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Weakly Solving Kalah Game Using Artificial Intelligence and Game Theory

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Abstract : This study aims to weakly solve Kalah, a two-player board game, by developing a start-to-finish winning strategy using an optimized Minimax algorithm with Alpha-Beta Pruning. In weakly solving Kalah, our focus is on creating an optimal strategy from the game's beginning rather than analyzing every possible position. The project will explore additional enhancements like symmetry checking and code optimizations to speed up the decision-making process. This approach is expected to give insights into efficient strategy formulation in board games and potentially help create games with a fair distribution of outcomes. Furthermore, this research provides a unique perspective on human versus Artificial Intelligence decision-making in strategic games. By comparing the AI-generated optimal moves with human choices, we can explore how seemingly advantageous moves can, in the long run, be harmful, thereby offering a deeper understanding of strategic thinking and foresight in games. Moreover, this paper discusses the evaluation of our strategy against existing methods, providing insights on performance and computational efficiency. We also discuss the scalability of our approach to the game, considering different board sizes (number of pits and stones) and rules (different variations) and studying how that affects performance and complexity. The findings have potential implications for the development of AI applications in strategic game planning, enhancing our understanding of human cognitive processes in game settings, and offer insights into creating balanced and engaging game experiences.

Keywords : minimax, alpha beta pruning, transposition tables, weakly solving, game theory
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