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A Hybrid PSO Based Task Selection and Recommended System for Cloud Data

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Abstract:
Cloud computing is an essential computing environment to provide maximum availability of services to users and industry. On demand, various services are provided to the cloud users through the internet and these services are provided by cloud service providers. Task scheduling is most important in the cloud computing environment because the user has to pay for the resources based on the usage and the load is distributed among the available resources by maximizing the utilization time and reducing the task execution time. Many algorithms were proposed in literature to efficiently schedule the tasks, one such algorithm is Particle Swarm Optimization algorithm (PSO). To enhance the performance of PSO algorithm by optimizing task response time a hybrid PSO based task selection and recommended system has been proposed in this paper. Using CloudSim the results are compared with the existing algorithms. In comparison, the proposed algorithm is giving better results than the existing algorithms.

Keywords*: Cloud computing, Quality of service, Task selection, Recommended system, Particle swarm optimization, Task scheduling.*

1. INTRODUCTION

Cloud computing is a new computing technology to enhance the use of virtualized resources which are designed for end users in a dynamic environment in order to provide reliable and trusted services. Using the concept of virtualization in this computing environment we can improve the utilization of physical resources. This technology allows abstraction and isolation of physical resources and reduces the hardware equipment requirement. Using virtualization, number of virtual machines for a single physical server can be created to execute multiple tasks. Due to this dynamic provisioning of the resources and on demand service of the cloud computing environment, task scheduling always plays a major role. The main objectives of the task scheduling in cloud computing environment are high system throughput, improve load balancing and reduce the task completion time. Usually in any cloud system, there are three main modules namely application, mapping algorithms and virtual machine. From application module cloud users submits a set of tasks to the cloud environment. These tasks are executed on physical resources. When the submitted tasks are to be executed on virtual machine there exist quality factors called quality of service. Using mapping algorithms a set of cloudlets are mapped to resources by estimating the expected time of completion of cloudlets then execute the cloudlets on selected resources [1-2].

2. MOTIVATION AND CONTRIBUTION

- Patricia Takako Endo Et al. described the challenges that are creating major effect on resource allocation in cloud computing. These challenges need to be addressed so as to achieve highest utilization of the resources and lowest cost rate for the cloud service users [3].

- Qiang Li Et al. described the architecture using feedback control theory and virtualization. All hardware resources are stored in a single place in memory which has sharing architecture in a distributed manner. Cloud users can request for the services as per SLA. There is quality measure between cloud users and provider which is quality of service. The main purpose of this paper is to secure SLA agreements. Problem with this type of architecture is that it is based on virtual machine architecture and a smaller amount of explanation is given on how to handle resource requests for every application within the time limit based on workload [4].

- Jiayin Li Et al. described an adaptive resource allocation algorithm for resource allocation. An adaptive min-min scheduling algorithm is used in this paper which is applicable for only static allocation. The task set is sorted in descending order of their execution time then these are mapped to the resources [5].

- S Majumdar Et al. described two-layer architecture for resource allocation policy in virtualization. There are mainly two types such as dynamic and static and it depends on a global agent and a local agent. The local agent computes current request and transfers it to a global agent. Global agent's main role is to optimize the current request and approve the configuration. In both the approaches the objective of the architecture is to achieve highest optimization in terms of quality of service. [6].

- Justin Y. Shi Et al. described resource scheduling for cloud computing environment. They described resource planning in multiple dimensions like space and time. Author has used EC2 technique which is developed by Amazon for cloud computing environment. Since it is best cloud web service and is elastic in nature to provide secure and reliable services to the cloud users [7].

- Fang-Yie Leu Et al. discussed various methods to decrease the unpredictability of access to cloud assets by the clients. They quantified the execution of live movement of virtual machines with various particulars and broke down the information. Virtual migration problem which is present in traditional virtualization concept is discussed and proposed a dynamic virtualization technique to overcome the problems in existing system. Since virtual machine problem is very crucial in task scheduling and is addressed by decreasing the unpredictability of accessing resources by cloud users [8].

