

# SURVEY OF CUCKOO SEARCH TECHNIQUE FOR SOCIAL MEDIA CONTENT APPLYING SENTIMENT ANALYSIS

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## Abstract

Sentiment analysis research has been increasing tremendously in recent times due to the wide range of business and social applications. Sentiment analysis from unstructured natural language text has recently received considerable attention from the research community. The Cuckoo Search is an optimization algorithm proposed by Yang and Deb in 2009. It applied in solving problems of optimization. It influenced by a bird cuckoo that lays their eggs in the nest of other host birds. The cuckoo egg laying and breeding is the first basic motivation for the development of new optimization algorithm. This optimization algorithm increases the efficiency, accuracy, and convergence rate. In this paper, a brief review is given about the cuckoo search algorithm and also about the optimization and its problems. Different categories of the cuckoo search and several applications of the cuckoo search are reviewed. In this paper, we also propose sentiment analysis model based on common-sense knowledge. The polarities of extracted concepts are determined using the contextual polarity lexicon which we developed by considering the context information of a word. Finally, semantic orientations of domain specific features of the review document are aggregated based on the importance of a feature with respect to the domain. The importance of the feature is determined by the depth of the feature in the ontology. Experimental results show the effectiveness of the proposed methods

**Keywords:** Sentiment analysis Cuckoo Search, Social Media, Data preprocessing, Clustering

## Introduction

It is increasingly necessary to design reliable systems as there is a great demand for products that offer quality and safety. The optimal reliability design is to determine a system structure which has the highest reliability for the minimum cost of manufacturing. Generally two major ways have been used to achieve higher system reliability. The first way is by increasing

the reliability of system components, and the second way is by using redundant components in various subsystems. In the first way, the system reliability can be improved to some degree, but the required reliability enhancement may be never attainable even though the most currently reliable components are used. Using the second way is to choose the optimal component combination and redundancy levels; the system reliability can be enhanced, but the cost, weight, volume, etc. will be increased as well. Besides the above two ways, the conjunction of the two approaches and reassignment of interchangeable components are alternative feasible ways to enhance the system reliability. Such problems of maximizing system reliability through redundancy and component reliability choices are called the “reliability-redundancy allocation problem” (RRAP). Various complex systems come out with the development of industrial engineering, and the reliability designing of these systems are very important. The increasing need for highly reliable systems further demands the study of reliability optimization. Thus, more accurate and efficient methods are needed in finding the optimal system reliability, otherwise, the safety and efficiency of a system cannot be guaranteed [40]

## Sentiment Analysis

The field of sentiment classification is an exciting new research direction due to the large number of real world applications where discovering people's opinion is important for better decision-making. Sentiment Analysis is the study that analyzes people's opinion and sentiment towards entities such as products, services in the text [41]. It has always been important to know what other people think. With the rapid growth of user-generated data on the Web, people are using online review sites, blogs, forums, social networking sites, and so forth for expressing their opinion. Therefore, a necessity of analyzing and understanding these online generated data/reviews has arisen. The user can know the merits and demerits of the product from the experiences shared by people

on the web, which can be useful for them in decision-making. E-commerce companies can improve their product or services on the basis of people's opinion and current trends. The automatic analysis of online contents to extract opinion requires deep understanding of natural text by the machine; capabilities of most of the existing models are known to be unsatisfactory [42]

## Cuckoo search algorithm

Cuckoo search (CS) algorithm is one of the nature-inspired population based stochastic global search meta-heuristic algorithm, developed by Yang and Deb in 2009. It is based on the obligate brood-parasitic behavior of some cuckoo species in combination with the Lévy flight behavior of some birds and fruit flies. These species lay their eggs in the nests of other host birds (almost other species) with amazing abilities such as selecting the recently spawned nests, and removing existing eggs that increase hatching probability of their eggs. On the other hand, some of the host birds are able to combat this parasitic behavior of cuckoos, and throw out the discovered alien eggs or build their new nests in new location. This cuckoo breeding analogy is used for developing new optimization algorithm. Nature systems are complex and thus, they cannot be modeled exactly by computer algorithm in its basic form. Simplification of natural system is necessary for successful implementation in computer algorithm. Yang and Deb simplified cuckoo reproduction process by three idealized rules:

