Web Service Reliability and Prediction Using CUCKOO Search Clustering

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Abstract: The web services, a novel paradigm in software technology, have innovative mechanisms for transcription services over diversified environment. It is capable to allow businesses, to adapt quickly changes in the business environment and the desires of different customers. The rapid introduction of new web services in a dynamic business environment can unfavourably affect the service quality and user satisfaction. Subsequently, assessment of the quality of web services is of paramount importance in selecting a web service for an application. In this paper proposed a time-effectiveness, reliability prediction approach of Web Service (WS) which employs a neighbourhood-based approach for identifying similar neighbours (Web services or service users) to predict the web service reliability. Services are categorized based cuckoo search. This collaborative reliability prediction method obtains better reliability prediction accuracy than other approaches. The Cuckoo Algorithm is used which is proved to be well converged and makes quick calculations. The simulation conducted on different types of network typologies proved that it is a practical and influential algorithm.

Keywords: Web-Service, Cuckoo Search Clustering, software technology, influential algorithm.

I. INTRODUCTION

One of the novel ideal models of programming development is web administration, which has inventive instruments of various sorts for different administrations over the web condition. The web administrations empower the business client to modify dynamically to change their business condition similarly as various customers need in a gainful manner. The fast improvement of new web benefits in an enormous business condition has also some antagonistic effects on the web client satisfaction similarly as nature of web administrations. Along these lines, decision of a not too bad web administration is regularly a basic procedure by considering the web administration quality.

This part demonstrates a period incredible dependability desire procedure for picking a capable web administration; anyway usage of a territory based strategy. This zone based procedure is used for recognizing similar neighbors, (kind of clients or web administrations) for finding a reliable web administration. In this work, the foreseen web administrations are assembled by using compelling Cuckoo look calculation. This people group arranged reliable neighborhood web administration estimate procedure has realized a precise and strong Web Services (WS).

II. PRELIMINARIES

This area gives some fundamental data about computerized web administrations synthesis and their procedure.

Web Services Composition

Essentially, the WS are known as conveyed application. There are numerous advantages of this WS procedure, for example, it tends to be powerfully summon and find request, unmistakable from different applications likewise execute in static authoritative.

Automated Web Services Composition

The mechanized arrangement of web administration approach makes the response or solicitation subsequently. The solicitation for this procedure goes to the mediator and procedures the understanding beginning with one external structure then onto the following utilized by the system following this procedure; these administrations are investigated dissemination focuses to achieve the criteria of mentioned client.

Starting at now, the procedure producer shapes these mentioned administrations. If there is something like one composite administration, it finds the criteria of the client. This procedure evaluator by then overviews them and returns the best chosen WS to Execution Motor (EM).The results are

sent to the requester. There solicitation or passes on through the interfaces with the system and gets reasonable response.

Service Registry: Essentially, the administration vaults are used to enlist the WS by the supplier of WS. It likewise uses the solicitation of the favored WS of clients. Every vault utilizes the fitting references connection of WS, which are normally facilitated on administration distribution centers.

Matching Engine (ME): The essential use of ME is to facilitate the web customer request from the database of the WS. If any practically identical match is found, it goes before the required web organization to the web server. In such a case, when it doesn't find any matches, it picks the web organization from web, by then updates or stores them in the database and advances the results back to the referenced author.

Composer: The author makes all the chose administrations to empower creation a solitary wanted web administration.

Web: Web is known as WWW arrange, every WS suppliers register its WSs utilizing UDDI vaults. On the off chance that, the favored WSs isn't found in database or vault, comparative web motor will begin look from suitable UDDI libraries and furthermore store it in database or archive for present and future use.

Evaluator: The designated WS assesses by utilizing an evaluator, which assesses the usefulness relying upon the guidelines and rudiments of interface and returns the precise administration which relies upon the specific WS criteria.

Web Server: Basically, registries are hosted on WS and these WS are hosted on World Wide Web (WWW). Therefore, the services directly exchange the data with different web

servers and databases, that implements process of decentralized data flow.

Service Registration: The administration enlistment process is known as web administration detail of a specific framework. Another administration is enrolled in the suitable vault by utilizing administration enlistment process. Amid this procedure, there are endless libraries utilized from different specialist organizations and these vaults are synchronized after some ordinary interim.

