

Applications of Artificial Intelligence and Machine Learning in Othello

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Abstract

The purpose of this project is to explore Artificial Intelligence techniques in the board game Othello. The project focuses on the creation and evaluation of AI players for Othello. It explores several techniques used in strong AI players, including improvements to minimax game-tree search algorithms and higher-quality evaluation functions. It also investigates machine learning methods to enable AI players to improve the quality and speed of play automatically based on training and experience.

Scope of Study

- Referee
 - GUI
 - Tournaments
- AI players
 - Search algorithms
 - Board evaluation functions
 - Machine learning

Referee

- Implemented in Python
- Supports varying types of players
 - AI programs in multiple languages
 - Humans
- GUI
- Tournaments

Search Algorithms

- Minimax
- Alpha-beta pruning
- NegaScout
- MTD(f)
- Selective search – Multi-ProbCut
- Quiescence search

Board Evaluation Function

- Complex features: mobility, stability
- Simple features: patterns of disks
- Training with machine learning
 - Gradient descent
 - Genetic algorithms
 - Artificial neural networks, backpropagation
 - Particle swarm optimization

Other AI enhancements

- Bitboards
- Transposition tables
- Opening book
- Parallelization

Expected Results

- Evaluate players based on performance in games against other players
- Compare several different AIs
- Players using machine learning would be expected to improve