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Efficient Cloud Server Job Scheduling using NN and ABC in cloud computing

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ABSTRACT: ***High work load not only translates to high operational cost, which reduces the marginal profit of Cloud-providers, which also direct towards low throughput of system. Henceforth, efficient job execution solutions are required to minimize the impact of Cloud computing on the environment. So, to generate such solutions, deep analysis of Cloud is obligatory with regard to their job-efficiency. Otherwise, Cloud computing with progressively persistent front-end client-devices interrelating with back-end data centers will cause an enormous load of jobs. To address this problem, data centre servers need to be managed in an efficient manner to drive computing. In proposed work, hybrid algorithm which is based on neural network with artificial bee colony and some concepts of scheduling has been introduced in work. On the basis of them, tasks execution will be enhanced and load will be reduced. The results evaluation will be done on the basis of total jobs completed in the MATLAB 2010a environment.***

KEYWORDS: ***Job Scheduling, Cloud Sever, Workload, Cloud Computing, Users, Efficiency, Neural Network.***

1. Introduction

Cloud Computing is a pay as per usage model (e.g., gas, electricity etc,) and provide resources as per needs. The characteristics of cloud computing are rapid elasticity, measured service, on demand self-service, ubiquitous network access, location-independent resources polling [1] [2] [3] [4]. Cloud computing is a business paradigm. It is also enhancing highly use of data, resources and promote for data sharing and storing through internet. It can also focuses on scheduling job and resources, providing security for storing data. Cloud Computing is service oriented model not user oriented one.

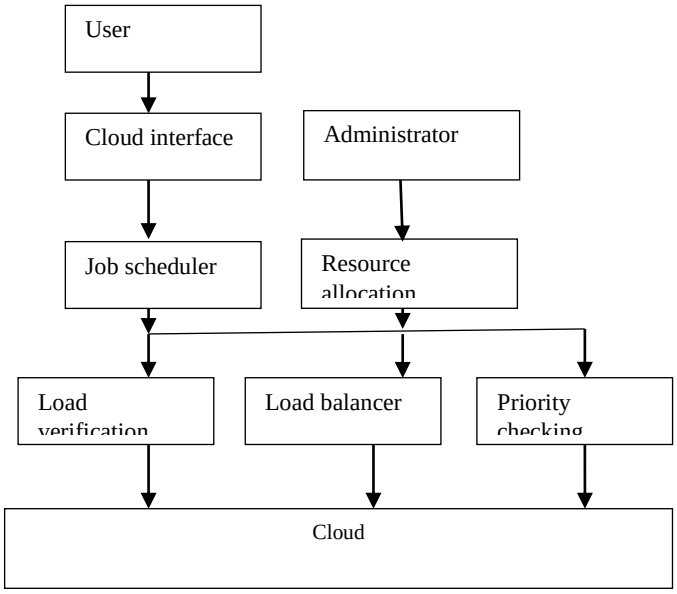


Figure 1: Scheduling in cloud Computing

Cloud computing can mainly provide four different service like Infrastructure as a service (IaaS), Software as a Service (SaaS), Platform as a Service (PaaS) and Communication as

a service (CaaS). At the time of providing different services, there are several problems addressed [5] [6] [7].

Among those addressed problems, job scheduling is one of the major problems for improving job utilization. Generally scheduling can be followed for giving equal preference to jobs and promote the efficient use of resources. There are many open source tools available for developing Cloud Computing like Eucalyptus systems, open Nebula etc., Job scheduling in cloud computing is mainly focused for improving the resources utilization such as bandwidth, memory and reduce completion time [8] [9]. In the below Fig 1, describes that nodes or servers establish communication with each other through two different links namely variable link and fixed link.

Nodes are connected through wireless medium (i.e., Variable link). Nodes are physically connected using fixed link (wired medium). The nodes are connected through Internet [10].