Translator: The interpreter's principle work is to decipher web administration reaction/demand starting with one outer page then onto the next outside structure.

Service Request: Administration demand is that the customers required explicit administrations and send the solicitation over the administration demand module.

III. RELIABLE MESSAGING MODEL

Web administration handling, encounters interruptions in discourses, reordered or duplicated achieving loss of the message. The host structure furthermore loses temperamental state and it experiences the failure. Accordingly, in this procedure, WS-Dependable Informing (RM) administration gives an interoperable show, which infers the RM administration from source to objective with authentic sending of the message. This procedure is particularized as an affirmation of movement. This show underpins the endpoints by giving this insistence of transport. It is the rule duty of the RM Goal and RM source to fulfill in case it raises a bungle or transport confirmations. The show named licenses endpoints to accomplish this assurances for affirmation of transport which is delineated as seeks after Tirelessness suspected is connected with the limits of endpoints to satisfy the affirmation movement, done by using some commitment procedure, without impacting the show procedure. There are four different key transport affirmations which give satisfied endpoints.

In any occasion once every message-At any rate once every message may screw up will be raised or passed on something like one endpoint, yet this procedure has an impediment that this message may pass on more than one time.

At Most Once Messages –At Most Once Messages are conveyed at most one with no mistake or duplication and this procedure will be raised on somewhere around one endpoint. This message has one disadvantage, it might lose some arrangement of messages and it causes message conveying process.

In Order Messages-All together Messages is conveyed by utilizing a portion of the particular requests that they are utilized for conveying messages. This confirmation of conveyance is incorporated with any sort of the previously mentioned conveyance affirmations. This method is required moreover of the arrangement seen by a complete recipient be non-lessening. It articulates about duplications or prohibitions.

Exactly once every message-Precisely once every message is conveyed with no mistake or duplication this message affirmation of conveyance is named as coherent "and" of the two earlier confirmations of conveyance.

The occasions and substances in an unobtrusive solid message trade process. At first, the Application Source advances a solid message conveyance. The RM source gets the approaching message and after this procedure, the RM goal recognizes it. Toward the finish of this procedure, the RM Destination advances the message to the proper Application
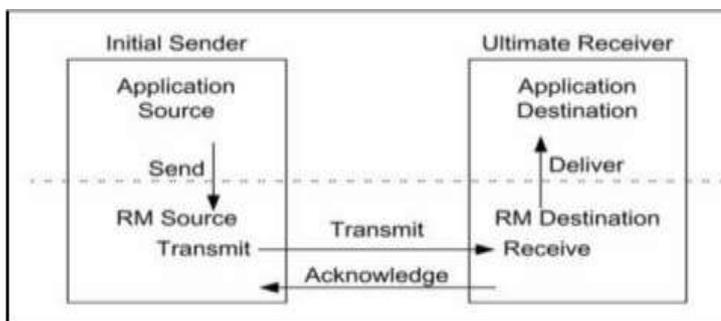
Destination   (AD)

Figure 1 Reliable Messaging Framework

The individual assumes an indispensable job and the general procedure is finished with every single occasion is clear all through this depiction.

IV. WEB SERVICES COMPOSITION METHODOLOGY

Step 1: Initially, web services are registered with appropriate registries.

Step 2: After the registration process, the service requester makes a requests for service.

Step 3: Then the translator converts the request query into a form to be utilized by internal system process.

Step 4: After this procedure, the solicitation goes to an arrangement module. Here, the Matching Engine (ME) approves the mentioned administration from a proper WSDBs. Amid this procedure, it discovers the ideal interface base administration arrangement, after which, it sends the results to the Evaluator.

Step 5: The evaluator at last assesses these chosen web benefits by utilizing two distinct advances. In the underlying advance, it forms the assessment procedure on essentials of usefulness based standards. The assessment then advances the chose administrations to the author. The writer creates the web administration parts, and uses the different WSDBs, so that, when one goes down another WSDB is utilized. Here, the timestamp is kept up legitimately with every single URL in WSDB. As of now, the solicitation touches base before the time terminated, it searches for the administration in WSDB.

Step 6: In the event that the Matching Engine (ME) doesn't get any solicitation for synthesis administration from WS database, it begins the looking procedure from web.

