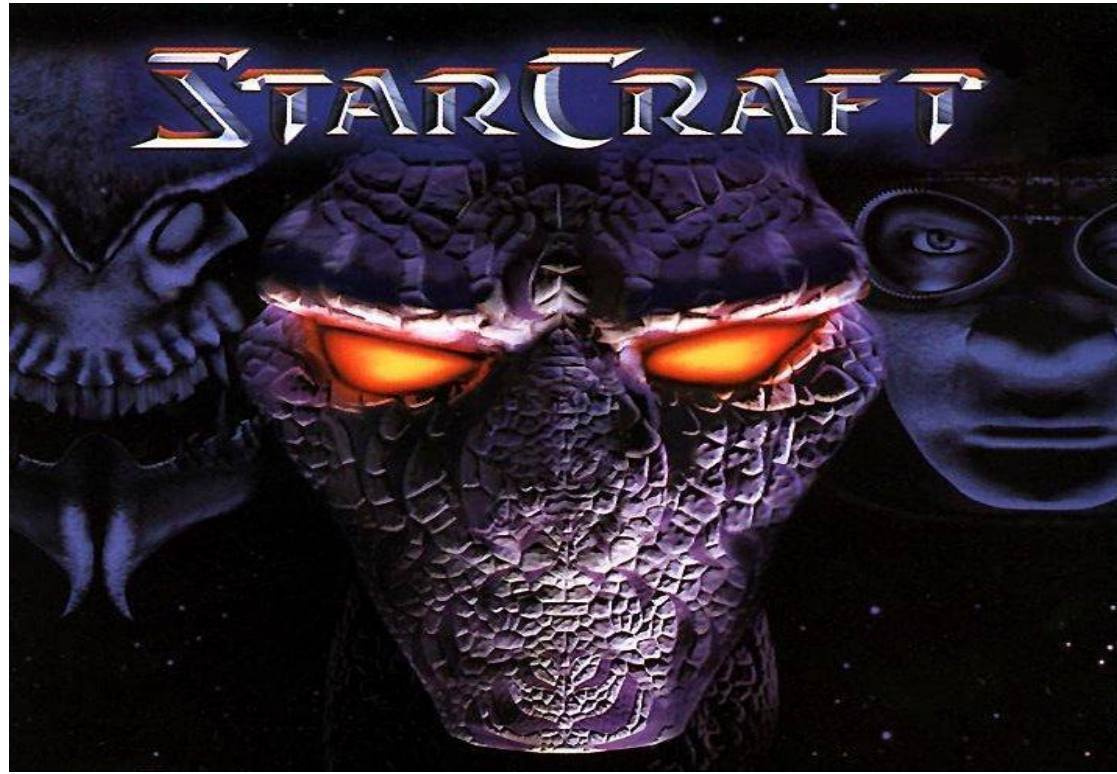




Evolving StarCraft AI

Why evolve AI to play StarCraft?

-Driven to perfect their science of proto-genetic evolution, the ancient, enigmatic race known as the Xel'Naga traveled to the distant fringe-world of Aiur.

- Humans compete in StarCraft all the time.
 - Professional gaming leagues show it requires skill
 - Koreans! It's practically a national sport.
- Lets make a bot that can do it better!
 - Humans can only control so many things at once
 - Humans need to sleep



Genetic Programming

-Believing that they could steer the race's evolution to the pinnacle of physical perfection, the Xel'Naga began to conduct their proto-genetic experiments.

- Who needs sleep?
 - Exploit the fact that computers can run indefinitely
- No need for a human expert
 - Using evolutionary techniques allows 'smart' solutions to grow naturally
 - No need for a Korean pro-gamer to work with the programmer

The Problem

-Templar warriors who have yet to reach the upper levels of the Khala are known as Zealots. These fearless warriors attune themselves to the Khala's disciplines and an invoke a near-berserker rage while in battle.

- A 9 vs 9 Protoss Zealot battle
 - A basic melee unit battle
 - Simple enough to achieve success but applicable to the larger game
- "Micro"
 - Micromanagement of individual units is essential
 - Pro gamers must practice this for hours a day
 - *Fast* clicking!