2. A Glance of existing algorithms

Each algorithms address one or two of the parameters on the basis of which scheduling is improved. The details of each method has been shown in form of table [11-26]

Table 1: Comparison of existing algorithms

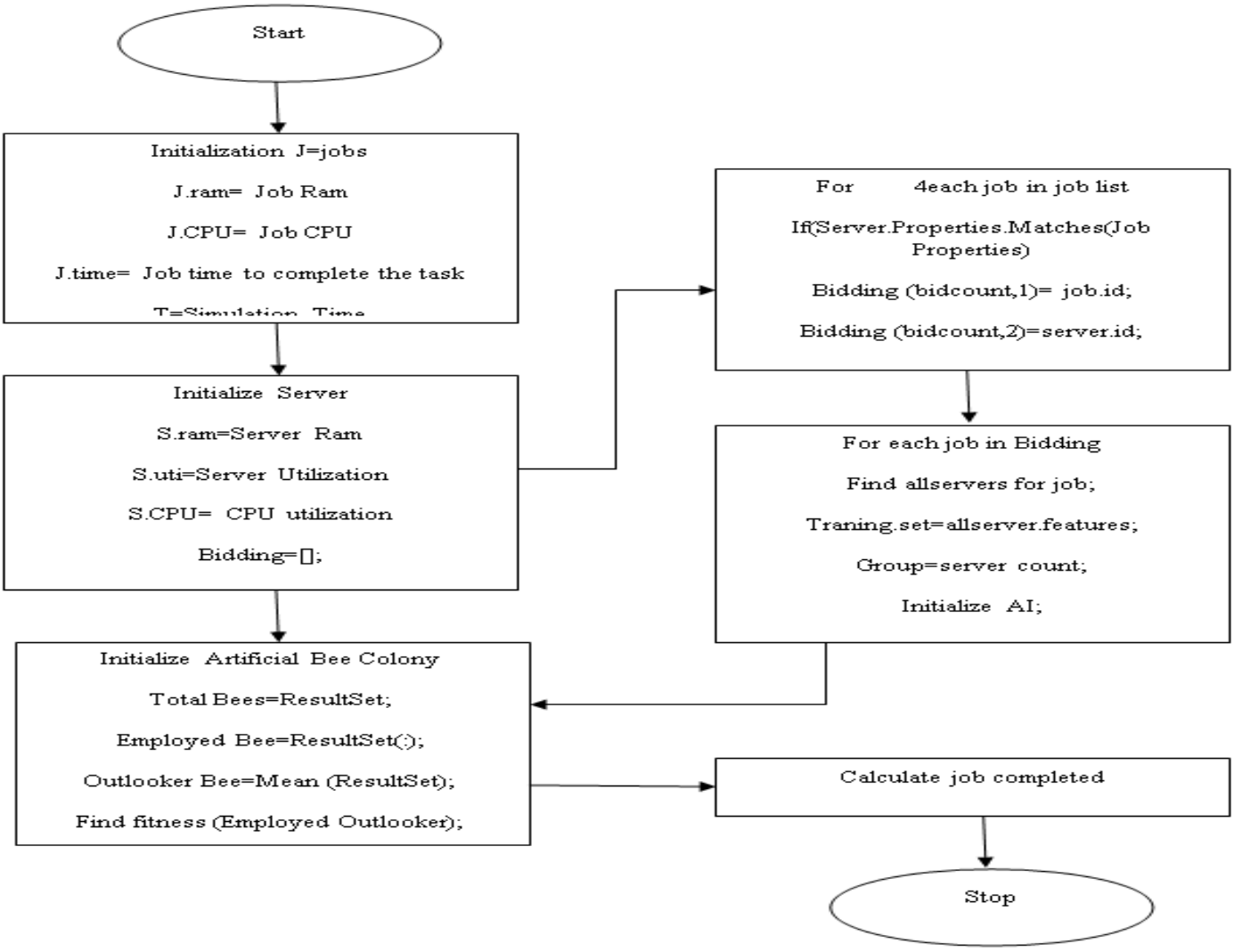
Sl. No.	***Algorithm***	***Target environment***	***Criterion***	***Simulation environment***	***Testing Workload***	***Load Size***	***Comparisons and Comments***
1.	Context Aware Scheduling	Mobile application requests running on cloud	QoS improvement and reduction of resource wastage	Event Driven Simulator	Requests for applications such as shopping assistants and voice assistants.	Peak load keeps tipping during work hours	Successful for a normal workload as well but works best for peak days.
2.	Energy Aware Fault Tolerant Framework	Public Cloud	Reduction in soft errors and maintenance of energy efficiency	Runtime Simulation Engine	Deadline Sensitive Workloads.	Large	Better in terms of energy efficiency as compared to Triple Modular Redundant System.[3]
3.	Green Scheduling Algorithm with neural predictor	Public Cloud	Improve Energy Efficiency and Minimize Drop Rate.	CloudSim and GridSim	Generated Workloads same as requests to NASA and ClarkNet web servers.	Copies a normal day's trend i.e. large during working hours and small at the start and end.	Four modes are introduced among which prediction along with additional servers is most successful for all workload tested.

