Introduction to AI

Exploring the Foundations & Applications of AI

Marine Biology 340

Undergraduate Lecture

The Dawn of a New Era

Artificial Intelligence is rapidly reshaping our world, moving from science fiction to fundamental reality. This presentation explores the core concepts that define AI, its problem-solving capabilities, and its role in modern applications.

$1.8T

Projected AI Market by 2030

A significant leap, underscoring AI's transformative economic impact.

Intelligent Agents

Perceive, Think, Act

Defining Intelligent Agents

AI Defined

Machines mimicking human cognitive functions like learning, reasoning, and problem-solving.

Intelligent Agents

Autonomous entities designed to perceive their environment and act to achieve specific goals efficiently.

Optimization

Agents continuously improve performance based on sensory inputs, internal state, and feedback from actions.

Real-world Examples

Self-driving Cars

Perceive roads, obstacles, and traffic; act to navigate safely.

Robotic Vacuums

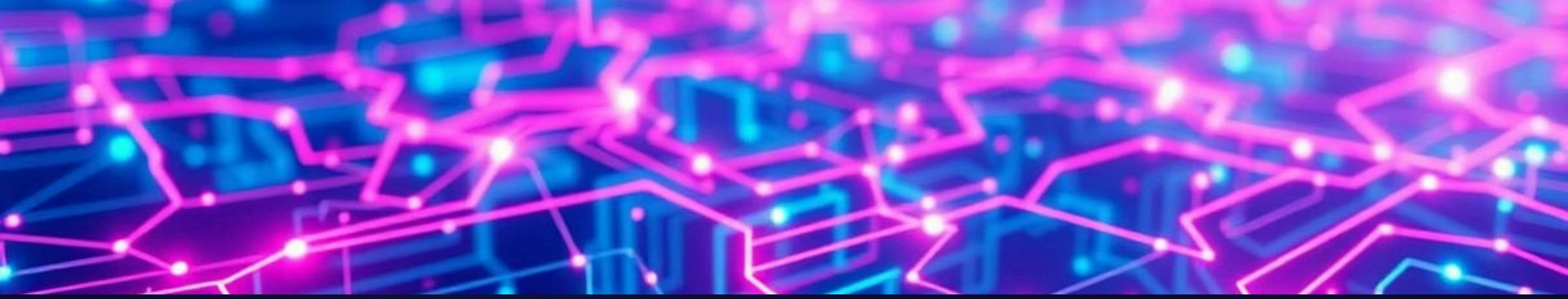
Map rooms, detect dirt, and clean autonomously (e.g., Roomba).

Chatbots

Process language inputs, understand intent, and generate relevant responses.

Solving Problems by Searching

Uninformed & Informed Strategies



Uninformed Search Strategies

Problem-solving in AI involves finding optimal action sequences to reach desired goals. Uninformed search methods explore the problem space systematically without domain-specific knowledge.

Breadth-First Search (BFS)

Explores layer by layer, finding the shortest path in unweighted graphs. It is complete and optimal.

Depth-First Search (DFS)

Explores as deep as possible along each branch before backtracking. Memory efficient for large trees.

Informed Search Strategies

Informed search leverages domain knowledge, often through heuristic functions, to guide the search more efficiently towards the goal state.

Heuristic Function

Estimates the cost from the current state to the goal, helping prioritize promising paths.

A* Search

Optimal and complete for many problems, combining cost-to-date with heuristic estimates for efficient pathfinding.

AO* Search

Designed for AND/OR graphs, efficiently solving decomposable problems such as planning and theorem proving.

Adversarial Search

AI in Games

Adversarial Search & Game AI

Adversarial search focuses on multi-agent decision-making in competitive environments where agents aim to maximize their own utility while minimizing their opponents'.

Min-Max Algorithm

An optimal strategy for two-player zero-sum games, assuming both players play optimally.

Alpha-Beta Pruning

An optimization technique for Min-Max, significantly reducing the number of nodes evaluated by pruning branches that cannot influence the final decision, often by 99% in complex games.

