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A Lion Optimization Algorithm for an Efficient Cloud Computing With High Security

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Abstract: **Cloud computing is a developing paradigm to provide reliable and resilient infrastructure allowing the users (data owners) to store their data and the data consumers (users) can access the data from cloud servers. This paradigm reduces storage and maintenance cost of the data owner. However, cloud data storage still gives rise to security related problems. In case of shared data, the data face both cloud-specific and insider threats. In this work, we propose lion optimization algorithm (LOA) optimized centrality measure fragmentation and replication of data in the cloud for optimum performance and security that consider both security and performance issues. The Lion Optimization Algorithm (LOA) is introduced. Special lifestyle of lions and their cooperation characteristics has been the basic motivation for development of this optimization algorithm. In our methodology, Mating that refers to deriving new solutions and Territorial Defense and Territorial Takeover intend to find and replace the worst solution by new the best solution. Likewise, we divide a data files and replicate the fragmented data over the cloud nodes using LOA optimized centrality measures. Each of the nodes stores only a single data fragment of a particular data file that guarantees that even in case of a successful attack, no significant information is revealed to the attacker. We also proposed a fused technique which is used for the encryption and decryption to enhance the high security for the data in the cloud environment. This can be implemented after the LOA performance and also protects the information in the cloud efficiently. We also compare the performance of the LOA methodology and fused encryption and decryption techniques with other standard replication schemes. The higher level of security with improved performance overhead was observed.**

Index Terms: **Centrality Measures, DROPS, FOA, GA, LOA**

I. INTRODUCTION

Cloud computing means gathering and getting to data, and projecting over the web rather than your PC's hard drive. The cloud is only a picture for the Internet. Cloud drops innovation is tied in with verifying information over the cloud since when the clients redistribute their information to unapproved official control, it offers ascend to security related concerns. The information gives and take may manifest because of outsider by different clients and hubs inside the cloud. On reaching the information by outsider clients and procedures must be not allowed, else, one frail individual will put the whole cloud at danger (M. Yazdani & F. Jolai, 2016). Likewise, the security practice must be unease in the improvement of information mending time.

Some portion of the harmness are 1) neighboring individual which makes a path to an adversary to sidestep the client lines. 2) The offsite data stockpiling cloud utility needs clients to move data in mists thought and shared area that may starting point a decision of security concerns. 3) Grouping and flexibility of the cloud, consent to the physical properties to be shared among heaps of clients. These mutual properties might be reallocates to different clients for the outcome in information bargain at some moment time.4) A multi-occupant virtual environment may result in VM to escape the constraints of virtual machine monitor(VMM) which can hold up to different VMs may contact to outsider information. 5) In cross occupant virtualized set-up, because of unseemly media sanitization, the purchaser records can likewise gets spilled.

A. *Data security tactics*

- In Cloud drops technology, a record is apportioned into wastes, and copies the trash information over the cloud hubs. Every one of the hubs supplies just a solitary rubbish of a specific information record that ensures that even on account of any fruitful assault, where the assailant can't get an important information.
- The nodes are amassing the junks are partitioned by a specific space by methods for chart T-shading to make illicit an adversary of concluding the spots of the wastes.
- For a cloud to be sheltered every single taking an interest body must be bolted. In a framework with

different units, the frameworks security with the most significant level is equivalent to the security level of the weakest substance.

In this article, a new algorithm for DROPS (Mazhar Ali & Khan, 2016) is proposed for cloud environment using the concept of lion optimization algorithm (LOA), which was proposed in (M. Yazdani & F. Jolai, 2016). LOA is a nature inspired algorithm based on the special lifestyle of lions and their cooperative behaviors. To evaluate the performance of the proposed algorithm, a comparative study is done among the proposed algorithm, DROPS based on FOA algorithm (S.Periyanatchi.2019), and also with the GA.

The remainder of an article is ordered as follows. Section 2 provides an overview of the literature methodology. Section 3 presents our network model and fruit fly algorithm for cloud drops technology. Section 4 discusses the proposed methods of LOA and the fused encryption and decryption technique with an algorithm and Section 5 shows results and discussion .Section 6 concludes this thesis.

