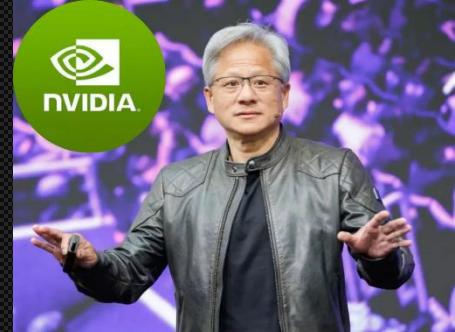


Photo illustration

The acceleration of AI research, envisioning businesses utilizing AI agents for customer interactions



agentic AI as a "new labor model, new productivity model, and a new economic model



The age of agentic AI is here," emphasizing the emergence of AI agents capable of performing complex tasks autonomously



Nadella introduced AI agent tools designed to act autonomously on behalf of users, capable of tasks like reviewing customer returns and checking supply-chain invoices

## Agentic Model (AI with Decision-Making Abilities)

Agentic models are AI systems that can take actions and make decisions autonomously. These models go beyond classification and generation—they interact with the environment and take actions accordingly.

### Examples in AI:

- Self-driving cars (Deciding when to stop, turn, accelerate)
- AI-powered robots (Automating warehouse operations)
- Game-playing AI (AlphaGo, OpenAI Five for Dota 2)
- Personal AI assistants (AutoGPT, BabyAGI)



A  
I  
AGENTS



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## Hybrid Models (Combination of Multiple Approaches)

Some AI systems use a combination of discriminative, generative, and agentic models for better performance.

### Examples:

Self-driving cars (Use CNNs for image recognition + RL for decision-making)

Chatbots with memory (Use transformers for text generation + RL for adaptive learning)

AI art generators (Use GANs for image generation + CNNs for style transfer)



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## Artificial Intelligence

## Structure of AI

Machine Learning

## Artificial Intelligence

Machine Learning

Deep Learning

Structure of AI

# Artificial Intelligence

Machine Learning

Deep Learning

Discriminative

Structure of AI

# Artificial Intelligence

Machine Learning

Deep Learning

Discriminative

LLM



Gemini

Agentic AI

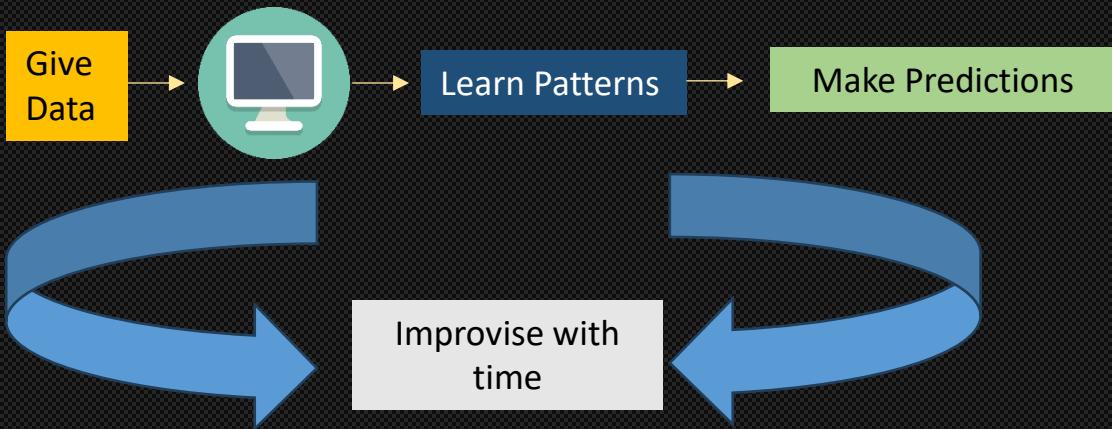
Generative AI

Structure of AI

## Machine Learning

Machine Learning (ML) is a type of technology that allows computers to learn from data and make decisions without being directly programmed.

Imagine teaching a child to recognize fruits. If you show them many apples and tell them, "This is an apple," they will eventually learn to identify apples on their own. Similarly, in ML, we provide a computer with a lot of data, and it learns patterns to make predictions or decisions.

