Artificial Intelligence Course Overview: My Path to Intelligent Systems

Explore the fascinating world of Artificial Intelligence, from foundational theories to practical applications. This course will equip you with the knowledge and skills to build intelligent systems. This presentation will provide an overview of the concepts of the course, Algorithm, and practical applications covered during jan - june 2025 session, led by instruction **Razorshi Prozzal Talukder**, presented by **Abu Bokor**(0562310005101004).

What is Artificial Intelligence?

Theory: The Core of AI

AI is the field dedicated to creating machines that mimic human intelligence. It enables computers to learn, solve problems, perceive, and understand language.

- **Definition:** Building smart machines capable of human-like tasks.
- **Applications:** Robotics, recommendation systems, self-driving cars, healthcare, finance.

Lab: AI in Action

We'll dive into real-world AI applications through compelling case studies and videos, showcasing how AI transforms industries.

Intelligent Agents: Sensing and Acting

Agents Defined

An agent is anything that perceives its environment through sensors and acts upon that environment using actuators.

Simple Reflex Agents

Act based only on the current perception, with no memory of past states.

Model-Based Agents

Maintain an internal model of the world to better understand their environment.

Goal & Utility-Based Agents

Goal-based agents aim for specific outcomes, while utility-based agents optimize for success or "happiness."

In the lab, we classified agents in real-world scenarios and wrote basic logic for simple agent behaviors.

Navigating with Search Algorithms

Search algorithms are fundamental to AI problem-solving, enabling agents to find paths and solutions efficiently.

Uninformed Search (Blind)

- **BFS:** Explores level by level, guarantees shortest path.
- **DFS:** Explores deep first, memory efficient.
- **IDS:** Combines DFS space efficiency with BFS completeness.
- **Bidirectional:** Searches from both ends, faster for long paths.

Lab: Implemented BFS and DFS in Python to solve maze and pathfinding puzzles.

Informed Search (Heuristic)

- **Heuristics:** Rules of thumb to guide search, improving efficiency.
- **Best-First:** Uses heuristics to always pick the most promising path.
- **AO* & Beam Search:** Advanced techniques for complex problems and resource limits.

Lab: Implemented Best-First Search, visualizing how different heuristics influence path discovery.

Game Playing & Constraint Satisfaction

Adversarial Search

Minimax

A decision rule used in turn-based games for optimal play, assuming a rational opponent.

Alpha-Beta Pruning

An optimization technique for Minimax, drastically reducing the number of nodes evaluated.

Lab: We built a Tic Tac Toe AI with Minimax and optimized it using Alpha-Beta Pruning.

Constraint Satisfaction Problems

Defining CSPs

Problems where variables must satisfy specific conditions (e.g., Sudoku, map coloring).

Solving Techniques

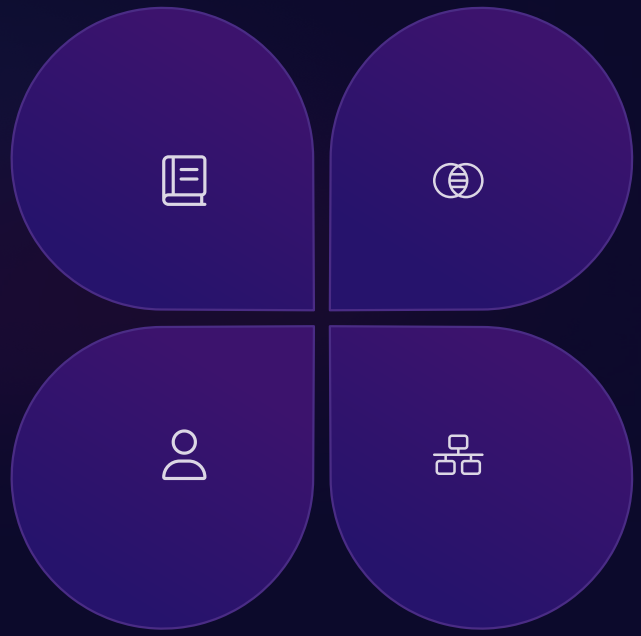
Methods include Backtracking, Branch and Bound, and ensuring various levels of consistency.

Lab: Solved the Graph Coloring problem, implementing backtracking with real-time constraint checking.

Knowledge & Probabilistic Reasoning

Knowledge Representation

Structuring facts and rules to allow AI systems to understand and infer.



Reasoning

Using logical inferences from represented knowledge to solve problems.

Likelihood & Fuzzy Logic

Estimating data probability and handling ambiguity with partial truths.

Bayesian Networks

Graphical models representing probabilistic relationships between variables.

Lab: Converted logical statements, designed Bayesian Networks, and built fuzzy logic rules to tackle uncertainty.