II. LITERATURE REVIEW

The authors (Gan, G. & T. l. Huang, 2010) suggests an optimized algorithm based on genetic annealing algorithm for scheduling the task. Thus the QOS requirement of different type of task is considering in cloud, this result efficiently distribution of resources in the cloud environment. Hu Yan. (2013) (Guo,. L, & Zhao, 2012) is spots on Multi-objective Task Assignment by using Particle Swarm Optimization (PSO) algorithm in Cloud Computing. In this literature, the both cost and time are optimized where it increased the efficiency and reduces the cost of the network. The authors (Hu Yan, 2013) focus on calculation and communication cost. To take into account both calculation and communication cost, the Particle Swarm optimization based heuristic is presented to cloud resources. Monir and Mohammed et al suggests Divisible Load theory (DLT) to divide the load into fractions and scheduling them to reduce the entire total cost among available processors. DLT is used as equipment to access general computation load in areas of aerospace data, image processing, non-linear processing and scheduling large scale divisible data in Grids and in cloud computing environment. However, this will realize load balancing as processing nodes will receive fraction of load and no node will be congested. DLT analyzes the optimal fraction of load that is to be allocated to each processor. This literature claims to reach drop off in delay cost and hence the total cost is decreased. The authors (P. Durga devi & S. Srinivasan, 2015) proposes a Hybrid optimization based on Meta-heuristic Swarm Optimization (MSO) and Cuckoo Search (CS) for data scheduling in cloud environment. Their scheduling representation has three modules- scheduler system, set of cloudlets and VMs, mapping algorithm which assign a cloudlet to a particular VM which take minimum time for allocation and execution. The objective is to minimize the make span time, response time and to maximize the resource utilization. In this hybrid approach, authors have used MSO as main search algorithm for scheduling cloudlets (tasks) on VMs while CS is used to speed up the convergence by improving the search space used by MSO. The authors (T. Loukopoulos & I. Ahmad, 2004). presented a Genetic Algorithm (GA) based data replica strategy to tackle continuously changing read/write demands. The authors (P. Kumar & Verma, 2012) improved the GA by using the Min-Min and Max-Min algorithms for generating the initial population. This provided a better initial population and better solutions than the standard GA, which initialized the population randomly. (Mazhar Ali & Khan, 2016) proposed the DROPS methodology, a cloud storage security scheme that jointly deals with the security and performance in terms of recovery time. The data file was trashed and the remains are dispersed over multiple nodes.

III. PRELIMINARIES

Before delve into the subtleties of the propose approach, we present the related ideas in the accompanying for the solace of the perusers. A similar writer of this article has been proposed this strategy in (S.Periyanatchi.2019). This area advises how to manage the cloud with some advancement issues. Here the natural fruit fly so as to comprehend the FOA the fundamentals and a calculation has been clarified in beneath.

Basic idea of FOA: It is a proficient strategy for finding worldwide centrality measure improvement dependent on the chasing conduct of the natural product fly. On contrasting, the tactile perception of the natural product fly is superior to that of different species, particularly the feeling of smell and representation. The olfactory organ of a natural product fly can assemble various scents from the air, but a nourishment source 40km away. Thusly, the organic fruit fly flies to the staple, utilizes its intense mental picture or vision to find the nourishment and where its colleagues assemble, and then it heads out toward that path to arrive at the goal.

Organic fruit fly qualities of looking for nourishment in a basic manner and are additionally diminished to a few stages and methodology with models, as reference for any people. To discover the centrality measures for the Division and Replication of Data in Cloud which is proposed in (Mazhar Ali & Khan, 2016). The followings steps are depicted as beneath:

A. Centrality Measures

The centrality measures have been utilized for examining system and recognizing focal hubs of these systems .Such systems are spoken to by coordinated or undirected and weighted or unweighted charts. A coordinated chart, likewise named digraph G, which is our thought in this work, it is spoken to by (V, E) pair, where V is a lot of hubs and E is the arrangement of coordinated associations among hubs. The greatest utilized centrality measures to recognize a focal hub in a digraph, which we will audit in the accompanying subcategories, are degree, betweenness and closeness.

