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An EHO-Grounded Task Planning to Improve Resource Application in Cloud Computing

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Abstract: In cloud computing, job scheduling is closely related to processing costs and resource use. To ensure the best work completion, a variety of optimal task scheduling techniques make good use of these parameters. Here, a task scheduling method called Elephant Herding Optimization based Task Scheduling (EHOTS) is used to give users with the best possible scheduling of their work to increase resource utilization and cut costs associated with processing in a cloud computing environment. The EHOTS is set up to perform an objective function using a variety of variables, including load and processing. The experiment is carried out using an appropriate tool, and simulation results have shown that EHOTS performs better than GA and PSO methods in terms of quality performance based on total cost with minimum and maximum numbers of repetitions and jobs. Task scheduling especially increases the cloud-based system's source utilization and processing costs. To provide optimal scheduling, numerous optimization methodologies are used to enhance task scheduling performance. Based on the scalability and price of resource distribution dynamically, the best job scheduling has improved cloud computing efficiency. To improve the exploration and exploitation capability of the search space and produce the best solution, oppositional logic is also integrated with optimization techniques.

Keywords: *EHOTS, GA, PSO, Optimization.*

1. Introduction

In cloud computing, job scheduling is closely related to processing costs and resource use. To ensure the best work completion, a variety of optimal task scheduling techniques make good use of these parameters. Here, a task scheduling method called Elephant Herding Optimization based Task Scheduling (EHOTS) is used to give users with the best possible scheduling of their work to increase resource utilization and cut costs associated with processing in a cloud computing environment. The EHOTS is set up to perform an objective function using a variety of variables, including load and processing [1].

Task scheduling has a strong relationship with resource utilization and processing costs. Task scheduling is demonstrated to be carried out optimally by applying a variety of bio-inspired optimization strategies in the previous study. Yet, there have not been many improvements made to task schedules to lessen the drawbacks of optimization techniques such as reliance on fundamental conditions and local optimization problems [2]. In order to lower the overall cost of processing and memory and to improve performance in a cloud computing environment, an Elephant Herding Optimization based Task Scheduling (EHOTS) is implemented in this paper. In a cloud context, the simulation results are characterized based on total cost, the minimum and maximum number of repeats, and the number of tasks.

1.1 Task Scheduling Sculpt with Many Objectives: An EHOTS Approach

The scheduling of tasks for basic devices in cloud computing causes a proportionate increase in resource utilization. The primary challenge in a cloud environment is the allocation of Virtual Devices (VDs) to activities in scheduling as shown in Figure I. Users' jobs will primarily be split into a series of tasks that are processed across numerous VDs [3]. Three steps will be carried out here: In accordance with a defined plan, sources, and tasks will be linked largely in terms of overall task data and active VDs. Following the provision of the best task scheduling plan by a task scheduler based on the association used to group assignment requests, the best task scheduling strategy for cloud computing is implemented, and users will receive the results.