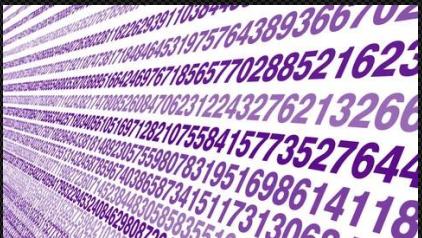


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# Machine Learning

Training Data



Model



New Data



Trained Model



Predictions



## Types of Machine Learning

Supervised Learning

Unsupervised Learning

Reinforcement Learning

### Examples:

- Spam detection (Email is spam or not)
- House price prediction
- Image classification (Cats vs. Dogs)

### Examples:

- Customer segmentation in marketing
- Anomaly detection (fraud detection banking)
- Topic modeling in NLP

### Examples:

- Self-driving cars
- Game-playing AI (e.g., AlphaGo)
- Robotics



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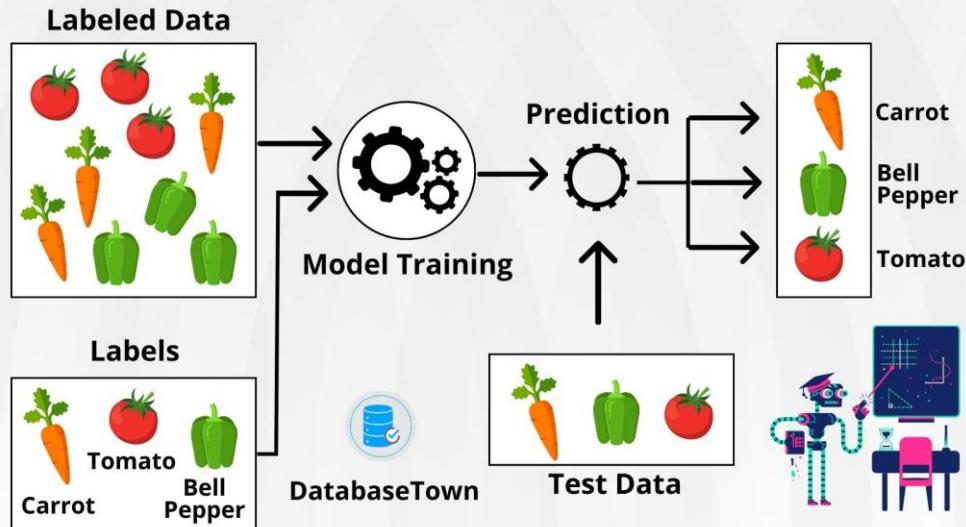
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# Supervised Machine Learning

Supervised Learning ek aisa Machine Learning type hai jisme hum model ko labeled data (yaani ki input-output pairs) ke saath train karte hain. Matlab, model ko pehle se pata hota hai ki kaunsa input kis output se match karta hai. Phir model ye pattern samajhne ki koshish karta hai taaki naye data ke liye bhi sahi prediction kar sake.

## SUPERVISED LEARNING

Supervised machine learning is a branch of artificial intelligence that focuses on training models to make predictions or decisions based on labeled training data.



## Supervised Machine Learning

### Some Algorithms

- Linear Regression
- Logistic Regression
- Decision Trees
- Random Forest
- Support Vector Machines (SVM)
- K-Nearest Neighbors (KNN)
- Naive Bayes
- Gradient Boosting (e.g., XGBoost, LightGBM)
- AdaBoost

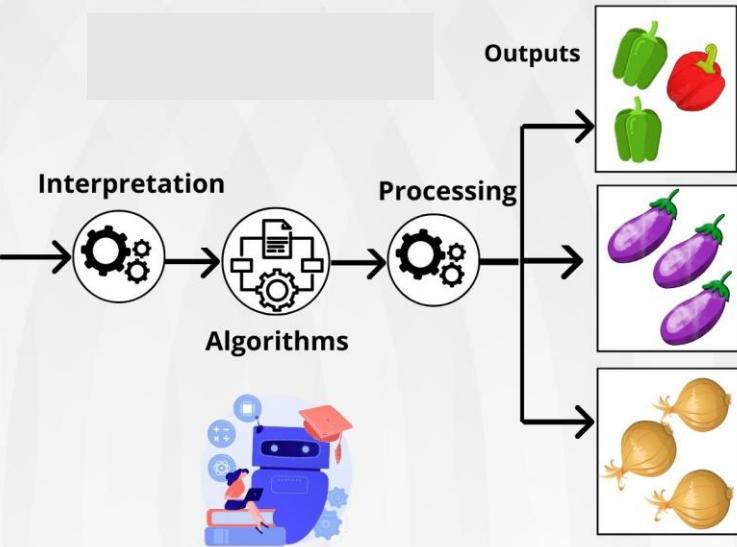
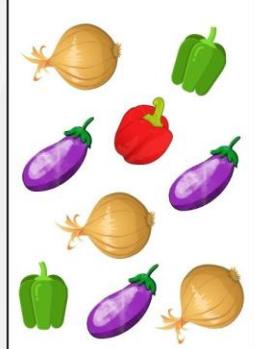
## Unsupervised Learning

