

# Hybrid Optimization EHO-GA for Task scheduling in Cloud Environments



K.Loheswaran, D.Palanivel Rajan, P. Divya

**Abstract** Cloud computing is an emerging technology with highly scalable service adopted by different kinds of people from around the world. In cloud environments one of the major problems is task scheduling; most of existing algorithm is not optimal. The proposed hybrid optimization method has combination of Elephant Herd Optimization (EHO) and Genetic Algorithm (GA) for find an optimal resource to schedule task in the Cloud. This proposed method has improves the performance of task scheduling by considering the parameters of response time, makespan, and cost of the cloud. The proposed method has implemented in CloudSim 3.0 toolkit and evaluated the performance with existing algorithm. The Experimental results were proven that proposed algorithm has given better performance compared to other scheduling algorithm.

**Keywords:** Cloud Computing, Elephant Herd Optimization, Task Scheduling, Genetic Algorithm,

## I. INTRODUCTION

The group of interconnected PCs that comprises of more than united computing virtual resources is known as the cloud. As of late, the progression of distributed computing has recreated the brisk game plan of between associated server farms that are topographically scattered for offering high calibre and trustworthy administrations[1,2]. Distributed computing gets the congruity and change the IT business around the globe. With its creating application and advancement, distributed computing offers colossal open entryways, just as goes up against numerous troubles in the progression of business IT [3,4].

Furthermore, the complexity of task scheduling is different in computing sources in different cloud nodes. Moreover, it's exchanged the data among different nodes and clusters in cloud environments makes the complicated for task scheduling. Most of the existing methods have concentrated on CPU and resources utilization but none of doesn't perform effectively [5,6].

Most of the algorithm works about limitation of resources utilization, and gives resources as per undertaking needs and workloads. In any case, this algorithm did not consider the data transmission necessities of tasks, nor did it think about the dynamic difference in their resources prerequisites.

Here the resources are like memory utilization, bandwidth and CPU are utilized by numerous clients, so it is minimal hard to build efficient algorithm. The efficiency of the algorithm is affected by numerous things like the processor control, speed, space and memory [7,8].

In the interest of this the heterogeneity of figuring sources additionally makes harm the improvement of algorithm. The primary aim of task scheduling techniques in cloud is to keep up the right load on processors by thinking about the bandwidth capacity and increment their use, proficiency and to diminish their job execution time [9, 10].

The major contribution of the paper as follow:

1. The novel hybrid algorithm for resolve the problem of task scheduling in the cloud environments.
2. The Evaluated the performance of proposed system has considering the parameters of response time, makespan and cloud cost.
3. Based on evaluation the proposed method has given better results than existing scheduling algorithm.

The paper has structured as follows: Section 2, discussed about related works in scheduling algorithm. In Section 3, described elaborately about proposed methodology and section 4 discussed about experimental results and discussion. Finally, entire paper has concluded in the section

## II. RELATED WORK

*Suo wang et al* proposed an algorithm for task scheduling named as collaborative task scheduling. The proposed model has effectively performed in the parameters of less energy cost. This model has resolved the problem of task scheduling but parameters has considered only less energy cost. Base on evaluation results the proposed model achieves high efficiency and scheduled more task with less energy cost [11].

*Bahman Keshanchi et al* provide an improved genetic algorithm for task scheduling in cloud and that name called as N-G. We confirmed the proposed conduct model utilizing NuSMV and PAT model checkers. At that point, we broke down the rightness of the proposed N-GA calculation regarding anticipated details of the proposed social model. The confirmation results demonstrate that the social model backings some coherent issues, for example, achieve capacity, reasonableness, and stop free [12].

*Q.N. Meng and X. Xu* introduced a parametric evaluating model that estimating factors are based on Value Measures and Metrics (VMMs). Moreover, the relapse connection among factors and a cost was created by the ACO-based SVR troupe. The proposed techniques has ACO-based SVR gathering used Ant colony optimization to expand the execution and utilized boosting to yield better result and increasingly solid relapse. The proposed system has achieved better results in MSE compare to other algorithm.

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Especially, author has tried to predict the price forecasting while they used real world data from china trade market. [13].