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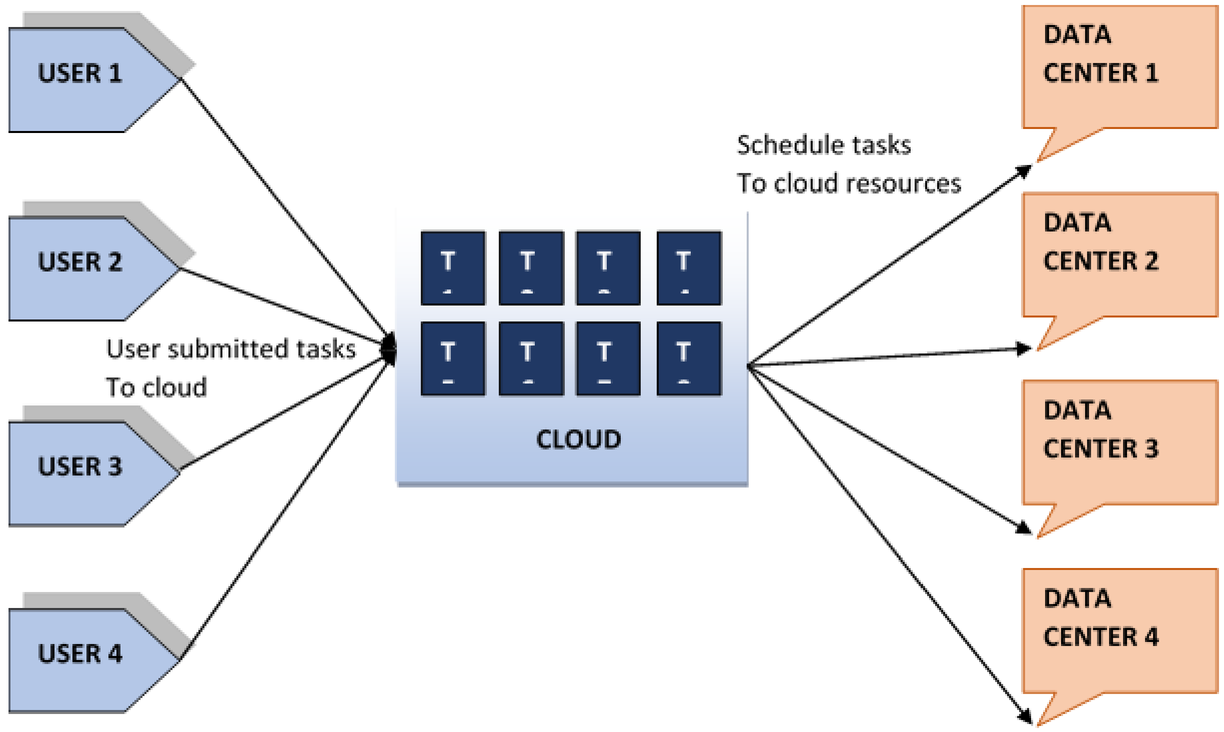

Fig I: Tasks Scheduling in Cloud Computing.

1.2 An Elephant Herding Optimization, (EHO)

An Elephant Herding Optimization (EHO) is a bio-inspired method for resolving global optimization issues that are derived from the elephant herding nature. The EHO is explained using three rules:

(a) The elephant population is divided into a small number of clans, and each clan is further divided into a predetermined number of elephants;

(b) At every creation, a predetermined number of male elephants will leave their families and live alone away from the main elephant crowd; and

(c) The clan's elephants coexist while being led by a queen. In cloud computing, work scheduling is closely related to resource usage and processing costs.

Several scholars particularly use these variables to determine the best task-scheduling strategy. An Elephant Herding Optimization based Task Scheduling (EHOTS) approach is used in this research to provide the optimum scheduling of user tasks in order to increase resource efficiency by lowering processing costs in a cloud environment [4]. The EHOTS are implemented using the proper tool, and the simulation results show that EHOTS performs better than GA, PSO, and ALO techniques in terms of the total cost with minimum and maximum numbers of repetitions and jobs.

In cloud computing, the scheduling of tasks has a considerable impact on both the expenses of processing and the consumption of resources. A number of strategies for optimally scheduling tasks make the most of these available resources to guarantee that assignments are finished quickly and effectively [5]. In this scenario, an Elephant Herding Optimization based Task Scheduling (EHOTS) technique is used in order to achieve maximum resource utilization while also reducing processing costs associated with the cloud computing environment. The EHOTS are initiated with the use of an objective function that takes into account load and processing time.

In order to lower the overall cost of processing and memory and to improve performance in a cloud computing environment, an Elephant Herding Optimization based Task Scheduling (EHOTS) is designed. The outcomes of the simulation are presented in terms of the total cost, minimum and maximum numbers of repeats, and the number of tasks in a cloud environment.

Recent research has shown that a wide variety of bio-inspired optimization algorithms can be utilized to schedule work in a manner that is both efficient and effective [6]. Unfortunately, very few advancements have been made to task scheduling in order to meet the limitations of optimization strategies. These limitations include a dependency on primary circumstances as well as difficulties associated with local optimization.

The utilization of cloud resources increases proportionally whenever tasks for fundamental devices are scheduled there. While working in a cloud environment, one of the most fundamental challenges involves the process of assigning Virtual Devices (VDs) to tasks in the schedule [7]. To begin, the responsibilities of the users will be broken down into a series of activities that will be carried out across a number of virtual desktops (VDs).

