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Adaptive Gentic Optimization Algorithm For Dynamic Resource Allocation In Cloud Computing

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ABSTRACT: Cloud Computing is regarded as one among eminent technology which is greatly necessitated for various applications which demands proficient dynamic resource allocation to meet customer satisfaction through consistent and assured services. The essential services are offered on the needy basis of users and hence cloud systems are termed as 'on demand' technology. Optimal resource allocation is the most thought-provoking concern in the prevailing system. A novel meta heuristic algorithm is presents to alleviate the above-mentioned issue. Adaptive Genetic Optimization Algorithm (AGOA) is greatly exploited for extemporize proficient resource allotment process in cloud. The dynamic resource allotment is attained through task scattering or requests in Virtual Machines (VMs). The optimized searching space which is acquired through AGOA are instructed for searching direction adjustment in automatic manner with the help of optimization method of probability. There will be improved individual performance when there exists better fitness. The fitness function value is an important criterion in AGOA. for finding out the individuals either to survive or die. Also, it is validated that recommended AGOA offers improved performance while comparing with the prevailing approaches.

Key words: Cloud Computing, resource allocation, Adaptive Genetic Optimization Algorithm (AGOA)

1. INTRODUCTION:

Many researchers have been fascinated in one amid the emerging arena of research namely Cloud computing which combines entirety into unique. It is regarded as 'on demand' technology since essential services are afforded on the user's needy basis. Several cloud services can be requested by multiple cloud users in cloud computing technology. Entire resources should be accessible by the requesting user in proficient way to meet the user demand the cloud computing platform users are assured through service level agreement (SLA) in which resources are offered as services on the needy basis [1] [2]. The user needs are extremely high now-a-days due to emerging new technologies as well the user necessities possess dynamic heterogeneity besides no platform relevance. When the resource sharing is not rightly distributed in cloud computing background, resource wasting might happen. Dynamic load balancing amid diverse servers is regarded as the most essential task of cloud computing platform for evading hotspots as well as enhances resource exploitation. The two main aspects need to concentrated are satisfying user needs along with effectual dynamic resource management [3].

Virtualization technology is one of the promising solutions for effective dynamic resource management in cloud computing environment. The obligatory services accommodation within a virtual machine image besides mapping it on a physical server is accomplished as well assured for user with more demanding SLA. This is considered as one of the solutions to mitigate resource heterogeneity as well as no platform relevance. Virtualization technology is one where complete system load balancing can be managed dynamically through which virtual machines (VMs) remapping in addition physical resources remapping on the basis of load change [4] [5]. These benefits helps virtualization technology systematic implementation in cloud computing. The complete service utilization and resources adaptation to the cloud computing background dynamically helps in attaining eminent performance. Resource utility can be enhanced through load balancing as well as right resources allocation ensuring [6].

Resource Allocation (RA) in cloud computing is defined as process of allocating existing resources to the needed cloud applications over the internet. If there is no exact allotment, resource allocation starves services. Resource source management for every distinct module is done through permitting service providers for mitigating resource provisioning [7]. Resource Allocation Strategy (RAS) is mainly meant for exploitation besides allocation of limited resources surrounded via cloud environment boundary for satisfying cloud application requirements through cloud provider activities integration [8]. It also necessitates every application type as well as resource extent for accomplishing a user job. Resource effective utilization can be greatly achieved by means of proficient scheduling methodology. Various prevailing scheduling algorithm are Min-Min, Max-Min, X-Sufferage, Genetic Algorithm, Particle Swarm Optimization etc. Three scheduling methods such as Min-Min, Max-Min and Genetic Algorithm have been conferred along with performance metrics. The sampled data is validated against standard Genetic Algorithm besides suggested Improved Genetic Algorithm. The combination of Min-Min and Max-Min are utilized for new scheduling algorithm.

Dynamic Adaptive Particle Swarm Optimization algorithm (DAPSO) is greatly exploited for simple PSO algorithm performance enhancement for task runtime optimization achieved through particular task set makes pan minimization beside make best use of resource utilization. The independent task scheduling in cloud environment is done through presenting a task scheduling algorithm additionally. Here this research utilizes combination of Dynamic PSO (DAPSO) along with Cuckoo search (CS) algorithm termed as MDAPSO. It is also revealed that , MDAPSO and DAPSO outclass the basic PSO algorithm [9]. Also, validation is done through performance evaluation of the suggested MDAPSO pertaining to original PSO.