AR.Arunarani *et al* surveyed a paper related to task scheduling techniques in the cloud environments. There are 65 articles were surveyed and all taken from 2003 to 2018 based on scheduling problems. These studies are based on time complexities and limitations. Finally, the authors are concluded that future research concentrate on further enhance the efficient and effectiveness of task scheduling. So as to improve well known and scheduling strategies in cloud computing, new techniques should be created which incorporate financial models and heuristic methods alongside techniques were nature inspired essentially. By consolidating various methodologies and considering input parameters, for example, execution and running cost, it is conceivable to give an amazing way to deal with task scheduling in cloud environments [14].

Bo Wang *et al* proposed an algorithm of parallelism awareness to solve the problem of task scheduling in the cloud. They formulate as optimization trouble maximizing the general resource usage with deadline constraints of jobs. Considering reduce the quantity of selection variables by using introducing a technique calculating the begin time and finish time for every job into the optimization problem, transforming a hassle as a binary programming. Moreover, the results proved that performance of the proposed system but they consider only energy constraint for each task [15]. The overall studies were considered few of authors only considered multiple parameters while solving the task scheduling but not in a constrained manner. Here we proposed a hybrid methodology has provided in a constrained way to solve the problem of task scheduling in the cloud environments.

### III. PROPOSED METHODOLOGY

#### 3.1 Elephant Herd Optimization (EHO)

One of the largest animals in the world is Elephant. There are two kinds of Asian and African elephants are traditional species in the world. Elephants were live in clans under the control of a matriarch. Mostly, male elephant were avoided staying along with family group while growing up. These two elephant behaviors can be expressed into two operations: the first operation is exploitation which is tribe (group of family) updating operator and the second operation is exploitation which is the separating operation. A group comprises of one female with her calves or certain related females. Females like to live in family gatherings, while male elephants will in general live in confinement, and they will leave their family aggregate when growing up. In spite of the fact that male elephants live far from their family gathering, they can remain in contact with elephants in their tribe through low-recurrence vibrations. The following steps of Elephant herd optimization have given below. There are

- i. Tribe updating operator

As earlier mentioned above, all the elephants were live in tribe under the control of a matriarch. Mostly, the male elephant were separated from family while growing up. So, every elephant in the tribe is  $t_i$  following next position has inclined by matriarch  $t_i$  it will be developed as Eq. (1)

$$E_{new,t_i,j} = x_{t_i,j} + \alpha * (E_{best,t_i} - E_{t_i,j}) * r \quad (1)$$

Where updating the position of elephant  $j$  and tribe  $t_i$  new and old for each elephant by  $E_{new,t_i,j}$  and  $E_{t_i,j}$  correspondingly. Then, scale factor is  $\alpha \in [0,1]$  it determines the fittest elephant in the tribe  $t_i$ . Again, there fittest elephant will not updated by using eq. (1), the fittest position can be simplified as E

$$E_{new,t_i,j} = \beta \times E_{center,t_i} \quad (2)$$

Whereas  $\beta$  has factor of  $[0,1]$  which determines the values of the  $E_{center,t_i}$  taking place  $E_{new,c_i,j}$ .

- ii. Separating Operator

When male elephant has leave his family and live alone until then they reach pubertal. We assume this condition as separating process, further it can be modeled as separating process for solving optimization problems. So as to further enhance the performance capacity of the EHO technique, let us consider that worst fitness from elephant individuals used to implement by separating operator as shown in Eq.(3).

$$E_{worst,c_i} = E_{min} + (E_{max} - E_{min} + 1) \times rand \quad (3)$$

Whereas  $E_{max}$  and  $E_{min}$  indicates that position of the upper and lower bound of individual elephant. The worst individual elephant has represented as  $E_{worst,c_i}$ . The uniform and stochastic distribution ranges are  $[0, 1]$ . In Fig.1.shows the Hybrid EHO-GA Task Scheduling Framework.

#### 3.2 Genetic Algorithm

The Genetic Algorithm (GA) is a powerful local search optimization. Genetic algorithms have been viewed as inquiry methodology that can rapidly find elite districts of huge and complex hunt spaces; however they are not appropriate for adjusting arrangements, which are extremely near ideal ones. Nonetheless, genetic algorithm might be explicitly intended to give a compelling nearby pursuit also. Truth be told, a few genetic algorithm models have as of late been given this point.

