What is Machine Learning?

Machine Learning (ML) is a branch of artificial intelligence (AI) that enables computers to **learn from data** and make decisions without being explicitly programmed. It involves the use of algorithms that analyze patterns, recognize trends, and improve their accuracy over time.

Types of Machine Learning

Supervised Learning

1. The model is trained on labeled data (i.e., input-output pairs).
2. Example: Spam detection in emails (spam or not spam).
3. Algorithms: Linear Regression, Decision Trees, Random Forest, Neural Networks

Unsupervised Learning

1. The model learns from **unlabeled data** by finding hidden patterns.
2. Example: Customer segmentation in marketing.
3. Algorithms: Clustering (K-Means), Principal Component Analysis (PCA), Autoencoders.

Reinforcement Learning

1. The model **learns by trial and error**, receiving rewards or penalties.
2. Example: Self-driving cars, AlphaGo (game-playing AI).
3. Algorithms: Q-Learning, Deep Q Networks (DQN), Proximal Policy Optimization (PPO).

Applications of Machine Learning

✅ **Healthcare** – Disease prediction, medical image analysis
✅ **Finance** – Fraud detection, stock price prediction
✅ **E-commerce** – Recommendation systems (Amazon, Netflix)
✅ **Self-driving Cars** – Autonomous vehicle navigation
✅ **Natural Language Processing (NLP)** – Chatbots, speech recognition

How Machine Learning Works?

1. **Collect Data** – Gather training data (images, text, numbers, etc.).
2. **Train the Model** – Feed data into an ML algorithm.
3. **Make Predictions** – Use the trained model to analyze new data.
4. **Improve & Optimize** – Adjust parameters to enhance accuracy.

Popular ML Libraries & Tools

- **Python:** Scikit-learn, TensorFlow, PyTorch
- **Data Processing:** Pandas, NumPy
- **Visualization:** Matplotlib, Seaborn