

A parallelised and distributed approach to implementing Conway's Game of Life

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Abstract

We intend to explain our two solutions for implementing Conway's Game of Life in Golang, namely the Parallel and Distributed versions. Within this report, we will discuss the impacts of thread usage in both our implementations, as well as the effect of distributed computation as opposed to single-machine computation. In essence, we found that execution time was sped up as we increased thread count, reduced branch instructions and implemented a halo exchange mechanism.

I. INTRODUCTION TO THE PARALLELISED SOLUTION

As an initial attempt, we began by implementing a single-threaded Game of Life (GoL) Engine, expanding upon this work with parallelisation by virtue of concurrent go-routine workers. Recognising that branch instructions throttled efficiency of `getNeighbourCount`, we removed if-statements, introduced bit-masking and assignment which drastically improving runtime.

- single threaded implementation
- events passing (alive cells, turn completed)
- PGM image output implementation
- SDL implementation (flipped cells events)
- using channels and goroutines to create multiple workers (parallelising the solution)
- switching to a memory sharing solution instead of using channels (TODO?)
- implementing halo exchange

II. BENCHMARKING METHODOLOGY

- use built in golang benchmark framework
- run command
- output to txt
- run python script to plot graphs
- barchart of time taken against threads used
- runs benchmarks on all pgm images
- repeats benchmarks until results fall within a certain standard deviation (TBC)

III. PARRALELISING THE PROGRAM

- show workers pseudocode
- show handler pseudocode
- flowchart/ diagram of how channel communication workers
- simple flowchart of how the whole program works currently

IV. PARALLELISING BENCHMARK AND CRITICAL ANALYSIS

- show graph for 5120x5120.gpm for single implementation vs parralel implementation
- describe the differences between each graph
- explain the differences by referencing the flowchart/ how the code worker
- explain the shape of the graph (why it resembles a 1/x graph). e.g. bottlenecks in channel communication...

V. MEMORY SHARING

THIS SECTION WILL BE USED IF WE DECIDE TO IMPLEMENT MEMORY SHARING OVER CHANNEL COMMUNICATION

VI. BENCHMARKING AND CRITICAL ANALYSIS OF THE MEMORY SHARING

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VII. IMPLEMENTING HALO EXCHANGE TO BE IMPLEMENTED

VIII. BENCHMARKING AND CRITICAL ANALYSIS OF THE HALO EXCHANGE

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IX. BENCHMARKING AND CRITICAL ANALYSIS OF ENABLING SDL

- show graphs and describe shape and differences of with vs without SDL
- explain how SDL works
- explain how this causes bottlenecks

X. COMPARING THE PARRALEL BENCHMARKS

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Table 1: *Example table*

Name		
First name	Last Name	Grade
John	Doe	7.5
Richard	Miles	2

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Text requiring further explanation¹.

XI. RESULTS

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¹Example footnote

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XII. DISCUSSION

i. Areas for improvement

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ii. Thanks

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- [Figueredo and Wolf, 2009] Figueredo, A. J. and Wolf, P. S. A. (2009). Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330.