

Adversarial Search

Artificial Intelligence(CS5100) – HW3

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1. Search Techniques Implemented

a. Alpha Beta Pruning:

The algorithm calculates heuristic values for four possible moves (Up, Down, Right, Left) of PacMan with respect to Ghost moves. Out of these four moves based on the best heuristic value the best move is selected and PacMan moves in that direction. In the algorithm the heuristic calculation at the terminal node is based on the following factors:

- Current game score
- The shortest distance between PacMan and ghost
- Negative Multiplier if the ghost is not edible
- Positive Multiplier if the ghost is edible
- Distance between the pills and PacMan

The heuristic is measured as a weighted sum of above factors.

i. Algorithm:

1. If depth is less than 1, calculate heuristic of that node
2. If max player:
3. Assign highscore to -ve (Infinity)
4. Temp = alphaBeta(depth-1,alpha,beta,!maxplayer)
5. Get max(highscore,temp)
6. Alpha=max(alpha,highscore)
7. If beta<alpha
8. Break//Don't expand
9. Return highscore
10. If min player:
11. Assign highscore to +ve Infinity
12. Temp = alphaBeta(depth-1,alpha,beta,maxplayer)
13. Get min(highscore,temp)
14. beta=min(alpha,highscore)
15. If beta<alpha
16. Break//Don't expand
17. Return highscore

- ii. Complexity: b - branching factor(Possible pacman($b=4$)/ghost Moves($b=3$)), d =search depth. The min max algorithm alternately branches between the PacMan and Ghost

Time Complexity	Space Complexity
Adding for each level alternating between PacMan and ghost we get: $1+4+4*(3^4)+4*4*(3^4)+\dots$ Which is equivalent to $O(b^d)$ but it can be reduce to a factor of $O(b^{d/2})$ based on the ordering of nodes from heuristic. This is the advantage of AlphaBeta over minimax algorithm	$O(b^d)$ which is calculated from the fact that at depth d there $O(b^d)$ nodes that are yet to be explored.

- iii. Environment: Fully Observable
iv. Observations: The best gameplay included going to level 4 with a score of around ~9000. The gameplay can be improved by avoiding scenarios of having adjacent ghosts.

2. References:

- https://en.wikipedia.org/wiki/Alpha%E2%80%93beta_pruning
- Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach.