**ABSTRACT**

Genetic Algorithms are a robust search technique that mimics the process of natural evolution to direct the search procedure from a randomized initialization to a more prospective direction in a very large search space.

In recent years, GA is widely used in multiple scientific domains, the need for a high performing genetic algorithm is essential. The performance of the genetic algorithm is measured by the speed of the search or by the reliability of the algorithm. Since from the beginning of GA, significant process has been made in various aspects of GA in attempt to improve the performance further on all types of problems and search space.

The performance of the genetic algorithm is very much attributed to the premature convergence of the individuals in the population and diversity, in turn is determined by the chromosome structure, population size and selection pressure.

This research tries to improve the performance of the genetic algorithm by tuning various attributes of genetic algorithm. The tuning is done by changing the chromosome structure, at the initial search space and by reducing the initial population size. All the tuning methods are applied in 0/1 knapsack problem to analyze the performance.

First tuning method is done by modifying the structure of the chromosome. Generally in GA, the chromosomes are represented in the form
of binary coded strings. Gray coding is one of the coding scheme. Here gray coding is applied to convert binary represented strings to gray strings. Gray coding is another way of coding parameters into bits which has the property that an increase of one step in the parameter value corresponds to a change of a single bit in the code. Tuning by gray coding scheme shows notable improvement both by profit and convergence than Standard Genetic Algorithm (SGA) on various parametric conditions.

In order to improve the performance of the genetic algorithm further, this research tries to overcome the selection pressure exhibited on high fit individuals by traditional selection mechanisms through a simple and adaptive multi population genetic algorithm called Multi Clustered Parallel Genetic Algorithm (MCPGA). Here the initial population is separated into different clusters based on their fitness values. Then the genetic operators are applied in each cluster. The algorithm performs well when compared to SGA. The algorithm is analyzed by varying the different parameters and the optimal parameters are identified.

For further improvement in performance the initial population can be reduced by identifying the best individuals from the initial population. To satisfy this Population Reduction (PR) method is introduced, in which the best individuals are identified by applying tournament selection mechanism. Tournament selection produces better result both in terms of profit and convergence in fixed and variable number of generations. PR method shows good improvement than SGA.
Though GA is expert at solving optimization problems, it is not directly suitable to solve problems with user specific constraints. The techniques to solve such constrained optimization problems mostly rely on additional penalty functions to be applied to the infeasible solutions that exist in the search space. A reasonable choice of penalty function is essential for an optimal convergence of GA. To handle this constraint optimization problem, a biological inspired genetic operator Gene Inactivation (GI) operator is introduced. It is implemented for 0/1 knapsack problem and compared with SGA to analyze the performance. The result shows good improvement in both profit and convergence.

As per the analysis of the tuning methods, it is obvious that all the tuning methods are more effective in terms of improving the performance of the algorithm by quick convergence.