- V. Geetha Et al. provided a survey on various classes of existing cloudlet scheduling algorithms and gave a review on different existing classes. Cloudlet behaves as a workload in cloud computing environment. Planning arrangement can be connected at two levels in cloud namely: PaaS layer and Service Level Agreement (SLA). They described various policies related to virtual machine management to create a software framework which is mainly used for simulation in cloud computing. In this strategy, data center resources are used for simulation and the

results are showing that the proposed model is having enhanced performance [9].

- Dumitrescu, C. L Et al. described a simulation technique termed GangSim. GangSim is used as a simulation technique for grid computing environment for local and community resource allocation [10].

- V. Muni Sekhar Et al. described that cloud computing is providing on demand service to shared network. So, the service should be customized according to quality of service. Quality of service is fulfilled with non-functional specifications like security, mobility and virtualization by using some algorithms [11].

- Phani Chavali Et al. proposed a scheduling model to schedule the tasks using resource virtualization technology and the Software Defined Network (SDN). The proposed model has shown the enhanced performance [12].

- David A.Monge Et al. proposed a novel objective formulation model using which make span, cost and probability of getting failures were minimized [13].

- Najme Mansouri Et al proposed an efficient scheduling strategy based on PSO technique using which best VM can be selected to execute the given task. Using cloudsim the model has been developed and results were showing enhanced performance [14].

- Bela Shrimali Et al. proposed an optimization model based on multiple objectives to address energy related issues. The algorithm was implemented on cloudsim environment and results were showing the considerable amount of energy has been saved due to efficient VM allocation [15].

- Mohammed Abdullahi Et al. proposed a scheduling model based on optimization strategy by taking execution time and financial cost as QoS parameters and model has improved efficiency using cloudsim [16].

3. PROPOSED MODEL

3.1.Theoretical framework

The framework is focusing on the connection between virtual machine and cloudlet through the mapping. To handle the user's requests definitely there is a need of set of resources, but hardware resources are in limited number. Resource management is a big issue in cloud computing [18]. A better task scheduling is required to assign resources to tasks in order to achieve minimal cost and maximum performance. Particle Swarm Optimization is proposed in 1990s. It is a Meta heuristic algorithm and provides optimized solution in very less amount of time [19-21]. Cloud service provider targets maximum profit by resource utilization and user targets that their application is to be executed in minimum time and with less execution cost. The fitness function of the PSO algorithm can be used to optimize the following parameters.

- Task execution time
- Task execution cost
- Task rejection ratio
- Task throughput
- Task energy consumption

Each member in swarm is treated as a particle. All the tasks are treated as particles and they are randomly moving in the search space. pbest and gbest represents best personal value and best group value. New velocity is calculated and based on which the particles moves to next positions. The algorithm is making use of some random numbers and acceleration constants to help swarm movement towards its path in the given solution

space. Gaussian function is used to reduce the mean square error and improves the efficiency of the algorithm.

3.2.Experimental design

Algorithm

Hybrid PSO based task selection and recommended system for cloud data is as follows:

Step-1: Compute the task rating similarity requested by the active and normal user based on the QoS values

Step-2: Predict missing values of QoS using the weighted similarity measure

Step-3: Compute normalized confidence score for users

Step-4: Compute normalized confidence score for tasks

Step-5: Calculate weighted score for users

Step-6: Calculate weighted score of tasks

Step-7: Compute weighted predicted score for QoS missing value

Step-8: Initialize number of tasks, number of data centers, number of VMs and number of particles.

Step-9: Find the list of available VMs

Step-10: To each VM in the VM List

Do

Get the response time of the VM instance as RT.

Done

Step-11: Compute QoS predicted on demand cost of each VM using RT as metric.

Let α and β be the price rates for allocating various resources and the final cost function is shown below

$$F(c) = RT(\alpha s \mu + \beta (1-pk) \lambda e Wq)$$

Gaussian values as

$$Wq = Lq / \lambda e$$

$$L_q = \sum_{n=s}^{k} (n - s).P_n$$

Where

Effective Arrival Rate λe :

$\lambda e = \lambda (1-Pk)$

$Pn = (\lambda n / S!\, Sn-s\, \mu n)\, Po$, when $s \leq n \leq k$

λ = The arrival rate for the system,

μ = The service rate for each server

s = Number of Servers

K = System size (Finite); Total number of system $\leq$ k

Let Pn be the probability that there are n customers in the system in the steady-state. n = 0, 1, 2, 3… k

Step-12: Randomly assign each particle to each task.

