ARTIFICIAL INTELLIGENCE
&
MACHINE LEARNING

SESSION NO : 1

INTRODUCTION

Course Title :	**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**
Course Code :	24AD2001
L-T-P-S Structure :	3-0-2-0
Credits :	4
Course Coordinator :	SIRIPURI DIVYA

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

SYLLABUS

CO1: Brief History & Paradigms: Symbolic AI, sub symbolic AI, machine learning, the rise of data-driven AI. Intelligent Agents: Rational agents, agent environments, PEAS framework. Problem Formulation: States, transitions, costs, search spaces, applications Classical Search: Uninformed (BFS, DFS, UCS, IDS);Informed (Greedy, A*); Admissible/consistent heuristics; Heuristic Search: Hill climbing, variants of hill climbing Constraint Satisfaction: CSPs, arc consistency, forward checking, backtracking, variable ordering. Game Playing: Minimax, alpha-beta pruning. AI Applications: Search in robotics, logistics, games, expert systems.

CO2: Mathematical & Statistical Foundations for ML : Linear Algebra: Vectors, matrices, matrix operations, Eigen decomposition, SVD. Calculus & Optimization: Derivatives, gradient descent, convexity, Taylor expansion, optimization objectives. Probability & Statistics: Distributions, expectation, variance, covariance, Bayes' theorem. Data Handling: Noise reduction methods (FFT, etc.), Outlier detection (box plot ,etc..), imputation (using (KNN, Measures of centrality, etc..), scaling(standardization , normalization ,etc..),encoding (one hot vector encoding, image and text embeddings), variable types (ordinal ,categorical) . Feature Engineering: elimination, aggregation, feature selection methods (mutual information, information gain, Fisher score, etc.). Model Selection: Under fitting and Over fitting, Bias-variance trade off, cross-validation, train/val/test splits, learning/validation curves.

CO3: **Supervised Machine Learning Algorithms:** Linear Models: Linear regression, logistic regression, regularization (ridge, lasso). Basic Models: Curse of Dimensionality, KNN, Decision Tree (training & Pruning algorithms) Support Vector Machines: Max-margin principle, soft margin, kernel trick (RBF, polynomial, sigmoid), hyper plane geometry. Ensemble Methods: Bagging, random forests, AdaBoost, stacking. Probabilistic Models: Gaussian Naive Bayes, Gaussian Processes (regression/classification), calibration and confidence. Evaluation: ROC, AUC, confusion matrix, F1, recall/precision, model explain ability.

CO 4: Unsupervised & Advanced ML + ML Automation Clustering: K-means, C-means, Fuzzy C-Means, GMM, hierarchical, DBSCAN, mean-shift, cluster validity metrics. Dimensionality Reduction: PCA, LDA, t-SNE, UMAP, manifold learning. Anomaly Detection: Isolation forests, LOF, one-class SVM, auto encoders (as preview). Automated ML: Pipeline automation (sklearn, PyCaret), experiment tracking (MLflow). Ethics, Fairness, Explainability: Bias sources, mitigation, transparency, human-in-the-loop.

EVALUATION COMPONENTS

Evaluation Type	Evaluation Component	Weightage/Marks		Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	Lab End Semester Exam	Weightage	16		90					16
		Max Marks	50							50
	End Semester Exam	Weightage	24		180	6	6	6	6	
		Max Marks	100			25	25	25	25	
In Semester Formative Evaluation Total= 24 %	Continuous Evaluation - Lab Exercise	Weightage	10		90					10
		Max Marks	120							120
	Home Assignment and Textbook	Weightage	6		90	1.5	1.5	1.5	1.5	
		Max Marks	40			10	10	10	10	
	ALM	Weightage	8		90	2	2	2	2	
		Max Marks	40			10	10	10	10	
In Semester Summative Evaluation Total= 36 %	Lab In Semester Exam	Weightage	8		90					8
		Max Marks	50							50
	Semester in Exam-II	Weightage	14		90			7	7	
		Max Marks	50					25	25	
	Semester in Exam-I	Weightage	14		90	7	7			
		Max Marks	50			25	25			

INTRODUCTION TO AI

Artificial Intelligence is composed of two words Artificial and Intelligence, where Artificial defines “Man-Made," and Intelligence defines “Thinking Power", hence AI means “A man-made thinking power."

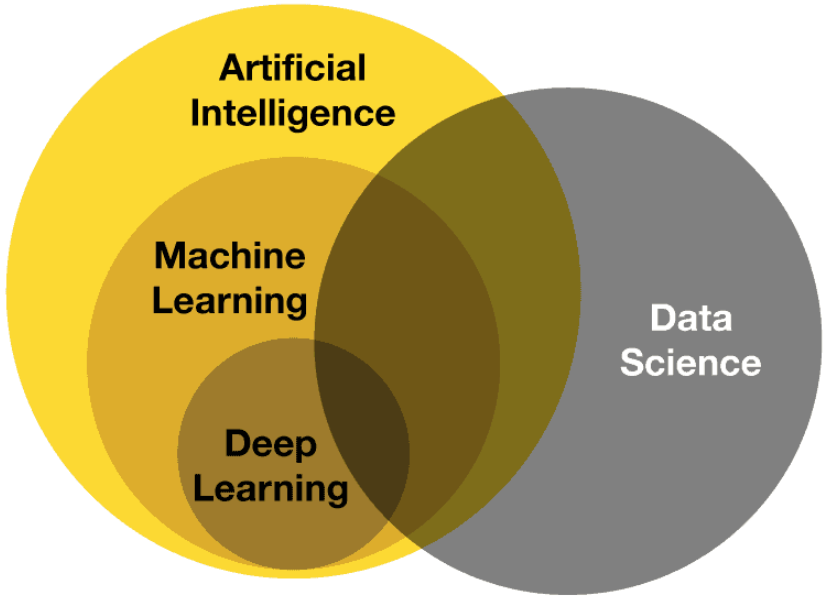
AI - DEFINITION

Artificial Intelligence (AI) refers to the simulation of human Intelligence in machines that are programmed to think and learn.