Unsupervised Learning ek aisa Machine Learning type hai jisme model ko bina kisi labeled data ke train kiya jata hai. Matlab, model ko input diya jata hai, lekin output ka pata nahi hota. Model khud patterns aur relationships find karta hai data ke andar.

# UNSUPERVISED LEARNING

Unsupervised learning is a type of machine learning where the algorithm learns from unlabeled data without any predefined outputs or target variables.

### Input Raw Data



## Unsupervised Learning

### Some Algorithms

- K-Means Clustering
- Hierarchical Clustering
- DBSCAN (Density-Based Spatial Clustering of Applications with Noise)
- Principal Component Analysis (PCA)
- Independent Component Analysis (ICA)
- t-Distributed Stochastic Neighbor Embedding (t-SNE)
- Gaussian Mixture Models (GMM)
- Autoencoders

Reinforcement Learning (RL) ek Machine Learning ka type hai jisme ek agent apne environment se interact karta hai aur reward system ke through seekhta hai.

## REINFORCEMENT LEARNING

Reinforcement learning is a machine learning paradigm that focuses on how agents learn to interact with an environment to maximize cumulative rewards.

Baby (Agent)



→  
State (Action)



Reward  
←



Sitting

Crawling

Feeder

## Reinforcement Learning

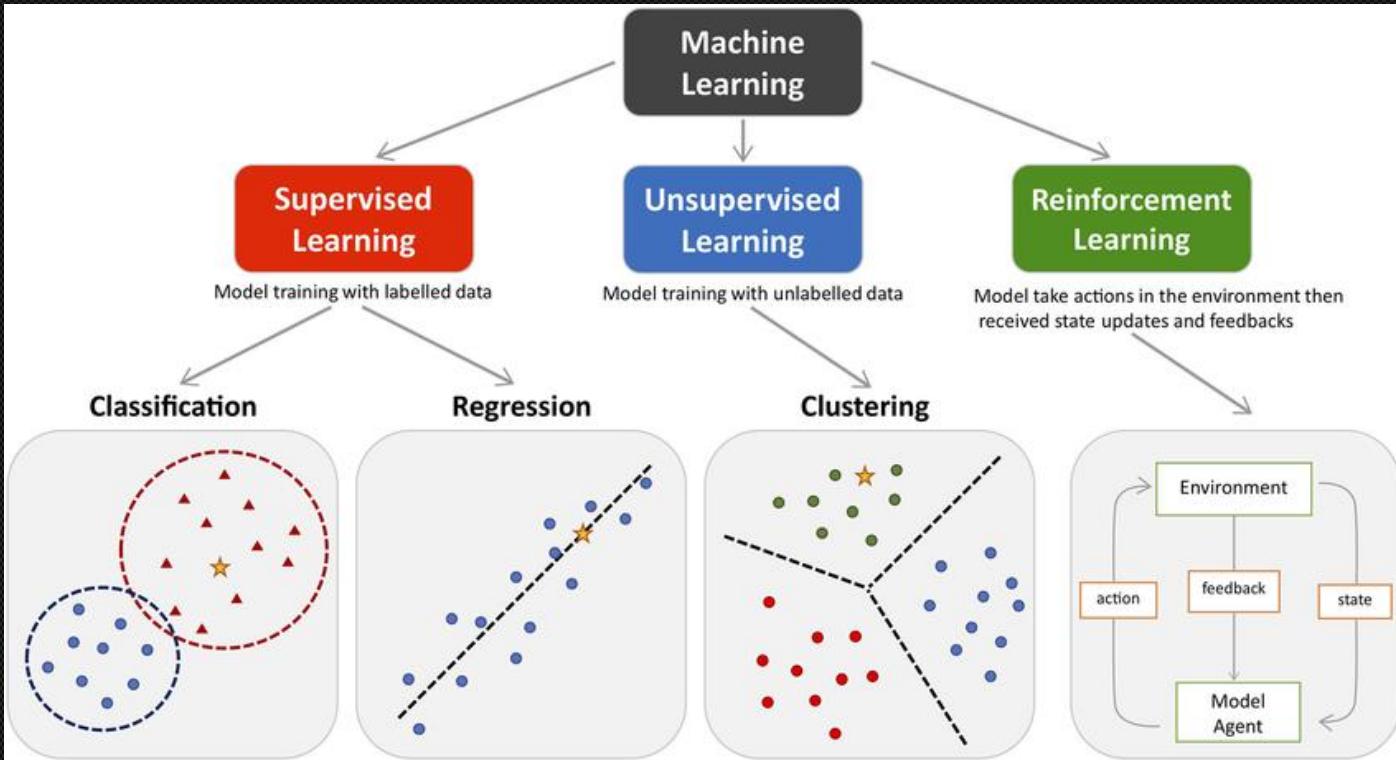
Reinforcement Learning (RL) ek Machine Learning ka type hai jisme ek agent apne environment se interact karta hai aur reward system ke through seekhta hai.