4.	EnaCloud	Public Cloud	Improve Energy Efficiency	iVic and Xen hypervisor	Web server and Data Servers ,Compute-Intensive ,Common applications	NA	10 % more energy efficient as compared to FCFS and 13% to Best Fit
5.	Energy Efficient Optimization Method	Public Cloud	Improve Energy Efficiency	Real System	Tasks which don't use the whole of the hardware	NA	It works efficiently in case of I/O intensive tasks wherein CPU usage is negligible.
6.	Least first	Public Cloud	Energy efficiency keeping QoS in mind	Numerical Study	NA	small	A higher priority is given to servers with a larger capacity.
7.	Priority					medium	
8.	IC-PCP	Public Cloud	Cost Minimization within Deadline	CloudSim	Scientific Workflows	NA	SCS and PSO are almost equally efficient in meeting deadlines but PSO incurs a smaller cost as compared to SCS. Both of them perform better when deadlines are relaxed. ICPCP misses out on deadlines in most cases.
9.	PSO						
10.	SCS						
11.	Hyper-heuristic Scheduling Algorithm	Public Cloud	Reduction of make span	CloudSim and Hadoop	Workflow and hadoop map-task	NA	Better as compared to hybrid heuristic algorithm due to less computation and case specific algorithm.
12.	Load Balancing Scheduling	Public Cloud	Maximize resource utilization and meet QoS	CloudSim	Computational Tasks	NA	Attains maximal utilization of available resources
13.	Earliest Deadline First (EDF)	Hybrid Cloud	Cost Minimization with Deadline Constraints	Java Based Discrete Time Simulator	Batch Type Workloads with Deadlines	Large	EDF overpowers FCFS as it successfully does the task within Deadlines taking into consideration the data transfer speeds and also handles runtime estimation errors successfully.
14.	FCFS					Small	
15.	Dynamic min-min	Multiple Clouds with	Energy efficient	Cloud Simulation	Workloads same as	Large	DCMMS handles situations with large

	Scheduling	Heterogeneous Resources	resource scheduling among multicloud heterogeneous system	Environment (developed by the author)	requests in Parallel Workload Archives.		workloads resource contention occurs due to greater number of Advanced Reservation jobs better. Its also more efficient in terms of energy.
16.	Dynamic Cloud List Scheduling					Large	

3. Simulation Work

In the figure 2, given below, we presented the proposed work in the step- wise form. Firstly, we initialized the total number of jobs J and initialised the performance parameters to all jobs like Job RAM, Job CPU utilization, Job time (to complete the task) and define the simulation time (T) of proposed work. After that, we initialized the Servers and set performance parameters to all servers like Server RAM, Server CPU utilization, Server utilization (to complete the task) and define the bidding parameters with bidding count in proposed work. If server properties match with job properties then we create Server ID with count. For each job in bidding, we apply hybrid technique of artificial intelligence Neural Network with optimization technique like Artificial Bee Colony (ABC) optimisation technique.



90Figure 2: Proposed flowchart

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We use ABC algorithm because ABC algorithm has high performance and easy for numerical optimization problems. The ABC algorithm is a recently introduced population-based meta-heuristic optimization technique inspired by the intelligent foraging behaviour of honeybee swarms with the references of AI. In ABC high numbers of objective functions are used so we can get an optimal solution according to bidding. According to proposed algorithm we complete our task and calculate the performance parameters like job completed count.

4. Simulation Result and Analysis

The whole simulation of work has been done in MATLAB environment in which various functions has been initialized as shown below in table.2 using neural network. In the end the proposed algorithm performance is measured using various metrics like jobs completed.

Table 2: Simulation Table

Tool	**MATLAB 2010a**
Metrics	Min. jobs, Max jobs.
Iterations	5
Algorithm	Hybrid (ABC+NN)

The above Table 2 describes the various features used for simulation of proposed work. The tool used for the implementation of proposed work is MATLAB , the results are calculated on the basis of Minimum number of jobs and maximum number of jobs required for scheduling during resource utilization in cloud computing. The experiment is done through 5 iterations and the average results are calculated. The algorithm used for proposed work is the combination of neural network approach and artificial bee colony algorithm. At first step, the simulation environment is generated and then applies the neural approach. After that Artificial bee colony algorithm is apply on it to get the better results. At last comparison between Proposed Hybrid approach and neural approach is taken. The hybrid approach gives better results as compare to previous neural approach.

