

1. Artificial Intelligence (AI)

- **AI = Artificial Intelligence** → machines ko human-like intelligence dena, so they can **think, learn, solve problems, aur decisions le sakte hain**.
- **Goal:** human brain jaisa behavior replicate karna.

Types of AI:

1. **Narrow AI (Weak AI)** → specific task, e.g., Siri, ChatGPT, Face ID
2. **General AI** → human-level intelligence, any task, future concept
3. **Super AI** → humans se zyada intelligent, mostly sci-fi

Subsets of AI:

- Machine Learning (ML)
- Deep Learning (DL)
- Natural Language Processing (NLP)
- Computer Vision (CV)
- Robotics / Expert Systems

2. Everyday Applications of AI

AI humare daily life me har jagah hai:

- **Face ID / Fingerprint** → recognize kar ke unlock karta hai
- **Voice Assistants (Siri, Alexa, Google Assistant)** → commands samajhta hai, answers deta hai
- **ChatGPT / Claude** → text generation, Q&A
- **Recommendations (Amazon, Netflix)** → likes/dislikes ke basis pe suggest karta hai
- **Maps / Uber** → routes optimize aur ETA calculate
- **Coding AI (GitHub Copilot)** → code suggest karta hai

3. Core AI Concepts

What is AI?

- Machines that **think, learn, predict, aur decisions le sakti hain**.

Pattern Recognition

- AI **patterns detect karta hai** in data.
- Example: Gmail spam filter → emails ke patterns detect karke spam/ham classify karta hai

Speech Recognition

- Voice ko **text me convert** karna
- Example: Google Assistant, transcription services

Computer Vision (CV)

- Images/videos ko **analyze karna, objects detect karna, faces pehchanna**
- Example: Face ID, self-driving cars, MRI scan analysis



4. Machine Learning (ML)

- ML = AI ka subset jaha machine **data se seekhta hai**, instead of manually coding rules

ML vs Rule-Based

- **Rule-based:** agar-then statements
- **ML:** machine khud patterns identify karke rules create karti hai

ML Categories:

1. **Supervised Learning** → labelled data
 - Regression → continuous output (house price)
 - Classification → categories (spam/ham)
2. **Unsupervised Learning** → unlabelled data
 - Clustering → group similar data (customer segmentation)
 - Association → items frequently bought together
3. **Reinforcement Learning** → agent rewards/penalties se seekhta hai
 - Example: Chess AI, Game bots

Popular Algorithms

- **Linear Regression** → continuous prediction
- **Logistic Regression** → yes/no prediction
- **Decision Tree / Random Forest** → decision-making

- **SVM** → best boundary to separate categories
- **XGBoost** → high-accuracy tree-based model

5. Deep Learning (DL)

- Subset of ML jo **neural networks** pe based hai
- Can handle **complex data** like images, audio, text
- DL uses **multiple layers to process data deeply**

6. Neural Networks (NN)

Structure:

- **Input Layer:** raw data aata hai
- **Hidden Layers:** complex patterns learn hote hain
- **Output Layer:** final result generate

Learning Components:

- **Weights & Biases:** decide karte hai kaunse input important hai
- **Forward Propagation:** prediction
- **Backpropagation:** error se learning

Key Architectures:

◇ **Feedforward Neural Network (FNN)**

- Simplest NN type
 - Data flows **one direction: input → hidden → output**
 - No loops, mostly used for **basic classification/regression**
 - Example: Predicting house prices
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◇ **Convolutional Neural Network (CNN)**

- **Best for images**
- Layers: Convolution → Pooling → Fully Connected
- Convolution layer: detect features like edges, textures
- Pooling layer: reduce size, retain important features

- Applications:
 - Image recognition (Face ID, cats vs dogs)
 - Object detection
 - Medical imaging
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◇ Recurrent Neural Network (RNN)

- **Sequence data ke liye**
 - Data **loops in hidden layers** → remembers past inputs
 - Example: Text prediction, speech recognition
 - Problem: Long-term dependencies forget ho jaati hain → solution = LSTM
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◇ Long Short-Term Memory (LSTM)

- Special type of RNN
 - Can **remember long-term dependencies**
 - Useful for:
 - Language modeling
 - Time-series forecasting
 - Speech & audio analysis
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◇ Transformers

- Modern architecture → replaces RNN/LSTM for NLP
 - Works on **attention mechanism** → focus on important words
 - Extremely powerful → used in:
 - GPT, Claude, Gemini, Llama
 - Machine translation, summarization, chatbots
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◇ Generative Adversarial Networks (GANs)

- Two networks: **Generator + Discriminator**
- Generator: creates fake data (images, text, audio)
- Discriminator: checks if data is real or fake

- Through competition → Generator becomes **very good at creating realistic data**
 - Applications:
 - AI art (MidJourney, DALL-E)
 - Deepfakes
 - Image super-resolution
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7. Generative AI (GenAI)

- Creates **new content** instead of just analyzing
 - Types:
 - Text → ChatGPT, Claude
 - Image → MidJourney, DALL-E
 - Audio → AI music generators
 - Video → AI video creation tools
 - Works by **learning huge datasets patterns**, then generate new outputs
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8. Large Language Models (LLMs)

- Trained on **massive text data**
 - Examples: GPT, Claude, Gemini, Llama
 - Can:
 - Generate human-like text
 - Answer questions
 - Summarize/translate text
 - Use **Transformer architecture**
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9. Computer Vision (Detailed)

- AI understands images/videos
- Tasks:

- Classification → identify what's in image
- Object detection → locate objects
- Segmentation → divide image into regions
- Applications:
 - Self-driving cars
 - Security cameras
 - Medical imaging

⚡ 10. Summary

Concept	What it does	Example
AI	Human-like intelligence	ChatGPT, Siri
ML	Learn from data	Spam filter
DL	Neural networks for complex data	Image recognition
FNN	Simple NN	House price prediction
CNN	Image processing	Face ID, cat/dog detection
RNN	Sequence data	Text prediction
LSTM	Long-term sequence memory	Time series, speech
Transformers	Focused on important features	GPT, Machine Translation
GANs	Generate realistic data	AI art, deepfakes
GenAI	New content creation	MidJourney, ChatGPT
LLMs	Large NLP models	GPT, Claude
CV	Image/video understanding	Self-driving, medical imaging
