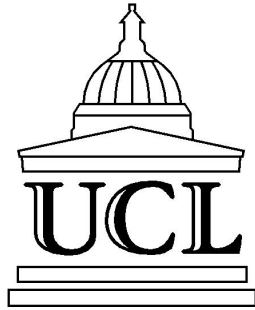
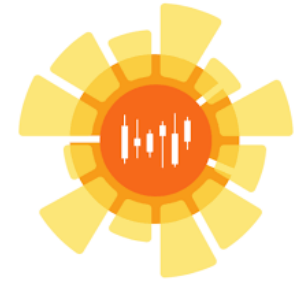


# Genetically Improved Software with fewer Data Caches Misses

GECCO companion 2023 also ArXiv 2304.03235



W. B. Langdon



You can evolve programs to use the cache better



WIKIPEDIA  
Genetic Improvement  
19.6.2023

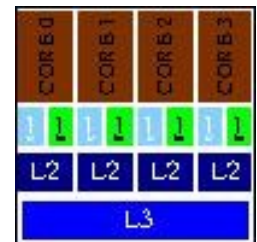
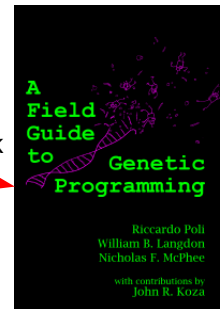


github.com/  
bloa/magpie



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# Why

- Programming is hard
- Parallel programming is very hard
- Efficient parallel programming is impossible
  
- The future is hybrid compute
  - DSP, FPGAs, multicore, GPU
  - Four years 2018-2022, 4x core count
  - If continues 2028: 131072 cpu per laptop
- Compute is cheap, data is expensive

# Why: Cache Vital

- Efficient parallel programming is impossible
- Need data at compute engine but people cannot program efficient data movement
- Data automatically moved to CPU via cache
- Cache is the bottle neck
- Cache proprietary, often changes with new hardware
- Cache has to be automatically programmed

# If you can measure it, you can evolve it

- Linux perf reports cache statistics
- Add perf cache misses to fitness
- Evolve using Magpie



[github.com/bloa/magpie](https://github.com/bloa/magpie)

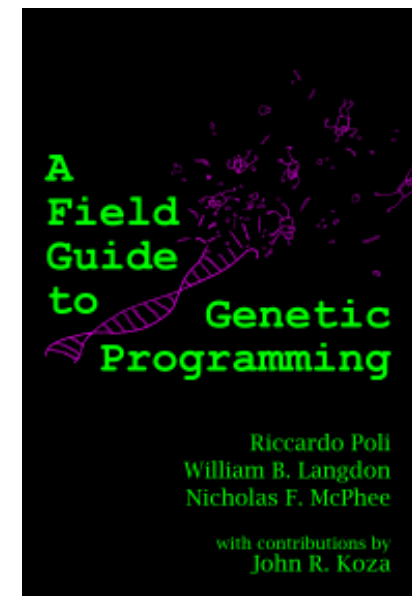
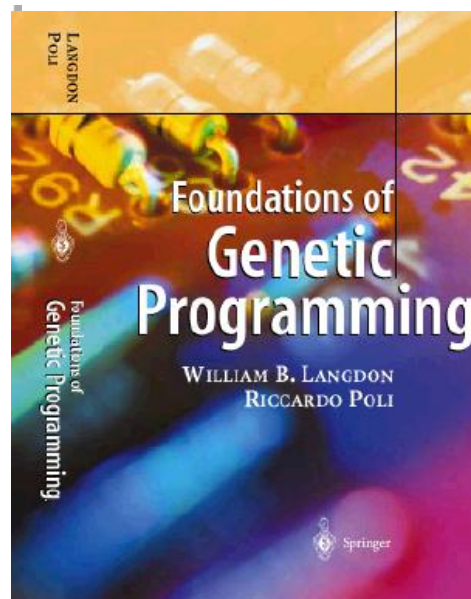
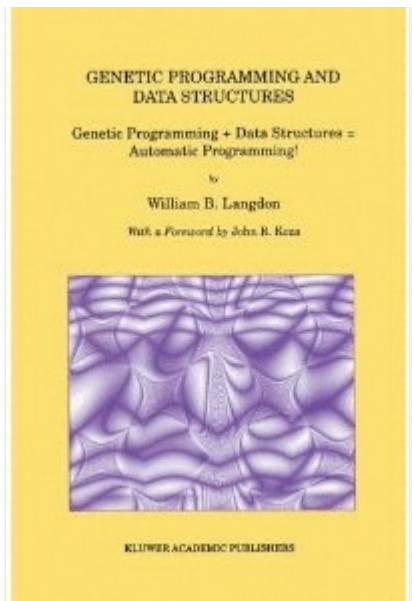
# Results

- Add L1 data cache misses to fitness
- Evolve three C programs and one C++ program to minimise cache misses in standard Intel CPU
- Industrial (Google, Uber), VLC, benchmark
- Mutated code works:
  - 2 data poor code: no overall cache gain
  - 2 data rich: reduced L1 cache misses
- **Code is not fragile**

# Genetic Programming



W. B. Langdon



# The Genetic Programming Bibliography

**16423** references, [16000 authors](#)

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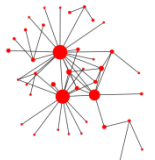


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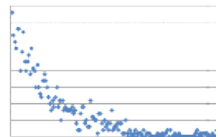
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