GI4GI: Improving Genetic Improvement Fitness Functions

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GI4GI: Energy Optimisation Example

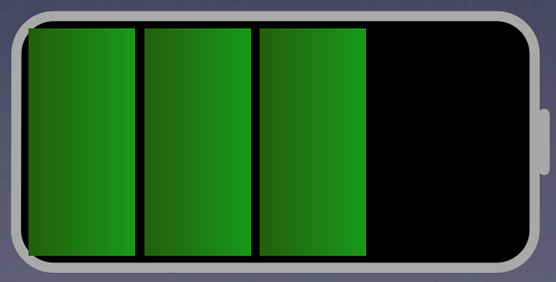
many factors affecting energy consumption, including:

screen behaviour

memory access

device communications

CPU utilisation



GI4GI: Energy Optimisation Example

a hardware-dependent linear energy model for GI:

$$power = C_{const} + C_{ins}\frac{ins}{cycle} + C_{flops}\frac{flops}{cycle} + C_{tca}\frac{tca}{cycle} + C_{mem}\frac{mem}{cycle}$$

$$energy = seconds \times power$$

Coefficient	Description	Intel (4-core)	AMD (48-core)
C_{const}	constant power draw	31.530	394.74
C_{ins}	instructions	20.490	-83.68
C_{flops}	floating point ops.	9.838	60.23
C_{tca}	cache accesses	-4.102	-16.38
C_{mem}	cache misses	2962.678	-4209.09

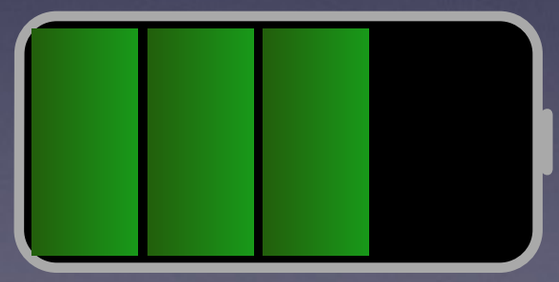
Table 2. Power model coefficients.

Post-compiler software optimization for reducing energy (ASPLOS'14) Schulte et al.

GI4GI: Energy Optimisation Example

Idea:

Use GI to evolve a fitness function *f* for energy consumption.

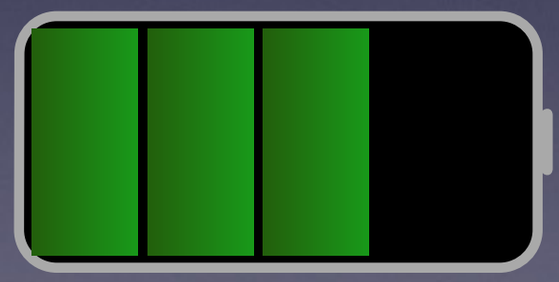


GI4GI: Energy Optimisation Example

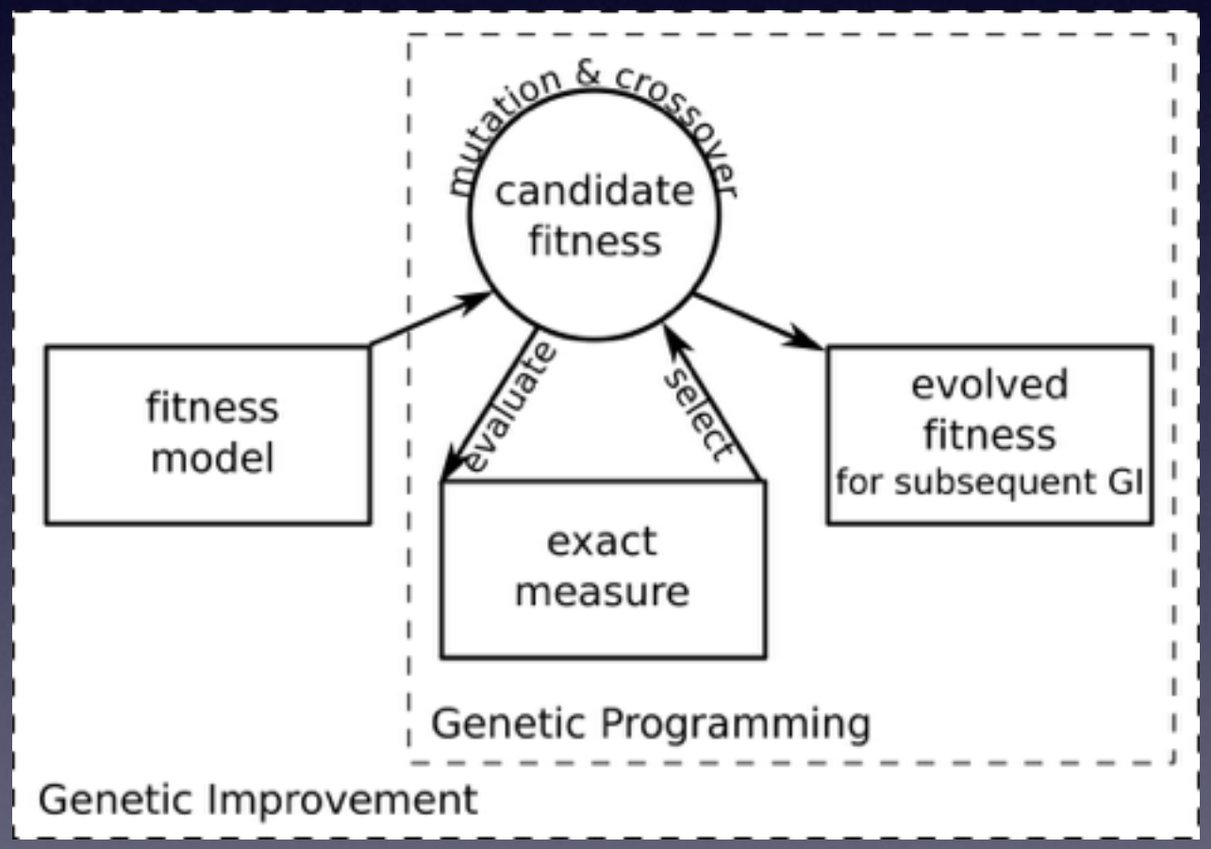
Idea:

Use GI to evolve a fitness function f for energy consumption.

Use f to improve energy consumption of software.



GI4GI


mutation & crossover
candidate
fitness
fitness
model
evaluate
select
evolved
fitness
for subsequent GI
exact
measure
Genetic Programming
Genetic Improvement

GI4GI: Software Architecture Example

objectives:

throughput maximisation

response time minimisation

performance optimisation

GI4GI: Software Architecture Example

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throughput maximisation

response time minimisation

performance optimisation

problems:

expensive to compute fitness

(multiple platform & architecture

simulations required; actual

implementations infeasible)

GI4GI: Software Architecture Example

GI4GI steps:

candidate performance model (or use GP to start from scratch)

execute a few instances of either simulation or actual architecture

calculate fitness function for subsequent GI (saves time/resources)

CREST

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