

GPU-BASED MASSIVELY PARALLEL IMPLEMENTATION OF METAHEURISTIC ALGORITHMS

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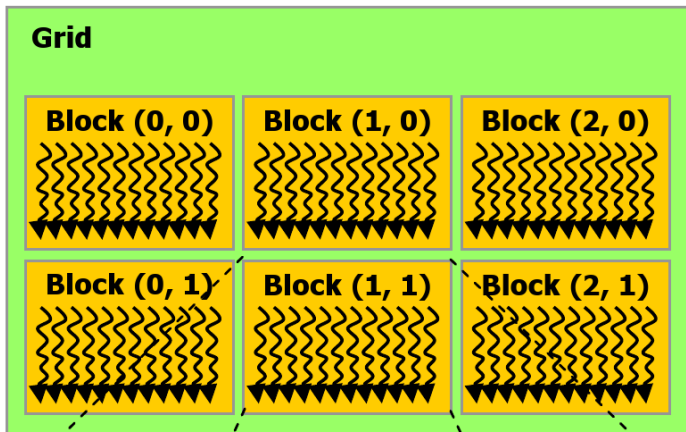
Computer Engineering Department
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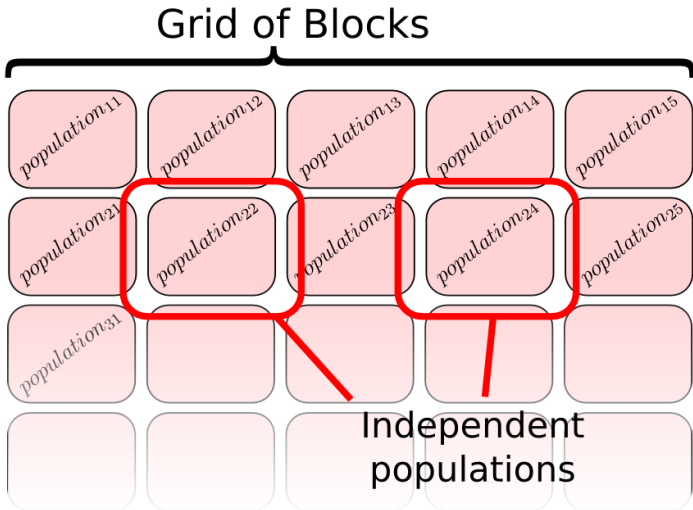
THREAD HIERARCHY ON CUDA GPU

In CUDA, **threads** are grouped in **blocks** and blocks constitute a **grid**. The unit of thread scheduling is **warp** (32 threads).



Grid of Thread Blocks

PROPOSED APPROACH TO PARALLELIZATION



GPU-BASED IMPLEMENTATION OF METAHEURISTICS

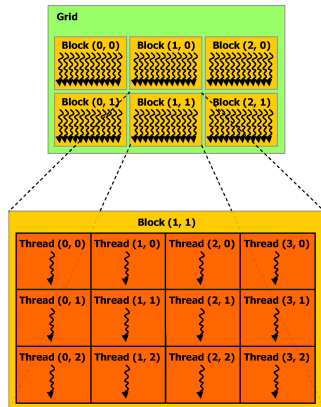
Two levels:

1 Coarse-grained parallelization

In a grid, there can be several hundred blocks evolving independent populations with same or different parameters simultaneously.

2 Fine-grained parallelization

On the population level, each individual can be evaluated and transformed in a separate GPU thread. Thus, the whole population can be represented as a block of threads.



Hundreds of populations with same or different parameters can be evolved in parallel, simultaneously.