Q-Learning

Deep Q-Networks (DQN)

SARSA (State-Action-Reward-State-Action)

Policy Gradient Methods



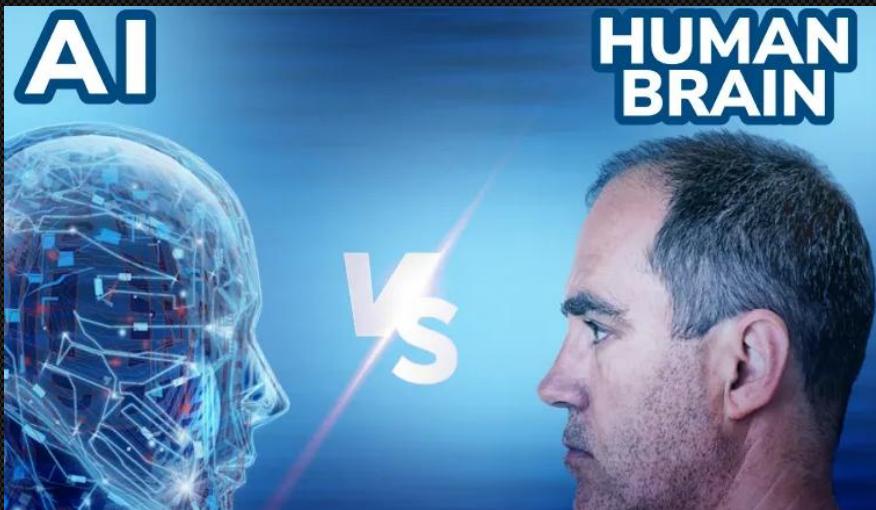
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## Deep Learning

Deep Learning is a type of **Artificial Intelligence (AI)** that helps computers learn and make decisions just like humans.