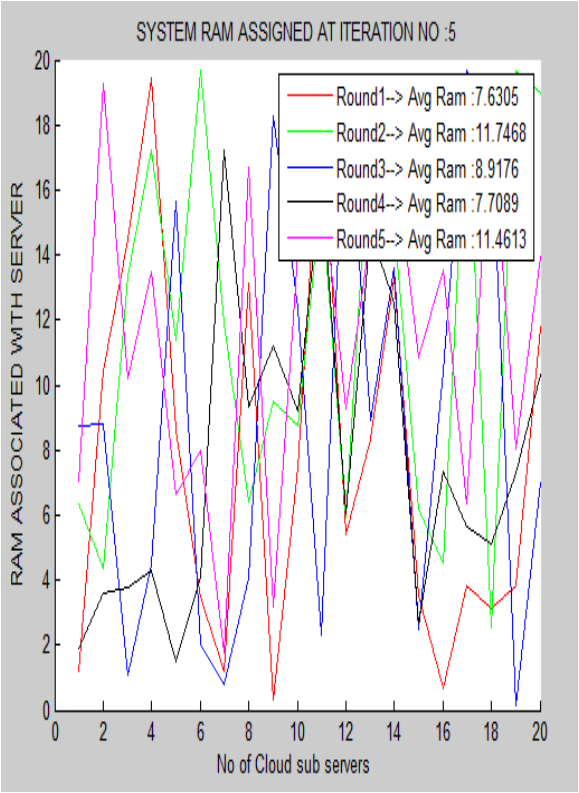

Figure 3: RAM associated with server

Above figure shows the RAM values associated with servers. For round 1 value of Average RAM is 7.603, round 2= 11.7468, round 3= 8.9176, round 4= 7.7089 and round 5 = 11.4613. For large no. of servers the RAM utilization is high.

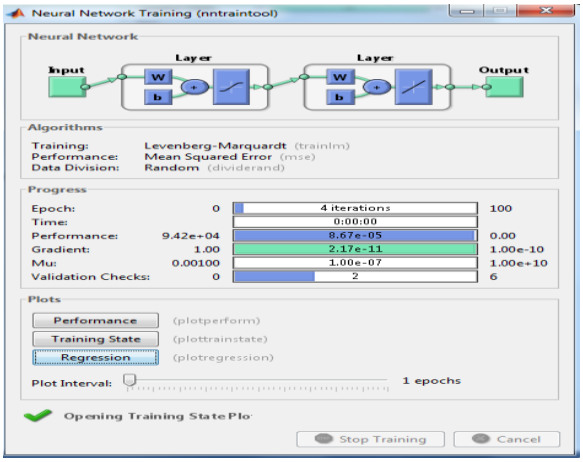

Figure 4: Neural Network Training

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The above Figure describes the structure that contains all of the information concerning the training of the network. The Plots like Performance, Training State and Regression are shown through this Figure.

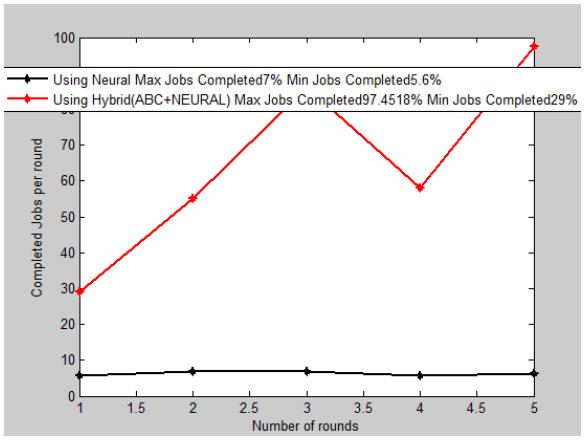

Figure 5: Completed Jobs per Round

Above figure shows the no. of jobs completed per round. By using proposed Hybrid algorithm (Neural + ABC) after 5 rounds, average of maximum completed jobs per round is 97.45% and the average of minimum jobs completed is 29% while by using Neural network alone average of maximum jobs completed is 7% and minimum jobs completed is 5.6%. Number of completed jobs of hybrid approach are more as compare to NN which has less number of completed jobs.