1) Degree Centrality Measure

The degree centrality characterized as neighborhood centrality measure since it is determined by just its coordinated associations. The degree centrality of a hub is determined by including of its approaching (indegree) and active (outdegree) association weights in Eq. (1):

$$C_D(\mathrm{v}) = \sum(\mathrm{id}\ (\mathrm{v}) + \mathrm{od}(\mathrm{v})) \qquad (1)$$

where the indegree*id(v)* is the summation of connection weights entering node *v*, and the outdegree*od(v)* is the summation of connection weights exiting node *v*.

2) Betweenness Centrality Measure

The betweenness defined as global centrality measure because it is calculated based on the shortest paths between node pairs in the graph. The betweenness centrality of a node is calculated by adding the proportion of shortest paths between node pairs that go through that node .for the directed graph *G*=(*V*, *E*), the betweenness centrality of a node *v* is defined in Eq. (2):

$$C_B = \sum_{S\neq v\neq t\in V} \sigma\mathrm{st}(\mathrm{v})/\sigma\mathrm{st} \qquad (2)$$

Where σ_{st} represents number of shortest paths from node *s* to node *t* and $\sigma_{st}(v)$ is the number of shortest paths from *s* to *t* that passes through node *v*.

3) Closeness Centrality Measure

Like betweenness, the closeness is a worldwide centrality measure determined dependent on the most limited ways idea. It discovers how much a node is near every single other node in the diagram. For a coordinated chart G=(V, E), the closeness centrality of a hub v is characterized in Eq. (3):

$$C_C(v) = \frac{1}{\sum t\in V d_{G(v,t)}} \qquad (3)$$

Where $t \neq v$, and $d_G(v,t)$ is the shortest path between nodes *v* and *t*. With regard to cloud network, the closeness is a measure of how quickly a node communicates with other nodes in the cloud network.

4) Strangeness Centrality Measure

The strangeness of a node n is the most extreme separation to any hub from a node n. A hub is progressively focal in the system, on the off chance that it is less offbeat. Officially, the unusualness can be given in Eq. 4:

$$\mathrm{S}(v_a) = max_b d(v_a, v_b) \qquad (4)$$

Where $d(v_a,v_b)$ represents the space between node v_a and node v_b. It also noted that in our strategies the centrality measures introduced above seem very meaningful and relevant than using simple hop-count kind of metrics.

B. Fruit Fly Optimization Algorithm for solving strangeness Centrality Measures (S. Periyanatchi, 2019)

In this section, FOA is used to find out the strangeness value of centrality measures with functions of respectively:

$$Y = 3 - X^2 \qquad (5)$$

and in the existing, the solution of the strangeness value is 3 according to the FOA methodology. The random initialization fruit fly position zone is [0, 10], the random fly path and space zone of iterative fruit fly food searching is [-1, 1]. On implementing 100 times of iterative search of closeness value and strangeness value, the program implementation result will steadily approach the solution of the functional incredible results.

Therefore the method for finding the strangeness centrality measure of an iterative search solution will be developed with the following steps which are comparable to the common algorithm.

1) Randomized initial fruit fly swarm location

$$X = 10 * rand();$$
$$Y = 10 * rand();$$

2) Give the random path and space for the search of food by an individual fruit fly.

$$X_f(i) = X + 2 * rand() - 1;$$
$$Y_f(i) = Y + 2 * rand() - 1;$$

3) Ever since the food area can't be known, the weirdness to the inception is along these lines evaluated first (spc), then the smell concentration decision value ($\mathrm{Sm_f}$) is calculated, and this value is the reciprocal of strangeness.

$$Spc_f(i) = (Xf(i)\text{^}2 + Yf(i)\text{^}2)\text{^}0.5;$$
$$Sm_f(i) = 1/ Spc_f(i);$$

4) On Substituting the smell concentration decision value ($\mathrm{S_f}$) into smell concentration decision function so as to find the smell concentration ($\mathrm{Smell_f}$) of the individual location of the fruit fly.

$$Smell_f(i) = 3 - Sm_f(i)\text{^}2;$$

5) To Find out the fruit fly with maximal smell concentration (finding the strangeness of centrality measures) among the all nodes.

$$[bestSmellbestguide] = strangeness(Smell);$$

To Keep the best smell focus worth and x, y arrange, and right now, the organic fruit fly swarm will utilize vision to fly towards that area so the strangeness centrality measures between the hubs can be discover.

$$X = X(bestguide);$$
$$Y = Y(bestguide);$$
$$Smellbest = bestSmell;$$

This steps must be processed in an iterative optimization manner, which repeatedly executes the steps 2-5, and judge whether the smell concentration (i.e) the strangeness centrality measures is superior than the previous iterative centrality measure, if yes, then execute Step 6.