brain-inspired system



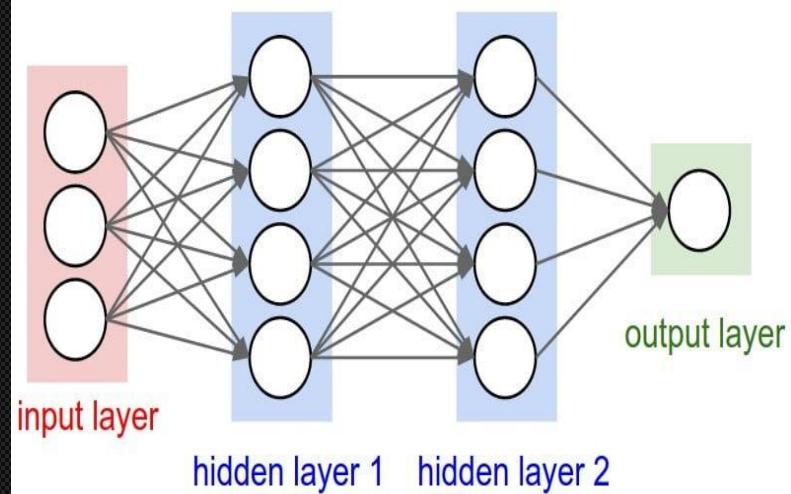
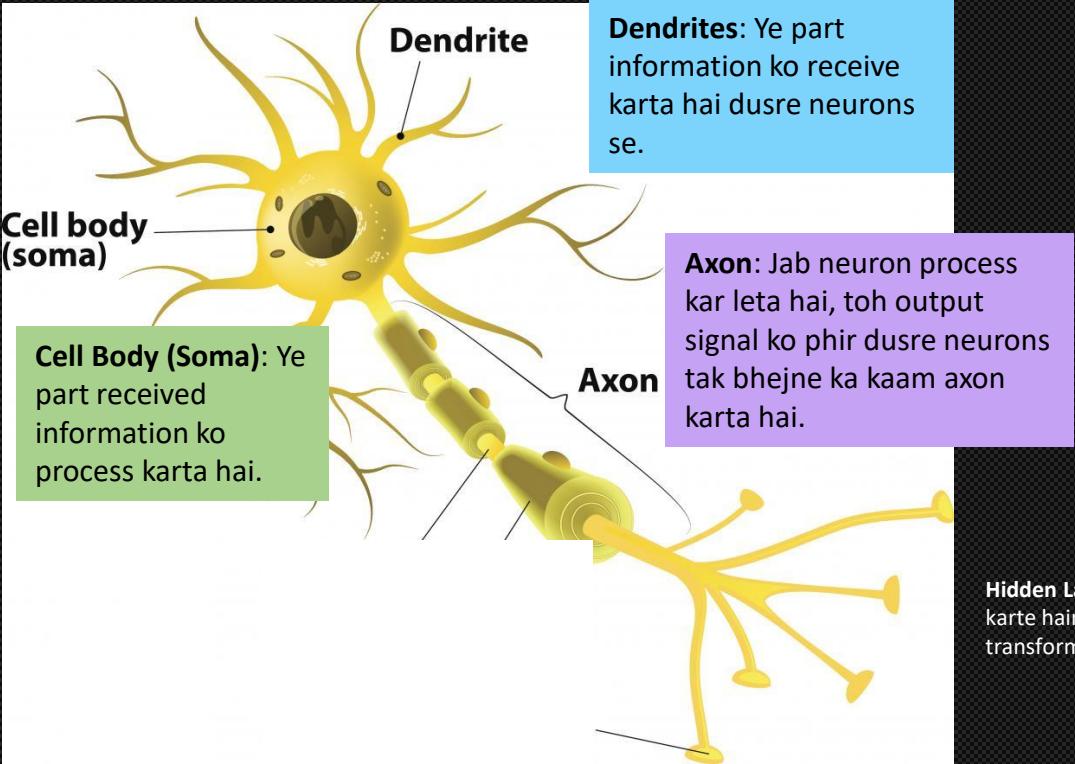
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**Hidden Layers:** Ye layers multiple neurons se banayi jaati hain jo input data ko process karte hain. Har neuron apne weights aur activation function ke through input ko transform karta hai.



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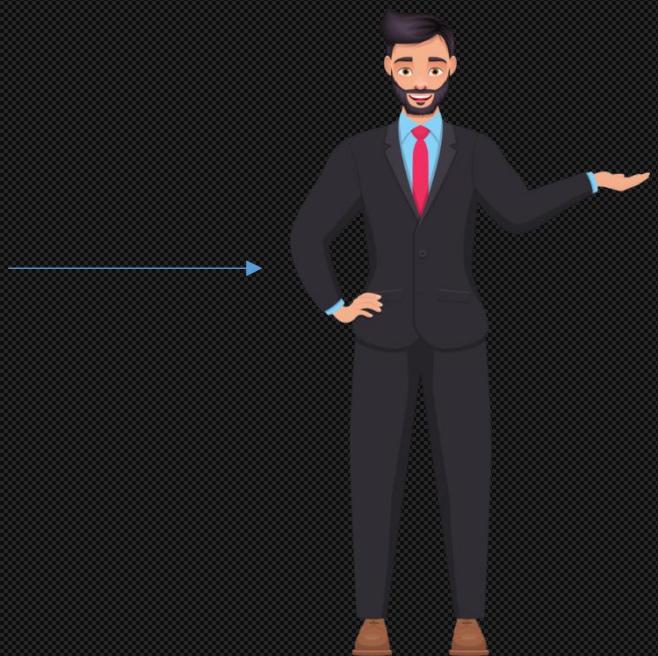
Nose



