Abstract

Five-in-a-row/Go-Moku board game

This project presents the design and implementation of a Five-in-a-Row board game application with an intelligent computer opponent. The objective is to develop a standalone interactive application that supports both human-versus-human and human-versus-computer gameplay while demonstrating the application of artificial intelligence algorithms. The application is developed in Unity Engine (C# as the primary language) and will include a polished UX/UI interface. The computer opponent is implemented using the **Minimax algorithm** with **alpha-beta pruning** to optimize game tree search and reduce computational complexity. At the highest level, the **threat-space search** algorithm will be utilized. A **heuristic evaluation function** is used to assess board states and determine optimal moves at different search depths, enabling adjustable difficulty levels. Additionally, a timer-based scoring mechanism is incorporated to record player performance and maintain high scores. The difficulty levels will be segregated based on a 'depth' system, where each difficulty will introduce/stack on top of previous, a better algorithm for determining cost calculation per every legal move. The board will follow a standard 15x15 checkerboard layout with each player getting to place one of two distinct pieces on the board till a winner is declared. This project enables gaining experience on the process of the end-to-end development of a gaming application, covering game logic design, designing UI/UX, and the implementation of intelligent AI behavior using search-based algorithms.

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Version management will be done through both Git and Unity Version Control (UVC). The end product is a standalone executable application (.exe)

Ref: L. Victor Allis, H. J. van den Herik, M. P. H. Huntjens, 1993. Go-Moku and Threat-Space Search