MDP to solve a maze problem

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Introduction

In this project, an application of MDP is considered in the context of an environment represented on a grid of size n x n. The environment contains walls that the agent must avoid, and a position with a high reward that the agent must reach. The agent can move in four directions (up, down, left, right) with a distance of 1 or 2 units.

Creation of 5 different mazes with different positions of the reward, and demonstrate different use cases of the model.

To achieve this goal, we will first calculate the probability matrix(P(n*n*8)) for the given maze and a set of probabilities for moving in various directions.

Next build the reward matrix based on the obstacles in the maze
Then run value iteration to generate value function
And finally move the agent from source to destination based on the values of the value function.

Methods implemented

findSourceAndTraget(maze)
Method to find the source and destination in the maze(map.csv).

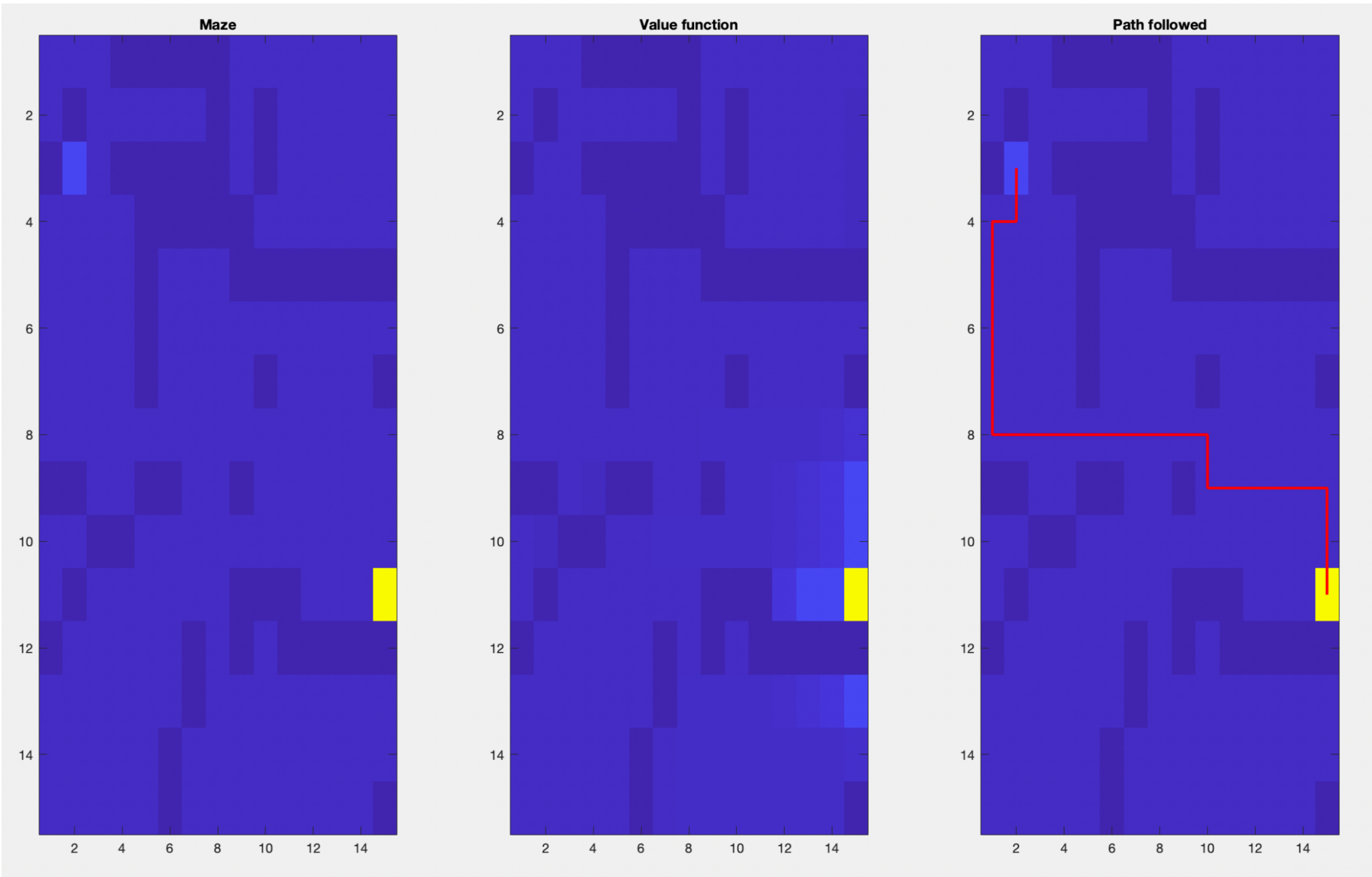
getProbs(a,maze,i, j,n,action_probabilities)
Method to find the best probability based on the current action, zero if not possible to move.

checkWall(action,maze,i,j,action_probabilities)
Returns low probability if there's a wall, high for goal and a given probability otherwise.

