PROSPECTS & SCOPE OF GENETIC ALGORITHM IN GREEN COMPUTING

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ABSTRACT

Humans are always attracted with greenery and nature. It is the responsibility of mankind to keep environment healthy and balanced by keeping the best and efficient utilization of resources. But, today with the use of fastest computers, servers, storage devices and other machines the nature has disturbed. Green Computing, a recent and new technology provides best possible solution for these problems. Hence, for finding best utilization and performance of various available resources Genetic Algorithm can be used. The main emphasis of this paper is to analyze the benefits of Green Computing and to study that how it can be achieved by the use of Genetic Algorithm and other Soft Computing techniques.

Keywords: Artificial Neural Techniques, Genetic Algorithm, Green Computing, Soft Computing

I. INTRODUCTION

Today, technology have advanced to such an extent that it's possible to send files from our smart-phones to distant computers in a quick and instant manner. As we are developing, and depending too much on faster machines to make our lives easy and better, without considering the fact, that they also contribute to many serious environmental problems.

Computers run on electricity which is produced by burning coal/oil. This process releases much harmful emission of gases like Co_2, sulphur, methane and other such gases (termed as greenhouse gases) into the atmosphere. These greenhouse gases accumulate and cause global warming, respiratory diseases, acid rains etc. Another factor that is a major cause of concern to the environment is the disposal of computer peripherals containing heavy metals, deadliest gases, flame-retardant plastics, and non bio-degradable material which easily reach and pollutes land and water.

Nowadays the protection and safety of environment has become crucial, moreover a necessity for the society's well being. Hence, in order to conserve energy in all the possible ways, respective governments advises all the sectors to make use of eco-friendly products and methodologies in every possible way. This paper discusses and describes that how to deal and develop best optimization of all the energy efficiency and resources in these machines in best and fruitful manner.

II. GREEN COMPUTING

Green computing, also called Green technology, is the environmentally responsible and eco-friendly use of computers and their related resources. In simple terms, it is "the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems—such as monitors, printers, storage

devices, and networking and communications systems — efficiently and effectively with minimal or no impact on the environment. Research still continues in making the use of computers as energy-efficient as possible, and designing algorithms and systems for efficiency-related computer technologies.

The importance of Green technology was made evident when computing attained critical mass in the early 1990s. The late 1990s and early 2000s witnessed many regulatory milestones, and the recent years witness companies innovating to incorporate green technology. It is the application of environmental science to offer economically cheap solutions that conserve the natural environment and resources, and curb the negative impacts of human involvement.

Some examples of the application of green technology in computing include:

- reducing the use of environmentally hazardous materials like CFC, lead and others,
- promoting the use of recyclable materials and minimizing use of non-biodegradable components,
- promoting practices such as energy cost accounting, virtualization, e-Waste recycling and the like,
- application of technology with change in lifestyle habits aimed at energy conservation

Businesses around the world have realized the importance of securing environment and how beneficial it can be done by Green technology. Businesses implement Green technology to reduce power consumption and for lowering costs. Data centers are an integral part of any organization as they are the central repository where the data of any given organization is stored. The proliferation of data centers required the constant addition of server, cooling and ventilation equipment that led to an ever-increasing demand of energy and increased presence of toxic and hazardous substances. This has made to look at ways to apply green technology in computing, to reduce the effect of serious environmental and health concerns.

Green Computing with respect to data centers leads a lot of cost savings over time. Reduction in energy costs from servers, cooling and lightning helps any organization saves a lot on their budget on power. However, the problem is actually greater than the growth in power consumption by data centers.

Another concept is to Reuseold computer/parts, replace the old parts with new ones or buy refurbished hardware to save cost, recycle computer parts. If we don't recycle them, they end up as e-waste.

