Multi-Objective Optimization for Dynamic Resource Provisioning in a Multi-Cloud Environment using Lion Optimization Algorithm

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AGENDA

- Problem Statement
- System Architecture
- Proposed Algorithm
- Lion Optimization Algorithm
- Multi-Objective Optimization
- Results and Discussion
- Conclusion and Future Scope
- References

PROBLEM STATEMENT

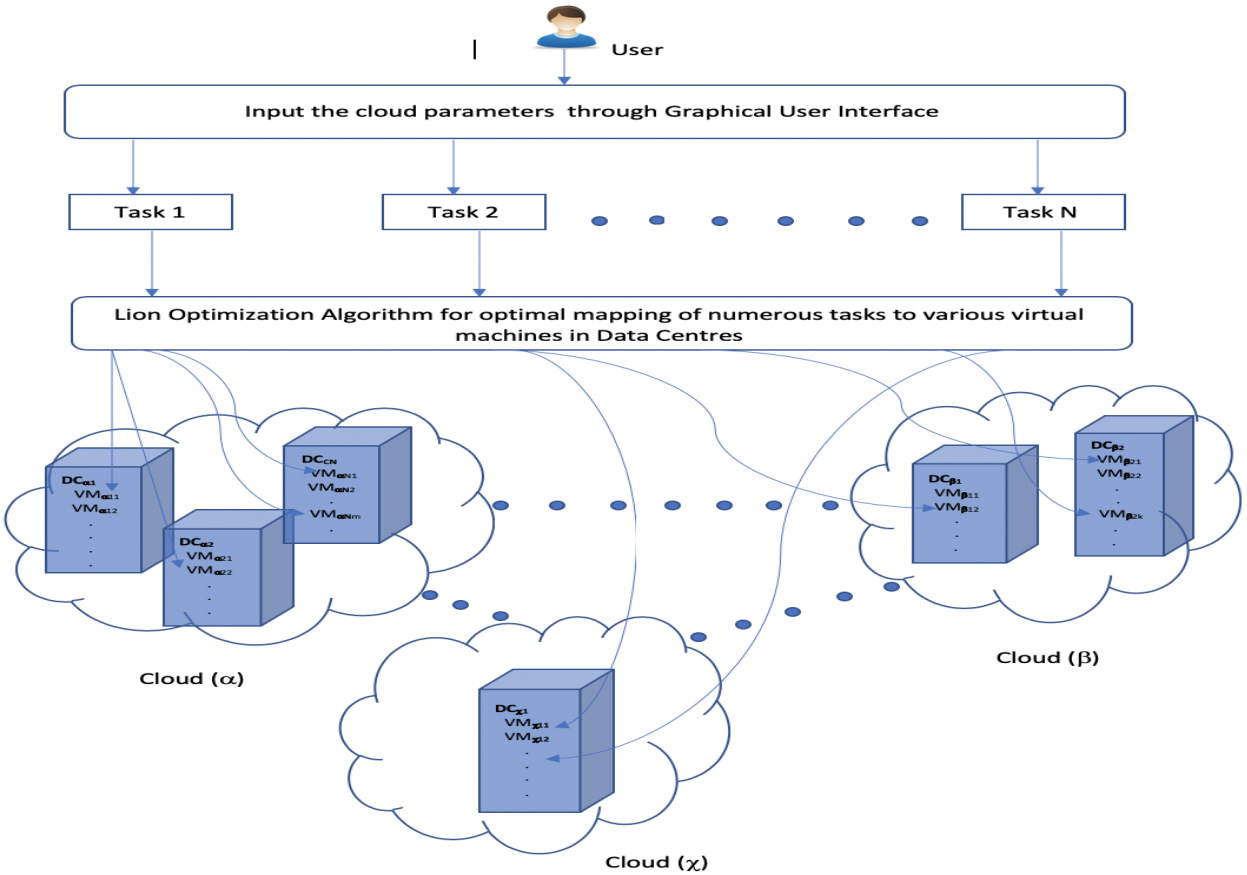
- In recent years , developments in multi-cloud have been prominent because of its indispensible use in our day-to-day life.