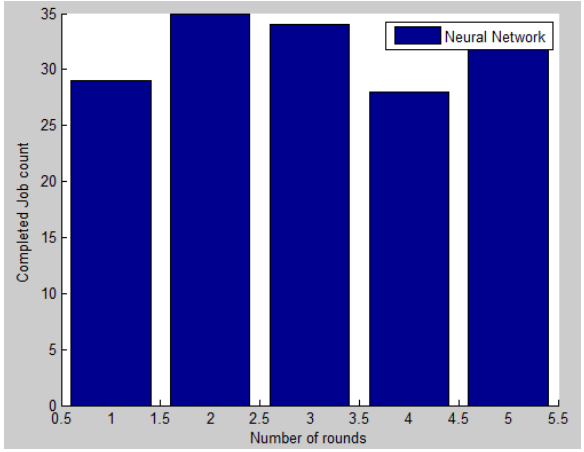

Figure 6: Jobs completed by neural approach

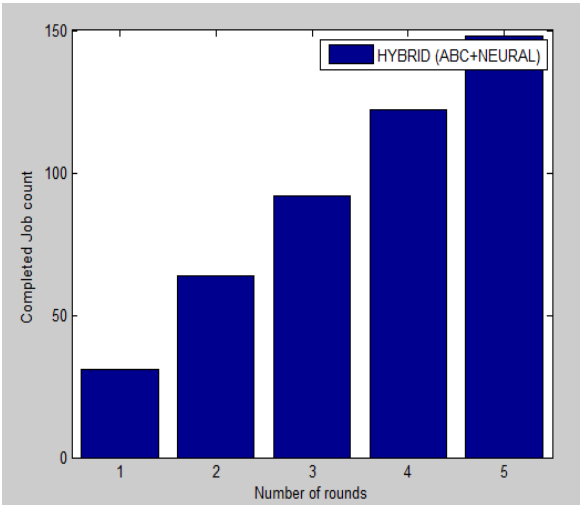

Figure 7: Jobs completed by Hybrid approach

The above Figure 6 and Figure 7 describe the comparison between Hybrid approach (ABC + Neural) and Neural technique used for resource utilization. The proposed Hybrid approach completed 150 jobs per given time while the neural network completed 35 jobs per given time. Hybrid approach gives better results as compare to neural approach.

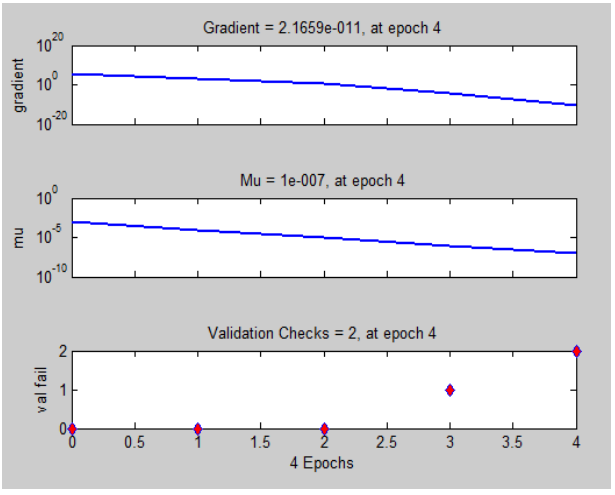

Figure 8: Training of dataset

Above graph shows the different types of parameter which are generated during training of dataset. We check whether we find best gradient value, mutation value and validation checks.

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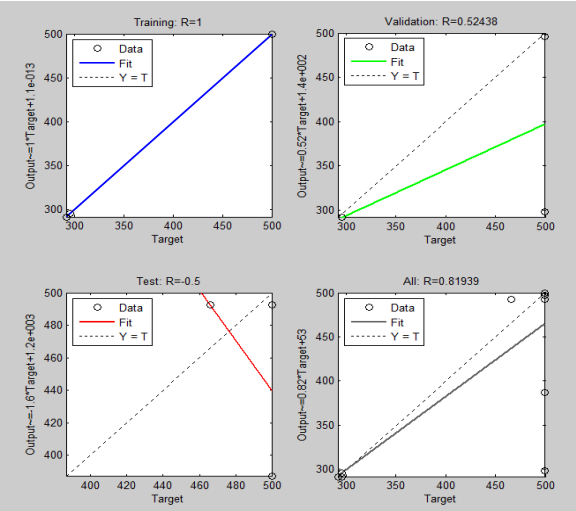