III. GENETIC ALGORITHM

Charles Darwinian evolution in 1859 is a robust search and optimization mechanism. Darwin's principle "Survival of the fittest" captured the popular imagination. This principle can be used as a starting point in introducing Evolutionary Computation (EC). The evolutionary concept can be applied to problems where heuristic solutions are not present or which leads to unsatisfactory results. As a result, evolutionary algorithms are of recent interest, particularly for practical problems solving.

The Evolutionary Algorithm (EA) was an attempt to mimic some of the processes taking place in natural evolution. Although the details of biological evolution are not completely understood. An Evolutionary Algorithm (EA) is an iterative and stochastic process that operates on a set of individuals or population. Each individual represents a potential solution to the problem being solved. This solution is obtained by means of an encoding or decoding mechanism. Initially, the population is randomly generated. Every individual in the population is assigned a fitness function, with respect to the problem under consideration, is the quantitative information the algorithm uses to guide the search.

Among the various evolutionary techniques, the Genetic Algorithms (GAs) are the most extended group of methods representing the application of evolutionary tools. Intuitively a GA proceeds by creating successive

generations of better and better individuals by applying selection, crossover and mutation operators. Replacement is usually done by generations of new individuals. The search is guided only by the fitness value associated to every individual in the population. This value is used to rank individuals depending on their relative suitability for the problem being solved.

At any given time, a number of different organisms may co-exist and compete for the same resources in an ecosystem. The organisms that are most capable of acquiring resources and successfully procreating are the ones whose descendantswill tend to be numerous in the future. Organisms that are less capable will tend to have few or no generations in the future.

Over time, the entire population of the ecosystem is said to *evolve* to contain organisms that, on average, are more fit than those of previous generations of the population because they exhibit more of those characteristics that tend to promote survival.

Evolutionary computation (EC) techniques use these evolutionary principles into algorithms that may be used to search for optimal solutions to a problem. In a search algorithm, a number of possible solutions to a problem are available and the task is to find the best solution possible in a fixed amount of time. For a search space with only a small number of possible solutions, all the solutions can be examined in a reasonable amount of time and the optimal one found. This *exhaustive search* becomes impractical as the search space grows in size.

The key distinguishing feature of an evolutionary search algorithm from traditional algorithms is that it is *population-based*. Through the adaptation of successive generations of a large number of individuals, an evolutionary algorithm performs an efficient directed search and hence is generally better than random search.

Evolutionary computing began by lifting ideas from biological evolutionary theory into computer science, and continues to look toward new biological research findings for inspiration.

IV. PROSPECTS & SCOPE

Global climate change due to CO_2 emissions is an issue of international concern that primarily attributed to fossil fuels. [1] In his study described that how Genetic Algorithm (GA) be used for analyzing world CO_2 emission based on the global energy consumption. They investigate the causal relationships among global carbon emission and energy consumption, using Genetic Algorithm (GA). The results presented provide helpful insight into energy system and CO_2 emission control modeling.

Forecasting of CO_2 emission can also be investigated with other Particle Swarm Optimization, Artificial Bee Colony, Ant Colony, or other algorithm. The results of the different methods can be compared with the GA technique.

Due to the increasing popularity of the Internet, which continues to be part of our daily lives, the communication systems of the coming era are predicted to consume large quantities of energy.This energy use comes at an environmental cost, and recent reports estimate that the industry now contributes 2% of the worlds CO_2 emissions, much more than other industry. While improving energy efficiency is the main aim of modern society and other is to move towards green, renewable energy sources the researchers are interested to find solutions of carbon footprint of data centers. The data centers that house various types of Internet services are actually the most significant consumer of energy.

Raymond, Bala Subramanian, William etc [2] in his work suggest that a significant part of this energy consumption can be attributed to data centers, where huge numbers of energy intensive servers host a variety of internet services i.e. the data centers that provide services are the most significant consumer of energy. In his work they present solution for delivering green data centers. They propose a Genetic Algorithm based solution for determining the optimal placement of services in data centre network, in order to maximize the overall renewable energy usage and minimize the cooling energy consumption.

