

Introduction

- Definition of AI:- Artificial Intelligence (AI) means making computers or machines think and act like humans
- Definition of Big Data Analytics:- Big Data Analytics means looking at a huge amount of information to find useful patterns, trends, or insights
- Big Data Analytics is changing how society functions by helping governments, businesses, and communities make smarter decisions

Historical Context

- **1943** – First neural network model by McCulloch & Pitts
- **1950** – Turing proposes the *Turing Test*
- **1956** – Term "AI" coined at Dartmouth Conference
- **1997** – IBM's **Deep Blue** defeats chess champion Garry Kasparov
- **2012** – Deep Learning revolution with **ImageNet** victory
- **2016** – **AlphaGo** beats world Go champion
- **Now** – AI in real life: chatbots, self-driving cars, health, finance

Why Society Needs AI and Big Data

- **Big Data Analysis** – AI can process vast datasets to find patterns humans can't.
- **Medical Diagnosis** – AI systems detect diseases (e.g., cancer, diabetic retinopathy) faster and more accurately.
- **Natural Language Understanding** – Powers tools like ChatGPT, translation, and voice assistants.
- **Predictive Analytics** – Used in finance, weather forecasting, and business planning.

AI Applications

- Healthcare
- Education
- Agriculture
- Transportation
- Finance

AI in Healthcare

- Medical history
- Lab results
- Prescriptions
- Imaging (X-rays, MRIs)

AI in Education

- Tracks student progress in real time
- Adjusts difficulty level automatically
- Repeats tough topics, skips mastered ones
- Suggests next best topic to learn

AI in Agriculture

- Crop Monitoring – Drones & sensors detect plant health and pests
- Smart Irrigation – AI decides when and how much to water
- Soil Analysis – AI recommends fertilizers based on soil quality
- Yield Prediction – Predicts harvest quantity using weather & crop data
- Weed & Pest Control – AI spots and treats only affected areas

AI in Transportation

- Perception – Detects people, cars, traffic signals, and obstacles
- Decision-Making – Chooses when to stop, turn, or change lanes
- Navigation – Uses maps and GPS to plan routes
- Learning – Improves driving with data from past trips

AI in Finance

- Analyzes market trends, news, and stock data in real time
- Makes split-second decisions to trade at the best price
- Can run 24/7 without emotional bias
- Used by banks, hedge funds, and even retail investors

Environmental Monitoring

- Analyzes huge datasets from satellites, oceans, and weather stations
- Faster & more accurate predictions of storms, droughts, and temperature changes
- Identifies hidden climate patterns across decades of data
- Helps create real-time climate alerts and disaster response systems

Ethical Considerations

- AI systems use large amounts of personal data to learn and improve
- If not protected, it can lead to data leaks, identity theft, or misuse
- People must have control over how their data is collected and used

Challenges

- Keeps personal, financial, and business information safe
- Prevents hacking, data breaches, and ransomware attacks
- Ensures data stays private, accurate, and accessible only to the right people

Economic Impact

- E-commerce – Online buying/selling (e.g., Amazon, Flipkart)
- Digital Payments – UPI, Paytm, Google Pay
- Online Services – EdTech, FinTech, HealthTech
- Remote Work & Gig Platforms – Freelance jobs via platforms like Upwork, Uber

Social Impact

- Educates people on rights, safety, and responsibilities
- Helps prevent misinformation and harmful behavior
- Empowers citizens to make informed decisions
- Essential for public health, digital literacy, and climate action

Role in Pandemic Response

- Mobile apps & websites to report and view case updates
- Uses GPS & Bluetooth to trace contact with infected individuals
- Real-time dashboards to monitor case trends and hotspots
- Helps health officials with testing, isolation & vaccination plans

AI & Big Data in Law Enforcement

- CCTV Cameras – Public and private spaces
- Digital Surveillance – Monitoring internet use, GPS, and social media
- Biometric Monitoring – Face recognition, fingerprint scanning
- AI Surveillance – Detects unusual patterns in crowds or online behavior

AI in E-Commerce

- Tracks what users view, buy, or search
- Learns user patterns and predicts what they'll like next
- Recommends items in real time to improve user experience and sales
- Used by Amazon, Netflix, YouTube, Flipkart, etc.