2. Literature Review

Better task scheduling is used to increase cloud computing capacity and efficiency while reducing processing times and single-system overload. The Task scheduling's primary goals are to maintain device stability, improve energy efficiency, create a strong device, and obtain future device deviations such as security and resource use [8]. Effective and trustworthy task scheduling makes good use of both the processing power of resources and the cloud storage's memory with the least amount of money spent. Because they produce minimal computation time with load balancing and maximum throughput, the superior task scheduling algorithms have boosted the efficiency of cloud computing.

Task scheduling is specifically employed to preserve resource strength, boost energy efficiency, create reliable resources, and produce future resource excursions like resource protection and consumption [9]. Using the cloud network, load balancing is used to manage task scheduling. Under both plans, the processing is done efficiently without subjecting the systems to an overburden of work. Prior to being distributed efficiently among systems, the tasks are first introduced to the cloud using an optimal task scheduling technique. Due to the task scheduling approach's intensive use of the CPU, storage, and resources, the cost of processing the tasks is a highly important consideration [10].

The cloud is an individual competent strategy that offers works through a network, and its relevance is expanding as networks start to take off. Many users are served by a variety of cloud vendors for economical and productive communication [11]. Using resources is accomplished by efficiently optimizing task scheduling. Resources for cloud information interior are distributed based on virtual device configuration and concurrent resource requests. The virtual machines are effectively utilized for efficient cost management to enhance job scheduling performance. One of the bio-inspired methods for effectively performing work scheduling among Virtual Machines (VMs) is the hybrid combination of the Cuckoo Optimization Algorithm (COA) and Particle Swarm Optimization (PSO) [12]. To improve the task scheduling strategy, a hybrid cuckoo PSO is developed, and outputs are assessed based on task scheduling time and cost.

The two fundamental building blocks of cloud computing are resource allocation and work sequencing, both of which are calculated using a bandwidth-aware divided scheduling approach. First, an analytical approach is employed for the distribution of genuine resources; next in cloud computing, divisible scheduling is used to assess how best to distribute resources using bandwidth between virtual devices [13]. Here, a divide-and-conquer strategy is added to boost the effectiveness and performance of the suggested approach. Based on response time and when compared to existing procedures, the effectiveness of the proposed method is determined [14].

With the aid of a service level agreement, task scheduling is particularly suited for cloud computing, where a number of businesses are using remote location data and performing data processing in a dispersed manner. In this case, the optimal virtual devices for job scheduling are determined by combining a genetic algorithm with bacterial foraging optimization [15]. These algorithms enable job scheduling that is both economical and environmentally friendly in order to reduce waste. Calculations of the algorithm's convergence speed, mobility, and variety are made and contrasted with those of competing approaches.

Many evolutionary methods are introduced to address the NP-hard task scheduling problem, however, convergence speed during the exploration and exploitation phases is a significant concern for algorithms [16]. The jobs are assigned using the Directed Acyclic Graph (DAG), which is then optimized using the PSO and hill-climbing approaches to address the NP-hard task scheduling problem. PSO and hill combined in a hybrid form of climbing are effectively used to demonstrate quick convergence for efficient task allocation amongst virtual devices. With the aid of already-completed jobs, the directed acyclic graph is created, and then optimization is used to produce the best acyclic graph for efficiently scheduling the tasks [17]. The effectiveness of the suggested method in comparison to other strategies like PSO is described by comparing the makespan and turnaround time of the algorithm.

Cloud computing builds it probably in favor of clients to utilize dissimilar applications in the course of the network devoid of having to establish them [18]. It is measured near be original equipment which is intended for managing and as long as online schemes. In favor of increasing competence in the cloud environment, proper task arrangement schemes are desired. Because of the restrictions and heterogeneity of devices, the concern of scheduling is extremely intricate. For this reason, it is supposed that a proper scheduling strategy can cover a momentous collision on falling makespans and attractive device effectiveness [19-20]. By means of the limitations of the conventional heuristic techniques utilized in task management, lately, the common of researchers comprise alert on cross meta-heuristic schemes for job arrangement. A heterogeneous earliest finish time approach is introduced with GA and PSO to evaluate the makespan for several tasks [21].