Eyes



Ears



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Nose



This is Panda

Yes



Eyes



Ears



Yes



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Nose



This is not a Panda

Yes



Eyes

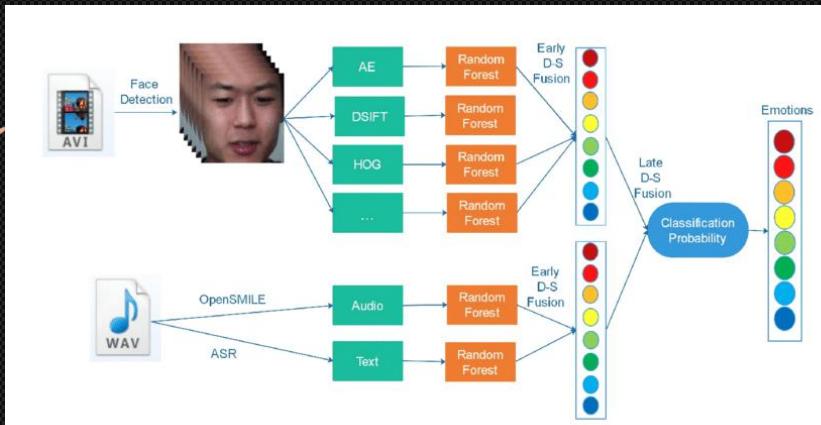
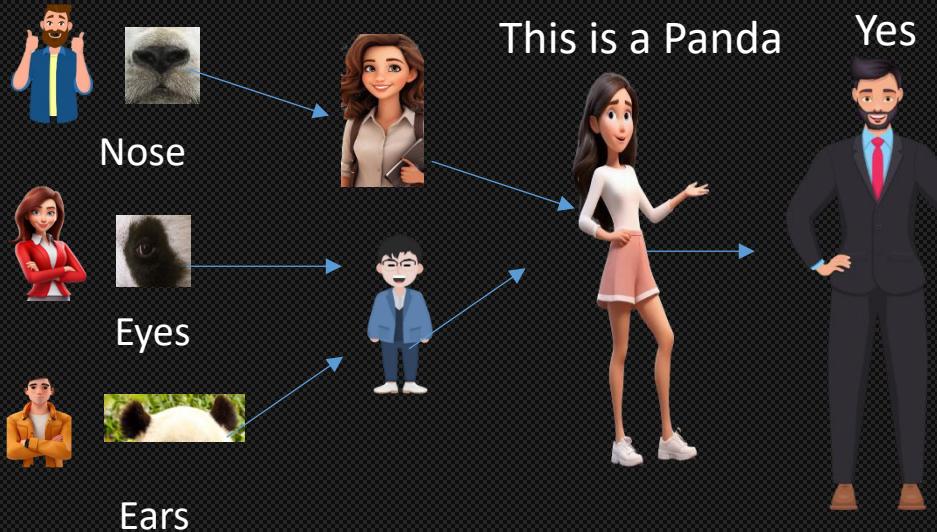


Ears



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model



Recognize  
panda face



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# Difference Between Deep Learning & Machine Learning

| Feature             | Machine Learning (ML)  | Deep Learning (DL)   |
|---------------------|--|--|
| Definition          | ML is a technique where computers learn from data to make predictions. | DL is a subset of ML that uses <b>neural networks</b> to learn from large amounts of data. |
| Data Dependency     | Works well with <b>small to medium</b> datasets.                       | Requires <b>huge</b> datasets for good performance.  |
| Feature Engineering | Humans manually select important features.                             | Learns important features automatically.   |
| Processing Time     | Faster for small datasets.   | Requires more time due to complex computations.  |
| Computation Power   | Can run on normal computers.   | Needs <b>GPUs/TPUs</b> for training deep models.   |
| Interpretability    | Easier to understand and interpret.                                    | Works like a "black box" (hard to interpret).  |
| Best for            | Structured data (Excel, CSV, tables).                                  | Complex tasks like images, speech, and text processing.                                    |

## Image Recognition

### •Machine Learning:

- Uses algorithms like **SVM, Random Forest**.
- Needs manual feature extraction (edges, colors, textures).

### •Deep Learning:

- Uses **CNN (Convolutional Neural Networks)**.
- Learns patterns automatically and performs better on complex images.