Step 7: WS seeks from various libraries and their outcomes are returned back to the evaluator and furthermore the ME additionally stores their references in WSDB for future procedure with the assistance of maturing factor. The primary motivation behind maturing factor is that, it rations the refreshed data of web administrations and the web administration substances are invigorated every single time when maturing factors time terminates.

Step 8: Maturing the evaluator assesses these web administrations changes and the updation relies upon their usefulness dependent on guidelines and interface based.

Step 9: At that point the Composer makes the got result out of the administrations and forward the outcomes to EM. The EM forms these WS and afterward interpreter results are sent back to the requester.

V. CUCKOO SEARCH

Cuckoos are known as charming feathered animals whose intrigue is the extent that owing to the engaging sounds made

by cuckoos; this winged creature is moreover pulled in because of their age system, which shows to be adversarial in nature. The winged animals are communicated to as brood parasites as they lay their incredible eggs in shared homes. The flying animals empty the eggs in the host winged animal home so as to build up their own eggs bring forth likelihood.

There are three various types of brood parasites are utilized and they are as per the following

•   Nest assume control over sort

•   Cooperation breed

•   Intra explicit brood parasite

Ordinarily, the host feathered creature makes a straight battle with the affecting fowl. If the host winged animal that arranges of pariah eggs, either deserts the home or disposes of the egg. Certain feathered animals are uncommon in the case of eggs and duplicating hues qualities which confines the chance of the egg being overlooked, planning to improving their productivity.
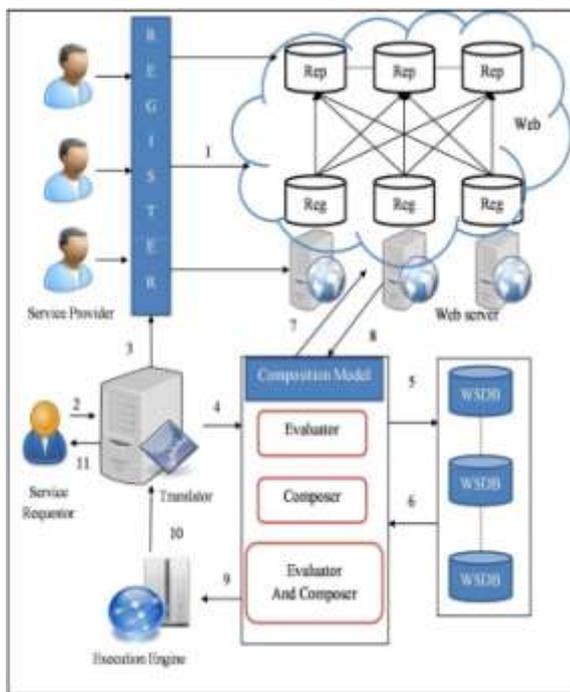

Figure 2 Basic Web Services Composition

The handling ventures of web administration arrangement process characterized in figure 2 has been talked about in segment 3.4

The egg laying feeling of cuckoo is a hypnotizing procedure. The parasitic cuckoo flying animal finds the host flying animal home, by then lays its own eggs in the host home. Generally, the bird's, which lay their eggs in the host earlier and the host

fowls, make their very own space for their eggs. This procedure moreover ensures the remarkable bit of host flying animal's that feeds to get by their chicks.