3. Motivation and Purpose of Research

Nature-Inspired Algorithms can be thought of as a way to arrange tasks and news amongst people or organizations all over the world via the Internet without worrying about the message being intercepted and without losing the integrity of the original information. On the other side, protecting information's intellectual property rights has received a lot of attention. The interest in exploratory task scheduling methods has been greatly stoked by this in recent years.

Considering the above research motivations, the following objectives have been chosen for the study.

(i) To take a look at the various frameworks used in cloud computing for scheduling tasks.

(ii) Provide a method for optimizing job scheduling in the context of cloud computing.

(iii) To evaluate the efficiency of an algorithm by comparing it to those developed by other academics.

4. The Projected Work:

Elephants are used to represent user jobs in cloud computing, and the scheduling mechanism is stated in terms of EHO. An elephant's location in a search is determined by the scheduling of tasks, and this scheduling problem can be solved. The location of the lead elephant indicates the optimal solution, and the fitness value of the lead elephant indicates the optimal value of the full optimization function with multiple objectives. By doing so, the optimal solution for scheduling user tasks in the cloud can be generated through the usage of an EHO. At each cycle, the elephants' positions are updated, and that data is then sent to a system that can handle active user duties. Elephants' FOMO is calculated based on their fitness ratings. Everything must be done again until it is perfect. Tasks in the cloud can benefit from the solution, which will be generated using the latest leader elephant's location as shown in Figure

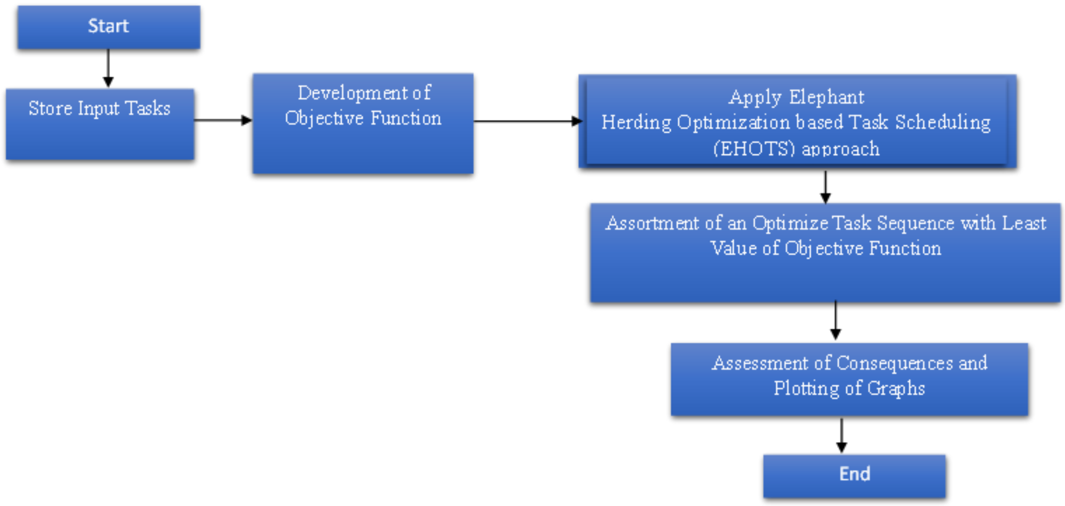

Fig II: The Proposed Block Diagram.

A bio-inspired method developed from elephant herding nature, Elephant Herding Optimization (EHO) is used to find optimal solutions to issues that span multiple geographic locations. The EHO is explained by the following three principles:

The elephant population is structured as follows: (a) there are only a small number of clans, and each clan has a fixed number of members; (b) a certain percentage of the male elephants in each generation will leave their families and live separately from the rest of the elephant population; and (c) within each clan, the members help each other survive under the leadership of a matriarch.

The EHOTS performs the following steps.

Step 1: Initially, the mapping between user tasks and elephants is to be done.