2. RELATED WORKS:

Karthick et al [10] represented clustering on the basis of burst time. In the course of scheduling process, conventional approaches such as Shortest Job First, Combinational Backfill, First Come First Serve, improved backfill using balance spiral method and EASY, produces fragmentation. This issue is mitigated through recommended approach in addition to starvation alleviation involved in process. It also outlined the prevailing scheduling algorithm in cloud computing along with concern associated with them. The optimum cloud scheduling problem is mainly mitigated through the suggested MQS technique through dynamic job selection. Also underutilized free space is exploited in a profitable manner.

Dutta et al [11] addressed cost based multi QoS job scheduling by utilizing genetic algorithm methodology. For attaining utmost advantage along with fulfilling user's jobs inconsistent QoS, user jobs mapping onto a computing resource is accomplished which is regarded as cloud provider key task. Linear programming problem formulation apart from simple rule or algorithm cannot be exploited for acquiring optimal solution in finite time since scheduling problem are regarded as combinatorial problems. A Few familiar genetic crosses over operators such as CX, PMX, OX, and mutation operators, swap and insertion mutation are utilized for making an improved schedule through suggested model and thereby assuring optimum solution in finite time.

Wang et al [12], utilized specific-design encoding and decoding techniques for model designing in an effectual way and a novel multi-objective genetic algorithm based on MOEA/D is presented. Cloud computing task is performed in large scale due to enormous task scheduling taking place in cloud and convergent speed is accelerated through designing a local search operator. The proposed model besides algorithm is validated through the numerical experimentation.

Mohan et al [13] presented resource allotment stratagem on the basis of market (RAS-M), addressing bulky data centres advanced resource consumption despite the fact offering services with greater QoS to Cloud consumers. The construction of structural design besides RAS-M market replica is accomplished depending on cloud consumer varied resource limitations. On the basis of various resource requirements, resources are allotted in dynamic way through this approach. Thereby achieving service suppliers and resource clients benefits simultaneously.

Ren [14] presented a modification of WLC [13] namely Exponential Smooth Forecast based on Weighted Least Connection (ESWLC) which considers time series and trials. Various steps involved are 1) construction of specific task assignment decision to the node later partaking number of tasks assignment to that node besides recognizing node abilities. 2) Construct a decision depending on knowledge of the node’s memory, CUP memory, number of connections as well as disk space amount presently being used. 3) At that time, prediction of node selection has to be accomplished depending on exponential smoothing.

3. PROPOSED METHODOLOGY:

3.1. PROBLEM FORMULATION:

Usually formulation of resource allocation performed at the Base Station (BS) is attained through mathematical optimization problem, specified by

$$\begin{gathered} \text{minimize} f(x,a) x \epsilon S \\ \text{Subject to } g_i(x,a) \leq 0 \;\; i = 1, \dots, m \\ h_i(x,a) = 0 \;\; i = 1, \dots, p \end{gathered} \tag{1}$$

Where x notates problem variable vector, $f(.,,)$ signifies objective function to be minimized over the vector x, a represents parameter vector that postulates problem instance,

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$\{g_i\}_{i=1}^{m}$ and $\{h_i\}_{i=1}^{m}$ notates inequality and equality constraint functions, respectively, and Srefers constraint set.
Normally this confers a minimization problem in traditional approach. A maximization problem is one considering objective function negation. The resource allocation problem formulation is given by Eq. (1) in which all elements in vector x are simply the variables describing allotted amount or radio resources configuration, such as transmit power level besides allotted subcarrier index.

The entire vector elements are regarded as system parameters or wireless propagation parameters, like bandwidth, subcarrier number, in addition to background noise level. $\{g_i\}_{i=1}^{m}$ and $\{h_i\}_{i=1}^{m}$ are utilized for stating the particular consequence as well resource allocation constriction like radio resources available amount , users' QoS necessities, besides all types of interference and noise.

The best possible solution characteristics are defined by means of objective function and design objective is crucial performance metrics for resource provision. The resource allocation x^*optimal solution is the vector used for attaining objective function best value amid completely probable vectors besides satisfying complete restrictions. A massive amount of data collection on historical scenarios is to be done and stored in cloud in case of prevailing wireless systems aided through cloud computing

The optimal or near-optimal solutions are attained for these historical scenarios through exploitation of cloud strong computing ability. Machine-learning-based resource allocation scheme is greatly utilized for hidden similarities extraction in these historical scenarios through solution classification. The BS is guided through machine-learning-based resource allocation scheme for radio resource allocation more proficiently. The new area BS deployment does not possess any historical scenarios datas. Fig 1 depicts the cloud framework .