The Cuckoo Search is known as meta-heuristic calculation. It is in like manner one of the forefront nature breathed life into calculation. In the Greek articulations, "meta" and "heuristic" are implied as "change" and "disclosure" to the extent "experimentation". The Cuckoo seek calculation depends upon the lead of the submit brood parasitic cuckoo species as a team with some natural item flies and feathered animals Toll flight direct. Cuckoo winged animal species lay their eggs in like way homes. If, the host youngster finds the eggs, laid by their own one of a kind egg it either surrenders the home or hurls these pariah eggs and makes another home. The procedure of cuckoo seek is showed up in Figure 3.
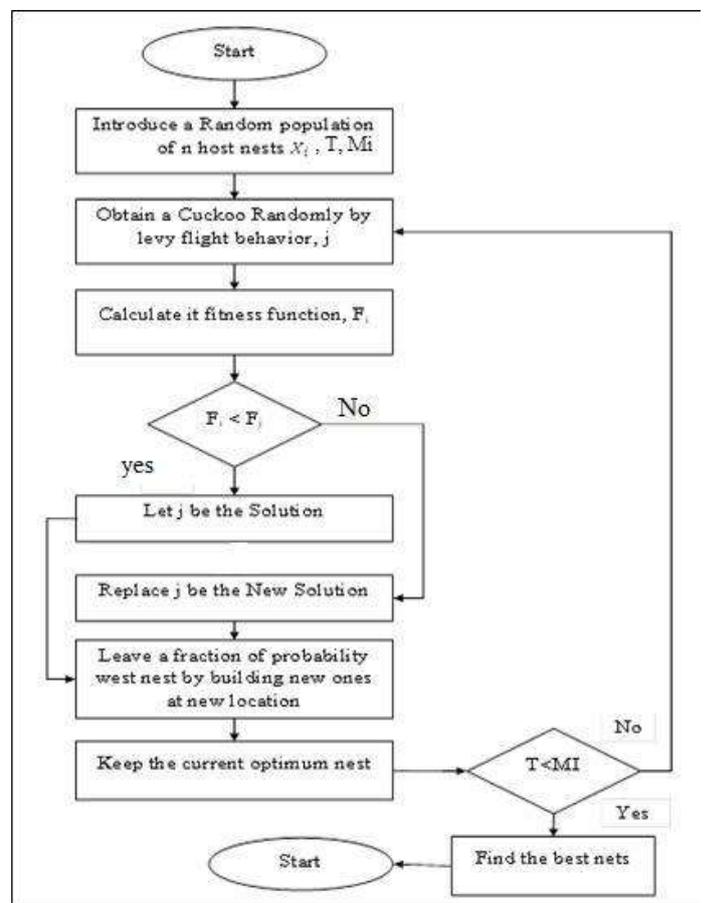

Figure 3- Flow Chart for Cuckoo Searching Algorithm

Cuckoo Search is characterized by using consequent three whimsical principles:

- The cuckoo lays one egg at any given moment, and haphazardly openings its egg in chosen home.

- The high caliber with best homes eggs is left over to the succeeding ages.

- The number of existing host homes is static, and the egg laid by a cuckoo is found by utilizing the hosts births a likelihood, which is characterized as [0, 1].

VI.   STANDARDS OF CUCKOO SEARCH ALGORITHM

Essentially, cuckoo look calculation takes note of that, each egg in a home connotes an extraordinary arrangement. Additionally a cuckoo egg means a fitting new arrangement, where the primary target is to swap the more fragile wellness arrangement by a recently created ideal arrangement. The Cuckoo Search Algorithm incorporates the accompanying advances:

Cuckoo Search Algorithm

Step 1 - Present a random population of n host nests, X_i.

Step 2 - Find a cuckoo randomly by Levy flight behavior, i.

Step 3 - Compute its fitness function, F_i.

Step 4 - Randomly select a nest among the host nests say j and calculate its fitness, F_j

Step 5 - If $F_i < F_j$, then replace j by new solution else let j be the solution.

Step 6 - Leave a fraction of probability Pa of the worst nest by construction new ones at new locations utilizing Levy flights.

Step 7 - Retain the present optimum nest, Go to step 8

Step 8 - if T (Current Iteration) < MI (Maximum Iteration).

Step 9 - Discover the optimum solution

Initialization: Initially if presents a random population of host nest =**1, 2, 3. . .).**

Levy Flight Behavior: Find a cuckoo by using cuckoo behavior of Levy flight is defined as

$$X_i(t + 1) = Xi(t) + \alpha \oplus Levy(\lambda), \alpha > 0$$

(3.1)

$$Levy(\lambda) = t(-\lambda), 1 < \lambda < 3$$

(3.2)

Fitness Calculation: Figure the wellness using the with the goal of locate an ideal arrangement. Pick an arbitrary home, it is characterized as. At that occasions the cuckoo eggs) is compared with the wellness of the existent in the fitting home. In the event that the estimation of the cuckoo egg is the estimations of the chosen arbitrarily home at that point chose) is swapped by the new arrangement.

$$Fitness\ Function =$$
$$Current\ optimal\ Solution - Previous\ optimal\ Solution$$

(3.3)

The estimation of the moving toward the regard zero which benefits that the variety from the standard game plan diminishes in perspective on improving the amount of cycles. Finally, the assumption is that, if the cuckoo egg is a like to a normal egg it is solid for the host winged creature to perceive the eggs. Wellbeing regard is changed in plans and the new game plan is swapped by the haphazardly picked home. Right when the >the, the host winged creature perceives the pariah egg, because of which; it may disregard the home or hurl the egg.