A Solution

- How does a human play?
 - Reaction to observed events
 - Precedence of reactions
- How does the A.I. play?
 - Two Options

Absolute Action tree

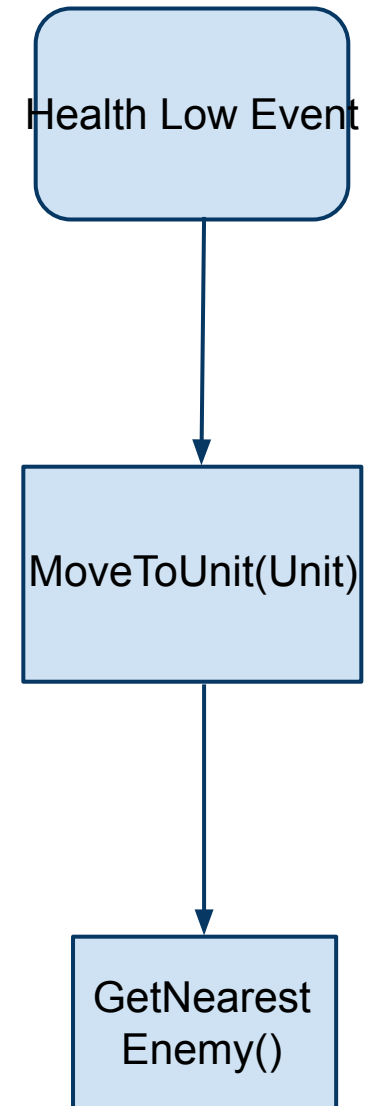
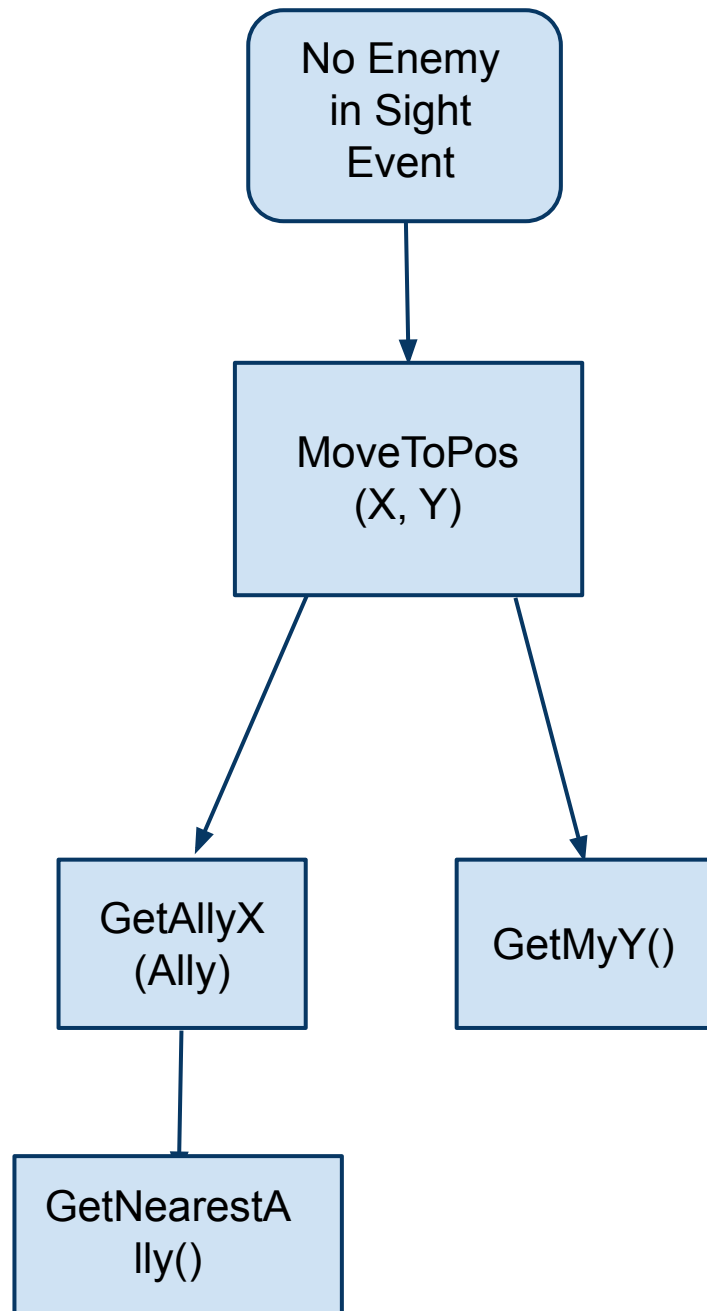
- A program constructed with conditional statements and actions that just runs in a loop.
- Nice, traditional GP model
- Far from the human model, prone to less than useful evolution

Event Model

- The bot responds to the same events a player would

*I see an enemy
My Health is low
I'm far from my allies*

- Still have action trees that can be evolved
- A bit more tailored to the problem