Fig 1: Cloud Architecture

3.2 Adaptive Genetic Optimization Algorithm (AGOA) based resource allocation:

This study tends for dynamic resource allocation enhancement in cloud by proposing AGOA method with the help of best objective function values. In general, GA has considered as a meta-heuristic method that resolves the issues in optimization progress through replicating natural selection (that is to say, adaptation to an environment implemented by living beings) [15]. It is capable of resolving the multifaceted issue; besides it does not only find one solution but an overall 'population' of 'individuals', which have considered to be candidate solutions for a problem. Different characteristics of every individual have coded into a 'chromosome' that has known as a string of genes, besides their values have been selected from a set of symbols. Figure 2 shows the feature selection process of GA algorithm.

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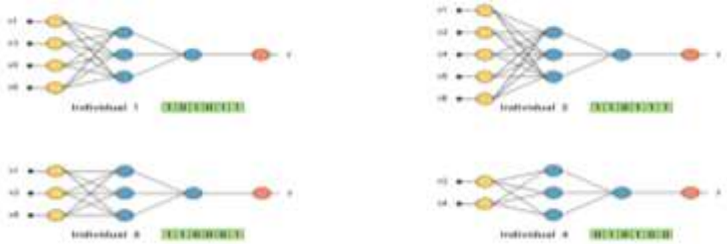

Fig 2 Genetic algorithm for feature selection

Being a stochastic search technique, GAs are capable of organizing population belongs to simultaneous search positions. There are three fundamental components involved in traditional GA as follows:

- optimization problem coding
- mutation operator
- information-exchange operators set

In order to optimize the target function, it has estimated by GAs at the points of a definition domain that has chosen arbitrarily. Figure 3 shows the flow diagram of the Genetic Algorithm.

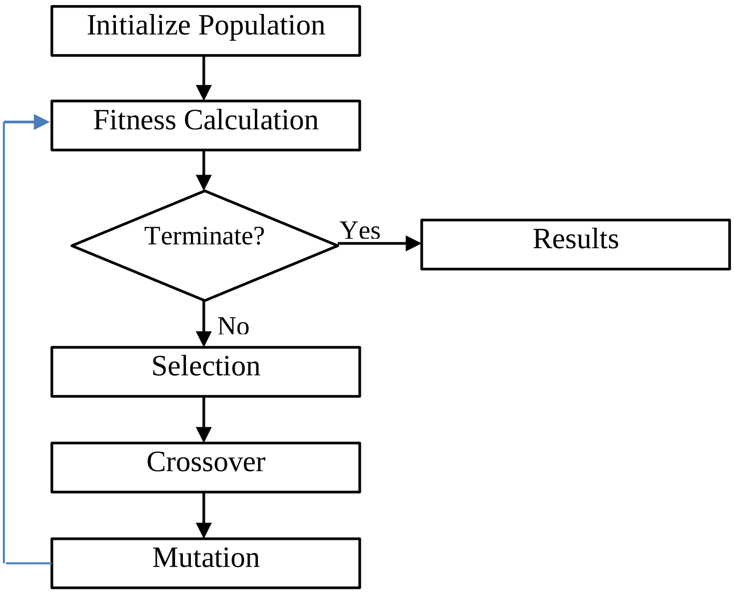

Fig 3 Flow diagram of genetic algorithm

During the process of resource allocation in the cloud, the resource utilization (i.e. CPU maximization, utilization of memory) has significantly optimized through scheduling algorithm. As per our knowledge, there is only a single process is operating in a uniprocessor, which subsequently migrates through several scheduling queues. From these queues, the scheduler chooses the operations to be run. The processor scheduling tends to designate the processes that need to be implemented by the processor[16]. As a consequence, the performance of the framework may get affected if there is a delay while concluding about the execution of the process (i.e. which process needs to be performed by the processor and which needs to wait.) The scheduling algorithm has utilized by one of the initial researches that apply the method called ‘first come first serve’ [8]. According to that, the least number of servers has determined, which has necessitated converging with SLAs for shared allocation and dedicated allocation resources.