- Many recent nature inspired algorithms like grasshopper optimization, hybrid bacteria foraging, whale optimization, etc, are used to solve multi-objective optimization problems like Process Selection, Machine Allocation, Finding the feasible solution and other maximization/minimization problem.

- Therefore, in this paper we are using Lion Optimization Algorithm (LOA) for optimizing multi-objectives like minimizing the cost, maximizing the revenue, etc, in order to improve dynamic resource provisioning performance in multi-cloud environment.

- As compared to Particle Swarm Optimisation (PSO), we have observed that LOA takes much less time with increasing no. of tasks.

SYSTEM ARCHITECTURE



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PROPOSED ALGORITHM

PROVISIONING OF TASKS TO VMS USING LOA

Require: *Parameters P_i*
Ensure: *Provisioned tasks to VMs inside clouds*

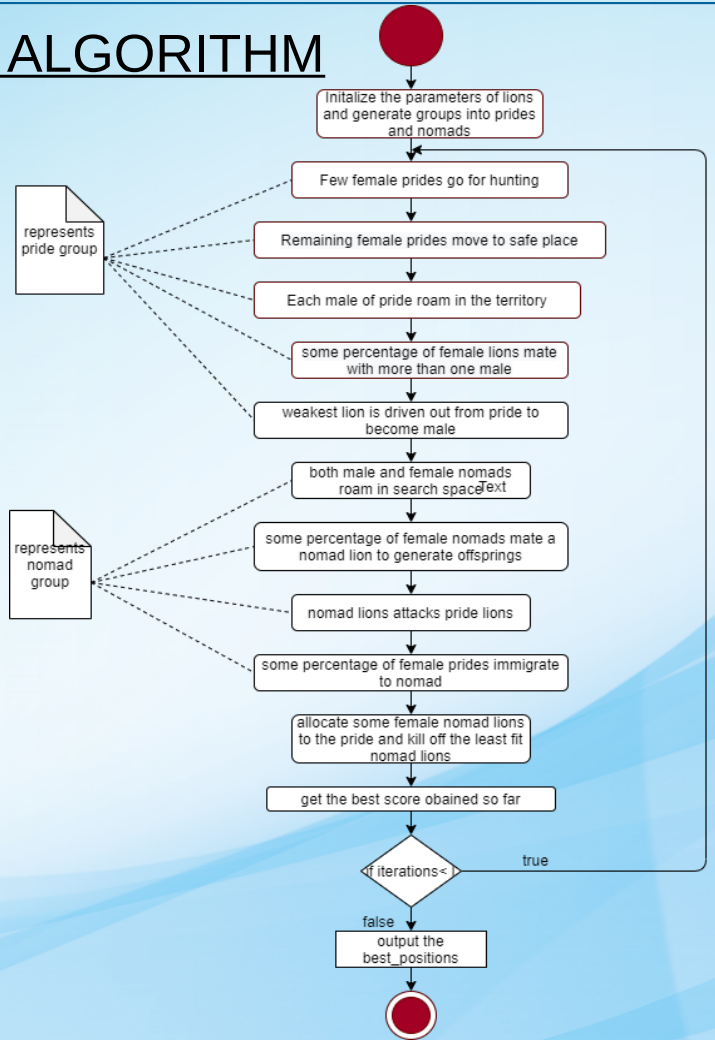
1. *Get Parameters P_i from the user through the GUI*
2. *Get or generate dataset*
3. *Create multi-cloud environment by creating clouds, data centers and VMs.*
4. *Call LOA function based on parameters.*
5. *The output of LOA function, i.e., best positions of lions is mapped to VMs.*
6. *Cloud Simulation starts*
7. *Provisioning of resources to tasks is done by broker*
8. *Cloud Simulation stops*
9. *Display results of Provisioned tasks*

CLOUD PARAMETER VALUES

Cloud Parameter	Value
No. of tasks	10-100
No. of Data Centers	5-25
VM Size	5000-25000 (MB)
VM RAM	256-512 (MB)
VM MIPS	150-500
VM Bandwidth	500-5000 (MB/sec)
No. of CPUs	1-4
File Size	100-500 (MB)
Output File Size	200-500 (MB)

LION OPTIMIZATION ALGORITHM

- Generate Population
- Hunting
- Move to Safe Place
- Roaming
- Mating
- Defence
- Migration