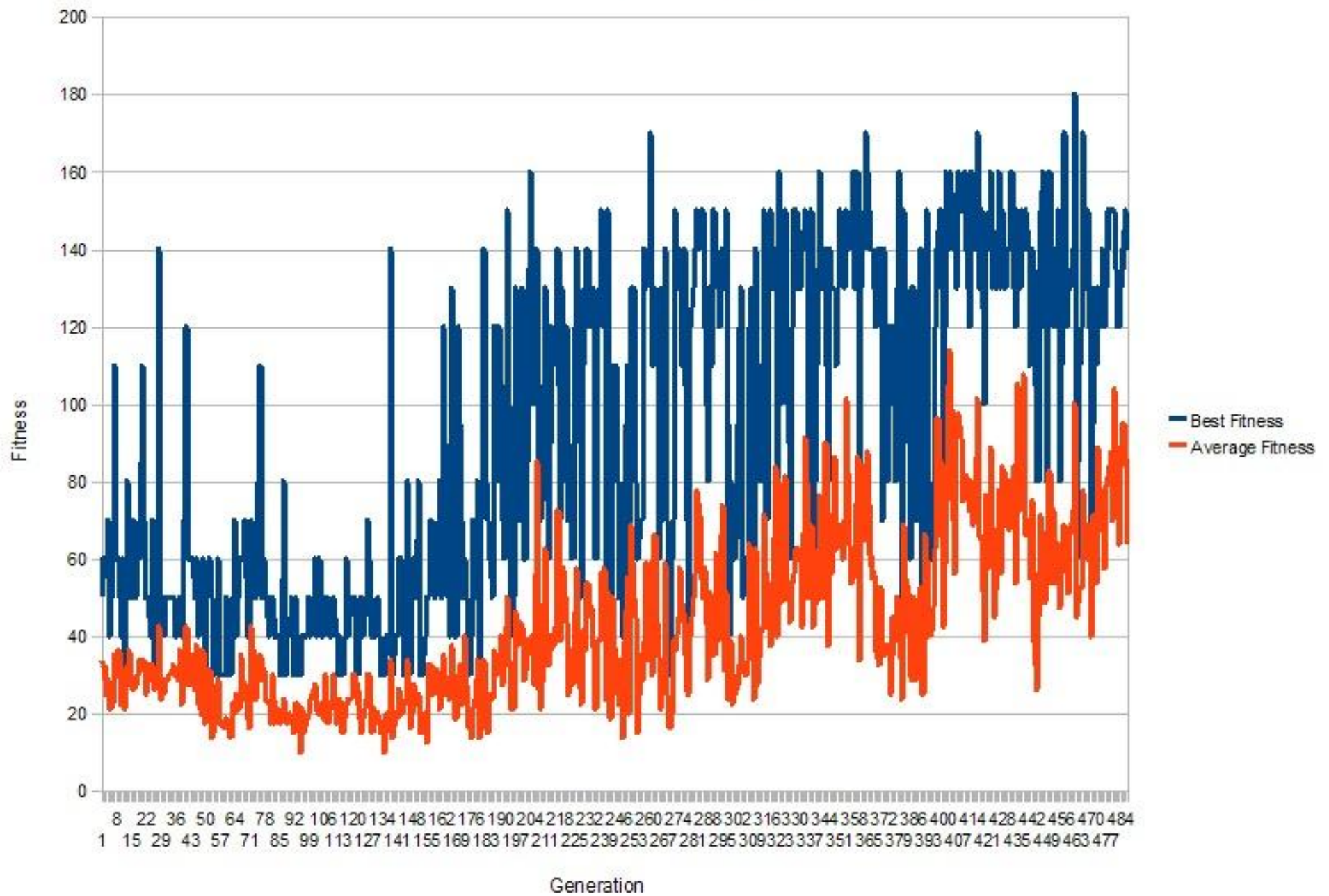


More Solution

The race that the Xel'Naga would eventually name 'Protoss' advanced rapidly and gained what their creators termed 'a distinct purity of form'.

- Population size of 16
 - With 9 Zealots running their routines this is actually more like $9 * 16$
- Crossover and Mutation after every population run
 - Extremely Elitist - Top 50% carried over
 - Top 25% Mutated
 - The last 25% are the children of crossover between random chromosomes
- Running for 400 generations gives good results
 - The average solution achieves success or near success
 - The best solution nearly always achieves success

Average and Best Fitness



Future Work

Although their protracted experiments produced many intriguing deviants and mutations, the races that the Xel’Naga cultivated always fell short of their enormous expectations.

- What could be better?
 - Although good solutions do arise there's room for improvement
 - Even good solutions don't run perfectly every time
 - Nondeterminism
 - Finer grained control for selecting positions, units, etc.
 - Evolving against a better opponent than the stock A.I.
 - Co-evolution

<http://www.youtube.com/watch?v=a0nwQYeyTPo>