Step 2: The elephant position, searching dimension, elephant populations, number of repetitions, and constant`s values provide initial values.

Step 3: All the elephant`s fitness values are calculated according to the elephant`s position information in the optimal solution-searching process. The elephant with minimum fitness value is denoted as the current best solution.

Step 4: The entire elephants are updating their positions.

Step 5: Step 3 to step 4 is continued for all repetitions.

Step 6: The position information about the last leader elephant will be added to the solution, which is used for generating the best execution scheme of tasks in the cloud computing environment.

The chaos BSA algorithm is implemented in the computational environment MATLAB 2019a, and its results are compared to those of the GA and PSO algorithms as shown in Table I.

5. Result and Discussion:

Table I: Experimental Parameters

Parameters	Values
Tool MATLAB	2019a
Operating System	Windows 10
Number of Elephant	[100, 1000]
Number of iterations	[20, 100]
Number of Tasks	[200, 800]

Total optimization function for a set of goals, when the attribute functions FPE and FLE are combined with a small number of weight factor coefficients, F_{me} is clearly demonstrated.

$$F_{me} = minimum\ \{w_1 F_{p1} + w_2 F_{p2}\} \quad (1)$$

Where, F_{p1} is first attribute processing expense function, F_{p2} is second attribute processing expense function and w_1, w_2 are respective weight factors. The minimum objective optimization functions is calculated for different task range of 200 to 800 and compared with existing approach. The consequences are compared and summarized below in Table II.

Table II: The value of FMO for 200 Tasks.

Number of Iterations	GA	PSO	EHOTS
20	0.398	0.387	0.274
40	0.397	0.385	0.281
60	0.296	0.378	0.279
80	0.296	0.383	0.283
100	0.394	0.376	0.275

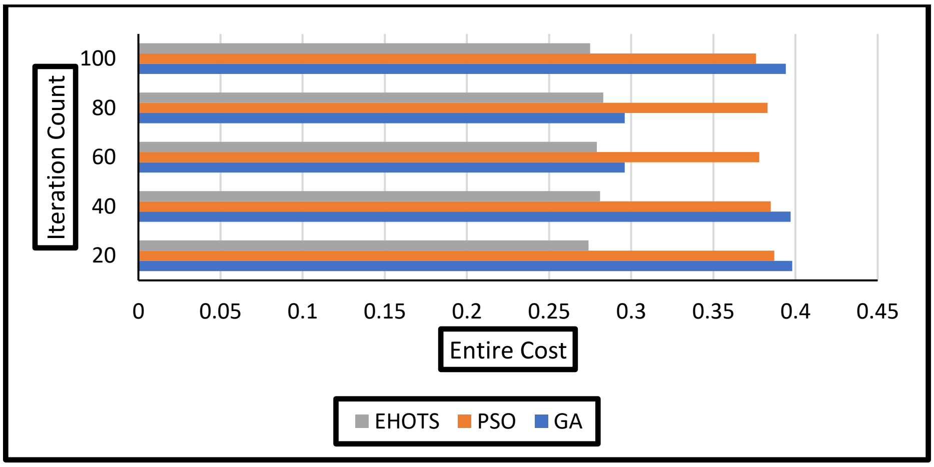

Fig III: The value of FMO for 200 Tasks.

Based on the number of iterations, Figure III and Table II show that PSO outperforms GA by a margin of 25% in terms of solution quality, whereas EHOTS outperforms it by a margin of 32% in terms of overall cost for a number of jobs that is considered to be on the lower end of the spectrum for 200 tasks.

Table III: The value of FMO for 400 Tasks.