C. Fruit Fly Optimization Algorithm for solving closeness centrality measures

In this section, FOA is used to find out the closeness value of centrality measures with functions of respectively:

$$Y = -5 - X^2 \qquad (5)$$

Before, the arrangement of the closeness worth is - 5 as per the FOA method. The irregular introduction natural fruit fly position zone is [0, 10], the arbitrary fly way and space zone of iterative organic product fly nourishment looking is [-1, 1]. On executing multiple times of iterative pursuit of closeness worth and closeness esteem, the program usage result will relentlessly approach the arrangement of the practical extraordinary worth.

An algorithm for closeness centrality measures is given in Algorithm 1.

Algorithm 1. Algorithm for closeness centrality measures

Step1: $X = 10 * rand();$
$Y = 10 * rand();$
Step2: $X_f(i) = X + 2 * rand() - 1;$
$Y_f(i) = Y + 2 * rand() - 1;$
Step3: $Spc_f(i) = (X_f(i)^2 + Y_f(i)^2)^0.5;$
$Sm_f(i) = 1/ Spc_f(i);$
Step 4: To measure closeness centrality
$Smell_f(i) = -5 + Sm_f(i)^2;$
Step 5: $[bestSmellbestguide] = closeness(Smell);$
Step 6: $X = X(bestguide);$
$Y = Y(bestguide);$
$Smellbest = bestSmell;$

This entire steps will be processed in an iterative optimization manner, which repeatedly executes the steps 2-5, and judge whether the smell concentration (i.e) the strangeness centrality measures is superior than the previous iterative centrality measure, if yes, then execute Step 6.

D. FOA for solving global centrality analysis

In this section tries to use FOA search global maxima value, the function is:

$$y = sin(x)/x \qquad (6)$$

From the above expression, we can evaluate the global centrality measures by using the fruit fly optimization algorithm which has been given in Algorithm 2.

Algorithm 2. Fruit fly optimization algorithm

Step 1: $X = 10 * rand();$
$Y = 10 * rand();$
Step 2: $X_f(i) = X + 2 * rand() - 1;$
$Y_f(i) = Y + 2 * rand() - 1;$
Step 3: $Spc_f(i) = (X_f(i)^2 + Y_f(i)^2)^0.5;$
$Sm_f(i) = 1/ Spc_f(i);$
Step 4: For Finding the best global centrality
$Smell_f(i) = sin(Sm_f(i)) + Sm_f(i);$
Step 5: $[bestSmellbestguide] = global(Smell);$
Step 6: $X = X(bestguide);$
$Y = Y(bestguide);$
$Smellbest = bestSmell;$

IV. PROPOSED DROPS BASED ON LION OPTIMISATION ALGORITHM (LOA)

The LOA was created dependent on the reenactments of the practices of lions, for example, chasing, mating, and protection. Lions have two hierarchical practices: inhabitant conduct and migrant conduct. Inhabitants live in gatherings called prides. An occupant lion may turn into a traveler, and the other way around. In the LOA, the underlying populace is produced haphazardly over the arrangement space where each and every arrangement is known as a "Lion". (%N) of lions in the population are selected randomly as nomad lions and the rest of the population are residents. Residents are divided randomly into (P) prides. (%S) of the lions in each pride are considered female and the rest are male. However, this proportion is reversed for nomad lions.(%R) is the roaming percent and the (%Ma) are the mating percentage of female lions. (%I) is the immigrate rate of female lions in each pride.

A. Proposed LOA

A calculation of LOA comprises of a few stages that are referenced in the accompanying and these means are proposed in [21] .

