CSE 546: Reinforcement Learning

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Final Project Abstract

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1.   Topic

We plan to implement a Ludo board game based on Reinforcement learning algorithms.

2.   Objective

We aim to create a multi agent environment for Ludo where 2-4 agents/players race around the board to finish by moving their pieces. The environment will provide feedback to the agents for their moves in terms of numerical rewards. One of the possibilities we are looking into is calculating death probability on different positions when the opponent's piece moves to the same position as the other player and introducing expected distance to the goal position which should reduce as the pieces move ahead on the board.
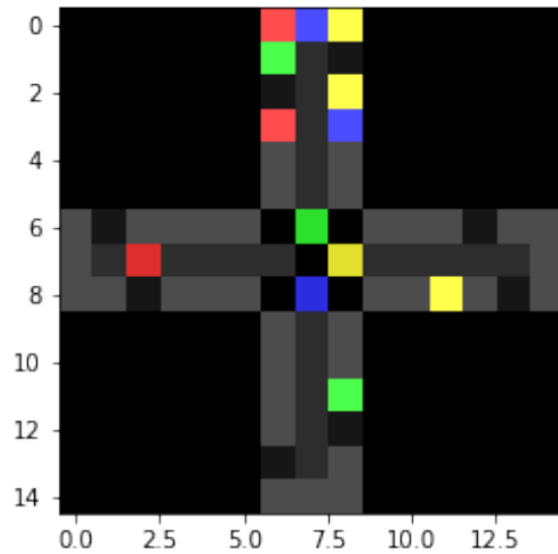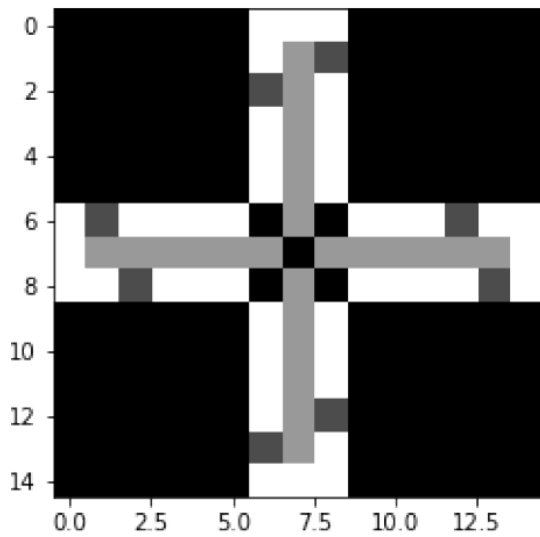
3.   Related work

The work we referred to provides an idea of how the game rules are formulated, how the number of legal game states are reachable from the initial state of the game, the probabilities for various positions and states and the training time for the agent's learning. It is implemented on the complete board grid and takes a lot of training iterations and time. As we will be decreasing the grid size and will train for less number of players, the complexity will reduce to a certain level but still a lot of permutations and combinations are to be calculated for each move. The most common algorithm implemented for this board game is the TD (Temporal Difference) method. We will try to implement Q-learning or Double Q-Learning algorithms or if feasible we can also try to implement DQN (Deep Q Network) for this project.

4. Technical outline
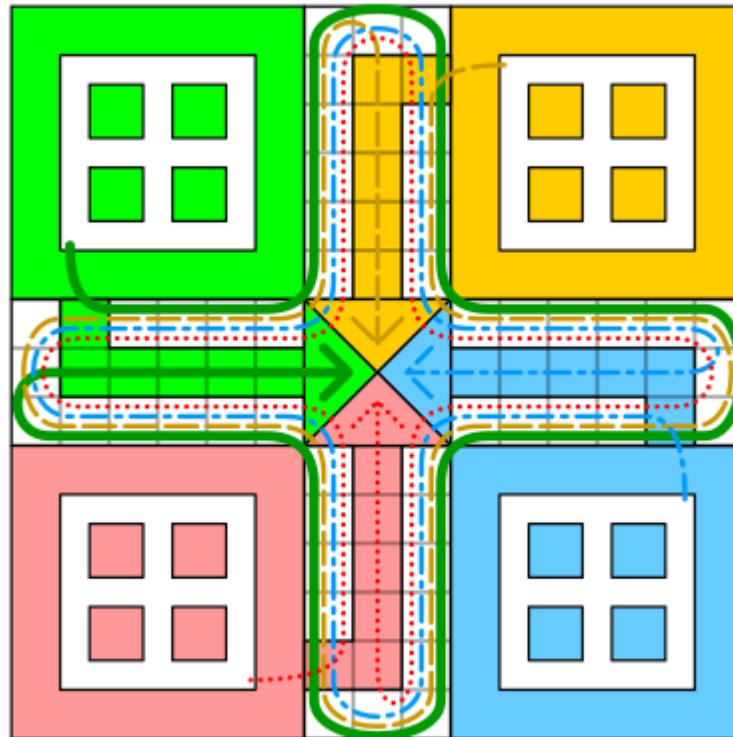
In general, Ludo game has upto 4 players and each piece should take around 62 steps to reach the goal. In order to make this computationally less expensive we have reduced the board size and set the number of players to two. We intend to use tabular methods to decide the actions in accordance with die rolls. Also, we plan on calculating the probability of death for each piece to choose actions. There are different strategies for this game like random move (play one of the pieces completely at random), aggressive move (player prefers to eliminate the piece of another player), defensive move (player defends his pieces against the danger of an attack) and fast move(player chooses to move the piece which is most ahead and tries to make it reach the final home location).

This is how our environment might look like:

5. References

- **https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6031999&tag=1**
- **https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6374142**
- **https://en.wikipedia.org/wiki/Ludo_(board_game)#/media/File:Ludo_paths.svg**