An improved fish swarm algorithm to assign tasks and cut down on latency in cloud computing

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ABSTRACT

Various researches have been conducted to discover the machinery that led to the evolvement of non-symmetric formation of groups by uncountable marine animals. The huge of tasks comes per unit of time brought obstacles to assign each to particular server, while task assignment have needed a fast strategy to make decision. Artificial fish affect the environment through their behavior and the behavior of their peers. Creating a synthetic fish model has two parts: variables and functions which could be used for task assignment. This paper present improved fish swarm algorithm (IFSA) for task assignment to reduce the latency in cloud computing that could achieve one green computing goals. The research trying to reduce the pending job numbers compared with exist research.

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1. INTRODUCTION

Resource allocation is vital in the cloud environment because it plays a key part in scheduling activities that are received on available resources and using them effectively. As a result, resource allocation must involve a smart technique that enables swift scheduling decisions [1]–[4]. There are two criteria to consider during resource scheduling [5]–[10]. First, the amount of time needed to perform all the necessary activities using the available resources, and second, the amount of energy utilized, which is calculated from the volume of processes employed to carry out those tasks [10]–[15].

Gai *et al*. [16] evaluated their design through a practical scenario simulation and provided reliable results for the evaluations. That paper provided tremendous aid in two different ways. First, the paper served as a first investigation into how to address energy waste problem in a successful networking environment. Next, the proposed design offers a future study with guidance and hypothetical support.

Green mobile crowd sensing (G-MCS) was proposed by Marjanovi *et al*. [17] and uses a quality-driven sensor supervision function to continuously select the k-best sensors for a certain sensing task. In order to help mobile devices work with the cloud in conjunction for energy-aware mobile crowd sensing (MCS), the mobile crowd sensing "MCS solution" uses a cloud-related architecture to achieve this purpose. In particular, it eliminates outdated sensor activity while satisfying sensing coverage requirements and sensing quality, which reduces the total energy usage of an MCS application. Here, they proposed a green mobile crowd sensing G-MCS model and evaluated its energy efficiency for a range of application requirements and sensor placement settings.

Guo *et al.* [18] focused on high-performance multi-label stratification approaches and their deployment to medical recommendations of the 5G domain communication. In that study, they recommended the two label selection approaches clustering-relate sampling (CBS) and frequency-based sampling for multi-label stratification (FBS). For projecting doctor labels to doctor recommendations, they applied their innovative 5G multi-label stratification approaches.

Mao *et al.* [19] approximated green mobile edge computing (MEC) system using devices to come up with an efficient mechanism for compute offloading. The implementation cost, task failure, and latency were used as the performance metrics. The lyapunov optimization-related dynamic computation offloading (LODCO) algorithm, which determines jointly the central processing unit (CPU)-cycle frequencies to mobile implementation, the offloading determination, and the pass-on power to computation offloading, has been proposed as a low-complexity online algorithm. The algorithm's decision-making relies just on the system's current state; no distribution info regarding the computation task appeal, energy harvesting, or wireless media operations is required. Every time the method is run, it must fix a deterministic problem for which the best solution is found either in clogged form or via bisection search.

Mobile-related stations and their routing protocol have been proposed by Sarddar *et al*. [20]. An approach was given to clarify the applicability of the recommended model. This task's suggested design aims to provide weight-based, optimal routing. The authors provided an approach to reduce network congestion and ensure a more refined data flow between mobile devices and cloud nodes using this unique procedure. Mitigation of mobile network congestion problems and improvement of data transmission rate are important for achieving green cloud computing. Table 1 provided comparisons of the proposed approach with recent literature. Few problems of resource allocation that can be resolved using load balancing methods were also listed. In order for this research to aid in identifying future research areas and benefit from them, we concentrated on highlighting the significance of resource allocation and its connection to load balancing. This research demonstrated the significance of all resource allocation as well as the scope of work in load balancing. Areas with a large concentration of fish are typically those with more food. Each artificial fish's subsequent actions are influenced by its immediate surroundings. Artificial fish has an impact on the environment through their own and their peers' actions. Variables and functions are the two components of building a synthetic fish model. The following contributions are made: 1) a cloud computing analysis of job scheduling and its components; 2) concentrate on load balancing difficulties using resource allocation techniques; and 3) consider the benefits and drawbacks of resource allocation.

This study presents an enhanced fish swarm algorithm (IFSA) for task assignment that can help cloud computing fulfill one of its green computing objectives by reducing latency. The following contributions were made to the paper: 1) a new IFSA was proposed; 2) the number of cluster nodes was increased to increase production while the core node was being expanded; and 3) the makespan of an IFSA was improved when compared to other techniques. The research is divided into sections; the first portion is a preamble that discusses the problem, reviews studies that have addressed it, and identifies its advantages and disadvantages before defining the key objectives. The proposed algorithm was discussed in the second section, which included the code and a diagram. The third portion discussed the results and compared them to existing frameworks, and the final part was a conclusion.