Stage 1: Initialize populace In this investigation, our objective is to determine the assignment planning for distributed computing and limit the make span of the arrangement, which is the greatest consummation time for all undertakings. In this way, we should delineate basic answer for a lion. A lion speaks to an undertaking planning arrangement, which is introduced haphazardly by mapping cloud errands (cloudlets) to cloud assets (virtual machines (VMs)).

Table 1: Values of LOA Parameters

Parameter	value
%N	20
P	4
%S	80
%R	20
%Ma	30
%I	40

In our proposed algorithm, each lion has the following parameters:

vmPositions List: initially contains random schedule of VMs.

vmBestPositions List: in order to save the best schedule for that lion.

Fitness: represents the make span of current vmPositions

Best Fitness: represents the make span of vmBestPositions.

As referenced already, the underlying populace will be arranged into occupants and travelers. Table 1 demonstrates the estimation of parameters utilized in the trial. Be that as it may, it is the turnaround for migrant lions: %(100−80) of the travelers are females and the rest are guys.

Step 2: Each pride will do the following namely:

- Hunting
- Remaining Females
- Roaming
- Mating
- Defense

Step 3: Each lion of Nomads will do the following:

- Roaming
- Mating
- Defense

Step 4: Migration

Step 5: Equilibrium

Step 6: Steps 2, 3, 4, and 5 are repeated till the last iteration.

B. Proposed pseudo code of DROPS based LOA

Input: List of Cloudlets (Tasks), List of VMs

Output: the best answer for assignments distribution on VMs

Step 1: Initialize

Set estimation of parameters Number of Lions, VMs, Iterations Generate arbitrary answer for every Lion Initiate Prides and Nomad lions.

Step 2: For each Pride

A few females are chosen haphazardly for chasing. Remained females push toward best chosen places of an area. Every male meanders in %R of domain. %M of females mate with at least one inhabitant guys. Weakest male drive out from pride and become traveler.

Step 3: For each Nomad lion

Both male and female move randomly in the search space %M of females mate with only one male Nomad males attack prides.

Step 4: For each pride

%I of females Immigrate from pride and become nomad.

Step 5: Do

Each gender of nomad lion are sorted based on their fitness value Best females are selected and distributed to prides filling empty places Nomad lions with least fitness value will be removed based on the max permitted number of each gender.

Step 6: If (t< Iterations)

Go to step 2

The proposed method was executed utilizing Network Simulator-2 programming. In this way, it tends to be practiced that the proposed LOA is an all the more dominant strategy to understand the cloud security. It has the high defending limit which spotlights on the security and execution, brought about expanded security level of information joined by a slight presentation drop. As issue of cloud security is contrasted and all the past strategies. The proposed system takes care of the outsider issue of distributed computing information during transmission to make a sheltered distributed computing system for the all clients. The examination confirms that the distributed computing security by utilizing LOA is structured in this paper is secure and successful.

C. Fused encryption and decryption (FED) technique

After completing the LOA, then the fused encryption and the decryption techniques is done for the data security enhancement in cloud. In this FED technique, initially the process of encryption is done which converts the original data of plaintext into its corresponding ASCII code value and then generates a key for the encrypted cipher text. For the decryption process, it is the vice versa of encryption which retrieves the original data from the cipher text by using a generated key. This fused encryption and decryption algorithm is explained in the following.

1) Encryption Algorithm

Step1: **calculate** the charter's quantity (n) without space in the file as plaintext (P).

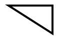
Step 2: **Change** the recovered plaintext into ASCII code.

*Step 3: S***tructure** a square matrix of size m*m >=n and fill it with ASCII code from left to right and top to bottom.

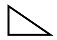
Step 4: **Arrange** a key K1 of size (m*m)

Step5: **Perform** the encryption as $C = K1 * p mod\ 26$, where C indicates as ciphertext of m*m.

Step 6: **Divide** the matrix C as diagonal, upper and lower matrix and read the content from left to right and top to bottom

Upper matrix as: 

Diagonal matrix as: 

Lower matrix as: 

2) Decryption Algorithm

Step 1: **convert** the received encrypted text into ASCII code

Step 2: **prepare** the ASCII codes into a matrix R of order m*m.

Step 3: **Partition** the matrix into as diagonal, upper and lower matrix and read their content from left to right and top to bottom.