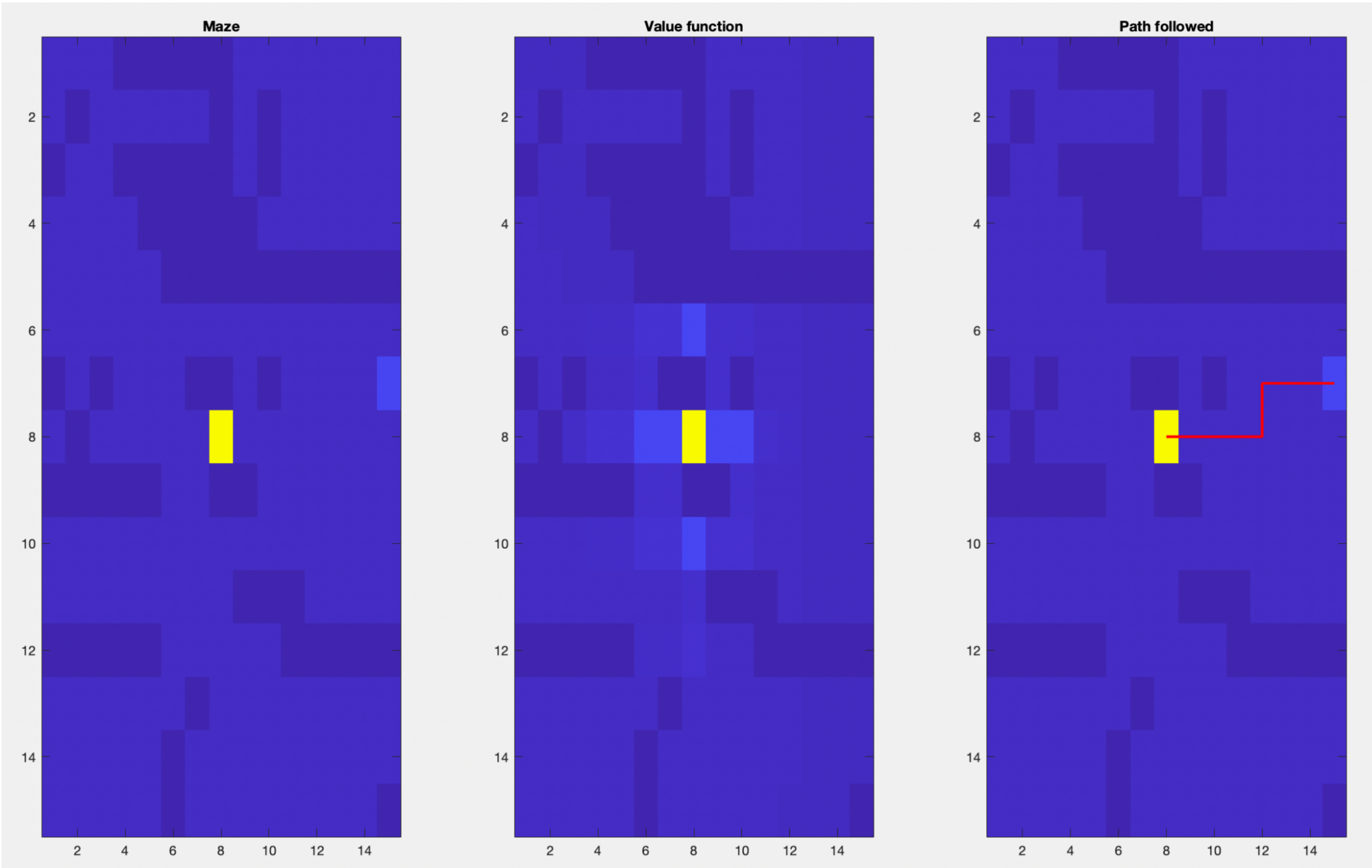
checkWallOnly(maze,i,j)
Checks if the given point is wall or not in the maze

get_next_state(i, j, a, n,d1,d2)
The method handles eight different actions("^","v","<",">","^^","vv","<<",">>"). It helps to build the value function by returning the next possible move.