Termination:

In the present case, cycle plan is compared with the best course of action and is facilitated just to resulting game plan, where the procedure is done by using. If the amount of accentuation is underneath the most outrageous cycle, the best home is held. A brief span later the procedure of the instatement step, request flight is resolved for the health limit and all of the winged animals are facilitated to next cycle. The cuckoo look calculation ends after it has gone to the.

VII.   CUCKOO SEARCH CLUSTERING ALGORITHM

Cuckoo Search Clustering Algorithm based designed as a clustering algorithm from Cuckoo Search Optimization algorithm to locate the optimal centroids of the cluster.

Fig. 4. Cuckoo Search Clustering algorithm

$$\cos(m_p, m_j) = m_p^t m_j / |m_p| |m_j|$$

Where: $m_p^t m_j$ = the dot product of the two vector

$$f = \frac{\sum_{i=1}^{N_c}\{\frac{\sum_{j=1}^{p_i} d(o_i, m_{i,j})}{p_i}\}}{N_c}$$

$m_{i,j}$ = j^{th} document vector which belong to cluster i;

o_i= the centroid vector of ith cluster

$d(o_i, m_{i,j})$= distance between document $m_{i,j}$ and the cluster centroid o_i

p_i = the number of documents which belongs to cluster C_i

N_c= number of clusters

In web document clustering area, it is possible to view the clustering problem as an optimization problem that locates the optimal centroids of the clusters rather than an optimal partition finding problem. This algorithm aims to group a set of input samples (data points) into clusters with similar features. It will work without the knowledge of the class of the input data during the process.

The Cuckoo Search Clustering Algorithm as Fig. 4.

VIII.   EXPERIENTIAL SET UP

The Cuckoo Search Clustering Algorithm is tested on 7 sector benchmark data set. It is a dataset of collection of web pages of 7 classes. For our testing process, 300 web pages are randomly selected from the dataset and clustered into 3 classes. The algorithm is tested by using Cosine Similarity as distance similarity measure of the two documents. The algorithm executes for 100 iterations and uses 10 cuckoos. The parameter pa is tested for 0.2, 0.25, 0.3 and 0.35. With pa=0.3, the algorithm executes the best fitness value around 50 iterations. So, 0.3 is selected as the pa value of our algorithm. The tested pa values and its cluster quality is as shown in Table.1.

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IX.   RESULT AND DISCUSSION

The fitness equation is also used for the evaluation of the cluster quality. The smaller the cluster quality value, the more compact the clustering solution. The different cluster quality values for the different pa values are as shown in Table 1. The cluster quality values over the number of iterations are as shown in Fig 3.

A famous method for evaluating measure in information retrieval (IR) is F-measure. The cluster results of the system are also evaluated using F-measure. It considers the precision (P), recall (R) and is shown in Eq (9). Eq (10) shows F-measure formula.

$$P = \frac{TP}{TP+FP} \qquad R = \frac{TP}{TP+FN}$$

$$F = \frac{2.P.R}{(P+R)}$$

Eq (9). Eq (10)

Table 1. pa values and cluster quality

pa	0.2	0.25	0.3	0.35
Cluster Quality	0.014 ± 0.017	0.012 ± 0.029	0.010 ± 0.014	0.012 ± 0.016

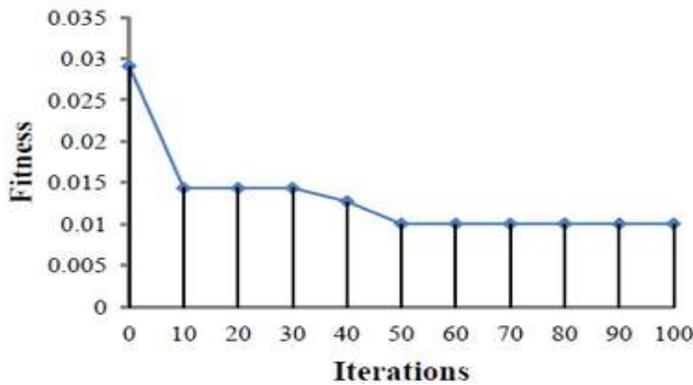**Fig. 5. Performance of Cuckoo Search Clustering Algorithm**

Table 2. Precision, Recall and F –measure

Precision	Recall	F-measure
0.711	0.673	0.691

Table.2 illustrates the F-measure of the proposed method. High F-measure shows the high accuracy. The proposed method achieves 0.691 of F-measure in clustering 300 web documents into 3 clusters.