Figure 9: Datasets for training

Above graph shows the description of datasets which are used for the training purpose of dataset. There are total four graph first for trainig data, second for validation, third for test data which are automatically taken from the training dataset and last for ouput of training. In the grapgh tow lines are present first is solid line and second is doted line which represents the accuacy of training. The three plots represent the training, validation, and testing data. The dashed line in each plot represents the perfect result – outputs = targets. The solid line represents the best fit linear regression line between outputs and targets. The R value is an indication of the relationship between the outputs and targets. If R = 1, this indicates that there is an exact linear relationship between outputs and targets. If R is close to zero, then there is no linear relationship between outputs and targets.

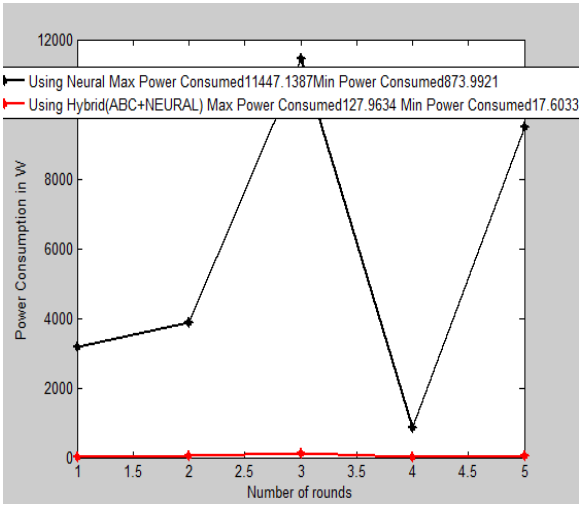

Figure 10: Comparison of Power consumption

Figure 10 is showing the difference of power consumption by means of number of jobs. It can be seen from the graph that by using neural network, power consumed is more but by using neural with ABC, the power consumption is very less.

5. Conclusion

With the growing cost of the power in the computer systems, more attention is given to the power management by the researchers as it is directly proportional to the no. of total jobs completed. High the jobs completed, high will be the efficiency of the system. High job execution mainly depends on the scheduling of the jobs according to the proposed algorithm. So, in this work, hybrid algorithm (Neural network with artificial bee colony) for scheduling of jobs has been proposed that will work on weight matrix.

It is concluded that the hybrid approach has less power consumption as compare to the neural network alone by means of number of jobs. The number of jobs completion is more in case of Hybrid algorithm that is for neural and for ABC. Hybrid is completing 150 jobs while neural network alone is completing 35 jobs.

REFERENCES

[1] Shahram Behzad, "*Queue based Job Scheduling algorithm for CloudComputing*", International Research Journal of Applied and Basic Sciences © ISSN 2251- 838X / Vol, 4 (12): 3785-3790 Science Explorer Publications.

[2] Pinky Rosemarry, Ravinder Singh, *"Grouping Based Job Scheduling Algorithm Using Priority Queue And Hybrid Algorithm In Grid Computing,"* International Journal of Grid Computing & Applications (IJGCA) Vol.3, No.4, December 2012.

[3] Jasbir Singh1 and Gurvinder Singh, *"Task Scheduling using Performance Effective Genetic Algorithm for Parallel Heterogeneous System",* International Journal

of Computer Science and Telecommunications, Volume 3, Issue 3, March 2012].

[4] Philippe Baptiste, Marek Chrobak , and Christoph Durr, *"Polynomial Time Algorithms for Minimum Energy Scheduling"* ,IEEE 2010.

[5] Neetu Goel, "*A Comparative Study of CPU Scheduling Algorithms,"* IJGIP Journal homepage: www.ifrsa.org.

[6] Jagbeer Singh, "*An Algorithm to Reduce the Time Complexity of Earliest Deadline First Scheduling Algorithm in Real-Time System",* (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No.2, February 2011.

[7] Sotomayor, b., rubã©, a., llorente, i. And foster, i. 2009. *Virtual Infrastructure Management in Private and Hybrid Clouds*. Internet Computing, IEEE 13, 5, 14-22.

