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IMPROVE THE EFFICIENCY OF GENETIC ALGORITHMS USING SOFT COMPUTING

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ABSTRACT
Soft computing is the use of approximate calculations to provide imprecise but usable solutions to complex computational problems. The approach enables solutions for problems that may be either unsolvable or just too time-consuming to solve with current hardware. Soft computing is sometimes referred to as computational intelligence.Soft computing provides an approach to problem-solving using means other than computers. With the human mind as a role model, soft computing is tolerant of partial truths, uncertainty, imprecision and approximation, unlike traditional computing models. The tolerance of soft computing allows researchers to approach some problems that traditional computing can't process.

1.INTRODUCTION

Soft computing provides an approach to problem-solving using means other than computers. With the human mind as a role model, soft computing is tolerant of partial truths, uncertainty, imprecision and approximation, unlike traditional computing models. The tolerance of soft computing allows researchers to approach some problems that traditional computing can't process.

Soft computing uses component fields of study in:

Fuzzy logic

Machine learning

Genetic algorithms

As a field of mathematical and computer study, soft computing has been around since the 1990s. The inspiration was the human mind's ability to form real-world solutions to problems through approximation. Soft computing contrasts with possibility, an approach that is used when there is not enough information available to solve a problem. In contrast, soft computing is used where the problem is not adequately specified for the use of conventional math and computer techniques. Soft computing has numerous real-world applications in domestic, commercial and industrial situations.

2.Problem Statement:

The classical Genetic Algorithms use strings representing chromosomes and genetic operators. After encoding solutions to a problem, the classical genetic algorithms are more like blind search, and perform well when very little prior knowledge is available. However, Genetic Algorithms do not have to be blind search, when additional knowledge about problem is available, it can be incorporated into genetic algorithms to improve the efficiency of Genetic Algorithms. The convergence speed of Genetic Algorithms with some special developed codes will be much faster than conventional Genetic Algorithms. That is very significant for finding more applications of Genetic Algorithms, as, in many cases, Genetic Algorithms' applications are limited by their convergence speed.

The research objectives are focused in following areas of genetic algorithms:

1. Chromosome encoding is an important issue in genetic algorithm because it represents the potential problem solution. So encoding i.e. the representation of the problem in the form of chromosome is problem dependent. A number of encoding techniques exist and each has its own merits and demerits. Some encoding techniques can be used only with specific crossover operators or certain operators cannot be applied on these encoding schemes. For example, binary coding being the simplest form of encoding is easy to use, but crossover operators like cycle or order cannot be

performed on it and neither inversion operator can be carried out on it. On the contrary, Permutation encoding supports these specific crossover operations and inversion but does not support simple crossover and has no mechanism to retain good building blocks. Seeing the merits and demerits of different encoding schemes, the researcher intends to do more work in this direction in identifying new encoding scheme that overcomes the limitation of existing schemes.

2. Selection is the vital operation in genetic algorithm that chooses parents from the population for crossing. After deciding on an encoding, the next step is to decide how to perform selection i.e. how to choose individuals in the population that will create offspring for the next generation and how many offspring each will create. The purpose of selection is to emphasize fitter individuals in the population in hopes that their off springs have higher fitness. Chromosomes are selected from the initial population to be parents for reproduction. Various selection techniques have been used in the past. Some are explorative and some are exploitative in nature consequential to either slow convergence or premature convergence (due to local maxima or minima) respectively. The researcher intends to explore new selection techniques so as to bring balance between exploration and exploitation and retain the best features of parents to generate better off springs.

3. Crossover is a fundamental operation of genetic algorithm. But it is to be adjusted according to the need of the problem. Crossover operator depends on the encoding used for the chromosomes, which is indirectly related to the type of the problem. In some cases, good building blocks (good genetic material) is broken (or lost) during the crossover operation. This leads to need of a crossover operator that keeps or changes the genetic material on the base of certain knowledge component. In addition

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to crossover there are other operations such as mutation, inversion etc. that are performed by the nature. The researcher intends to find out the effect of these operations on the performance of genetic algorithms and develop certain naive knowledge based operators that can improve the performance of genetic algorithms.

4. Maximum research works in genetic algorithms are carried out using haploid (Single stranded chromosome). Diploidy (Pair of chromosomes) and dominance (genotype to phenotype mapping) have not been given due weight age although in maximum complex systems nature uses them. The researcher intends to identify the utility of these in genetic algorithms.

3.Methodology and Test Functions

In past decades, different kinds of optimization algorithms have been developed like simulated Annealing, evolutionary algorithms, Genetic Algorithms, Ant colony Optimization, Particle Swarm Optimization and many more. These algorithms have shown excellent search abilities but often lose their efficacy when applied to large and complex problems. It has also been found that many optimization problems suffer from "Curse of Dimensionality" which implies that their performance deteriorates quickly as dimensionality of search space increases

This may be due to two reasons –

(i) solution space of problem increases exponentially with problem dimension and (ii) characteristics of problem may change with the scale. For example, Rosen rock function is uni -modal for two dimensions but becomes multi-modal for higher ones.

There are classes of continuous test functions that can be used as benchmarks. They are categorised as:

(a) Uni-modal, convex, multidimensional: It contains nice functions as well as malicious cases causing slow convergence to single global optimum.

(b) Multi-modal, two-dimensional with a small number of local extremes: It is used to test quality of standard optimization procedures in the hostile environment, namely that having few local extremes with single global on.

(c) Multi-modal, two-dimensional with huge number of local extremes: It is used to test intelligent resistant optimization methods like simulated annealing, genetic algorithms etc. This class of algorithms can be regarded as artificial as it justifies the optimization procedure on 2D surface and supports the methods by human intuitions. Moreover, two dimensional optimization problems appear very rarely in practice.

(d) Multi-modal, multidimensional, with huge number of local extremes: It is also recommended to test intelligent resistant optimization methods. It is used to test real quality of proposed algorithms. It justifies practical discrete optimization problems that provide instances with large number of dimensions.

4. CONCLUSION

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