LOA PARAMETER VALUES

LOA Parameter	Value
npop	50
prideNo	4
percentNomad	0.2
roamingPercent	0.2
mutateProb	0.2
sexRate	0.8
mateProb	0.3
migrateRate	0.4

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MULTI-OBJECTIVE OPTIMIZATION

- Makespan

$$makespan = max(endTime - startTime)_{task_i}$$

- Average Response Time (ART)

$$ART = \frac{\sum (endTime - startTime)_{task_i}}{n}$$
$$where\ n\ is\ the\ total\ no.\ of\ tasks$$

- Cost

$$cost = \sum (C_i * T_i)_{resource_i}$$
$$where\ 'C_i'\ is\ the\ cost\ of\ resource_i$$
$$'T_i'\ is\ the\ total\ time\ taken\ by\ resource_i$$

- Completion Time (CT)

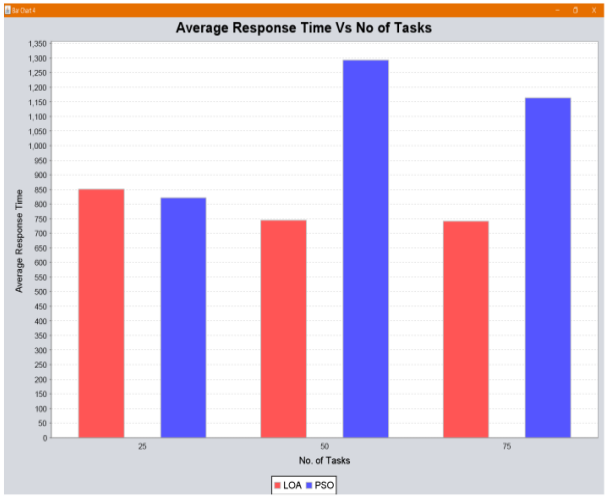
$$CT = \sum (endTime - startTime)_{task_i}$$

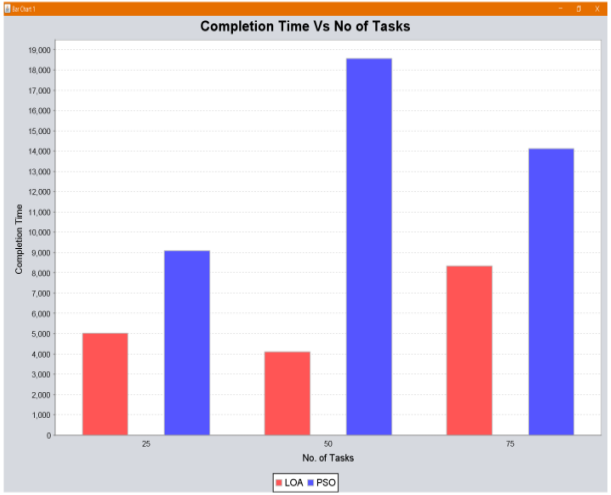
- Average Resource Utilization (ARU)

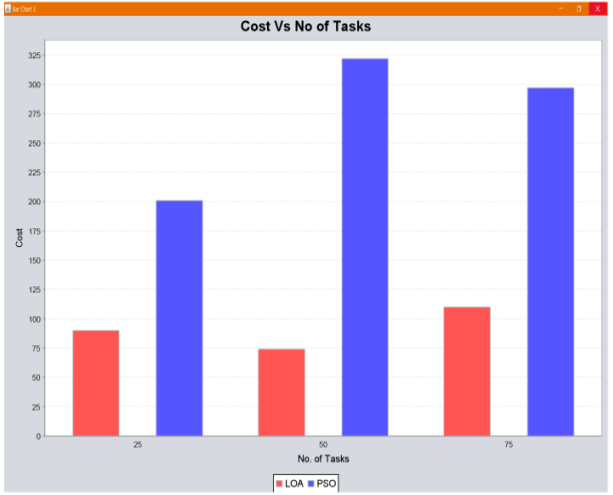
$$ARU = \frac{\sum (finishTime - startTime)_{task_i}}{makespan * m}$$
$$where\ m\ is\ the\ total\ no.\ of\ tasks$$

