Artificial Intelligence Foundations

Module 1: Introduction to Artificial Intelligence

- What is AI?
- History & Evolution of AI
- Branches of AI
- Applications of AI (Healthcare, Finance, Robotics, etc.)
- AI vs ML vs DL
- Ethics in AI
- Turing Test and Rational Agents

Module 2: Intelligent Agents

- Definition and Types of Agents
- Structure of Intelligent Agents
- PEAS Framework (Performance measure, Environment, Actuators, Sensors)
- Agent Environments (Fully vs Partially Observable, Deterministic vs Stochastic)

Module 3: Problem Solving & Search Techniques

- Uninformed Search
  - Breadth-First Search (BFS)
  - Depth-First Search (DFS)
  - Uniform Cost Search
  - Depth-Limited, Iterative Deepening
- Informed (Heuristic) Search
  - Greedy Best-First Search
  - A* Search Algorithm
  - Heuristics and Admissibility
- Adversarial Search
  - Game Playing: Minimax Algorithm
  - Alpha-Beta Pruning
  - Evaluation Functions

Module 4: Knowledge Representation & Reasoning

- Propositional Logic
- First-Order Predicate Logic
- Inference Rules
- Resolution & Unification
- Semantic Networks, Frames
- Ontologies

Module 5: Planning

- Classical Planning
- STRIPS Representation
- Partial Order Planning
- Hierarchical Task Networks (HTN)

Module 6: Machine Learning (ML) Basics

- Supervised, Unsupervised, Reinforcement Learning
- Regression and Classification
- Decision Trees, KNN, Naive Bayes
- Clustering (K-Means, Hierarchical)
- Model Evaluation Metrics (Accuracy, Precision, Recall, F1)

Module 7: Natural Language Processing (NLP)

- Text Preprocessing (Tokenization, Lemmatization)
- Part-of-Speech Tagging
- Named Entity Recognition (NER)
- Bag of Words, TF-IDF
- Word Embeddings (Word2Vec, GloVe)
- Sentiment Analysis
- Chatbots and Transformers (Intro)

Module 8: Expert Systems

- Definition and Architecture
- Rule-Based Systems
- Inference Engine
- Forward and Backward Chaining
- Applications in Medicine, Legal, etc.

Module 9: Robotics

- Introduction to Robotics & AI
- Path Planning
- Sensors and Perception
- Robot Kinematics and Control
- Localization and Mapping (SLAM basics)

Module 10: Fuzzy Logic

- Crisp vs Fuzzy Sets
- Membership Functions
- Fuzzy Rules and Inference
- Fuzzy Decision Making

- Applications in Control Systems

Module 11: Artificial Neural Networks (ANN)

- Biological Neuron vs Artificial Neuron
- Perceptron and Multi-Layer Perceptron
- Activation Functions
- Backpropagation Algorithm
- Introduction to Deep Learning

Module 12: Reinforcement Learning

- Markov Decision Processes (MDPs)
- Q-Learning and SARSA
- Exploration vs Exploitation
- Policy Learning

Module 13: AI Tools and Platforms

- Python Libraries: NumPy, Pandas, Scikit-learn, TensorFlow, Keras, OpenCV
- Tools: Jupyter Notebook, Colab
- Platforms: IBM Watson, Google Cloud AI, Microsoft Azure AI

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