"It is a branch of computer science by which we can create intelligent machines which can behave like a human, think like human and able to make decisions."

ML - DEFINITION

Machine Learning (ML) is a Subset of Artificial intelligence (AI) that enables systems to learn from data and improve their performance on a specific task over time, without being explicitly programmed.



ML algorithms identify patterns and make predictions or decisions based on the data they've been trained on.

HISTORY OF AI

The Birth of AI (1950s): Alan Turing

Introduced the Turing Test and Proposed the idea of a "Computing Machinery and Intelligence“

1956: Dartmouth Conference

John McCarthy Who coined the term in 1956, defines it as “The Science and Engineering of making intelligent machines, especially intelligent computer programs.”

HISTORY OF AI

The Golden Years (1960-1970)

Optimism and Progress:

ELIZA (1966): Created by Joseph Weizenbaum, a natural language processing computer program that simulated conversation.

Shakey the Robot (1966-1972): First general-purpose mobile robot able to reason about its actions.

Early AI Applications: Development of systems for medical diagnosis, symbolic mathematics, and chess playing.

HISTORY OF AI

The Rise of Modern AI (2000s-Present)

Machine Learning: Rise of new algorithms and techniques for data-driven learning.

Big Data & Improved Algorithms: Enhanced computational power and access to large datasets.

Key Innovations:

Deep Learning: Use of deep neural networks for image and speech recognition.

AI in Everyday Life: Virtual assistants (Siri, Alexa), autonomous vehicles, recommendation systems.

Milestones:

IBM Watson (2011): Won Jeopardy! against human champions.

AlphaGo (2016): Developed by DeepMind, defeated the world champion Go player

APPLICATIONS OF AI

1. Game Plying
2. Medical Diagnosis, Autonomous Control
3. Autonomous Planning and Scheduling
4. Expert Systems
5. Robotics
6. Natural Language Processing
7. Computer Vision
8. e- Commerce
9. Agriculture
10. Finance

Applications of AI in Healthcare

Diagnostics:

Medical Imaging: AI algorithms analyze X-rays, MRIs, and CT scans to detect diseases like cancer, fractures, and infections.

Pathology: AI systems assist in examining tissue samples for accurate diagnosis.

Personalized Medicine: AI analyzes patient data to tailor treatments to individual genetic profiles and health histories.

Robotic Surgery: Robots like da Vinci Surgical System enhance precision in complex surgeries, reducing recovery times and improving outcomes.

Drug Discovery: AI accelerates the process of discovering new drugs by predicting molecular interactions and potential side effects.

Applications of AI in Smart Homes and Cities

Home Automation: AI controls home devices such as lights, thermostats, and security systems for convenience and energy efficiency.

Smart Grids: AI optimizes energy distribution and usage in power grids, enhancing sustainability.

Urban Planning: AI analyzes data on traffic, pollution, and population to improve city planning and infrastructure.

Applications of AI in Education

Personalized Learning: AI systems adapt educational content to the learning pace and style of individual students.

Tutoring Systems: AI-powered tutors provide additional support and resources to students outside of the classroom.

Administrative Tasks: AI automates grading, scheduling, and other administrative tasks, freeing up time for educators.

Applications of AI in Transportation

Autonomous Vehicles: AI powers self-driving cars by processing data from sensors and cameras to navigate safely.

Traffic Management: AI systems analyze traffic patterns to optimize signal timings and reduce congestion.

Logistics and Supply Chain: AI optimizes routes for delivery trucks, manages inventory levels, and predicts demand.

Applications of AI in Agriculture

Precision Farming: AI analyzes data from soil sensors, weather forecasts, and crop health to optimize farming practices.

Crop Monitoring: Drones equipped with AI analyze aerial images to detect diseases and pests in crops.

Yield Prediction: AI models predict crop yields, helping farmers make informed decisions about planting and harvesting.

Applications of AI in Finance

Fraud Detection: AI systems monitor transactions in real-time to identify suspicious activities and prevent fraud.

Algorithmic Trading: AI algorithms analyze market data and execute trades at high speeds, optimizing investment strategies.

Risk Management: AI assesses credit scores and loan eligibility, helping financial institutions manage risks.

Customer Service: Chatbots and virtual assistants handle customer inquiries, providing efficient and accurate responses.

Self Assessment Questions

1. AI Technology makes the machines to ……

(a) Act like Human…
(b) Think like Human…
(c) Speak like Human…
(d) All the above …

2. AI is a rapidly evolving field with vast potential to transform numerous aspects of society

(a) True
(b) False

REFERENCE BOOKS AND WEB LINKS

Text Books:

1) Russel and Norvig, 'Artificial Intelligence', third edition, Pearson Education, PHI, (2015)
2) Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3nd Edition, Tata McGraw Hill Edition, Reprint (2008)

Web links:

1. https://www.geeksforgeeks.org/agents-artificial-intelligence/
2. https://www.simplilearn.com/what-is-intelligent-agent-in-ai-types-function-article
3. https://www.javatpoint.com/turing-test-in-ai
4. https://www.geeksforgeeks.org/turing-test-artificial-intelligence/
5. https://www.section.io/engineering-education/turing-test-in-ai/