Number of Iterations	GA	PSO	EHOTS
20	0.356	0.375	0.276
40	0.369	0.364	0.214
60	0.347	0.382	0.232
80	0.387	0.367	0.251
100	0.376	0.353	0.246

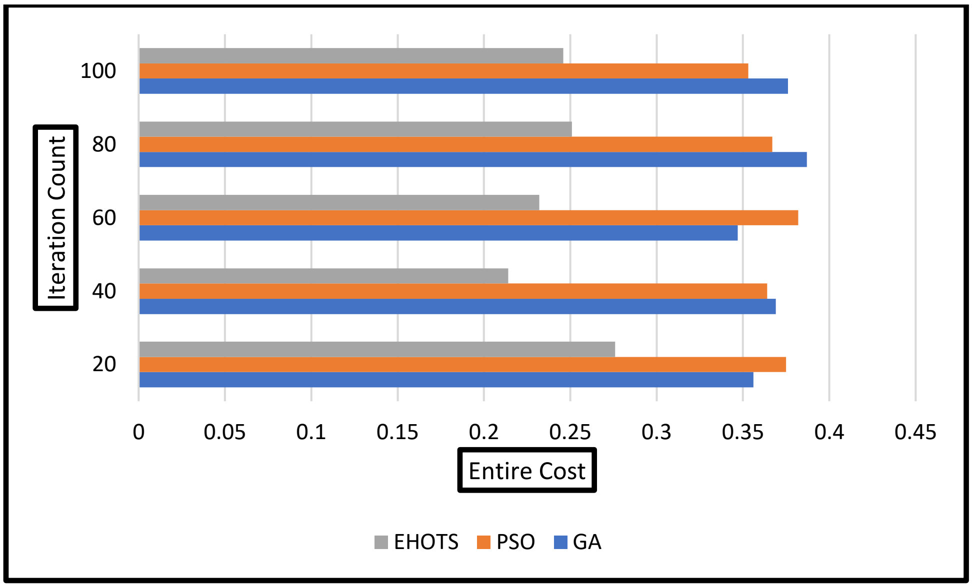

Fig IV: The value of FMO for 400 Tasks.

Based on the number of iterations, Figure IV and Table III show that PSO outperforms GA by a margin of 28% in terms of solution quality, whereas EHOTS outperforms it by a margin of 34% in terms of overall cost for a number of jobs that is considered to be on the lower end of the spectrum for 400 tasks.

Table IV: The value of FMO for 600 Tasks.

Number of Iterations	GA	PSO	EHOTS
20	0.412	0.387	0.312
40	0.426	0.375	0.309
60	0.435	0.368	0.324
80	0.427	0.352	0.294
100	0.419	0.332	0.324

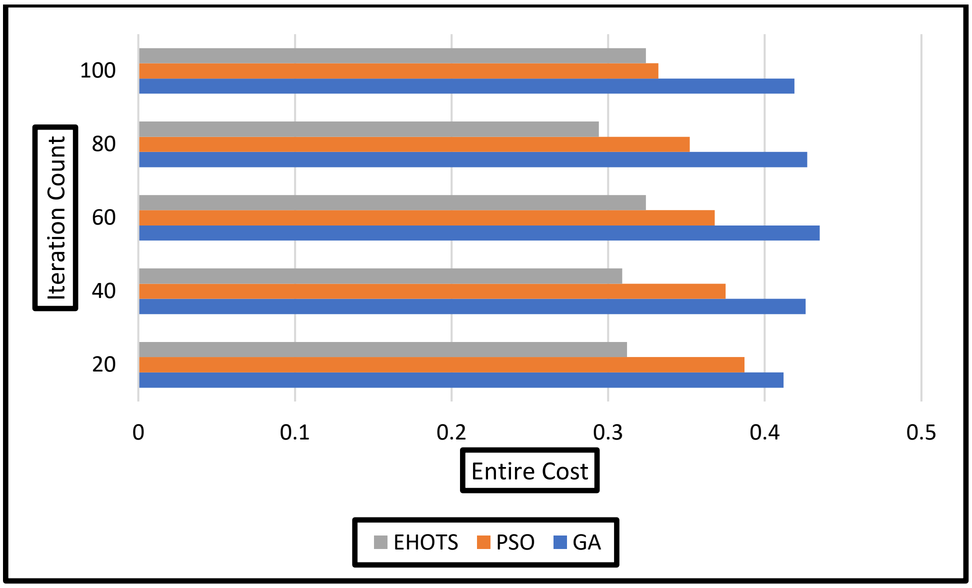

Fig V: The value of FMO for 600 Tasks.

