A1 – CS4300 Assignment A1 Lab Report

Random Actions in Wumpus World

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1. Introduction

A random action agent is written for the assignment. It is tested in a fixed Wumpus World board and run for many trials under various maximum number of steps allowed. We want to anaylsis its behaviour to answer the following questions:

- How likely will the agent be passing the square with the gold?
- How many steps can the agent survive? What is the mean, variance, and confidence interval?
- What is the impact of various maximum number of steps allowed on the values mentioned in the previous questions?

2. Method

We use a randi in CS4300_agent1.m to random and equally choose action from three available actions which are turn left, turn right and move forward. Then, we iterate CS4300_WW2 with CS4300_agent1 for 2000 trials keeping track of if the agent goes through gold and how many steps he survives. After every loop, We increment the max_steps by one and restart a new loop until the max_steps reaches 200. Thus, the total data sample size will be 2000 * 200 which is 400000.

3. Verification of Program

A large number of samples was generated and each was check to make sure it was any of the possible actions, {1, 2, 3}.

Figure 1 shows that the samples was fairly uniformly distributed.

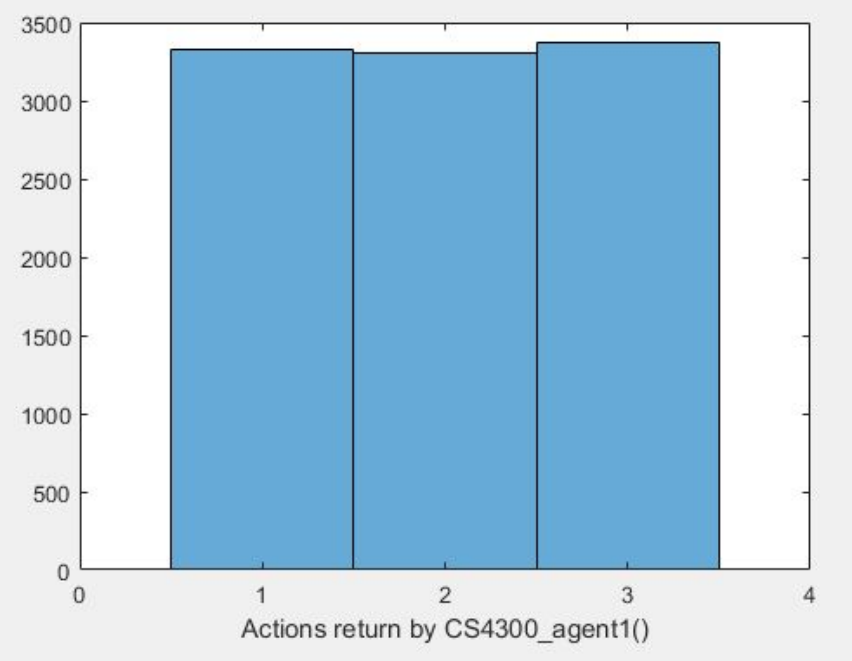

Figure 1. Histogram of Samples from the Agent Function.

4. Data and Analysis

The result shows with this board layout, the random agent has a chance of around 38% to go pass the square with the gold (figure 2) and can survive about 26 steps in average (figure 3) with a variance of about 470 (figure 4) and the 95% confidence interval of about 0.9 steps (figure 5).

As showed in the plots below, all four variables increase when the maximum steps increases and the increasing rate are getting smaller and smaller. The rate tends to reach 0 after sample size gets approximately 60. Furthermore, their minimum values of the four variables all start when the maximum step are equal to 0 (actually step #1 since the initial state is step 1) which means the statistic of the data are stabilizing with more samples given.

