

CS533 Homework 2: FrozenLake

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April 2021

1 Introduction

Synchronous value iteration is used to determine the optimal policy for navigating the FrozenLake grid-world scenario.

2 Methods

Four methods for synchronous value iteration are employed, of which two are serial and two are distributed. Each method was evaluated for running time over a range of map sizes. The distributed implementations are additionally evaluated with varying numbers of workers. All implementations are written in Python, with the distributed methods employing the Ray library.

3 Results

The performance of the various methods is demonstrated in figures 1 and 2.

4 Discussion

The second distributed method is faster than the first distributed method for all map and worker pool sizes because of greatly reduced overhead in communication. This is due to the grouping of calculations into batches, which are used *en bloc* to update the value function. Effectively, the communication overhead is reduced by a factor approximately equal to the number of states computed in each worker batch.

Of the four approaches, Distributed v2 and Serial v2 are the clear front-runners. For a small pool of workers, the distributed method does not provide any advantage, due to the overhead involved in instantiating and communicating with the worker processes. However, for very large maps and sizeable worker pools, the distributed implementation is expected to eventually outperform the serial implementation.

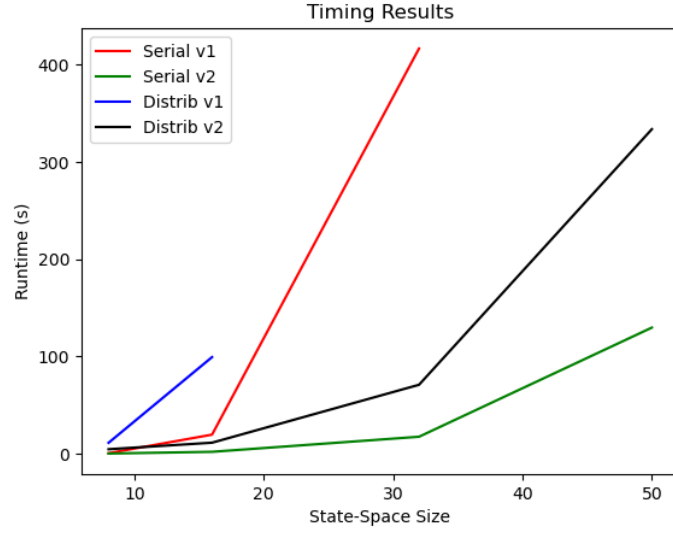


Figure 1: Running time of the four methods on various map sizes.

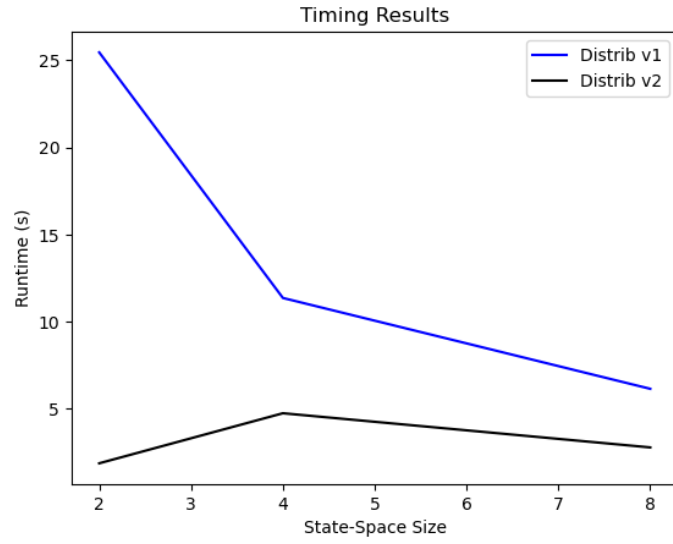


Figure 2: Running time of the two distributed methods on various numbers of workers. Map size = 8.