Learning Guide Unit 8

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Description

Learning Guide Unit 8

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Overview

Unit 8: Multi-Agent Systems

Topics:

- Multi-Agent Systems
- Multi-Agent Framework
- Representations of Games
- Computing Strategies with Perfect Information
- Group Decision Making
- Mechanism Design

Learning Objectives:

By the end of this Unit, you will be able to:

1. Explore how multi-agent systems support agent interaction.
2. Examine how Minimax algorithms help make decisions in game playing.
3. Analyze how the Alpha-beta approach reduces the computation time for Minimax algorithms.

Tasks:

- Peer assess Unit 7 Programming Assignment
- Read the Learning Guide and Reading Assignments
- Participate in the Discussion Assignment (post, comment, and rate in the Discussion Forum)
- Complete an entry in the Learning Journal
- Take the Self-Quiz
- Read the Unit 9 Learning Guide carefully for instructions on the Final Exam
- Take the Review Quiz
- Complete and submit the anonymous Course Evaluation

Introduction

Throughout this course, we have been learning about agents and the various techniques that agents can employ to make 'intelligent' decisions.

We explored how we can search a graph to find solutions. We also explored how to make searches more efficient through the use of Heuristics and Pruning. If you recall the example that was discussed using the Tic-Tac-Toe game showed how, from a particular position on the game board or 'state,' we could construct a graph by expanding each decision and then looking at the possible outcomes of each move in terms of whether it would lead to a win, loss, or draw. We now know that this kind of assessment is computing the 'utility' of an action. Moves that have desirable outcomes have a high utility and those with an undesirable outcome have low utility.

We explored the differences in decision-making when we have perfect information (or when we know with certainty what the outcome of an action will be) as well as partial information (when we do not have certainty of the outcome of an action and we must estimate the probability of the outcome).

We examined how to structure decisions, probabilities (known as beliefs), and outcomes into networks that we refer to as 'decision networks'. We also examined techniques for organizing out actions to achieve the outcomes represented in these networks as part of a planning process.

This has led us up to a pretty good understanding of how agents make decisions and take actions to achieve goals. In this unit, we throw a curveball at you and introduce additional agents.

In previous examples, our agents have interacted with the environment and we had a set of assumptions (sometimes beliefs) about what the results of an action would be within a particular environment. In this unit, we introduce the concept of multiple agents within a particular environment. Each agent acts autonomously to achieve its own goals. What makes this a bit different is the fact that each agent can have its own goals and will make decisions based upon its evaluation of the environment, its own utility, and its specific goals.

This adds an additional layer of uncertainty and complexity into the problem as an agent who, as part of its planning process, must determine or take into account the actions of another agent. In uncertain environments, this means that an agent must develop a set of beliefs on how the other agent will act and develop a set of contingencies based upon those actions.

Key concepts in this unit will include the idea of game playing and the different forms of games as well as an understanding of the Minimax algorithm.

Reading Assignment

Poole, D. L., & Mackworth, A. K. (2017). *Artificial Intelligence: Foundations of computational agents*. Cambridge University Press. https://artint.info/2e/html/ArtInt2e.html
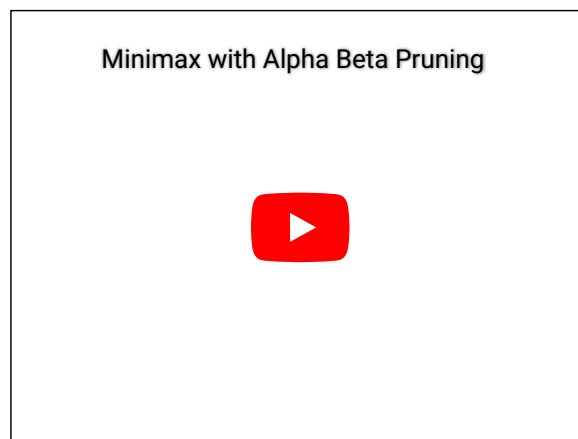
- Read Chapter 11 – Multiagent Systems

Video Resources

Sen, G. (2017, March 6). *What is the minimax algorithm? - Artificial intelligence* [Video]. YouTube.

Levine, J. (2017, March 15). *Minimax with alpha beta pruning* [Video]. YouTube.

Discussion Assignment

Explain in your own words, how the Mini-Max algorithm is used in decision-making and game theory. Make sure to explain how this algorithm applies the utility function to get the utility values for the terminal states. Feel free to add any diagram/tree structure to represent all the possible moves that allow a game to move from one state to the next state. Also, discuss how the alpha-beta pruning approach is used for optimization.

Your Discussion should be at least 250 words in length, but not more than 750 words. Use APA citations and references for the textbook and any other sources used.

Learning Journal

The Learning Journal is a tool for self-reflection on the learning process. The Learning Journal will be assessed by your instructor as part of your Final Grade.

Your learning journal entry must be a reflective statement that considers the following questions:

1. Describe what you did. This does not mean that you copy and paste from what you have posted or the assignments you have prepared. You need to describe what you did and how you did it.

2. Describe your reactions to what you did.

3. Describe any feedback you received or any specific interactions you had while participating discussion forum, discuss how they were helpful.

4. Describe your feelings and attitudes.

5. Describe what you learned. You can think of one or more topics from your week's lesson and explain your understanding in writings. Feel free to add any diagram or coding example if that helps you explain better.

6. Did you face any challenges while doing the discussion assignment or the self quiz? Were you able to solve it by yourself?

The Learning Journal entry should be a minimum of 400 words and not more than 750 words. Use APA citations and references if you use ideas from the readings or other sources.

Self-Quiz

The Self-Quiz gives you an opportunity to self-assess your knowledge of what you have learned so far.

The results of the Self-Quiz do not count towards your final grade, but the quiz is an important part of the University's learning process and it is expected that you will take it to ensure understanding of the materials presented. Reviewing and analyzing your results will help you perform better on future Graded Quizzes and the Final Exam.

Please access the Self-Quiz on the main course homepage; it will be listed inside the Unit.

Review Quiz

The Review Quiz will test your knowledge of all materials learned in this course. The results of this quiz will not count towards your final grade, but will help guide you in more thoroughly reviewing necessary topics and adequately preparing for the Final Exam.

Please access the Review Quiz under Unit 9 on the main course homepage; it will be listed inside the Unit.

Checklist

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