Step 4: **Apply** the key Ki, $2 <= i <= 4$, similar to every part for decryption process and rearrange into the matrix R.

Step 5: Then **Decrypt** matrix as:- $P = K1 - 1 * Rmod\ 26$.

Step 6: **Read** message row by row and convert back to the original data. It will produce the final data required by the user.

V. PERFORMANCE EVALUATION

Our proposed work as pursues, client sends the information record to cloud. The cloud chief framework after getting the record plays out: (a) Partition, (b) LOA enhanced centrality based hubs determination and stores one parcel over every one of the chose hub, and (c) hubs choice for pieces replication. The cloud director keeps up record of the part position and is thought to be a safe substance.

When the record is isolated into parts, proposed system chooses the cloud hubs for piece situation. The choice is finished by keeping an equivalent consideration on both security and execution as far as the entrance time. We pick the hubs that are most key to the cloud system to offer better access time. For that reason, our philosophy utilizes the idea of centrality to diminish access time utilizing LOA. The centralities decide how focal a hub depends on various measures as talked about in segment 3 &4. We select hub with three centrality measures, in particular: (a) Degree Centrality Measure, (b) Betweenness Centrality Measure, and (c) Closeness Centrality Measure.

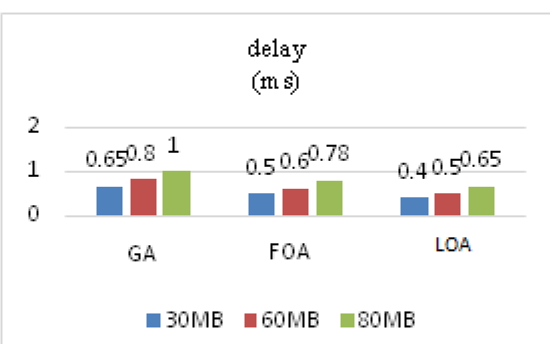


Fig.1.Data access delay comparison (in sec)

In the second chart, the result of LOA based fused encryption and decryption is compared with the existing methods of GA, FOA based on the defending attackers in the cloud network as shown in fig.2

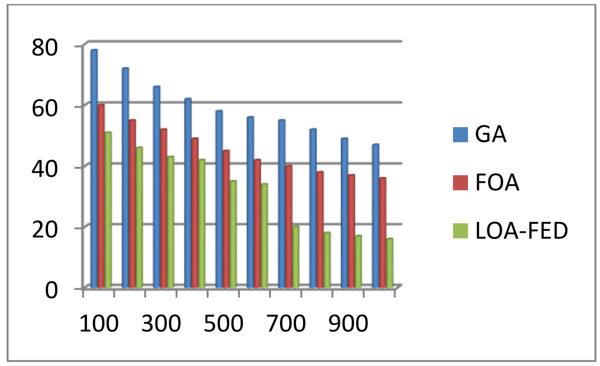


Fig.2. Attacker effort of various MB data corresponding learning rate

We execute evaluation of the system model developed in Section IV. Our LOA method compared with results of well known replication methodology, namely: (i) Greedy algorithm, and (ii) Genetic Replication Algorithm (GRA) and (iii) FOA. The main performance indicator is communication delay of node. In figure 1, Data access delays measured as an average time elapsed from the moment of sending data file request and having the requested data arrived. As expected, access delay becomes smaller for replicas located by LOA optimized centrality node selection compare with other techniques. From the figure 2 shows that the attacker efforts of various MB data corresponding learning rate. Here, our proposed LOA with the FED technique is highly secured and protected the information from the attacker than the previous techniques respectively.

CONCLUSIONS

We proposed the LOA based fused encryption and decryption technique consider both security level and execution as far as recovery time. The customer information was isolated and parceling the information is spread over various hubs. The information segment and dispersal guaranteed that no noteworthy data was available by a foe if there should arise an occurrence of an assault. No hub in the cloud, put away in excess of a solitary information piece of a similar document. The exhibition of the proposed philosophy was contrasted and customary replication procedures. The aftereffects of the reproductions demonstrate that the synchronous spotlight on the security and execution brought about expanded security level and execution improvement.

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