Natural Language Processing & Robotics

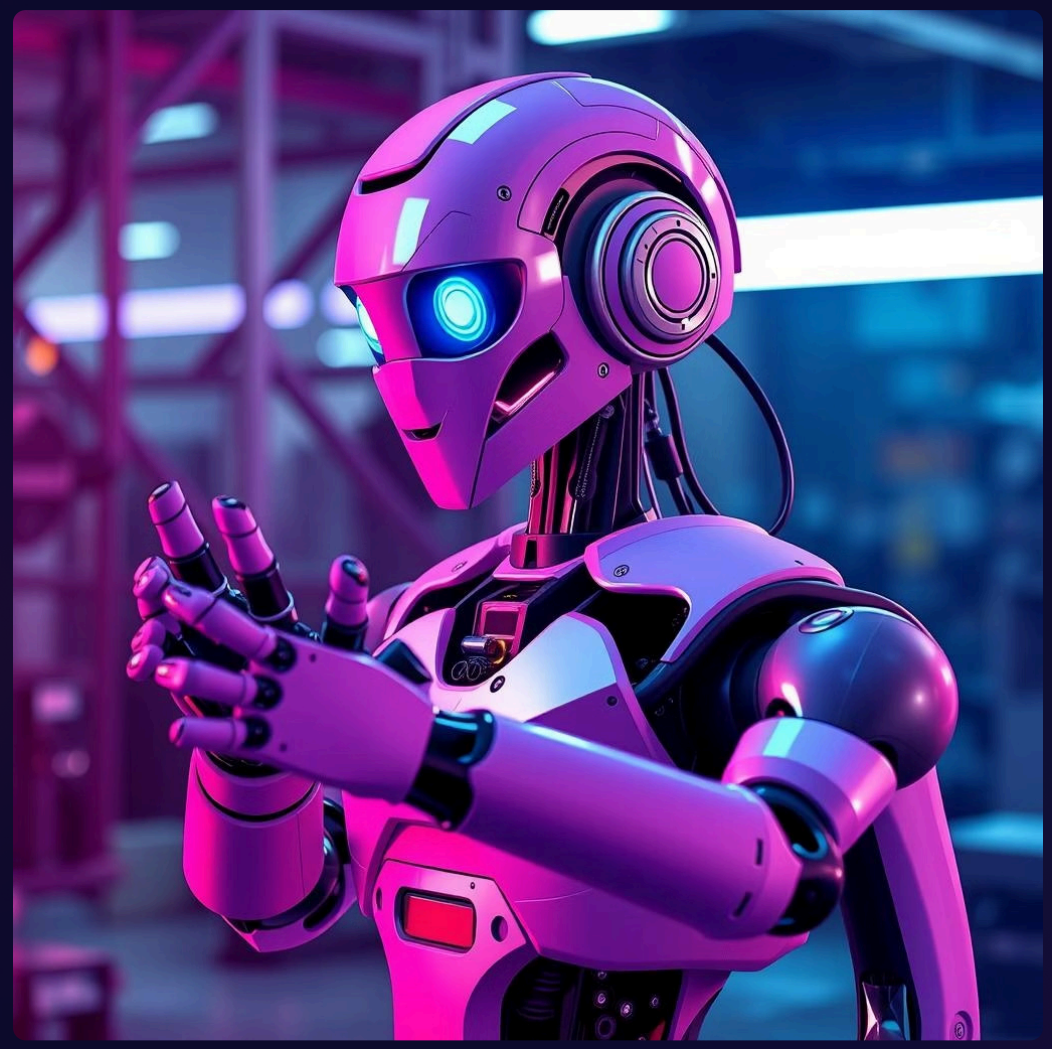
Natural Language Processing (NLP)

NLP empowers computers to understand, interpret, and generate human language, driving applications like chatbots and translation services.

- **Precision:** True Positives / (True Positives + False Positives)
- **Recall:** True Positives / (True Positives + False Negatives)

Lab: Built a basic keyword classifier and analyzed its performance using precision and recall.

Robotics



Robotics focuses on how robots sense their environment, plan actions, and execute them physically.

- **Sensors:** Gather information (e.g., cameras, IR, touch).
- **Actuators:** Enable movement and physical interaction (e.g., motors, grippers).

Lab: Simulated robot logic, including line-following behaviors and sensor-driven decision-making.

Course Conclusion: Your AI Journey

Integrated Learning

This course brought together diverse AI concepts, from theory to practical application, culminating in mini-projects.

Hands-On Mastery

You've gained hands-on experience by implementing algorithms and building working AI models.

Real-World Readiness

You are now equipped with the fundamental understanding and practical skills to connect AI theory with real-life challenges.

Ready to continue building the future with AI!