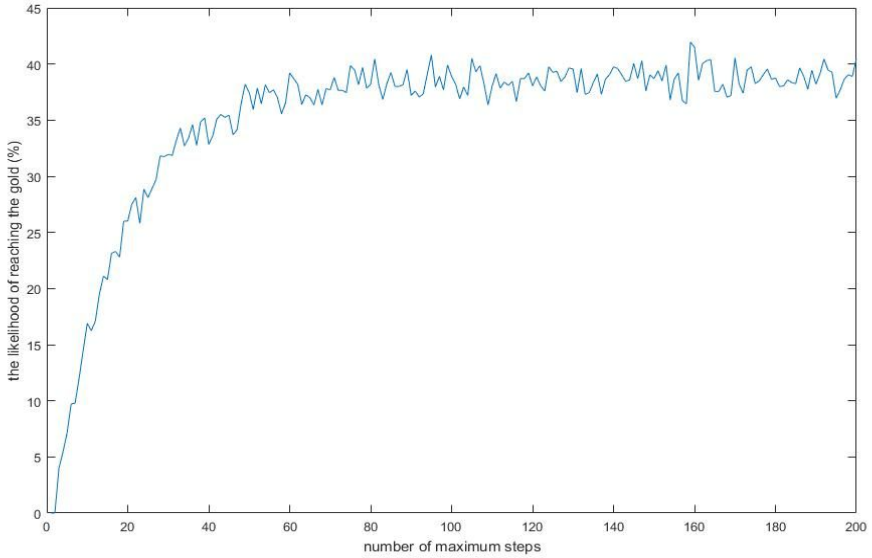

Figure 2. Plot of the Likelihood of Reaching the Gold (%) vs. the Number of Maximum Steps

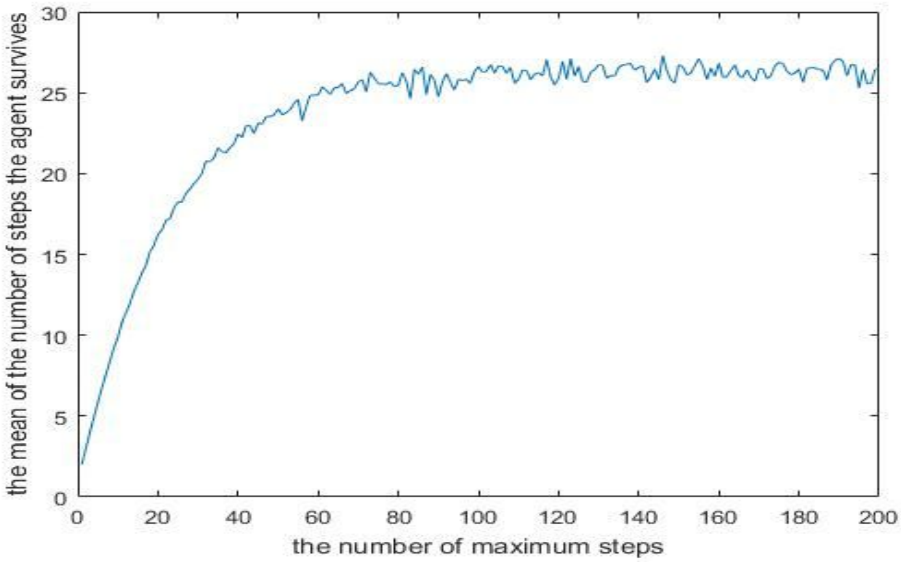

Figure 3. Plot of the Mean of the Number of Steps the Agent Survives vs. the Number of Maximum Steps

