4-18-2012

Applying Genetic Programming to Develop a Rubikâs Cube Solver

Follow this and additional works at: https://ecommons.udayton.edu/stander_posters

Applying Genetic Programming to Develop a Rubik's Cube Solver

By: Brian Bradley

Advisor: Dale Courte

Abstract

Genetic programming, a method of developing code using evolutionary principles in a computer simulation, can theoretically be applied to any problem. This work explored the applicability of genetic programming to the generating a human-readable set of rules that could be used to solve the cube. This involved developing a language to describe solutions to the cube as a series of rules, an algorithm to process those rules, and a fitness function to describe how good a possible solution is. Because of the high dimensionality of the problem, the difficulty in creating a good fitness function, and the need to develop both good rules and good solutions simultaneously, the ultimate goal was not achieved. However, through the effort to apply genetic programming to develop a Rubik's Cube solver, valuable information was gathered on what needs to be done for such an attempt to be successful.

Possible Actions

Back Clockwise
Inner Counterclockwise
Front Counterclockwise
Top Clockwise
Middle Clockwise
Bottom Clockwise
Left Counterclockwise
Middle Counterclockwise
Right Clockwise
Top Counterclockwise
Middle Counterclockwise
Bottom Counterclockwise
Left Clockwise
Middle Clockwise
Right Counterclockwise
Back Counterclockwise
Inner Clockwise
Front Clockwise

Examples of Rules

Antecedent (54 characters)

```
UUUUUUUUUUBUBBBUBUUUBUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU.AQBR.
UUUUUUUUUUBUBBBUBUBUBUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU.BNAM.
```

Consequent

Elements of Genetic Development

• Starting Population: Randomly generated, begins Evolution Process

•Fitness Function: Used to evaluate solutions, drives evolutionary process

•Creating the Next Generation: Solutions selected and "bred" for new generation

Simplification and Experiments

• Two color cube: Reduces size of the search space

• Nearly Solved Cube: Reduces complexity of solution

• Single Action Consequents: Reduces size of the search space

• Human Written Solver: Provides context for complexity of good solutions

Conclusions

• Rules and solutions (sets of rules) both need to be developed genetically

• Use of an near optimal cube solver in the fitness function likely beneficial

• The goal of developing a human readable solution genetically is attainable