Table 1. Review of the current literature

Author	Year	Method	Layer	Objective	Weakness
Gai *et al*. [16]	2016	Simulation scenario	Two	Energy reduction	The initial exploration in rectifying energy
Marjanović *et al*. [17]	2016	G-MCS	Cloudlet	Energy reduction	Geographical sensor distribution settings
Guo *et al*. [18]	2016	CBS and FBS	5G	Strengthen connection	Predicting doctor labels to doctor suggestions
Mao *et al*. [19]	2016	Green MEC	Offloading strategy	Reduce latency and task failure	The execution of the algorithm needs to rectify a deterministic issue in every time
Sarddar *et al*. [20]	2015	Weight-based optimized routing	Mobile related stations	Alleviate network congestion	Congestion situations are considered
Proposed	2021	IFSA	Cloudlet	Reduce latency	No offloading site considered

2. METHOD

This paper present IFSA for task assignment to reduce the latency in cloud computing that could achieve one green computing goals, the Table 1 show the gab through research and our work differentiation among them and to investigate reduction of the latency the weakness is no offloading site will be considered, the IFSA is a nature-inspired algorithm that mimics the behavior of fishentities in IFSA [21]–[23]. It was developed by Gandomi and Alavi in 2013 [22]. The IFSA designates observations made on the Antarctic fish species, which is reflected as the best-studied seawater animals. These Fish have the ability to form bulky swarms with no equivalent orientation existing among them. For decades, studies are being conducted to recognize the herding mechanism of the fish, and the individual circulation of the fish among the herds. The studies identified some of the features despite the observation of the basic unit of the association. An additional important factor deliberated is the exhibition of a predator; fish can abandon the herd when a predator is sighted, which in turn shrink the swarm congregation. The rise in the number and associated increase in the distance from the food are always considered during the conception of the herds.

The IFSA produces the optimum solution by considering the density-dependent desirability of the fish and the zones of high food concentration. The liaison amongst the fish position and the sovereign function is comparable. The smallest distance of a fish from the maximum density and food is implied in global optimum. The fish continuously attempt to move in the direction of the finest solution during the above-mentioned process, and consequently, improve the objective function, the IFSA has been successfully applied in several fields, such as network optimization, global optimization functions, economic dispatch issue, structural optimization, the study of parameters, optimum design string, and so on. The foremost process of the algorithm has the following sign updates: 1) induced movement (N), 2) random diffusion (D), and 3) foraging (F).

The IFSA has been recommended for continuous optimization problems. It has enriched performance when compared with some other prevailing algorithmics [24], [25]. Also, when matched with other system integration (SI) methods, its implementation is easier and robust, making it comparable to other nature stimulated algorithms and requires limited control parameters; practically, only a distinct parameter (time interval) needs to be tuned. In the IFSA algorithm, the fish search through a multiple dimensional search space for food and the location of the fish is represented as dissimilar decision variables, the modest illustration of IFSA is conveyed in Figure 1. The mathematical expression and justification of these operational processes are provided in the succeeding sections, initialize fish parameters by setting the size of populations in Figure 1. Then, according to the motion calculation, the positions of the fish will update the crossover and mutation according to the induced motion, foraging motion, and physical diffusion.

