

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

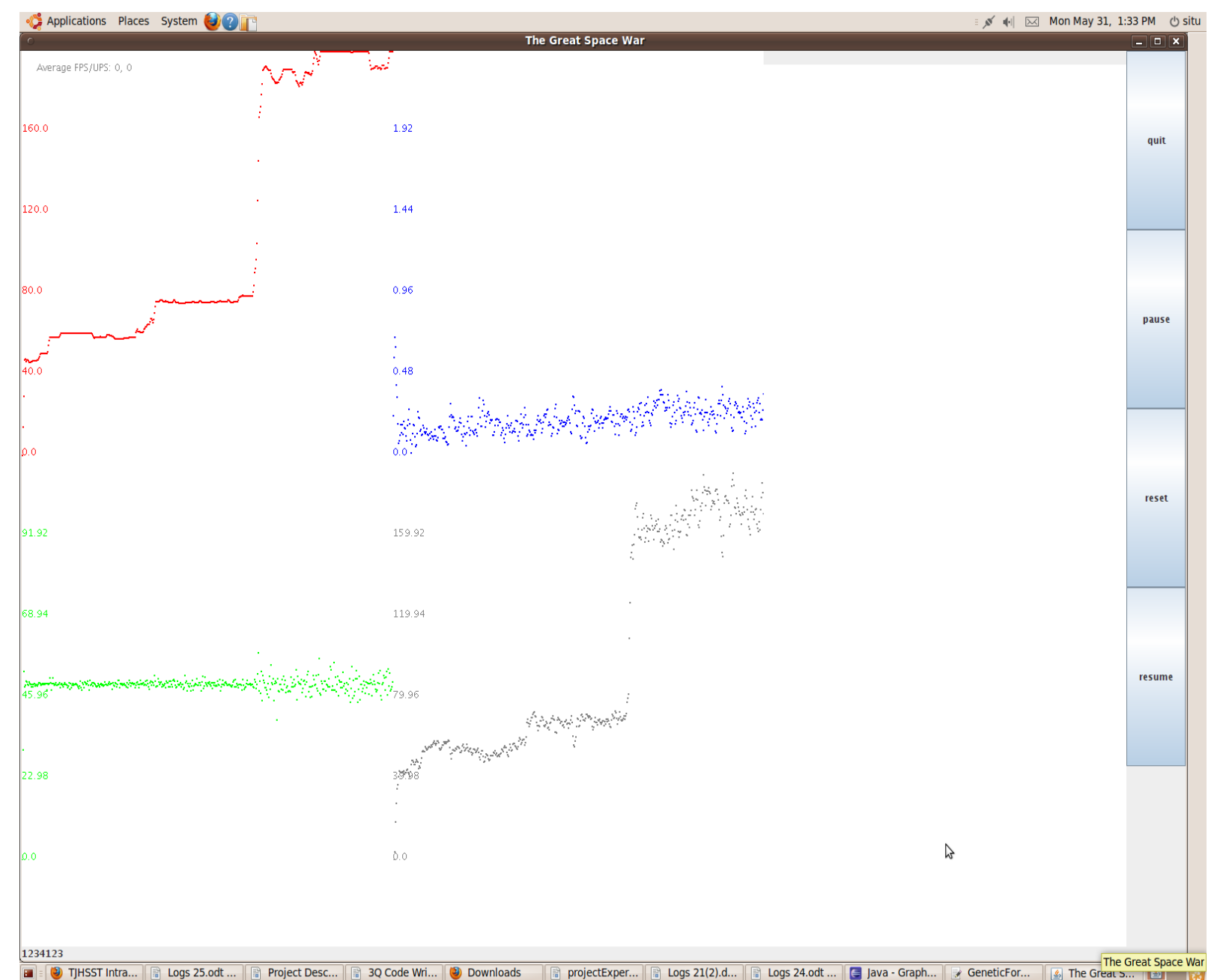
## Bharat Ponnaluri

### Computer Systems Lab 2009-2010

## Abstract

The AI in many strategy games makes decisions by using heuristic evaluation functions that are based on game data. This approach severely limits the intelligence of AI when brute-force calculations are not feasible. In Civilization 4, the AI often attacks by suiciding its armies against fortified cities. In Rome Total War, the AI attacks by simply marching its army towards you. These AI behaviors are easily exploited and are the result of the current method of AI designing. My goal is to design a real-time strategy game with an intelligent AI optimized by a genetic algorithm. The genetic algorithm will try to create an effective combination of evaluation functions.

**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**



## 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.

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.

$$2*x+3/10*x+2+10*x^3+9*x+1+3*x/5-8*x+8*5*x*5*3*x*1-8*x/8/6*x+6+8*x/5*8*x/7-8$$

Actual Formula is  $x^4+x^3+x^2+x+1$

## Results

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

## Conclusion

I have successfully created a genetic algorithm that generates expressions for a number over a wide range without stagnating. When I apply my genetic algorithm to generate a formula for a set of input-output pairs, it has trouble generating the correct formula for high-valued outputs due to its inability to recognize polynomials. Once I can get my genetic algorithm to recognize that a set of input-output pairs can be represented by a polynomial function, I will move on to having my genetic algorithm generate a heuristic for my game's AI.