Step-13: Randomly initialize each particle position and velocity.

Step-14: Set min position, max position and max velocity.

Step-15: To each particle compute fitness value and update global best and neighbor best positions.

Step-16: Update particle's position and velocity by using each instance CPUU and

March-April 2020
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$$Gaussianvalue: gv = \frac{1}{2.\pi} e^{(\sum gbest - pbest_i)}$$

$$UpdatedVelocity: V_{i+1} = w * v_I + (C.(CPUU))/NT*(pbest_i - x_i) + (C*(gv/PS))*(gbest_i - x_i)$$

$w = 0.9;$

$C = 2;$

$NT = number\ of\ tasks$

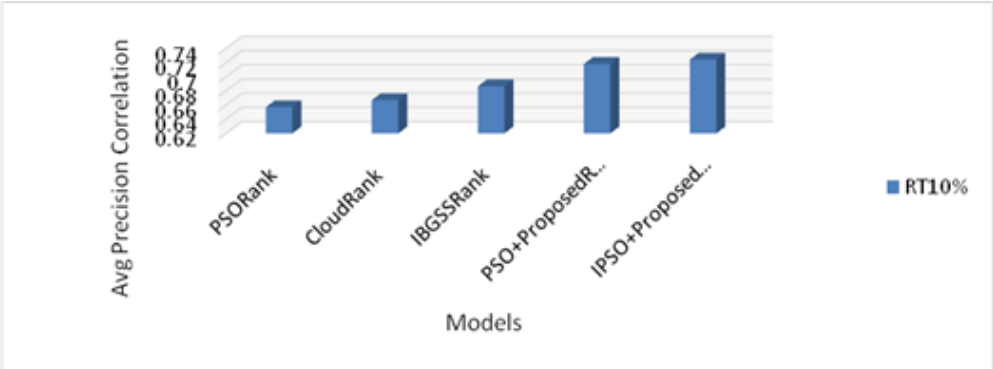
$PS:=Particles\ size$

Step-17: Repeat Step-15 until all tasks are scheduled

Step-18: Stop

4. SIMULATION RESULTS

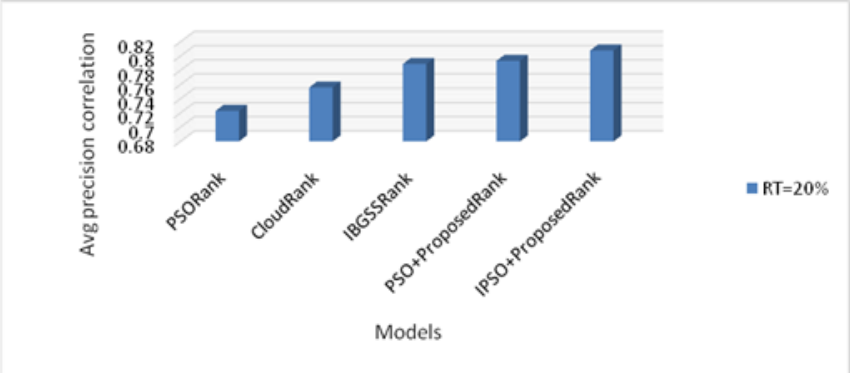
CloudSim is a simulator which provides an environment where we can design, model and evaluate various resource management techniques [22-23]. Many algorithms in literature were proposed to efficiently rank the cloud services so as to select the best rated services [24-25]. Using quality of service we can measure the quality of the cloud services. QoS makes use of many metrics to measure the performance such as response time, processing time, service throughput, data transfer rate and latency. To measure the performance of the cloud service using QoS, response time is used as the important factor [26]. Proposed algorithm is compared with the existing algorithms namely PSO ranking, cloud ranking and IBGSSRank and the results are shown as follows. Graph 1 shows the contextual ranking comparison of proposed ranking measure to the existing ranking measures on cloud web service dataset when response time RT=10%. The proposed algorithm is giving better results when compared with the existing algorithms.