Smart Cities Initiatives

- Sensors detect real-world data: temperature, motion, light, pressure, etc.
- Devices send this data to other devices or cloud systems
- AI can analyze and act on this data (e.g., turn off lights, send alerts)

Future Trends

- Speeds up machine learning and optimization tasks
- Handles massive datasets more efficiently
- Improves prediction accuracy in fields like drug discovery, finance, and climate modeling

Role of Government

- Protecting Citizens' Rights
 - Enforcing data privacy & cyber safety (via DPDP Act 2023)
 - Preventing misuse of AI in surveillance or bias
- Policy & Legal Frameworks
 - Developing national AI policies (via MeitY & NITI Aayog)
 - Ensuring AI systems are ethical, fair, and transparent
- Promoting Awareness
 - Digital India campaigns for digital literacy & safety
 - Training in schools and rural areas

Use-Case-1: Transportation & Logistics

- DHL:
Uses AI & Big Data to optimize delivery routes, predict package volumes, and reduce carbon emissions.
- FedEx:
Employs AI-driven logistics and data analytics to improve delivery times and enhance customer experience.

Use-Case-2: Energy Sector

- GE uses AI & Big Data to power its Digital Wind Farm platform, which improves turbine efficiency, reduces maintenance costs, and maximizes renewable energy generation

Use-Case-3: Telecommunications

- Automates network traffic balancing and load distribution
- Detects and resolves network faults in real time
- Enables self-healing networks using machine learning algorithms
- Optimizes signal strength and coverage based on user patterns

Use-Case-4: Entertainment & Media

- Analyzes user behavior, preferences, and watch history
- Recommends personalized content (movies, music, shows)
- Continuously learns and updates based on real-time data
- Improves user engagement and retention

Use-Case-5: Cybersecurity

- Monitors network traffic for anomalies and suspicious behavior
- Uses machine learning to identify new & evolving threats
- Automates incident detection & response
- Helps prevent data breaches, phishing, and malware attacks

Use-Case 6: Human Resources

- Scans and filters thousands of resumes quickly
- Matches candidates based on skills, experience, and keywords
- Removes human bias by focusing on objective criteria
- Speeds up shortlisting and improves hiring efficiency

Use-Case 7: Legal Industry

- Quickly scans large volumes of case laws, statutes, and legal documents
- Identifies relevant precedents and legal arguments
- Uses natural language processing (NLP) for accurate keyword/context matching
- Reduces time spent on manual research and increases precision

General AI vs Narrow AI

- General AI is a type of artificial intelligence that can think, learn, and solve problems like a human across many different tasks—not just one specific job.

General AI (Robot film)

- Learn anything a human can
- Transfer knowledge between tasks
- Understand context deeply
- Show creativity, common sense, and emotional intelligence

Narrow AI

- Narrow AI is a type of artificial intelligence that is designed to do one specific task very well — such as recognizing faces, recommending movies, or translating language.
- It cannot think or learn beyond its programmed function, unlike humans or General AI

Ex.OpenAI's GPT-4

- Understand and generate human-like language
- Solve math problems, write code, summarize legal documents, answer medical questions, and even compose poetry
- Works across multiple domains, learning patterns from massive datasets

Examples of Narrow AI

- Voice assistants (Siri, Alexa)
- Recommendation systems (Netflix, Amazon)
- Facial recognition
- Spam email filters

Current Status in the Real World

- Narrow AI is widely used in industry today
- General AI remains a theoretical goal under active research

Challenges in Achieving General AI

- Ethical implications
- Safety and control issues
- Massive computational power requirements
- Complex understanding of human cognition

Introduction to AI Fields

Image Processing

- Manipulation and analysis of visual data (images) to extract meaningful information
- Used in medical imaging, satellite imagery, object detection, and industrial automation

Tools for Image Processing

- OpenCV, PIL (Python Imaging Library), MATLAB, Scikit-Image

Computer Vision

- Enables machines to interpret and make decisions based on visual data (videos, images)
- Image Processing focuses on pixel-level changes; Computer Vision understands image content

Applications of Computer Vision

- Facial recognition, autonomous vehicles, surveillance systems, and AR/VR

Popular Libraries in CV

- OpenCV, TensorFlow, PyTorch, YOLO (You Only Look Once)

Robotics

- Design, construction, and operation of robots that perform tasks autonomously or semi-autonomously

Types of Robots

- Humanoid, Industrial, Autonomous Vehicles, Drones

Robotics Applications

- Manufacturing, healthcare surgery, military, space exploration

Natural Language Processing (NLP)

- Allows machines to understand, interpret, and generate human language

Tasks in NLP

- Text classification, sentiment analysis, translation, summarization, chatbots.

Popular NLP Tools

- spaCy, NLTK, GPT, BERT, HuggingFace Transformers

Career Map: AI & Big Data Analytics

Education Requirements

- Bachelor's degree in CS, IT, Math, Statistics, etc

Advanced Education

- Master's, PhD or Online Certifications in AI/ML, Data Science

Certifications

- Google AI, Microsoft Azure AI, IBM Data Science, Coursera, edX

Core Skills for AI Roles

- Python, R, TensorFlow, PyTorch, Statistics, Neural Networks

Core Skills for Big Data Roles

- Hadoop, Spark, SQL, NoSQL, Data Warehousing

Soft Skills

- Critical Thinking, Problem Solving, Communication, Teamwork

Role 1: Data Analyst

- Entry-level, focuses on interpreting and analyzing data patterns.