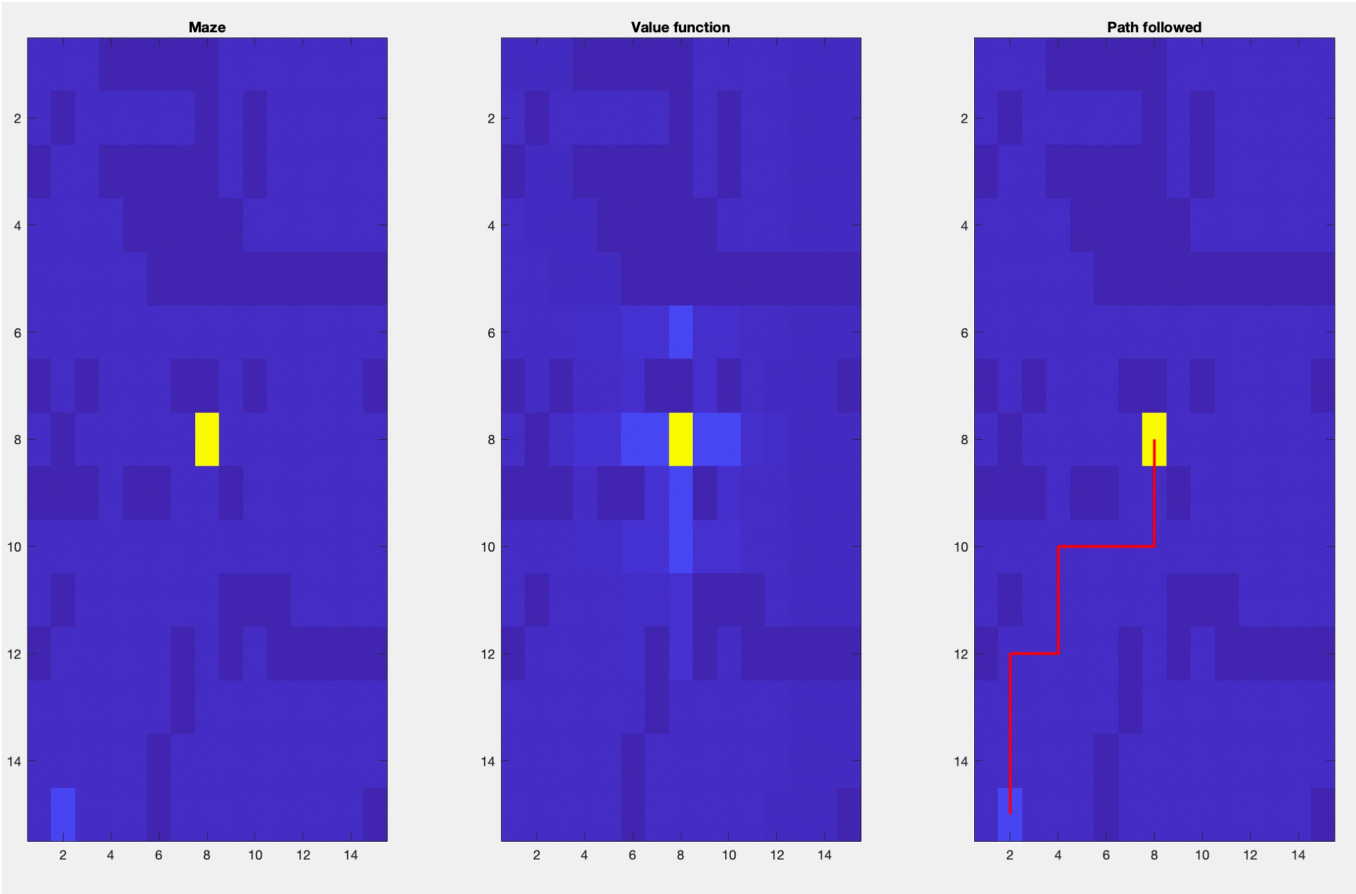
Results



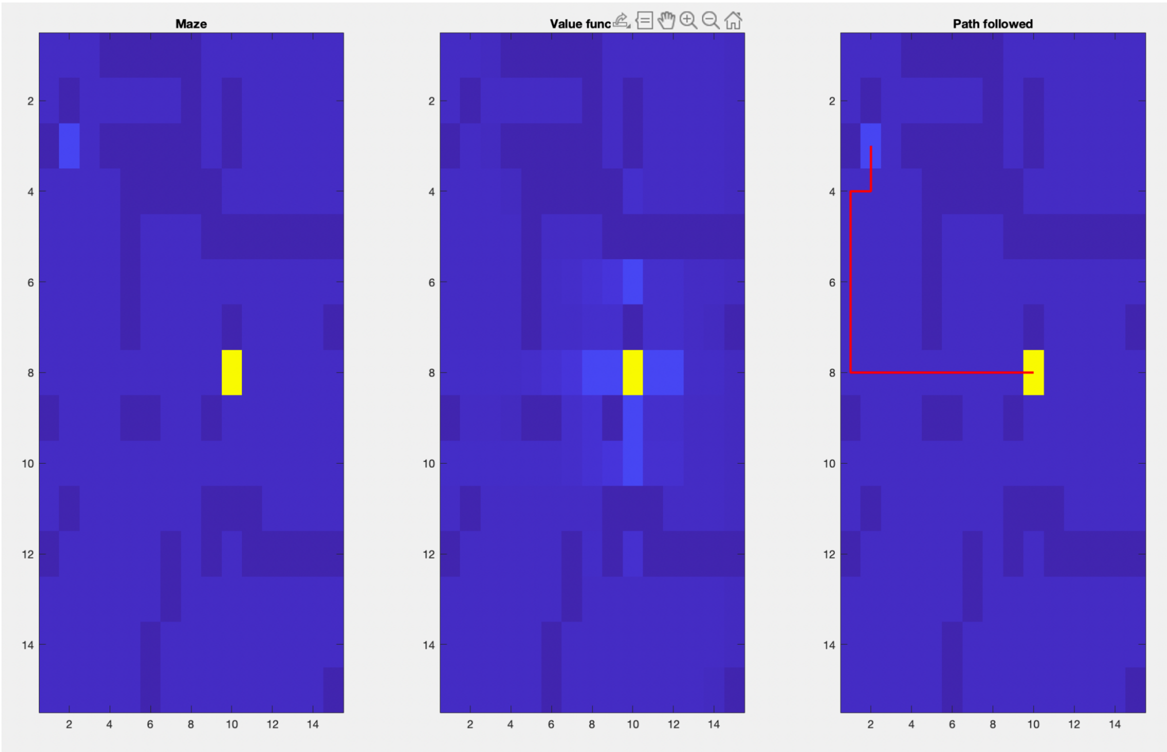
Using the value function, the agent can determine the optimal direction to move and is equipped to cover long distances. Specifically, the agent is capable of traversing downwards, leftwards, and rightwards to avoid collisions with walls in this scenario.