AI in Games: Mastering the Board

Tic-Tac-Toe

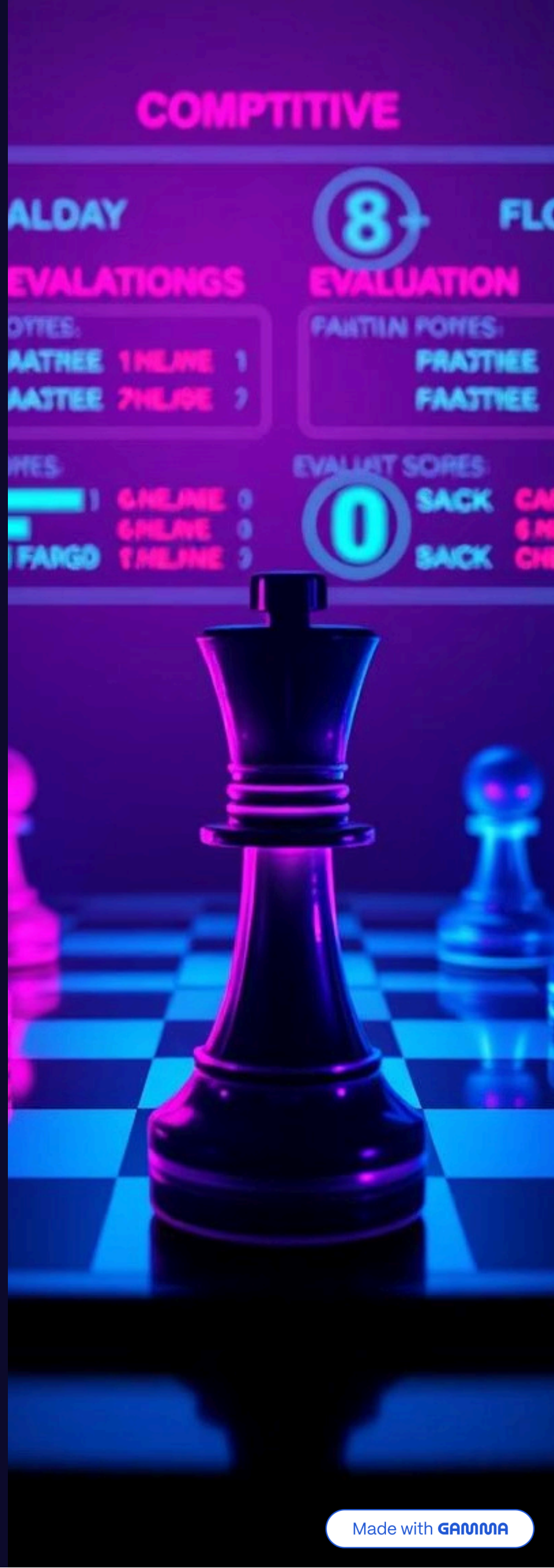
A classic simple example of Min-Max application.

Chess

Showcased by Deep Blue and Stockfish, advanced chess engines demonstrate AI's mastery of complex strategic games.

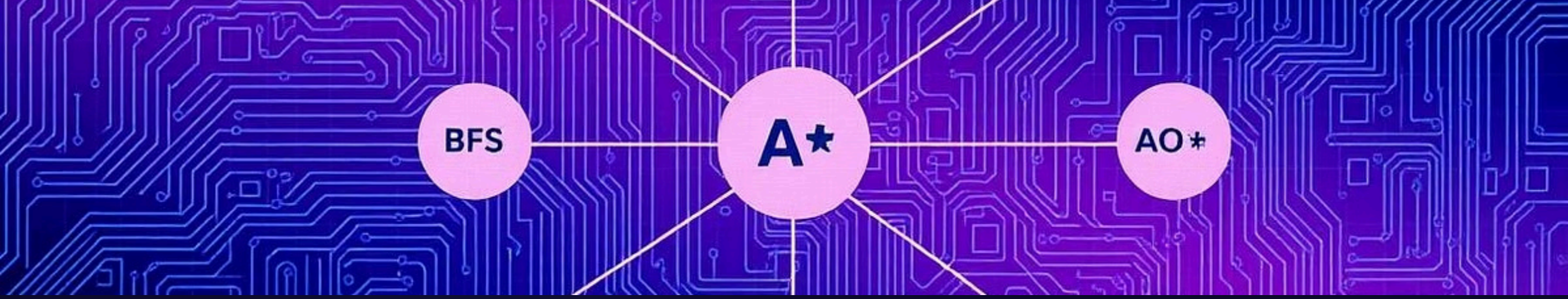
Advanced Engines

Modern game AIs often combine search with machine learning for unparalleled performance.



Core Lab Algorithms

Foundations of AI Practice



The Bedrock of AI Applications

These fundamental algorithms form the backbone of countless AI systems, enabling diverse functionalities from navigation to strategic decision-making.

DFS & BFS

Essential for efficient graph traversal and systematic exploration of state-spaces in problem-solving.

A* & AO*

Critical for intelligent pathfinding, complex problem decomposition, and robust planning in dynamic environments.

Min-Max & Alpha-Beta

Indispensable for developing strong decision-making capabilities in competitive scenarios and advanced game AI.

AI Tools, Challenges & Learnings

Navigating the AI Landscape

AI Tools in Practice

1. **SlidesGPT:** AI-powered presentation generation.
2. **Canva:** AI design assistance for various visuals.
3. **Pictory:** AI for quick video content creation.
4. **ElevenLabs:** Advanced voice synthesis for realistic audio.

AI tool market grew **40% in 2023**, reflecting rapid adoption.

Challenges & Learnings

1. **Data Bias:** Ensuring fair and representative datasets.
2. **Ethical Dilemmas:** Addressing moral implications of AI deployment.
3. **Computational Demands:** Managing significant resource requirements.
4. **Learnings:** Prioritizing data quality, model interpretability, and responsible AI development.

Conclusion & Future Scope

The Path Forward for AI

AI has evolved significantly from theoretical foundations to practical, impactful applications that are already transforming daily life and industries.

1

Continuous Innovation

New capabilities constantly emerge, pushing boundaries and raising new ethical questions.

2

Explainable AI (XAI)

A key focus to make AI decisions transparent and understandable.

3

General AI (AGI) Research

The pursuit of human-level intelligence remains a long-term goal.

4

Personalized AI Systems

Tailoring AI to individual needs and preferences for enhanced utility.

> AI will continue to reshape industries and human interaction, demanding thoughtful development and deployment.