Role 2: Data Scientist

- Advanced analytics, machine learning, predictive modeling

Role 3: Machine Learning Engineer

- Build ML models, algorithms, and data pipelines

Role 4: AI Research Scientist

- Conduct research on new AI techniques and applications

Role 5: NLP Engineer

- Work with human language processing systems

Role 6: Computer Vision Engineer

- Work with image and video data for automation

Role 7: Data Engineer

- Build and maintain large-scale processing systems

Role 8: Business Intelligence Analyst

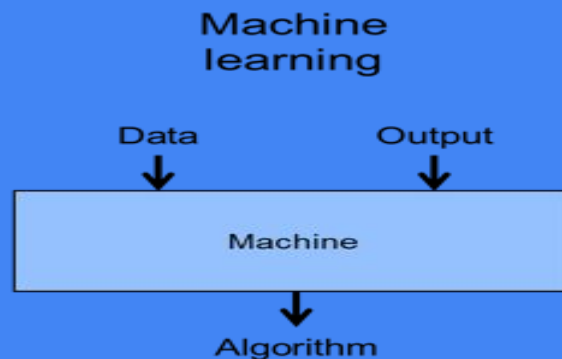
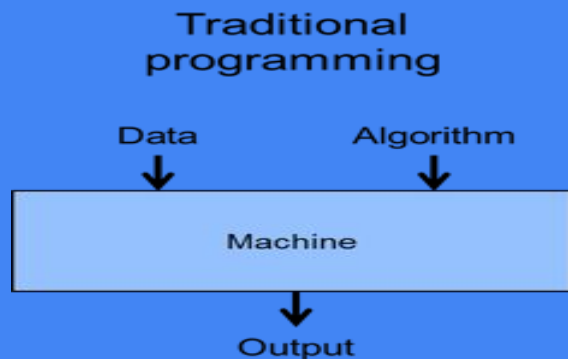
- Translate data into strategic business decisions

Job Search Platforms

- LinkedIn, Naukri, Kaggle Jobs, Upwork

Supervised vs Unsupervised vs Deep Learning

- Overview of Machine Learning Paradigms



What is Machine Learning?

- **Definition:-**Machine Learning (ML) is a branch of artificial intelligence (AI) that gives computers the ability to learn without being explicitly programmed

Types of ML

- 1) Supervised Learning
- 2) Unsupervised Learning
- 3) Reinforcement Learning

Supervised Learning

- **Definition:-** Supervised learning is a type of machine learning where the model is trained on a labeled dataset
- **Characteristics of Supervised Learning**
 - Mainly used in classification and regression
 - Common models include Linear Regression, Decision Trees, SVM, k-NN

Unsupervised Learning

- **Definition:-**Unsupervised learning is a type of machine learning where the model is trained on **unlabeled data**
- **Characteristics of Supervised Learning**
 - Mainly used in Clustering and Dimensionality Reduction
 - K-Means Clustering, Hierarchical Clustering, DBSCAN, PCA

Reinforcement Learning

- Definition:-Reinforcement learning (RL) is a type of machine learning where an agent learns to take actions in an environment to maximize cumulative rewards
- **Characteristics of Reinforcement Learning**
Game playing (e.g., AlphaGo), robotics, self-driving cars, automated trading

Examples of Supervised Learning

- Email Spam Detection
- Loan Prediction

Advantages of Supervised Learning

- High Accuracy
- Easy to Understand

Disadvantages of Supervised Learning

- Requires Labeled Data
- Expensive

Examples of Unsupervised Learning

- News Grouping
- Social Network Analysis
- Music Genre

Advantages of Unsupervised Learning

- No Labeled Data Needed

Disadvantages of Unsupervised Learning

- Hard to Interpret
- Lower Accuracy

Deep Learning

- **Definition:**-Deep learning is a subset of machine learning that uses artificial neural networks with multiple layers (deep neural networks) to model and learn complex patterns in large amounts of data
- **Characteristics of Deep Learning**
 - Performs best with large amounts of labeled data
 - Needs powerful GPUs or TPUs for training deep models.
 - Excellent for image recognition, speech translation, autonomous vehicles, etc.

Examples of Deep Learning

- Image Recognition
- Language Translation

Popular Deep Learning Algorithm

- AAN
- CNN
- RNN
- GAN