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# Important topics of Deep learning

## 1. Basics of Deep Learning

- What is Deep Learning?
- Difference between Machine Learning and Deep Learning
- Neural Networks and their working
- Activation Functions (ReLU, Sigmoid, Tanh, Softmax)

## 2. Neural Networks

- Perceptron and Multi-Layer Perceptron (MLP)
- Forward and Backpropagation
- Gradient Descent and Optimizers (SGD, Adam, RMSprop)
- Loss Functions (Cross-Entropy, MSE, Huber Loss)

## 3. Deep Learning Frameworks

- TensorFlow
- PyTorch
- Keras

## 4. Convolutional Neural Networks (CNNs) – For Image Processing

- Filters and Kernels
- Feature Maps and Pooling Layers
- CNN Architectures (AlexNet, VGG, ResNet, EfficientNet)
- Transfer Learning



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# Important topics of Deep learning

## 5. Recurrent Neural Networks (RNNs) – For Sequential Data

- RNN Basics and Challenges (Vanishing Gradient Problem)
- Long Short-Term Memory (LSTM)
- Gated Recurrent Units (GRU)
- Applications in NLP and Time-Series Forecasting

## 7. Generative Models

- Autoencoders
- Generative Adversarial Networks (GANs)

## 9. AI Deployment & Optimization

- Model Deployment (Flask, FastAPI, TensorFlow Serving)
- Model Optimization (Pruning, Quantization)
- AI on Edge Devices (TensorFlow Lite, ONNX)

## 6. Natural Language Processing (NLP) with Deep Learning

- Word Embeddings (Word2Vec, GloVe, FastText)
- Transformers (BERT, GPT)
- Attention Mechanism and Seq2Seq Models
- Sentiment Analysis, Chatbots, and Speech Recognition

## 8. Advanced Topics

- Self-Supervised and Semi-Supervised Learning
- Deep Reinforcement Learning
- Meta-Learning
- Explainable AI (XAI)



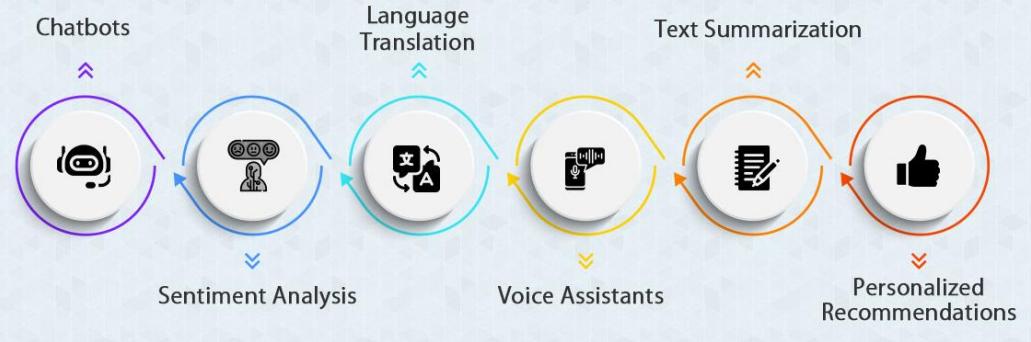
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# Natural Language Processing (NLP)

Natural Language Processing (NLP) is a branch of artificial intelligence (AI) that enables computers to understand, interpret, and generate human language. It allows machines to process and analyze vast amounts of natural language data, such as text and speech.

## Applications of NLP in Communication



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## Evolution of NLP

NLP has evolved over the years from simple rule-based methods to advanced deep learning techniques:

- 1. Rule-Based Systems (1950s-1980s):** Early NLP relied on hand-crafted rules and dictionaries.
- 2. Statistical Methods (1990s-2010s):** Machine learning models like Hidden Markov Models (HMMs) and Support Vector Machines (SVMs) improved NLP accuracy.
- 3. Deep Learning & Transformers (2015-Present):** Models like Word2Vec, LSTMs, and Transformers (BERT, GPT) revolutionized NLP by achieving human-like language understanding.



