

Chinnok

Competitor - Tinsley

- Champion Checkers player by far
- Dec. 1990 Tinsley defeated Chinook only 7.5-6.5
- Closest anyone came to defeating him in over 40 years
- Played a big part in Chinook's development

Checkers vs. Chess

- Fewer pieces
- Fewer special rules
- Fewer legal squares on board
- Fewer piece types

Checkers vs. Chess

- Pieces only move forward until become a king
- Fine line between a win and a draw
- Branching factor (avg. # moves) is less - deeper searching possible
- Endgame plays a bigger role
- Searches performed at beginning will include positions from opening, middle, and endgame
- Checkers research addresses some of the same issues that chess will eventually
- Checkers is simpler than chess

Game Phases

- Opening
- Middlegame
- Early Endgame
- Late Endgame
- Database

First 4 have 22 user-adjustable parameters

Last phase has perfect knowledge.

First move in game might reach all the way to the database phase

Opening Book

- Anti-book (U.S. Open)
 - 20 positions
 - traps required searches of 26 and 33 ply
 - reduced number of positions to add to program manually
 - 3 losses to Tinsley due to opening mistakes
- Colossus's opening book
 - corrected several hundred positions
 - search for new moves to surprise Tinsley
 - 8 "gold" moves and 30 "silver" moves
 - make it appear that it was "thinking"

Search

- alpha-beta search
- history heuristic
- transposition tables to avoid repeat analysis
- iterative deepening
- forward pruning of lines with material deficit

Extending Search Lines

- Positions where a move is forced (all others have worse minimax value)
- Checkers knowledge used for interesting line
 - useful captures
 - checkers running un-opposed to crown
 - promotions of checkers to kings
 - one side forced to repeat a move
- Heuristic tests for potential extension searches to weed out those likely to not be helpful.

Searches

- Deeper search = stronger play
- Average 20-ply searches + extensions (U.S. Open)
- Tinsley has been able to analyze positions that would be 60 ply deep
- Iterative deepening of 2 ply at a time
- Reached the point when deeper searching produces diminishing returns

Draw

- When at a node with two draw subtrees - use more difficult one.
- Use a line that requires other side to sacrifice.
- Minimax scores used to choose "strong draw" over line with only a small advantage.

Challenges

- Evaluation of positions where heuristic evaluations greatly misestimated.
 - 1 tactical combination caused 50% errors
 - 2 tactical combinations caused 25% errors
- Tactical tables to indicate if a two-for-one worked.
 - 1 meg, 1 bit each abstract board
- Hand tuning heuristics far better than other AI methods.
- Choice of one side or the other - clustering.

Endgame Databases

- 8 piece endgame database - working on 9 piece
- 440 billion positions in 6 gigs for 8 piece
- 6 pieces beyond human comprehension
- Difficulties computing a database this large
- Need it to be compact but usable in real time
 - Just store result of winning positions
 - Only store half of the positions (odd vs. even)
- Database eliminates large parts of the search tree

Perfect Player

- Currently working on a perfect player
- Only way with no error is through brute-force
- AI solutions
 - More error
 - Poorer compression
 - More expensive Runtime

Chinook

- Database of 800 Grandmaster games - found alternative moves
- Able to predict opponent's move over 80% of the time
- Proved standard position misconceptions in Checkers literature.