RESULTS AND DISCUSSION

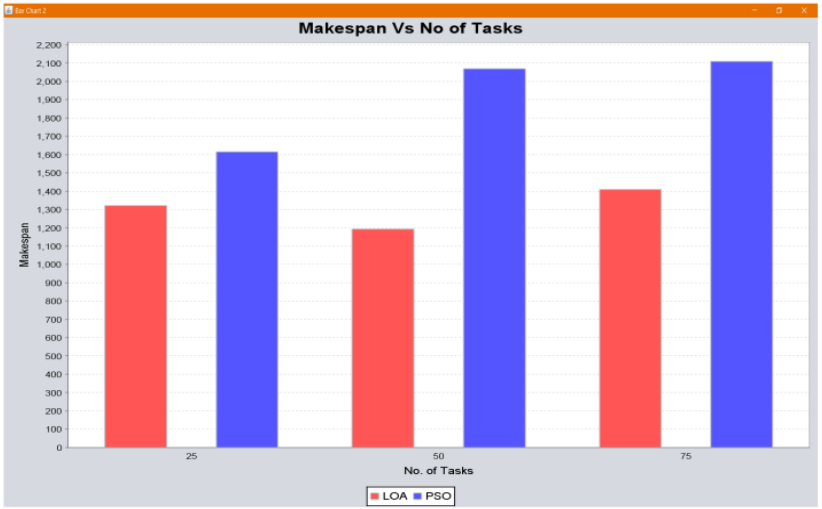
For the given parameters , No. of tasks = 50, No. of Data centers = 15, VM size = 15000 MB, VM Ram =512 MB, VM MIPS = 400, File Size = 300 MB, VM BW = 4000 MB/sec, Output File size = 400 MB, No. of CPUs = 2

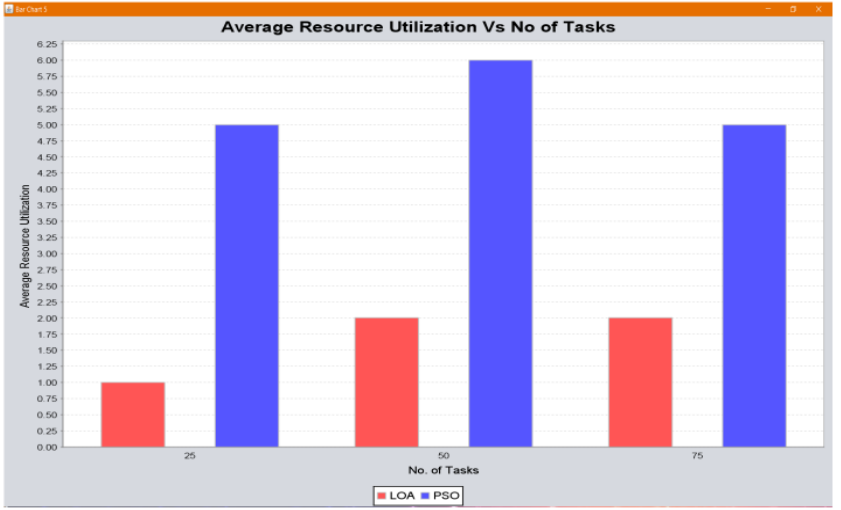






RESULTS AND DISCUSSION





PERFORMANCE COMPARISON OF LOA OVER PSO

Objectives	PSO	LOA	PC(%)
CT(ms)	18564	4117	77.82
Makespan(ms)	2070	1192	42.41
Cost(Rs)	323	74	77.089
ART(ms)	1294	745	42.42
ARU(%)	6.25	2.08	66.72

$$PC\% = \frac{(Value_{LOA} - Value_{PSO})}{Value_{PSO}} * 100$$

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CONCLUSION AND FUTURE SCOPE

- This paper addresses performance, efficiency and reliability issues of resource provisioning.
- The proposed method using LOA outperforms dynamic resource allocation for all considered objectives.
- The result of the proposed method shows better percentage of improvement as compared with the traditional PSO algorithm.
- In future, we have planned to consider the performance of the same parameters used in LOA and simulate them in the federated cloud environment .
- There will be a study on how to incorporate Live VM migration as an effective mechanism to balance the load.

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Q/A

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