[8] MEI, L., Chan, W. K. and TSE, T. H. 2008. *A Tale of Clouds: Paradigm Comparisons and Some Thoughts on Research Issues*. In Asia-Pacific Services Computing Conference, 2008. APSCC '08. IEEE, 464-469.

[9] Lai, C-F., Chang, J-H., Hu, C-C., Huang, Y-M., & Chao, H-C., (2011). *CPRS: A cloud-based program recommendation system for digital TV platforms*. Journal Future Generation Computer Systems, Vol. 27, Issue 6. Retrieved October 25, 2011 from http://dl.acm.org/citation.cfm?id=1967928.

[10] Pardeep Kumar and Amandeep Verma, *"Scheduling using improved genetic algorithm in cloud computing for independent tasks,"* in Proceedings of the International Conference on Advances in Computing, Communications and Informatics. 2012, ICACCI '12, pp. 137–142, ACM.

[11] Liang Luo,Wenjun Wu, Dichen Di,Fei Zhang,Yizhou Yan,Yaokuan Mao*,"A resource scheduling algorithm of cloud computing based on energy efficient optimization methods"*, International conference on Green Computing, pp: 1-6, 2012.

[12] Bo Li, Jianxin Li, Jinpang Huai, Tian yu Wo, Qin Li, Liangh Zhong*,"EnaCloud-An Energy-Saving Application Live Placement Approach for Cloud Computing Environments"*, CLOUD'09. International IEEE Conference Cloud Computing, pp: 17-24. 2009.

[13] Marcos D Assuncao, Marco AS Netto, Fernando Koch, Silvia Bianchi*,"Context-Aware Job Scheduling for Cloud Computing Environments"*, 5th International IEEE Conference on Utility and Cloud Computing(UCC), pp: 255-262, 2012.

[14] Truong Vinh Truong Duy, Sato Y.,Inoguchi Y.*,"Performance evaluation of a Green Scheduling Algorithm for energy savings in Cloud Computing"*, International Symposium Workshops and Ph. D. forum on Parallel and Distributed Processing, pp: 1-8. 2010.

[15] Yiqiu Fang,Fei Wang, Junwei Ge,*"A Task Scheduling Algorithm Based on Load Balancing in Cloud Computing"*, Proceedings of the International Conference on Web information systems and mining, pp: 271277, 2010.

[16] Tien Van Do, Csaba Rotter,*"Comparison of scheduling schemes for on-demand IaaS requests"*, Journal of Systems and Software, Volume 85: Issue 6, pp: 1400-1408, 2012.

[17] Van den Bossche R.,Vanmechelen K.,Broeckhove J.*,"Online cost-efficient scheduling of deadline-constrained workloads on hybrid clouds"*, 3rd IEEE International Conference on Cloud Computing Technology and Science (CloudCom), pp: 320-327, 2011.

[18] Jiayin Li, Meikang Qiu, Zhong Ming, Gang Quan, Xiao Qin, Zonghua Gu*,"Online optimization for scheduling preemptable tasks on IaaS cloud systems"*, Journal of Parallel and Distributed Computing, Vol: 72, Issue 5, pp: 666-677, 2012.

[19] Saeid Abrishami, Mahmoud Naghibzadeh, Dick H.J. Epema*,"Deadline-constrained workflow scheduling algorithms for Infrastructure as a Service Clouds"*, ,

Journal of Future Generation Computer Systems Pages: Vol. 22: Issue 1, pp: 158-169, 2013.

[20] Maria A. Rodriguez,Rajkumar Buyya*,"Deadline based Resource Provisioning and Scheduling Algorithm for Scientific Workflows on Clouds"*, IEEE Transactions on Cloud Computing, Volume: 2, Issue 2, pp: 222-235, April, 2014.

[21] Chun-Wei Tsai, Wei-Cheng Huang, Meng-Hsiu Chiang, Ming-Chao Chiang, Chu-Sing Yang,*"A HyperHeuristic Scheduling Algorithm for Cloud"*, IEEE Transactions on Cloud Computing, Vol: 2, Issue 2, pp. 236250, April, 2014.

[22] Tawfeek M.A.,El-Sisi A.,Keshk A.E., Torkey F.A.,*"Cloud task scheduling based on ant colony optimization"*, 8th International Conference Computer Engineering and Systems, pp: 64-69, 2013.