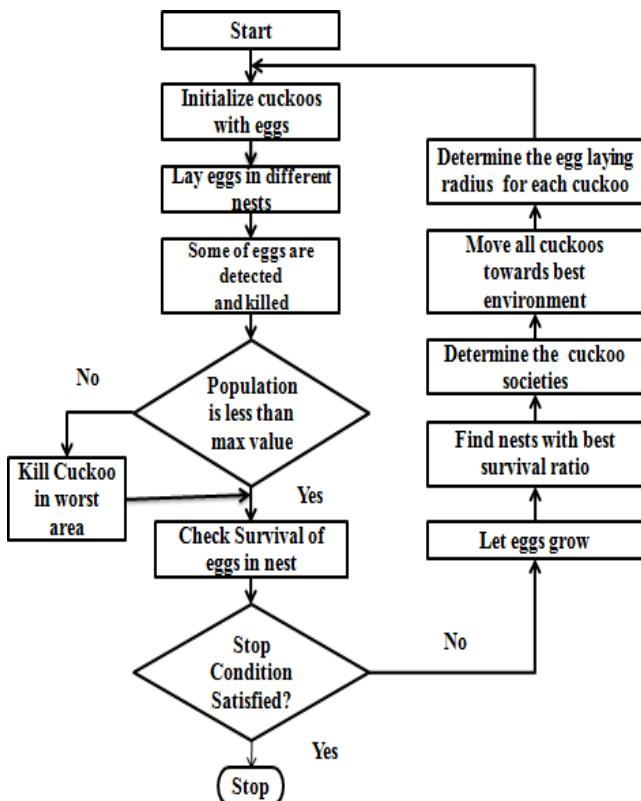
1. *Each cuckoo lays one egg at a time, and dumps it in a randomly chosen nest.*
  2. *The nests with high quality of eggs will carry over to the next generation.*
  3. *The number of available host nests is fixed, and a host can discover an alien egg with a probability  $p_a \in [0, 1]$ . In this case, the host bird can either throw the egg away or abandon the nest so as to build a completely new nest in a new location. The above three rules can be transformed into the following cuckoo search methodology:*
1. *An egg represents a solution and is stored in a nest. Artificial cuckoo can lay only one egg at the time.*
  2. *The cuckoo bird searches the most suitable nest to lay eggs (solution) in order to maximize their eggs survival rate. Elitist*

*selection process is applied, so only the high quality eggs (best solutions near to optimal value) which are more similar to the host bird's eggs have the opportunity to develop (next generation) and become a mature cuckoo.*

*3. The number of host nests (population) is fixed. The host bird discover the alien egg (worse solutions away from optimal value) with a probability  $p_a \in [0, 1]$  and these eggs are thrown away or the nest is abandoned, and completely new nest is built, in a new location. Otherwise, the egg grows up and is alive for the next generation. New eggs (solutions) lay by a cuckoo chooses the nest by Lévy flights around the current best solutions.*

For the implementation point of view, [40] used each egg in a nest represents a solution, and each cuckoo can lay only one egg (thus representing one solution), the aim is to use the new and potentially better solutions (cuckoos) to replace a non-so-good solution in the nests. In this case, there is no distinction between eggs, nest or cuckoo, as each nest corresponds to one egg which also represents one cuckoo. The new nest is generated according to the law Lévy flight. Lévy flight represents one of the ways of motion used by birds for searching for food in the environment.