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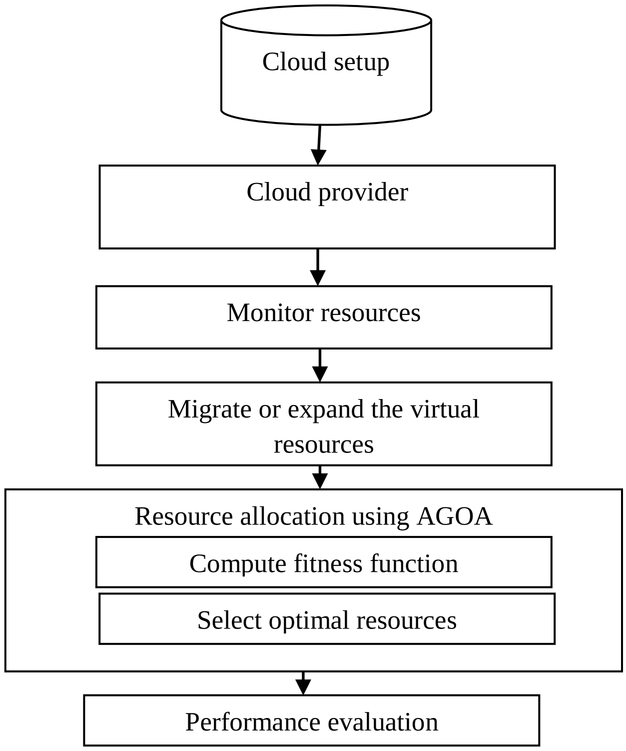

Fig 4 Overall block diagram of the proposed system

Figure 4 shows the overall block diagram of the proposed system. Initially, a cloud setup is done and it monitors the resources of the cloud provider [17]. Then the resource allocation is done using proposed AGOA approach by selecting the optimal resources.

Pseudocode of the Proposed AGOA is presented below.