X.   NEW CUCKOO SOLUTION

The cuckoo laid eggs which correspond to a new solution set. The cuckoo will move from the current position to the new position determined as follows:

$$x_i^{(t+1)} = x_i^{(t)} + \alpha * levy(\lambda)$$

$$x_i^{(t+1)} = x_i^{(t)} + \alpha * S(x_i^{(t)} - x_{best}^{(t)}).r$$

Where

$x_i^{(t)}$ = current solution
$x_i^{(t+1)}$ = next solution
$x_{best}^{(t)}$ = current best solution
S= random walk based on levy flight
α = step size parameter
r = random number

In Mantegna's algorithm, the step Length can be calculated

$$S = \mu / |v|^{1/\beta}$$

Where β is a parameter between [1,2] and considered to be 1.5. μ and v are drawn from normal distribution as

$$\mu \sim N\left(0, \delta_\mu^2\right), \quad v \sim N\left(0, \delta_v^2\right)$$

$$\delta_\mu = \left\{ \frac{\tau(1+\beta)\sin(\pi\beta/2)}{\tau[(1+\beta)/2]\,\beta\,2^{(\beta-1)/2}} \right\}^{1/\beta}, \quad \delta_v = 1$$

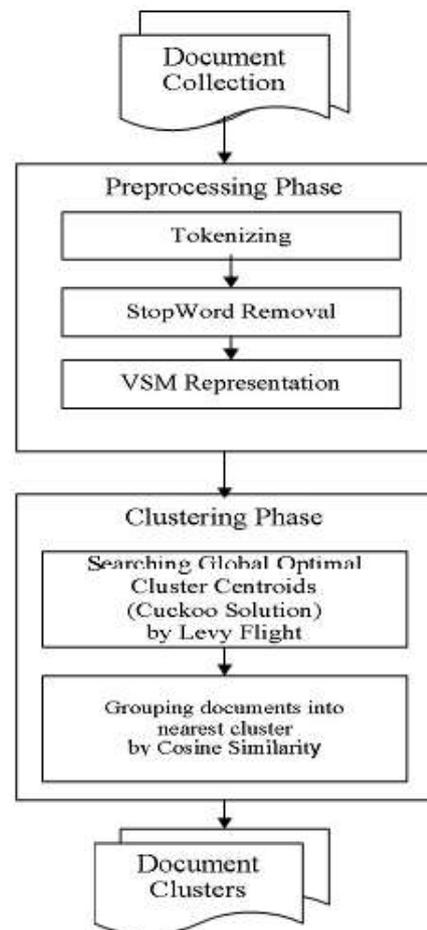The block diagram of the proposed method is as shown in Fig. 6.

Fig. 6. Block Diagram of the proposed method in web document clustering

In Fig.6, the documents to be clustered must be collected first. The proposed method includes two phases: preprocessing

phase and clustering phase. In preprocessing phase, each document will be tokenized and the stop words such as a, an, the etc., will be removed. The remaining words will be represented in Vector Space Model with their TFIDF weight values. In clustering phase, the distance from the center documents to the other documents will be measured by Cosine Similarity measure. The documents to the nearest center will go to this cluster. For next center document selection, the old center will be moved to the new center by Cuckoo Solutions. This clustering process will be performed for a defined number of criteria. The algorithm will finally produce the user-defined number of document clusters.

XI. CONCLUSION

Cuckoo Search Clustering Algorithm is proposed and applied in web document clustering area. The result shows that the cluster quality and the evaluation measure obtained are good. As our future work, the clustering accuracy can be improved by semantic web document clustering with the help of word net, ontology or Wikipedia. Our proposed method has been applied in web document clustering area. This Cuckoo Search Clustering Algorithm can also be applied to other datasets. And it can also be compared to other swarm intelligence clustering algorithms.

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