GPU-BASED IMPLEMENTATION OF METAHEURISTICS

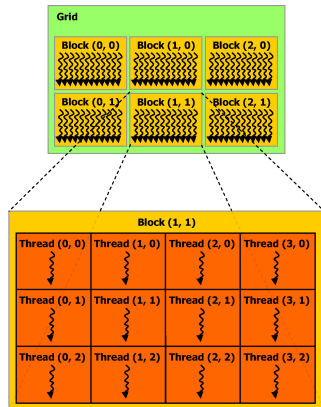
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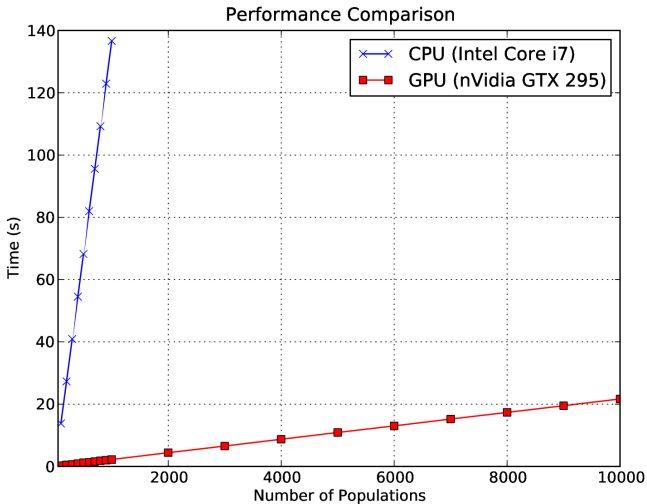
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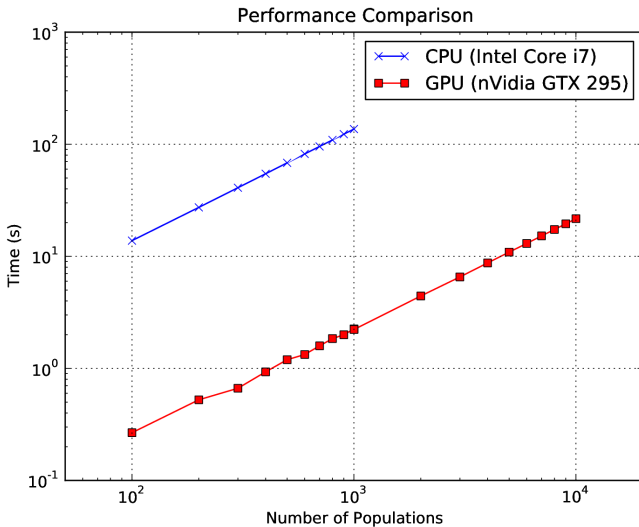


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PERFORMANCE COMPARISON



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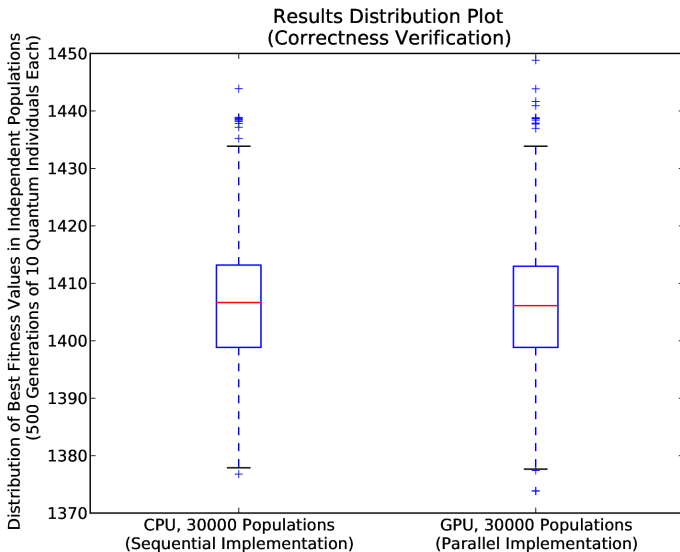


RESULTS

- 1 Pentium-III 500MHz (Visual C++ 6.0)**
0.723 experiments / second (according to [1])
- 2 Intel Core i7 2.93GHz (1 core, ANSI C)**
7.33 experiments / second
- 3 NVidia GTX 295 (CUDA C)**
890 experiments / second (**about 120x speedup**)
- 4 8 GPUs (GTX295+GTX285+Tesla s1070+Tesla C2070)**
3089 experiments / second (**over 400x speedup**)

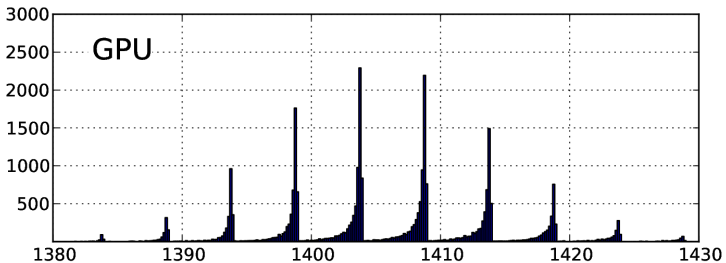
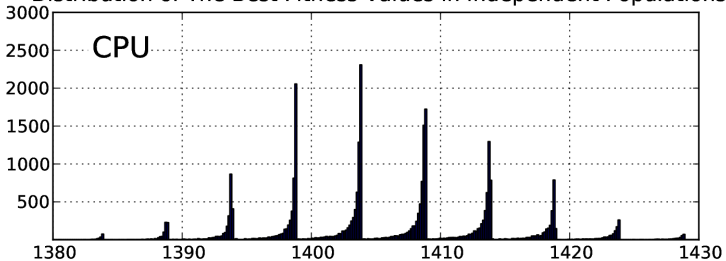
¹Han, K. H., Kim, J. H.: Genetic quantum algorithm and its application to combinatorial optimization problem. Proceedings of the 2000 Congress on Evolutionary computation, 2000

CORRECTNESS VERIFICATION



CORRECTNESS VERIFICATION

Distribution of The Best Fitness Values in Independent Populations



Thank you for your attention