

Introduction to Artificial Intelligence

Introduction to Artificial Intelligence (AI)

Quick reference guide – concise, organized, and easy to read.

1. What Is AI?

Definition	Key Idea
Artificial Intelligence	The field of computer science that creates systems capable of performing tasks that normally require human intelligence.
Goal	Enable machines to perceive, reason, learn, and act autonomously or with minimal human intervention.

2. Core Areas of AI

Area	Typical Tasks	Example Applications
Machine Learning (ML)	Learning patterns from data; making predictions	Spam detection, recommendation engines
Natural Language Processing (NLP)	Understanding and generating human language	Chatbots, sentiment analysis
Computer Vision	Interpreting visual information	Facial recognition, autonomous driving
Robotics	Physical interaction with the environment	Manufacturing robots, delivery drones
Planning & Reasoning	Solving problems through logical steps	Scheduling, game playing
Expert Systems	Encoding domain knowledge for decision support	Medical diagnosis, fault detection

3. Fundamental Concepts

3.1. Data ? Information ? Knowledge ? Wisdom (DIKW Pyramid)

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1. **Data** – Raw facts (e.g., sensor readings).
2. **Information** – Processed data (e.g., aggregated statistics).
3. **Knowledge** – Patterns and relationships (e.g., a model).
4. **Wisdom** – Insightful decisions based on knowledge.

3.2. Types of Learning

Type	Description	Typical Use
Supervised	Model learns from labeled examples (input/output pairs).	Image classification
Unsupervised	Model discovers structure in unlabeled data.	Customer segmentation
Semi-supervised	Small labeled set + large unlabeled set.	Speech recognition
Reinforcement	Agent learns via trial and error, receiving rewards/punishments.	Game playing, robotics

3.3. Model vs. Algorithm

- **Algorithm** – Procedure or set of rules (e.g., gradient descent).
- **Model** – The result of applying an algorithm to data (e.g., a trained neural network).

3.4. Evaluation Metrics

Task	Common Metric
Classification	Accuracy, Precision, Recall, F1 score, ROC AUC
Regression	Mean Squared Error (MSE), R^2
Clustering	Silhouette score, Adjusted Rand Index
Generation (NLP/vision)	BLEU, ROUGE, Inception Score, FID

4. Popular AI Techniques

Technique	Core Idea	When to Use
Linear / Logistic Regression	Simple linear mapping (or probability) from inputs to output.	Baseline models, interpretability needed.

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Technique	Core Idea	When to Use
Decision Trees & Random Forests	Hierarchical splitting of data; ensembles reduce variance.	Tabular data, mixed feature types.
Support Vector Machines (SVM)	Finds optimal separating hyperplane with margin maximization.	High-dimensional data, limited training samples.
Neural Networks (Deep Learning)	Stacked layers of nonlinear units learn hierarchical representations.	Images, speech, large text corpora.
Convolutional Neural Networks (CNNs)	Convolutions capture spatial patterns.	Computer vision, video analysis.
**Recurrent Neural Networks (RNNs) & Transformers		