Based on the number of iterations, Figure V and Table IV show that PSO outperforms GA by a margin of 26% in terms of solution quality, whereas EHOTS outperforms it by a margin of 37% in terms of overall cost for a number of jobs that is considered to be on the lower end of the spectrum for 600 tasks.

Table V: The value of FMO for 800 Tasks.

Number of Iterations	GA	PSO	EHOTS
20	0.365	0.324	0.268
40	0.379	0.314	0.252
60	0.383	0.336	0.261
80	0.359	0.304	0.272
100	0.367	0.249	0.239

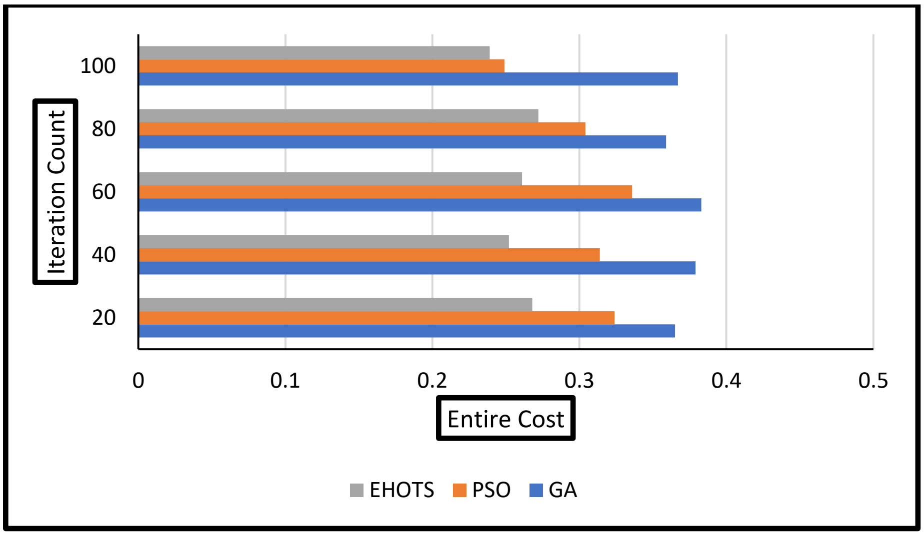

Fig VI: The value of FMO for 800 Tasks.

Based on the number of iterations, Figure VI and Table V show that PSO outperforms GA by a margin of 28% in terms of solution quality, whereas EHOTS outperforms it by a margin of 38% in terms of overall cost for a number of jobs that is considered to be on the lower end of the spectrum for 800 tasks.

As a result, this demonstrates that the proposed EHOTS is capable of achieving better outcomes than GA and PSO when compared in terms of the number of tasks and the number of repetitions. According to the graphs, there is a correlation between the number of repetitions and a decrease in the total cost of the complete process. As a result, it explains that the cost is decreased all the way through the process of searching for the ideal solution.

6. Conclusion:

Task scheduling in cloud computing has a significant impact on processing costs and resource consumption. Several optimal task scheduling approaches make the most of these resources to ensure jobs are completed efficiently. To maximize resource utilization while decreasing processing costs in a cloud computing setting, an Elephant Herding Optimization based Task Scheduling (EHOTS) strategy is employed here. An objective function including load and processing time is used to kick off the EHOTS. In cloud computing, processing costs and resource utilization are closely related to how tasks are scheduled. Many studies have utilized these characteristics to determine the best way to schedule tasks. In this research, we show how to use Elephant Herding Optimization-based Task Scheduling (EHOTS) to provide optimal scheduling of users' tasks, which improves resource utilization while cutting down on processing costs in the cloud. The EHOTS is implemented using the MATLAB 2019a tool, and the simulation results describe the higher efficiency of EHOTS compared to GA, PSO, and ALO based on total cost with minimal and maximum numbers of repetitions and jobs. When compared to other approaches, this one has been found to be more cost-effective in the long run because to the fact that it chooses the most appropriate virtual machines for each activity. Yet, EHOTS solely captivated in a restricted paramount potential assessment at the later advancement phase because of little convergence precision. When the function is far from the basic maximum or in the negative limit, the EHOTS may also fail to produce the optimal result.

Conflict of Interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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