Connect Four AI

Dr. Korzhova, Fall 2014, (CIS4930) - Jason Maynard, Joshua Philpott, Nataliya Ivanova

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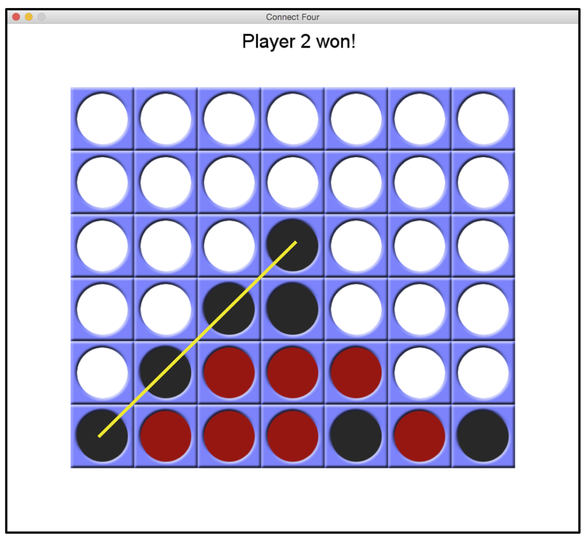
Description of system

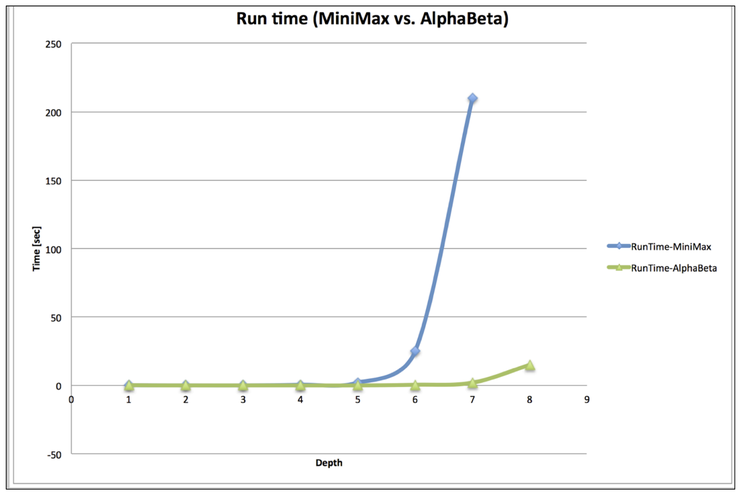
An intelligent Connect 4 adversarial game with PyGame graphical user interface (GUI).

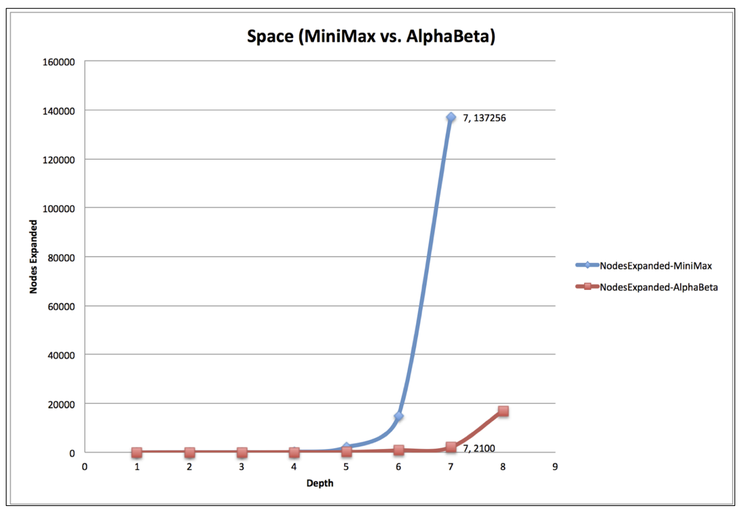
- A variant of tic-tac-toe (7x6 matrix)
- AI algorithms: MiniMax, alpha-beta (DFS)
- MiniMax: O(b^m) time complexity
- MiniMax: O(b*m) space complexity
- AlphaBeta: O(b^(d/2)) optimal time complexity (worst still O(b^d))



Summary of results

- User chooses MiniMax, AlphaBeta, depth of tree.





Conclusions and discoveries

- Test data is consistent with theoretical time and space complexity
- Easy to beat with depth <= 4
- Can play up to level 5 for MiniMax
- MiniMax depth = 5 results in “good” game play
- AlpahBeta increases “good” game play depth to level 7
- Alpha-Beta and “CheckOpenThree” method delivers improvements over traditional approaches seen in robotics

Recommendations / Improvements:

- Create table of starting / ending moves
- Other heuristics to be considered such as “even” vs. “odd” and “topping” strategies.

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Main conclusions

- in early implementation, the agent will intentionally make a bad move if it saw an inevitable loss in the future
- adding depth score improved the algorithm
- tradeoff of the algorithm is complexity vs. time
  - if goal is to choose the best possible move, the algorithm will calculate all possible moves at each stage which will take a lot of time
  - game flow has greater priority