In nature, animals search for food in a random or quasi random manner. In general, the foraging path of an animal is effectively a random walk because the next move is based on the current location/ state and the transition probability to the next location. Which direction it chooses depends implicitly on a probability which can be modeled mathematically. For example, various studies have shown that the flight behavior of many animals and insects has demonstrated the typical characteristics of Lévy flights study shows that fruit flies or *Drosophila melanogaster* explore their landscape using a series of straight flight paths punctuated by a sudden 90° turn, leading to a Lévy flight-style intermittent scale-free search pattern. Even light can be related to Lévy-flights. Subsequently, such behavior has been applied to optimization and optimal search, and preliminary results show its promising capability. As Lévy flights have infinite mean and variance, CS can explore the search space more efficiently than algorithms by standard Gaussian process. This advantage, combine with both local and search capabilities and guaranteed global convergence, makes cuckoo search very efficient [40]



## Cuckoo Search Algorithm Types

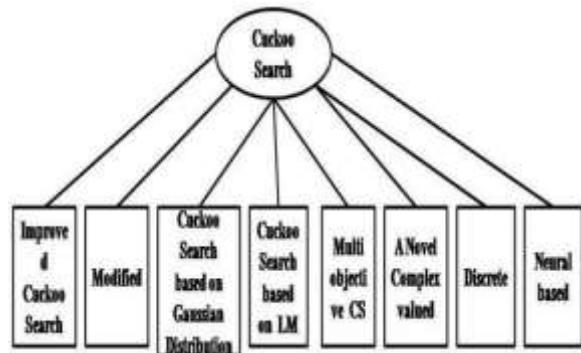
The cuckoo search algorithm is also used to test functions of optimization benchmarks. The standard benchmark functions are developed to compare this cuckoo algorithm with the other algorithms [8]

Some types of cuckoo search algorithms are

**An efficient cuckoo search algorithm for numerical function optimization [9]:** Cuckoo search algorithm is metaheuristic algorithm, it is the best-known brood parasitic bird, the cuckoos have explained in obtaining the global solution for numerical optimization problems. Therefore, the involvement of fixed step comes in exploration and exploitation behavior might get slow down the search process considerably.

**Multimodal Optimization [10]:** In this, Numerical results are to show that the cuckoo search algorithm can successfully locate multiple solutions in both non-noise and additive white Gaussian noise is the relatively high degree of accuracy.

**Cuckoo Search via Levy flights [1]:** It is a new meta-heuristic algorithm for solving optimization algorithm, based on the obligate brood parasitic behavior of bird cuckoo species with



the combination of Levy flight behavior of some birds and fruit flies. This algorithm is used to test functions and then it compares with the other algorithms like genetic algorithm and particle swarm optimization. Many types of cuckoo search algorithm developed by the many researchers. In that the major types of cuckoo search are

I Cuckoo search can find the better solutions and efficiently for the many continuous optimization problems. In some cases, the solutions cannot be found for some optimization problems.

So Hybridization is applied to optimization algorithms to find the solutions for a set of problems. The cuckoo search is hybridized with other optimization algorithms like heuristic, learning techniques, one rank CS are show in table 1

Name	Author	Application	Reference
Hybrid CS	Li and Yin	For shop scheduling problems.	[11]
Improved CS for Global optimization	E.Valian et.al	To enhance the accuracy and convergence rate.	[12]
Modified-CS	Tuba,Walton et al.	For Unconstrained Optimization problems	[13][14]
Based on Levenberg-Marquardt (LM)	Nawi et al.	Helps in reducing errors and avoids local minima in an algorithm.	[15]
Multi objective CS	Yang and Deb	In Job Scheduling Problems	[16]
A Novel Complex value	Zhou and Zheng	Reducing the local convergence and	[17]

		Enhance the information of nests.	
Discrete	Jati and Manurung	For solving traveling salesman problem.	[18]
Neural based	Khan and Sahai	Employee health and safety (HS) risk on employees at their workplaces,	[19]

