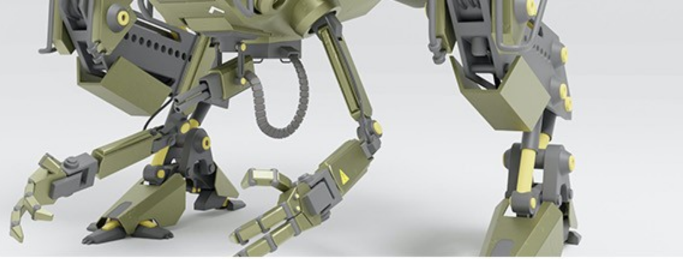
UNIT III

Adeversarial Search and Games

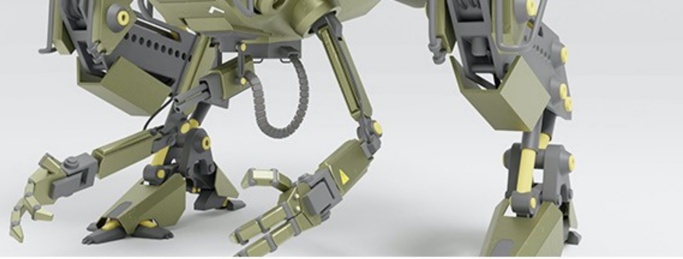
Contents

Unit III	Adversarial Search and Games	07 Hours
Game Theory, Optimal Decisions in Games, Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.		
#Exemplar/Case Studies	Machine Learning At Google: The Amazing Use Case Of Becoming A Fully Sustainable Business	
*Mapping of Course Outcomes for Unit III	CO3, CO4	



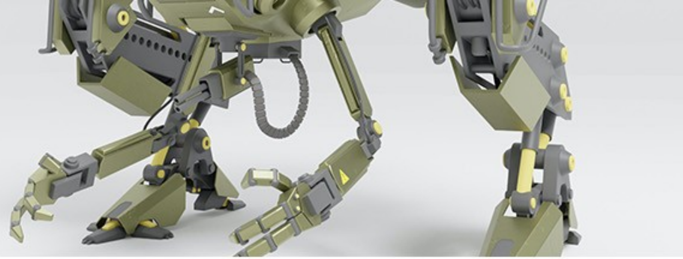
Stochastic Games

- Many games, such as dice tossing, have a random element to reflect this unpredictability. These are known as stochastic games.
- A strategy for an agent is a probability distribution over the actions for this agent. If the agent is acting deterministically, one of the probabilities will be 1 and the rest will be 0; this is called a pure strategy.
- If the agent is not following a pure strategy, none of the probabilities will be 1, and more than one action will have a non-zero probability; this is called a stochastic strategy.
- The set of actions with a non-zero probability in a strategy is called the support set of the strategy.
- In real life, many unpredictable external events can put us into unforeseen situations.
- Many games mirror this unpredictability by including a random element, such as the throwing of dice.
- We call these stochastic games



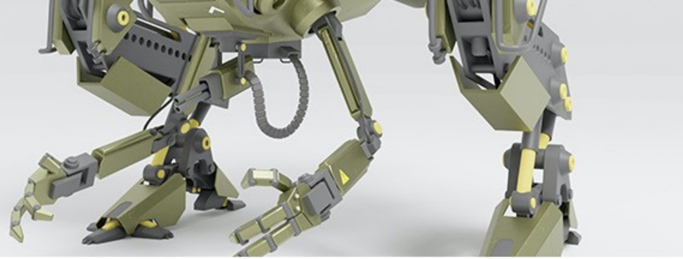
Partially Observable Games

- Partial observability means that an agent does not know the state of the world or that the agents act simultaneously.
- Partial observability for the multiagent case is more complicated than the fully observable multiagent case or the partially observable single-agent case.
- The following simple examples show some important issues that arise even in the case of two agents, each with a few choices.
- A partially observable system is one in which the entire state of the system is not fully visible to an external sensor.
- In a partially observable system the observer may utilise a memory system in order to add information to the observer's understanding of the system.
- An example of a partially observable system would be a card game in which some of the cards are discarded into a pile face down.
- In this case the observer is only able to view their own cards and potentially those of the dealer.



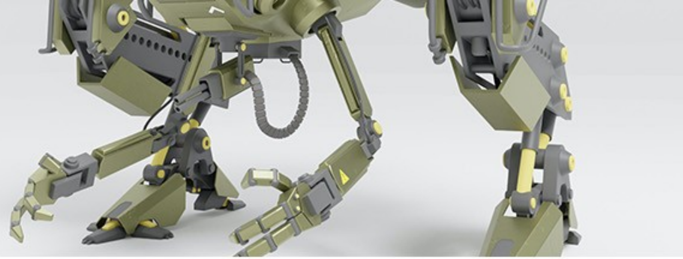
Partially Observable Games

- They are not able to view the face-down (used) cards, nor the cards which will be dealt at some stage in the future.
- A memory system can be used to remember the previously dealt cards that are now on the used pile (large collection arranged one over other).
- This adds to the total sum of knowledge that the observer can use to make decisions.
- In contrast, a fully observable system would be that of chess. In chess (apart from the 'who is moving next' state) the full state of the system is observable at any point in time.
- Partially observable is a term used in a variety of mathematical settings, including that of Artificial Intelligence and Partially observable Markov decision processes
- Chess has often been described as war in miniature, but it lacks at least one major characteristic of real wars, namely, partial observability.



Partially Observable Games

- Applications of Partially Observable Games:
- Partially Observable Games have numerous real-world applications, including:
- Robotics: Robot navigation, exploration, and manipulation tasks in uncertain and partially observable environments.
- Healthcare: Optimal patient treatment scheduling and management under uncertainty.
- Financial Planning: Portfolio optimization, trading, and risk management in financial markets.
- Game Playing: Modeling opponents in games with hidden information, such as poker and strategic board games.
- Partially Observable Games (POMDPs) are a powerful framework for modeling decision-making under uncertainty and partial observability. They provide a way to represent and solve problems where agents must reason about hidden states and make optimal decisions based on incomplete observations.



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