

# Multi-Dimensional Parallel Genetic Algorithm using OpenMP

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## Abstract

We present a detailed description of a multi-dimensional genetic algorithm implemented in C++11 and the OpenMP library. The use of the OpenMP library allows for the algorithm to be implemented using parallel processing and hence operate in an extremely efficient manner. The algorithm also offers a considerable degree of flexibility in allowing the user to experiment with different cross-over operators. Results are presented for several multi-dimensional functions and in comparison to more common genetic algorithms available.

Keywords: Genetic Algorithms, Parallel Algorithms, OpenMP

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## INTRODUCTION

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## GENETIC ALGORITHM COMPONENTS

### Chromosome Builder

The Chromosome Builder is responsible for creating a family of chromosomes from the domain space chosen by the user. Each chromosome is represented as an array of *boolean* values. Although C++ provides a bitset data structure, as part of its Standard Template Library (STL), it does not have the flexibility of determining the length of a bitset at runtime. Therefore an array was chosen which could be dynamically altered to map to the user supplied domain space. The length of the chromosome is bound by the domain space, for a given dimension of range  $[a:b]$  we have

$$2^{N_1-1} < (b - a) \cdot 1000 \leq 2^{N_1} \quad (1)$$

### Roulette

### Crossover

### Mutate