## Applications Of Cuckoo Search Algorithm

I Nguyen Thang Trung, Ngoc Dieu[21] proposed a paper on power generations to minimize the cost of flues. The problem is considered non-convex and piecewise quadratic fuel cost function of thermal units in the objective of the problem with complicated constraints such as prohibited operating zones (POZ) and power loss. CSA is used mainly for searches optimal solution based on random walks. One Rank Cuckoo Search algorithm is used i.e. Two modifications are done to the basic CSA method to enhance its search ability for an optimal solution within minimum time. The First modification is exploitation and exploration phase corresponding to the new solution via levy flight of new eggs is the replacement of egg. The second modification is the technique for handling the inequality constraints. i.e. The ORCSA was proposed by the Ahmed et.al 2013. In this, the input is in power with probability to generate in different values. This method obtains better cost with time when compared to other methods. It is a more efficient method for solving ELD The cost and vulnerabilities optimization in cloud using CS algorithm with Levy flights:Cloud computing is using in various aspects. Mohamed, Zinedine proposed that when minimizing the cost and vulnerabilities resulting some risk and threats. So the set of techniques is used to minimize the number of vulnerabilities and security threats to the information system in the cloud. To minimize the risk of proxy attacks, maximizing the distance between the vulnerable node and a potential victim node is done.  $h_j$  is host distance,  $n_j$  is network distance (distance between the node and the victim node which is outside the subnet).

$$\varepsilon = \text{Max} \sum_{j=1}^n (h_j + n_j)$$

Cloud computing security frameworks are-Gathering information, Network mapping, vulnerabilities exploration, audits and penetration tests, vulnerabilities enumeration and categorization, technology selection for vulnerability remediation, security solutions implementation [22]. It is a non-deterministic polynomial time hard (NP-Hard). It can be solved with a heuristic approach. Cuckoo Search algorithm with Levy flights is the best algorithm to solve the problems because CS is reliable and gives better solutions when compared to the other algorithms. The security technology is used to decrease the vulnerability and costs are called Set covering problem (SCP). This problem is combinatorial optimization problem. A Novel Cuckoo Search Optimization Algorithm based on Gauss Distribution: "A meta-heuristic is a concept which is used to define heuristic methods that are applied to a wide set of different problems [23]. Levy flights are random steps.

$$X_i(t+1) = X_i(t) + \alpha \oplus \text{Levy}(\lambda)$$

In this the consecutive steps of the cuckoo from a random walk process to obey a power law step length distribution. For each random variable, a probability density function is used to express its probability distribution [24]. Example, the number of phone calls per minute, and the number of users of a web server per day all obey the Poisson distribution

$$p(n, \lambda) = \frac{\lambda^n e^{-\lambda}}{n!}, (n = 0, 1, 2, \dots)$$

$\lambda > 0$  it is the mean or expectation of the occurrence of the event during a unit interval. Gaussian distribution the most popular distributions, because many physical variables including light intensity, and errors/uncertainty in measurements, and many other processes obey the normal distribution.

$$X_i(t+1) = X_i(t) + \alpha \oplus \sigma_s$$

$$\sigma_s = \sigma_0 \exp(-\mu k)$$

$\sigma_0$  and  $\mu$  are constants,  $k$  is current generation,  $\alpha > 0$ . Replace the equation 3 with equation 5. It is used to solve the standard test functions and engineering design optimization problems. Adaptive Cuckoo Search for Optimal Network Reconfiguration and Distributed generation: To optimize the network topology and placement of distribution generation (DG) in Distribution networks to reduce the power loss and energy loss voltage stability enhancement. Duong Quoc Hunga, N. Mithulananthana, R.C. Bansal proposed [25] that is the Distribution systems will have more power loss and poor voltage regulation and voltage stability; This is the main problem in distribution systems. Some researchers have

proposed both Distribution network reconfiguration (DNR) and DG to improve the distribution network[26]. Adaptive cuckoo search is used for the DN Rconsiderations of DG. It is normally from small scale to the large scale distribution networks. Teaching-learningbased CS algorithm in Structure designing and machining processes: Huang and Gao proposed Optimization in Structural designing and machining process [27]. In the designing process, the quality of the product is very important. To get the highly quality of the product the optimization process is used. In this, „Teaching-learningbased optimization (TLBO) is used. It is a hybrid algorithm. The TLBO is proposed by (Rao et al. 2011a; Rao et al. 2012), for continuous optimization problems. The main use of this algorithm is to improve the local search ability. The TLBO is used to searches for an optimum by each learner trying to achieve the experience of the teacher, which is treated as the most learned person in the society. The Teaching-Learning process is like the teacher and learner process in the classroom. It consists teaching phase and learning phase. The “Teacher phase” means learning from the teacher and the “Learner phase” in this, the learners learns through the interaction among them [28] The important parameters are a number of design variables ( $D_n$ ), discovering probability( $p_a$ ), and size( $P_n$ ). The solutions should be updated for better results. The worse solutions are replaced by the new updated solutions. This algorithm is used in the design of vehicles (eg: size of car), milling process etc.