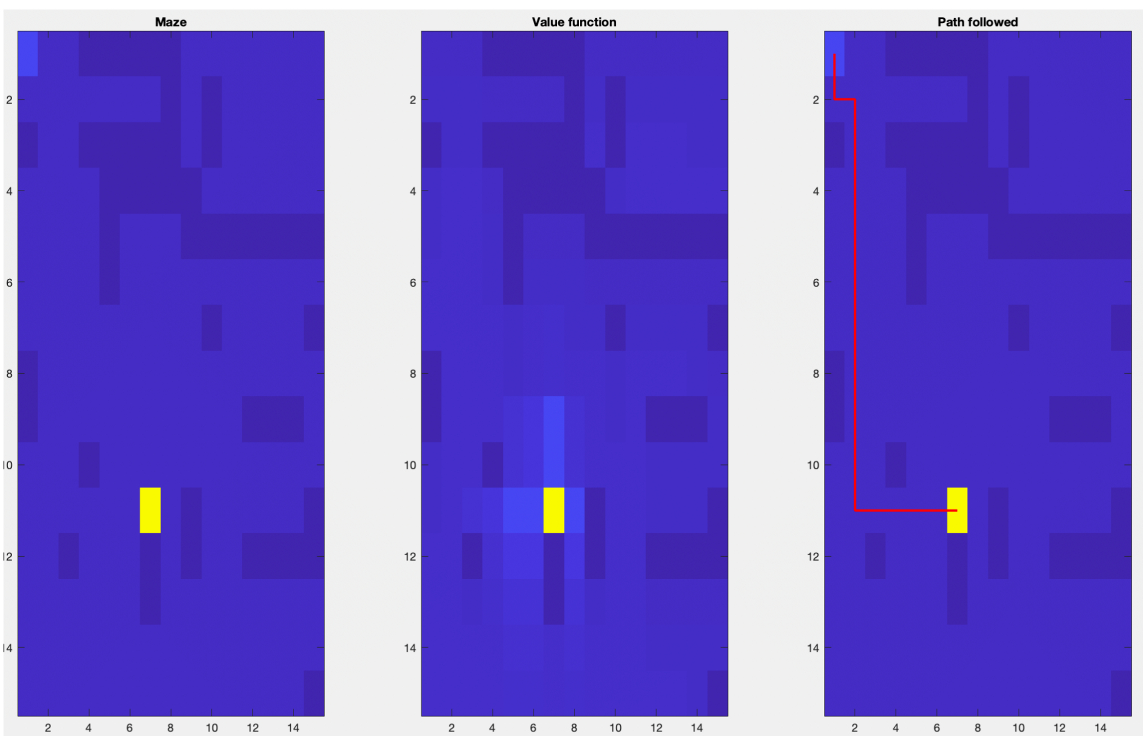


The agent is capable of making decisions to move in short distances and can navigate towards the rightward and upward directions based on the value function.



The agent is equipped to move towards the goal while avoiding collisions with walls by moving in the upward and rightward directions.





Agent capable of taking long distance decisions.