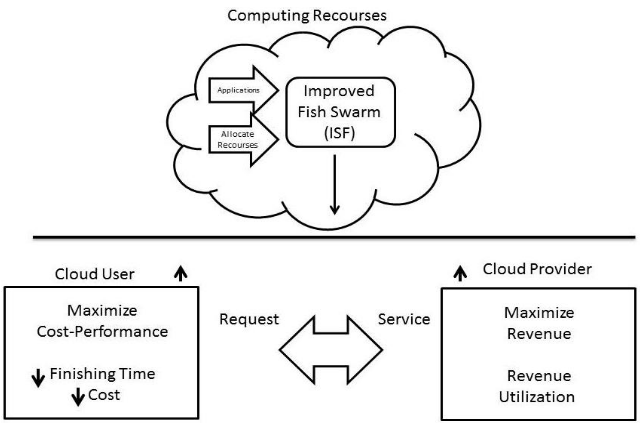

Figure 1. A basic concepte of the IFSA

Various researches have been conducted to discover the machinery that led to the evolvement of non-symmetric formation of groups by uncountable marine animals. The substantial mechanisms recognized are security from predators, feeding ability, environmental condition, and enhanced reproduction. Antarctic fish is the most examined marine animals. The noteworthy skill of fish is that they can assemble into big swarms. Even now, there are numeral suspicions about the mechanism that direct the movement of ISF. To explain the detected creation of IFSA behavior, here are some of the suggested conceptual models. The product of the above models states that fish swarms as the intricate unit of organization for this kind. The following algorithm illustrates the search process of the IFSA in Figure 2. Whenever predators (example shark, sea birds, whales, and penguins) act violently on fish swarms, there is a decrease in the concentration of the swarm. After the attacking action of predators, the formation of fish entity becomes a multi-objective task that mainly involves two goals: 1) reaching food and 2) increasing fish number. The desirability of fish to raise their number and finding of the food source are revealed as the main function. They direct the fish to the global minimum. In this mechanism, all fish move in the direction of the best solution while searching for the best food source.

```
Begin
(i) Define population size (S) and iteration (Imax)
(ii) Random initialization.
Set the iteration counter I = 1;
Initialize the population ();
Set the foraging speed Vf, the maximum diffusion speed Dmax, and the maximum induced speed Nmax.
(iii) Fitness evaluation.
Evaluate each Fish individual according to speed (), task cost (), weight ().
(iv) While I <Imax do
Sort the population/Fish from best to worst.
for i = 1: S (all Fish) do
Perform the following motion calculation.
Movement induced by other Fish individuals
Foraging activity
Physical diffusion
Implement the genetic operators.
Update the Fish individual position in the search space.
Evaluate each Fish individual according to its position.
End for i
Sort the population/Fish from best to worst and find the current best.
Imax = I+1.
End while
(vi): Evaluate the Fish best solution.
End
```

Figure 2. Pseudocode of the IFSA algorithm

3. RESULTS AND DISCUSSION

We considered the number of cases being entered periodically, we chose five tasks as productive tasks and they come every four hours, to handle these tasks. Figure 3 shows the number of jobs waiting, in this figure, $5m1$ meaning using $5m1$ as a core node, and by gathering with $4m1$, which is $5m1 + 4m1$. If we use $5m1$, there will be an increase in production, which is overloaded of the core node, so we need to add a number of nodes to distribute the load. On it, which helps in increasing production and during the expansion of the core node, by extending the cluster nodes to be 9 node that could be sufficient to accommodate the results of the jobs.

3.1. Execution time

The task implementation time refers to the interval from the commencement of the task to its completion. Before deciding whether to offload a task or not, especially for the compute-intensive tasks, it is crucial to evaluate the task's execution time. The recommended task's implementation time, as measured by nodes and iterations, is shown in Figure 4.

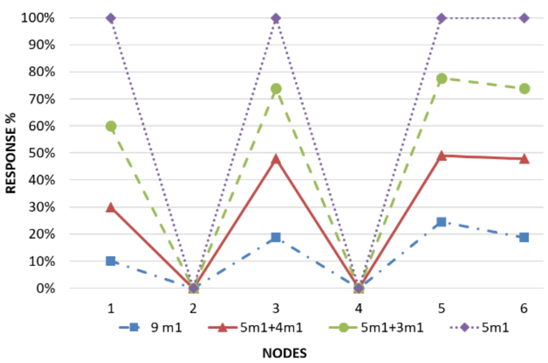

Figure 3. Illusitate the jobe pending using (IFS)

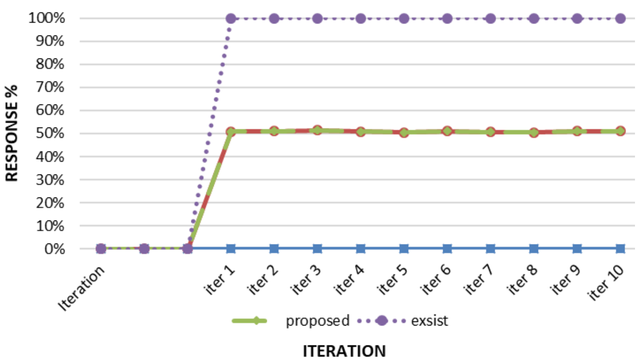

Figure 4. Excecution time

4. CONCLUSION

In this study, the job scheduling and related features of cloud computing were examined. The study emphasized on the difficulties and advantages of load balancing using resource allocation techniques. We considered the number of cases being entered periodically, we chose five tasks as productive tasks and they come every four hours, to handle these tasks the work shows the number of jobs waiting, the experments show the $5m1$ meaning using $5m1$ as a core node, and by gathering with $4m1$, which is $5m1 + 4m1$. If we use $5m1$, there will be an increase in production, which is overloaded of the core node, so we need to add a number of nodes to distribute the load. On it, which helps in increasing production and during the expansion of the core node, by extending the cluster nodes to be 9 node that could be sufficient to accommodate the results of the jobs.

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