#### **Cuckoo Search for Secured Vehicular Adhoc Network (VANET)**

The number of protocols is used to achieve the secure information broadcasting in VANET. VANET is an intelligent transport system (ITS). It provides communication between the vehicles to vehicle or vehicle to infrastructure. Dr. B. Ramakrishna et.al[29] proposed an Adaptive Routing Protocol based on Cuckoo Search (ARPCS) i.e. the combination of topology based routing protocol and geographic based routing protocol. If the network density is high then the topology routing based approach is applied, if the network dense is low then the geographically based routing approach is applied. It can overcome the drawbacks of topology based routing protocol and geographic routing protocol. ARPCS provides reliable and reduces the congestion in the network and improves the delivery of the packet. The drawback of geographic routing protocols is created loops in maintaining routes and discovering routes due to vehicle mobility. Therefore it loses its memory of past traffic history, so it cannot discover the new routes. The drawback of topology based routing protocols is route instability because of high

vehicle mobility it brakes route antenna array like relative current and phase of elements and interspacing elements. The main aim is to suppress the side lobes and the null control in certain directions in the radiation pattern (Radiation pattern of the antenna is the distribution of power outflow of power from the antenna and in the flow of power to the antenna). In the wireless application the antenna pattern is designed as a strong beam towards the arrive signal and to rescind the interfering signals, these antennas are called as smart antennas. There are many techniques applied to suppress the sidelobe but null control is to lessen the effect of undesired interference in the signal. When the  $2N$  isotropic radiators are placed along the x-axis then array factor in the azimuth plane is,

$$AF(\emptyset) = 2 \sum_{n=1}^N I_n \cos[kx_n \cos(\emptyset + \varphi_n)]$$

Where  $k=2\pi/\lambda$  is wave number,  $I_n$ ,  $\varphi_n$ , and  $x_n$ , are excitation amplitude, phase, location of  $n$  th element respectively.

#### **Cuckoo search algorithm for feature selection:**

A Feature or variable or attribute refers to elements of data. Feature selection is data pre-processing technique used in the classification of IDS[25]. It is used to remove the unnecessary, redundant attributes from the given datasets. It improves accuracy and decreases training time. The main aim is maximizing the classification performance and minimizes the number of features. The feature selection can be done with BCS (Binary Cuckoo Search Algorithm), the problem is which features to select, or which features are not to select in a given problem, to solve this the binary vector is used i.e. where 1 is either to select the feature for a given data and 0 is nor to select. To employ this binary, vector the equation (10) provides binary values. Now the feature selection is using in IDS (Intrusion Detection System) by using cuckoo search algorithm. The intrusion detection is a type of security management system for computer or networks. ID collects the information from various areas in the computer to accredit security contravention which attack may be from outside of the organization and misuse attack i.e. from the inside of the organization. ID uses vulnerability assessment i.e. detecting the confidential resource and attacks the computer or network. For example, the car can be protected from theft by lock system if the thief tries to break the lock and steal the car it is burglar alarm that detects the car lock is broken and alerts the owner by an alarm. So here the firewall protects the organization from malicious attacks from the internet and IDS detects that someone is trying to break through the firewall then it alerts the system organization if there is vulnerability in security. They are different attacks like DoS attack (Denial of Service Attack), Scanning attack, and also protocol attacks or network

attacks. In this the feature selection is based on Cuckoo search algorithm, the KDD-NSL dataset is employed for implementing this approach. CONCLUSION CS is the best search algorithm that it inspired by the breeding behavior of cuckoos. It gives the brief description of the applications of the nature-inspired algorithm. CS algorithm is in various domains including Industry, Image processing, wireless sensor networks, flood forecasting, document clustering, speaker recognition, shortest path in distributed system, in the health sector, job scheduling. The Cuckoo algorithm performs various nature-inspired algorithms in terms of improved performance and less computational time.

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