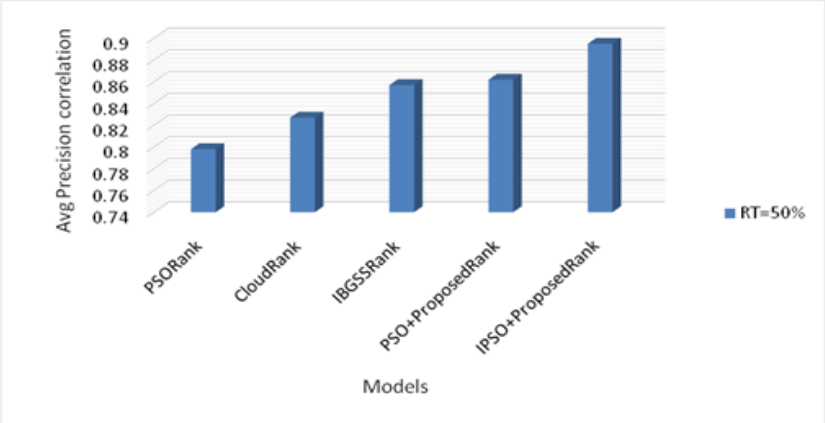
Graph 1. Contextual ranking comparison of proposed ranking measure to the existing ranking measure on cloud web service dataset when RT=10%

Graph 2 shows the contextual ranking comparison of proposed ranking measure to the existing ranking measures on cloud web service dataset when response time RT=20%. The proposed algorithm is giving better results when compared with the existing algorithms. Graph 3 shows the contextual ranking comparison of proposed ranking measure to the existing ranking measures on cloud web service dataset when response time RT=50%. The proposed algorithm is giving better results when compared with the existing algorithms. Graph 4 shows the comparison of proposed ranking algorithm to the existing

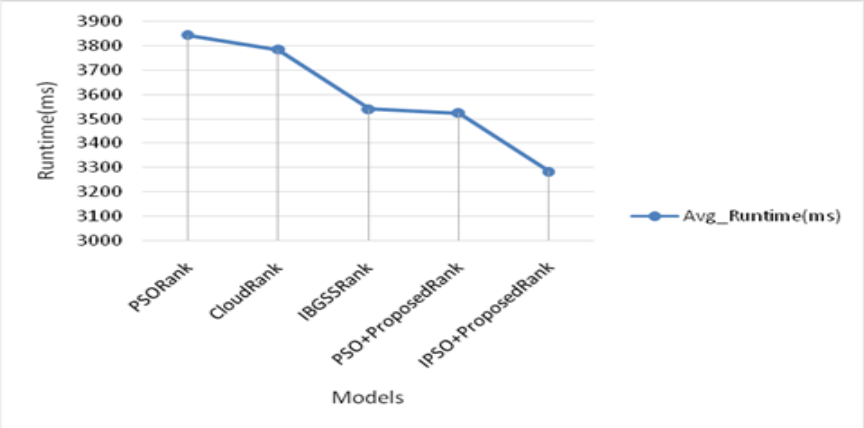
algorithms using runtime in milliseconds. The proposed algorithm is giving better results when compared with the existing algorithms.



Graph 2. Contextual ranking comparison of proposed ranking measure to the existing ranking measure on cloud web service dataset when RT=20%



Graph 3: Contextual ranking comparison of proposed ranking measure to the existing ranking measure on cloud web service dataset when RT=50%



Graph 4: Comparison of proposed ranking measure to the existing ranking measure using runtime in milliseconds

5. CONCLUSION AND FUTURE WORK

CloudSim provides simulation and modeling of various mapping algorithms in cloud computing. In

cloud computing, cloud Broker has huge number of tasks and huge number of resources; it uses least number of the resources by using virtualization. Cloud Broker can assign tasks to virtual machine by using an efficient multi objective task scheduling algorithm. So, in cloud computing, resource allocation plays a vital role. The proposed hybrid PSO based task selection and recommended system maintained a fair distribution flow between virtual machines and tasks. To enhance the performance of PSO algorithm by optimizing response time the hybrid PSO based task selection and recommended system has been proposed in this paper. Using cloudsim the performance of proposed algorithm is compared against the existing algorithms. In comparison, the proposed algorithm is giving better results than the existing algorithms. In future the proposed algorithm can be extended by integrating with a hybrid self-adaptive PSO and QoS based machine learning model for cloud service data to efficiently schedule the tasks in the cloud computing environment.

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