

# Design of a Real Time Strategy Game with a Genetic AI

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## Results

### Abstract

Currently the AI in many strategy games makes decisions by plugging in game data into a heuristic. Obtaining an optimal set of evaluation functions and constants is difficult. My goal is to design a real-time strategy with an intelligent AI created by a genetic algorithm. I will use a genetic algorithm to create effective combinations of evaluation functions that allow the AI to make intelligent decisions. The AI will also take advantage of patterns in other player's behavior.

### Background and Introduction

Genetic algorithms are good at evolving optimal heuristics without user input by applying the principles of natural selection. Genetic algorithm work by randomly creating a combination of evaluation functions for a heuristic. The suboptimal chromosomes are removed and the better ones swap data and randomly mutate.

### Discussion

#### Graphics Speed

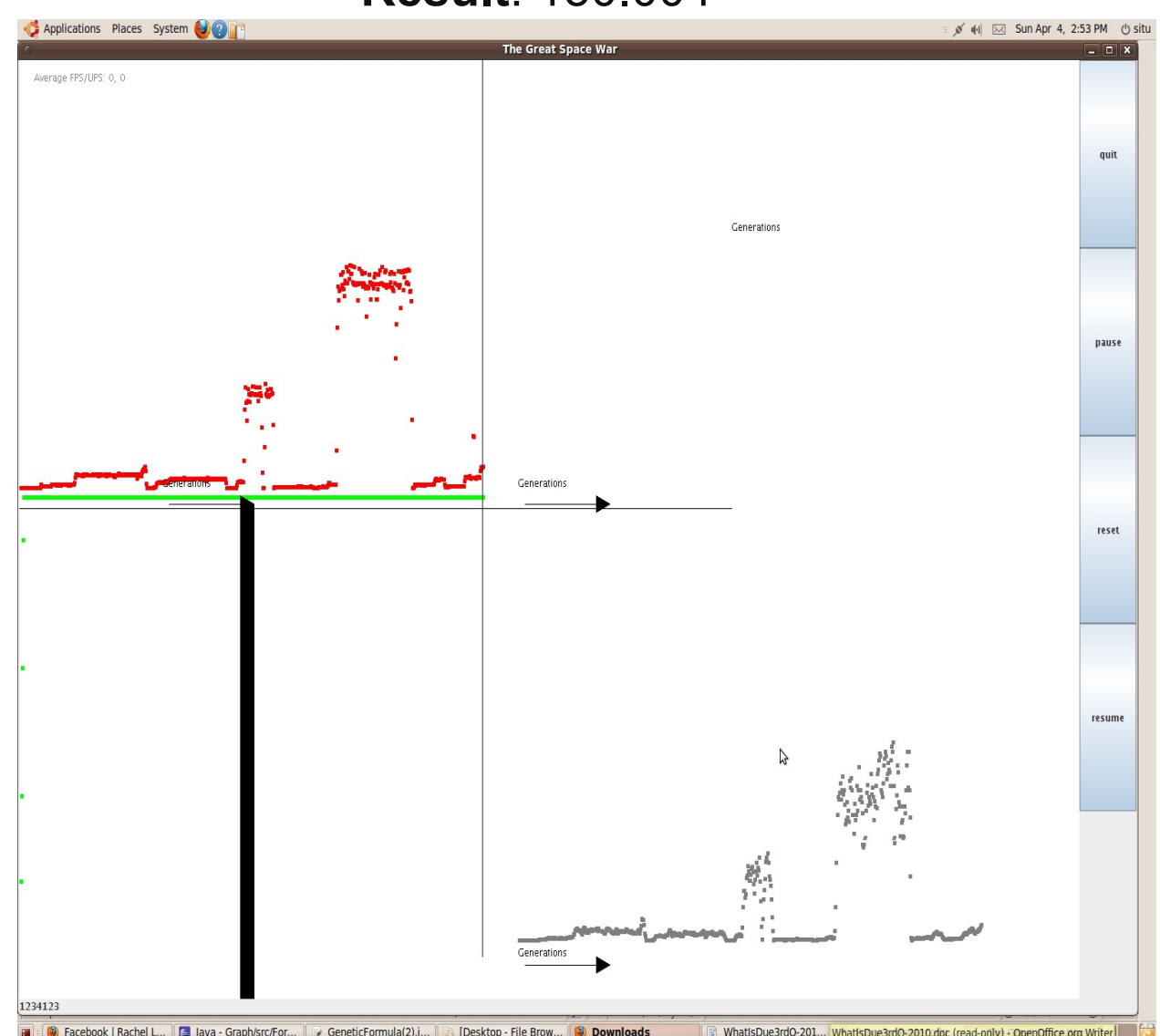
Number of Troops On Map	Update time(s)	Rendering Time(s)
10	0.61	0.75
1500	0.70	1.2
2500	0.64	2.25

In summary, my current code has significant speed issues. Speed is important so that my genetic algorithm can run faster with graphics.

### Genetic Algorithm

Target Number	% deviation from Target(Dynamic mutation)	% deviation from Target(0.05 mutation rate)
1	0.05413%	0.1346%
100	0.000715%	0.029571%
200	0.001976%	0.0006975

Sample Expression for 150:  $10.16-5.28+7.90*10.03+8.96*8.1075-0.14-6.60+4.50*-0.03$   
**Result: 150.004**



The red dots represent the highest fitness, the green dots represent the standard deviation, and the gray dots represent the average fitness over time. Values near the top are higher values.

### Conclusion

I have successfully created a genetic algorithm that generates expressions for a number over a wide range. However, the standard deviation of the fitness values becomes 0 after a while, which is why there is a green line in the screenshot. The maximum and average fitness values vary significantly over time, which is good. However, the fitness values do not show long term improvement after the beginning. Once I fully optimize my genetic algorithm, I will use it for my game's AI.