<u>Pseudocode of Proposed AGOA</u>

```
Initialize population through choosing arbitrary individuals
for the defined number of generations do
for The population size do
Assign two individuals (resources) as parent1 and parent2.
Execute crossover to produce a new individual (child).
Implement mutation to child.
Estimate the distance within child and parent1, denote as d1; and the distance amid
 child and parent 2, denote as d2.
Determine the fitness of child, parent1, and parent2
Evaluate (1) for dynamic resources
if (d1 < d2) and (f > f1) then 12: switch parent1 with child
else
if (d2 <= d1) and (f > f2) then
Switch parent2 with child.
end if
end if
end for
end for
Excerpt the optimal resources
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The above algorithm in which the populations are initialized first by choosing the arbitrary individuals which means the cloud provider. Then the population generation and the size are initialized. Then two individual resources are assigned as a parent 1 and parent2 based on the Proposed Algorithm. After assigning the resources a new resource is find using crossover operation and then mutation operator. Based on the distance value of the child the fitness values are calculated for both the individual resources. Finally, a dynamic resource is predicted through the best fitness value which resources are allocated by finding the optimal resource.

4. EXPERIMENTAL RESULT:

Throughout this segment, the performance of suggested AGOA algorithm has compared with other existing algorithms, such as PSO and RAS-M considering the parameters, namely accuracy and time complexity for AGOA efficiency evaluation.

4.1 Accuracy:

The optimal state of the model can be signified by the maximum accuracy of the proposed algorithm.

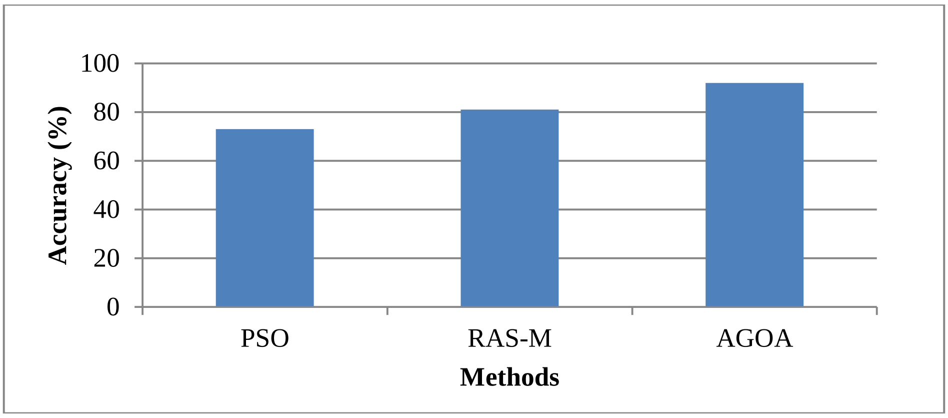

Fig 5 Accuracy Evaluation of Proposed AGOA with Other Methods

Fig 5 compares the accuracy rate obtained by the proposed and prevailing models, in which the evaluated methods have plotted on X-axis, and Y-axis stands for the Accuracy values. For the provided data, the proposed AGOA approach proves that it is capable of delivering superior accuracy rates against PSO and RAS-M algorithms. Hence, it can be declared the efficiency of the AGOA to enhance the process of resource allocation across cloud computing.

4.2 Time complexity:

The minimal time complexity of the model represents the better performance of the proposed approach.

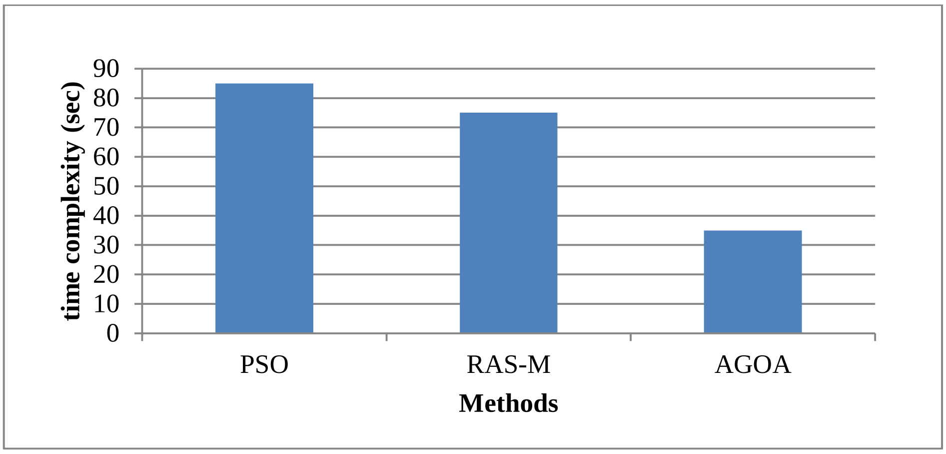

Fig 6 Time complexity Evaluation of Proposed AGOA with Other Methods

In Fig 6, charts demonstrate time complexity comparison of the procured for the proposed and prevailing models, where the X-axis plots the implemented methods, and Y-axis stands for the values of time complexity. For the provided data, the suggested AGOA shows its capability to procure considerably reduced time complexity than PSO and RAS-M algorithms. Therefore, the efficiency of the AGOA can be declared to enhance the process of resource allocation across cloud computing.

4.3 Response time:

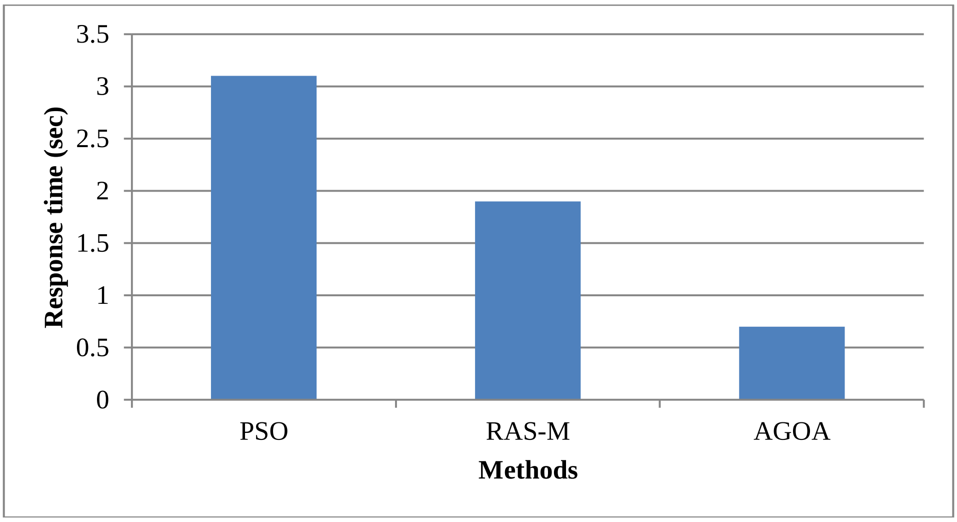

Fig 7 Response Time Evaluation of Proposed AGOA with Other Methods

Fig 7 compares response time outcomes attained by the proposed and prevailing techniques, in which the evaluated methods lie on X-axis, and the Y-axis holds the values of response time. The charts represent the ability of suggested AGOA approach to secure comparatively lesser response time than PSO and RAS-M strategies. Consequently, the proficiency of the AGOA approach can be established to improve the process of load balancing across cloud computing.

5. CONCLUSION:

Recent times, in commercial and industrial sectors, cloud computing has emerged as an innovative stratagem. During this research, the genetic heuristics-based AGOA has utilized to attain the effective resource allocation algorithm, exclusively for the cloud computing data centers. The cloud service providers vitally necessitate dynamic resource allocation to facilitate numerous customers beside reduced response time. It has also considered being a significant factor to increase the turnover of cloud service providers by fulfilling the requirements of their customers. Moreover, this study confers the core resource allocation method and its influence over the cloud system. Empirical findings depict the ability of proposed AGOA for response time reduction, minimizing time complexity, along with superior accuracy.

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