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## NATURAL LANGUAGE PROCESSING

## PLATFORM PROVIDERS



## SOFTWARE PROVIDERS



## END USERS



## SERVICE PROVIDERS



## FRAMEWORK &amp; TOOLKIT PROVIDERS

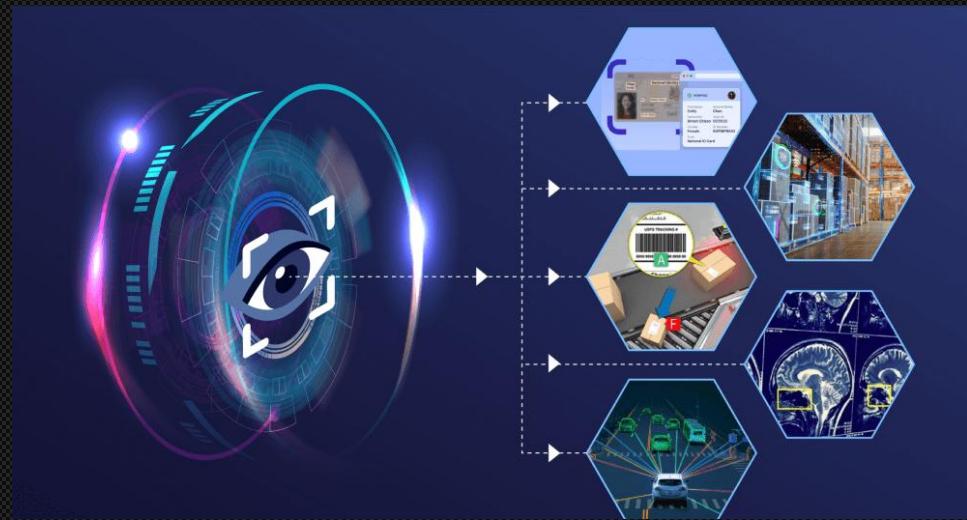


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## Computer Vision

**Computer Vision (CV)** is a field of **Artificial Intelligence (AI)** that enables machines to interpret and understand visual data from images or videos, just like humans. It allows computers to recognize patterns, detect objects, and analyze scenes.



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## Computer Vision

### Evolution of Computer Vision

The field has evolved significantly over time:

**1. 1960s-1980s:** Early computer vision systems relied on basic image processing and edge detection.

**2. 1990s-2010s:** Introduction of Machine Learning (ML) techniques like Support Vector Machines (SVMs) and Convolutional Neural Networks (CNNs).

**3. 2012-Present:** Deep learning revolutionized CV, especially with **AlexNet** in 2012, followed by **ResNet, YOLO, and Transformers (ViTs)**.



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## LLM (Large Language Model)

**LLM (Large Language Model)** ek **AI model** hai jo **bahut bade text datasets** se train kiya jata hai aur **human-like text generate** kar saka hai

**Example:**

- **ChatGPT, Google Gemini, Claude, Llama**
- **AI Chatbots (Siri, Alexa, Bard)**
- **Code generation (GitHub Copilot)**



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## What is needed to build an LLM ?

### 1) Data (Bahut Sara High-Quality Data)

- LLM ko train karne ke liye bahut saare text datasets chahiye.
- Example: Common Crawl, OpenWebText, Wikipedia, Code datasets

### 2) Neural Network Architecture (Transformer Model)

- LLMs Transformer-based models ka use karte hain, jaise:
- GPT (Generative Pre-trained Transformer)
- BERT (Bidirectional Encoder Representations from Transformers)
- T5 (Text-to-Text Transfer Transformer)



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## What is needed to build an LLM ?

### 3) Powerful Hardware (GPUs & TPUs)

- LLM ko train karne ke liye **bahut powerful GPUs ya TPUs** ki zaroorat hoti hai.
- **Example:** NVIDIA A100, H100 GPUs ya Google TPUs

### 4) Training Algorithms

- LLMs ko **unsupervised learning** aur **self-supervised learning** se train kiya jata hai.

#### • Techniques:

- **Masked Language Modeling (MLM)** – BERT ke liye
- **Causal Language Modeling (CLM)** – GPT ke liye
- **Reinforcement Learning from Human Feedback (RLHF)** – LLM ko better responses dene ke liye fine-tune karta hai.



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## What is needed to build an LLM ?

### 5. Optimization Techniques

- Gradient Descent aur Backpropagation se models optimize kiye jate hain.
- Fine-tuning & Transfer Learning se LLMs ko specific tasks ke liye improve kiya jata hai.

### 6. Deployment & Scaling

- LLMs ko APIs aur cloud platforms par deploy kiya jata hai.
- Example: OpenAI API, Hugging Face, Google Cloud AI, AWS, Azure AI



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