In their paper they proposed a green data centre solution that uses a GA-based service placement approach based on targeting countries with the highest production of renewable energy and the best conditions for cooling. From this study they analyzed that this technique is feasible to make significant improvements in the proportion of renewable energy utilized in data centre operation, hence reduces the quantity of fossil fuels burned and ultimately carbon emissions. At the same time, it shows that this improved renewable energy utilization did not come at an increased monetary cost.

[3] Another researcher in his work showed that how to increase the availability of computational resources, while minimizing system power consumption and operational expenses. They showed a power efficient resource allocation algorithm for tasks in cloud computing data centers, based on genetic algorithms which ensure performance and scalability to millions of tasks. Resource allocation is performed taking into account computational and networking requirements of tasks and optimizes task completion time and data center power consumption. The evaluation results, obtained using a dedicated open source genetic multi-objective framework showed that the developed approach is able to perform the static allocation of a large number of independent tasks on homogeneous single-core servers within the same data center with a quadratic time complexity.

Various other authors from time to time have also applied other soft computing techniques to balance the load [4] they investigated the different algorithm and studied the pros and cons of these algorithms.

A.Azadeh, R. etc [5] in his study presents a genetic algorithm (GA) with variable parameters to forecast electricity demand in agricultural, low energy consuming and energy intensive sectors using stochastic procedures. The economic indicators used in this paper are price, value added, number of customers and consumption in the last periods for agricultural and low energy consuming sectors and price, value added, number of customers, price of the substitute fuel and energy intensity in energy intensive sector. Three kinds of models; linear logarithmic, exponential and quadratic are used to find which leads us to minimum error for the related sector. The GA applied in this study has been tuned for all its parameters and the best coefficients with minimum error are identified, while all parameter values are tested concurrently. The estimation errors of genetic algorithm models are less than that of estimated by regression method. Finally, analysis of variance (ANOVA) is applied to compare genetic algorithm (three models), regression and actual data. Furthermore it is shown that genetic algorithm estimation is closer to actual data with less (Mean Absolute Percentage Error) error than that of estimated by regression. The data from 1979 to 2003 is used to forecast electricity consumption in the aforementioned sectors as the case study.

Over the last few years, the engineers, researchers, and vendors have teamed up to design and develop [6] the intelligent models and algorithms that constrict the use of electrical energy in computing devices in the large-scale heterogeneous systems.

Another researcher [7] proposed a load balance technique based on Artificial Neural Network. ANN predict the demand and then allocate resources according to demand. Thus, it always maintains the active servers

according to current demand, which results in low energy consumption than the conservative approach of over-provisioning. Furthermore, high utilization of server results in more power consumption, server running at higher utilization can process more workload with similar power usage. Finally the existing load balancing techniques in cloud computing are discussed and compared based on various parameters.

Another [8] researcher in his work presents the results of simulation work performed to enhance the effectiveness of Green Cloud Computing using Artificial Neural Networks. It has been shown that to predict that whether the cloud architecture will be green or not can be made more accurate by employing Artificial Neural Networks. The advantage of this work is that it eliminates the need to invest on the costly hardware to conduct experiments to predict whether the cloud computing architecture will be green or not. By simulation work both time and expenditure can be reduced.

V. CONCLUSION

Green IT is continuously interesting people and organizations all over the world. Green IT has gained a lot of importance because of the rising energy costs and its impact on the environment. The need to manufacture and store energy has increased mainly due to the volume of systems that the organizations generally rely on. The power consumption by companies is a critical issue. The idea of using green computing is beneficial as it helps the companies dispose their electronic waste in an effective way so that the environment is not hampered. This is also done in order to help reduce the CO2 emissions from data centers that are responsible for global damage. The paper discusses the role of various soft computing techniques in the performance of Green computing and finds that the maximum efficiency can be attained by using these techniques.

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