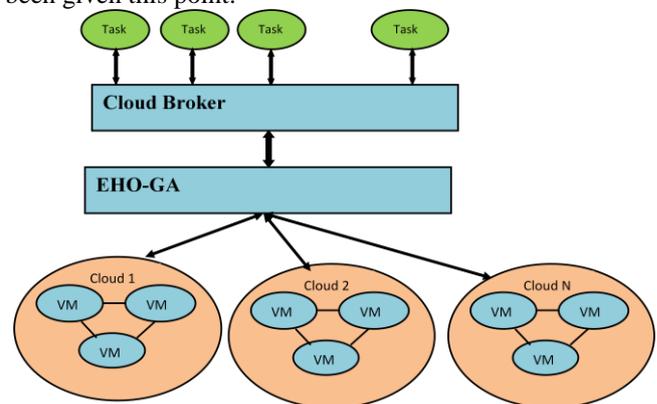


Fig.1. Hybrid EHO-GA Task Scheduling Framework

The genetic algorithm consider as a three main types of process at each process to make anext generation from the current population. In Fig.2.shows the flowchart of the proposed system.

- Selection
- Crossover
- Mutation

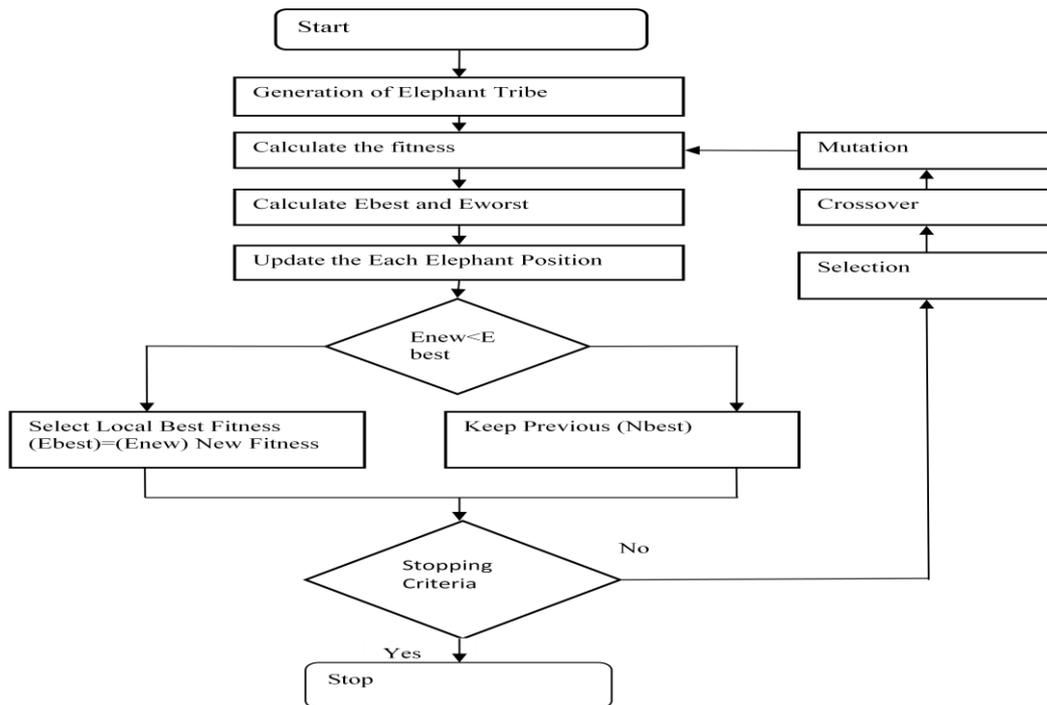


Fig 2.Flowchart of EHO-GA Algorithm

#### IV. EXPERIMENTAL RESULTS AND DISCUSSION

The proposed system has implemented in CloudSim 3.0, Core i7 processor, 8 GB RAM and 64 bit OS. In the Cloudsim, the user submits their requests, i.e., tasks in the order of cloudlets. Every cloudlet is associated with the number of instructions to be executed, size of the file, length, etc.. These cloudlets will be later submitted to a broker for mapping to the desired virtual machines. This simulation tool works on the policies that are installed in the broker. In Table.1 shows the parameter of experimental setup for proposed system. The virtual machines are created on the host which in turn is created in the broker. The task scheduling algorithm will function in the datacenter broker. The code of the proposed algorithm is written in the datacenter broker. The virtual machines and data center scheduler can be time-shared or space-shared.

