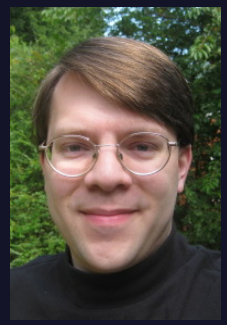
CREST

Using Genetic Improvement & Code Transplants to Specialise a C++ Program to a Problem Class

Authors



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Genetic Improvement

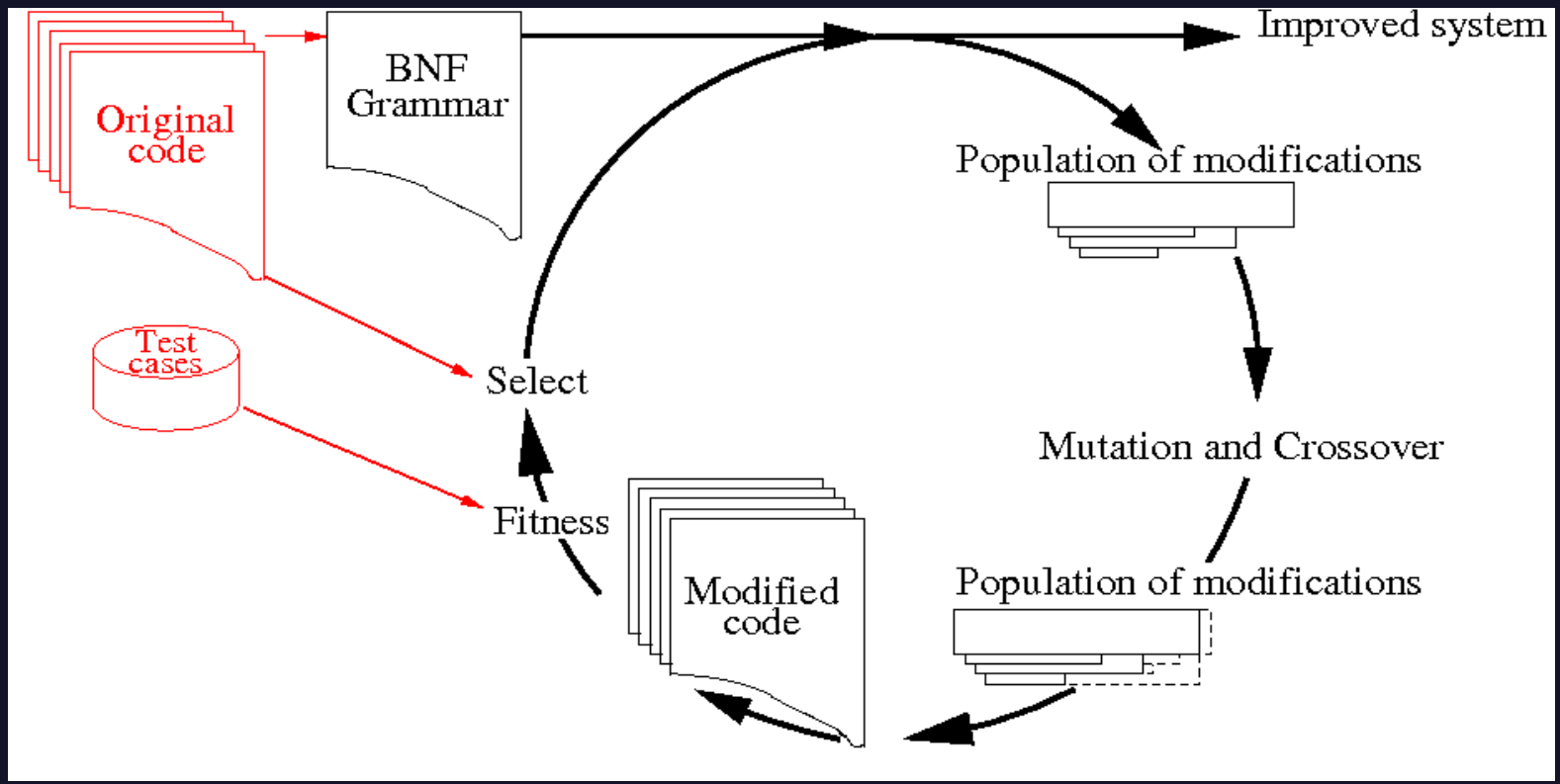
Seeks to automatically improve an existing program

Criteria can be non-functional properties of the system

Uses genetic programming

Relies on a set of test cases

Genetic Improvement



Contributions

Introduction of multi-donor software transplantation

Use of genetic improvement as means to specialise software

Motivation for choosing a SAT solver - impact

Bounded Model Checking

Planning

Software Verification

Automatic Test Pattern Generation

Combinational Equivalence Checking

Combinatorial Interaction Testing

and many other applications..

Motivation for choosing MiniSAT

MiniSAT-hack track in SAT solver competitions

- human-optimised versions of MiniSAT available

- good source for software transplants

Results

Solver	Donor	Lines	Seconds
MiniSAT (original)	—	1.00	1.00
MiniSAT-best09	—	1.46	1.76
MiniSAT-bestCIT	—	0.72	0.87
MiniSAT-best09+bestCIT	—	1.26	1.63
MiniSAT-gp	best09	0.93	0.95
MiniSAT-gp	bestCIT	0.72	0.87
MiniSAT-gp	best09+bestCIT	0.94	0.96
MiniSAT-gp-combined	best09+bestCIT	**0.54**	**0.83**

Results

Achieved 17% runtime improvement on MiniSAT

for the Combinatorial Interaction Testing domain

by combining best individuals

MiniSAT

Core algorithm developed in the 1960s

Optimised by experts for over 13 years

Achieved 17% improvement using GI in 14 hours

(for a particular problem class)

Results

Resultant version of MiniSAT is 4% better than any of the human-modified versions of MiniSAT

In 2011 SAT competition up to 9% runtime improvement achieved vs. 17% by specialising and using GI with transplantation and filtering

Impact

First use of transplantation within GI

Shown the approach improves highly-optimised software

Speed-up achieved within *hours* not years