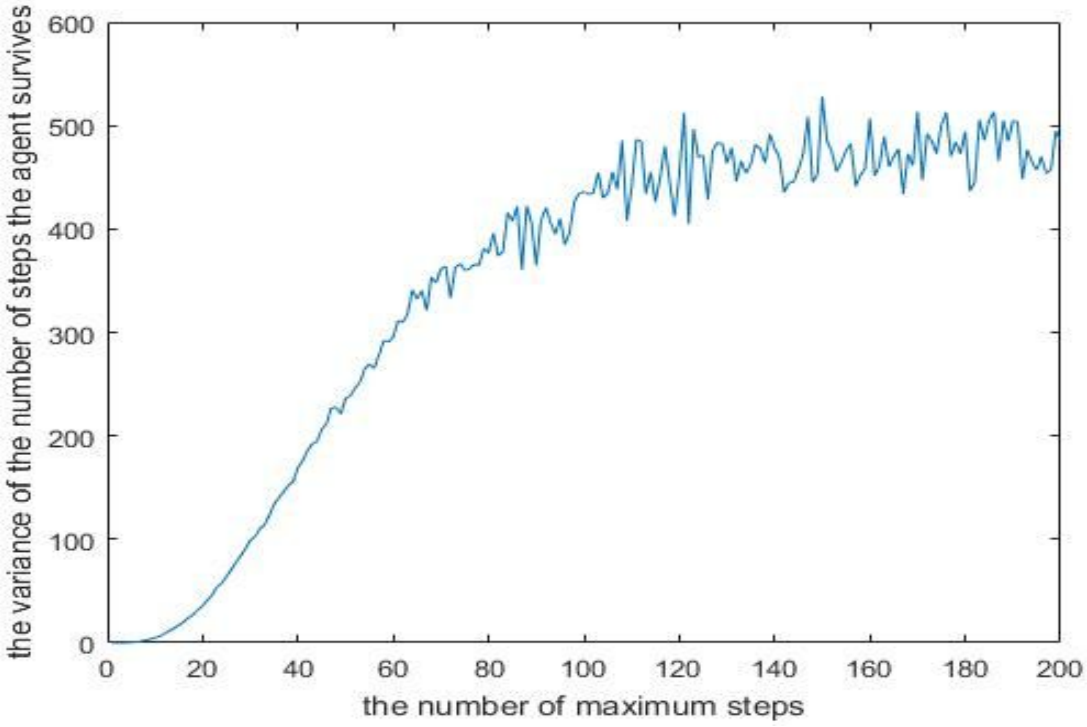

Figure 4. Plot of the Variance of the Number of Steps the Agent Survives vs. the Number of Maximum Steps

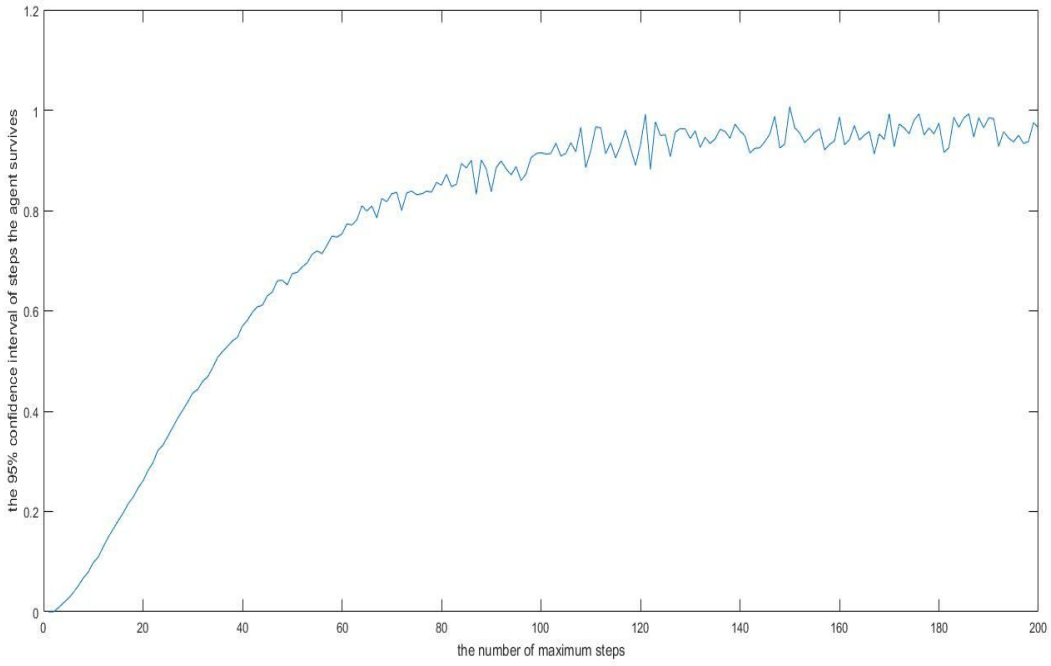

Figure 5. Plot of the Confident Interval of the Number of Steps the Agent Survives vs. the Number of Maximum Steps

5. Interpretation

The values we recorded shows that when the maximum number of steps allowed is increased, all of the likelihood of reaching the gold, the average steps the agent can survive, the variance, and the confidence interval increases. However, after a certain threshold, the impact of increasing the maxsteps is severely decreased. The reason of this behaviour can be caused by the rarity of the agent surviving a large number of steps, therefore increasing the max steps does not have the same impact comparing to lower max steps. This theory can be proved by further experimentation.

6. Critique

A better way to visualize how does the maximum steps impact the possibility of reaching each cell could be accumulate whenever the agent pass through the cell and shows the total possibility on each cell. I believe that we could analyze much more aspects on the agent's behavior based on that. The possibility of the agent bump into the wall based on the maximum steps is also an interesting subject to study. We have already did two improvement in our code while coding. One of which is the method of how to accumulate survive steps. We change from loop the trace object to acquire its size. The other is using build in function to calculate the mean and variance.

7. Log

Haochen Zheng (Section 2, 4, 6)
A total of 80 minutes was spent performing the experiment in Matlab.
A total of 170 minutes was spent performing the experiment in writing the report.

Tim Wei (Section 1, 3, 5)
A total of 90 minutes was spent performing the experiment in Matlab.
A total of 150 minutes was spent performing the experiment in writing the report.