Table.1. Parameters settings of EHO-GA Algorithm

S.No	Task (Cloudlet)	
1	Total No. of Task	500-10000
2	Length of the Task	500-15000
Virtual Machines		
1	No. of Virtual Machines	1500
2	RAM	512-2500
3	Bandwidth	500-1500
4	Million instructions per second	500-2000
Data Center		
1	No. of Hosts	2-5
2	No. of Data Centre	12

Table.2. Comparison of makespan time with other existing algorithm

No. of Task	HEHO-GA	EHO	PSO	GA
1000	401	415	465	480
2000	805	825	967	980
3000	1233	1257	1330	1400
4000	1600	1638	1675	1700
5000	1870	1896	2010	2050

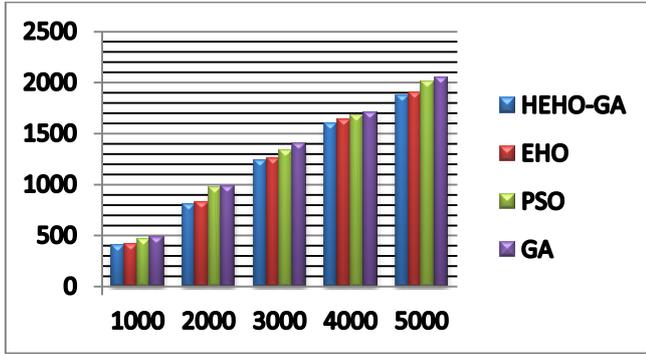


Fig.3.Comparison of makespan with different algorithms

Table.3. Comparison of Cost

Task	HEHOGA	EHO	PSO	GA
1000	11	13	12	15
2000	33	35	45	47
3000	58	60	65	68
4000	83	85	88	87
5000	93	96	99	105

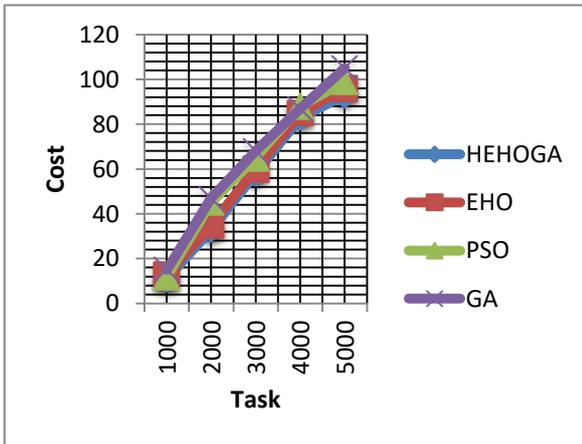


Fig.4.Comparison of Cost

Table.3. Comparison of Response Time

Task	HEHOGA	EHO	PSO	GA
1000	12	13	15	17
2000	32	36	47	53
3000	59	62	61	77
4000	81	84	87	93
5000	92	93	95	103

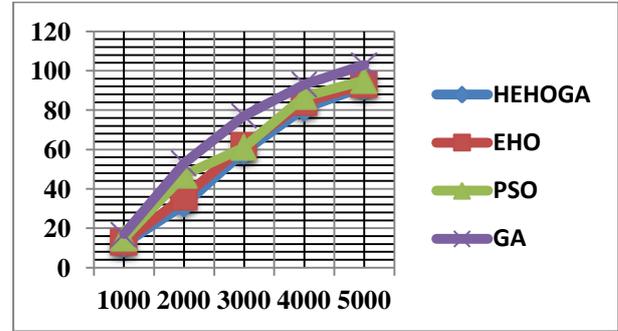


Fig.5.Comparison of Response Time

In Table.2 & Fig.3 shows that performance of the proposed system and comparison of existing algorithm such as Elephant herd optimization (EHO), Particle Swarm Optimization and GA. First we compare makespan to other algorithm, its shows better results than existing algorithm. In Table.3 & Fig.4shows the comparison of cost to other algorithm, the main disadvantage in genetic algorithm is global optima but here we using our proposed method to solve such a problem. In Table.4 & Fig.5shows the performance of the response time and its also proved the proposed system effectiveness. So, the results were given effectively in the parameters such as makespan, cost and response time.

V. CONCLUSION

The proposed optimization method has combination of Elephant Hard Optimization (EHO) and Genetic Algorithm (GA) for find an optimal resource to schedule task in the Cloud. In genetic algorithm has a major disadvantage of global optima but proposed hybrid EHO with GA has overcome the problem. This proposed method has improves the performance of task scheduling by considering the parameters of Resource Utilization, Load Balancing, make span, and cost of the cloud. Moreover, the results were proved the performance of the proposed system is better than existing. In Future scope, the resource utilization has done in the dynamic and considers other nature inspired algorithm to give optimal solutions in the task scheduling.

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