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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	**A STUDY ON THE MODERATING EFFECT OF BRAND PARITY ON THE ANTECEDENTS OF BRAND LOYALTY** *DEEPAK BABU & Dr. A. P. GEORGE*	1
2.	**CORPORATE SOCIAL RESPONSIBILITY - INITIATIVES ADOPTED BY INDIAN ENTERPRISES** *P. BHEEMAIAH & G. RAVI KUMAR*	8
3.	**SOCIAL ACCOUNTING REPORTING AND PROFITABILITY OF COMPANIES IN NIGERIA: EVIDENCE FROM THE BUILDING AND CONSTRUCTION SECTOR** *DAFERIGHE, EMMANUEL EMEAKPONUZO, OFFIONG, PATIENCE ETIM & EMAH, JOSEPH ALFRED*	12
4.	**ASSESSING THE LEVEL OF ASSERTIVENESS AMONG COLLEGE STUDENTS** *RUKMINI. S & Dr. C. RAMASWAMY*	20
5.	**SURVEY ON DIFFERENT TECHNIQUE FOR DETECTION AND RECOVERY OF MISBEHAVING NODE IN MANET** *M.SUMATHI & Dr. M. GUNASEKARAN*	23
6.	**OPPORTUNITIES AND CHALLENGES FOR THE HANDLOOM INDUSTRY: WITH SPECIAL REFERENCE TO WEAVERS OF MADHYA PRADESH** *NAMRATA KISHNANI*	28
7.	**A COMPARATIVE STUDY OF AODV AND AOMDV WITH RATE ADAPTATION IN MANET** *G.SATHIYA & A.SRIDHAR*	34
8.	**COMPARATIVE STUDY ON K-MEANS, ANT, BEE, FIREFLY AND CUCKOO OF NATURE INSPIRED ALGORITHMS** *G. MADHAMMAL & Dr. M. GUNASEKARAN*	39
9.	**A COMPARATIVE STUDY OF AODV AND CROSS LAYERED AODV FOR MULTIPATH ROUTING IN MANET** *R.KAMALAM & A. SRIDHAR*	43
10.	**AN EMPIRICAL STUDY ON THE DETRIMENTAL EFFECTS OF EMPLOYEE SURVEILLANCE IN INDIA** *JIJO JAMES INDIPARAMBIL*	48
	REQUEST FOR FEEDBACK & DISCLAIMER	52

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COMPARATIVE STUDY ON K-MEANS, ANT, BEE, FIREFLY AND CUCKOO OF NATURE INSPIRED ALGORITHMS

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ABSTRACT

Nature does things in an amazing way. Behind the visible phenomena, there are innumerable invisible causes hidden at times. Philosophers and scientists have been observing these phenomena in nature for centuries and trying to understand, explain, adapt and replicate the artificial systems. This paper presents an overview of significant advances made in the emerging field of nature-inspired computing (NIC) with a focus on the physics- and biology-based approaches and algorithms. In this research provides an empirical view of different technology in the nature-inspired algorithm. There are fifteen reviews are collected, studied and analyzed.

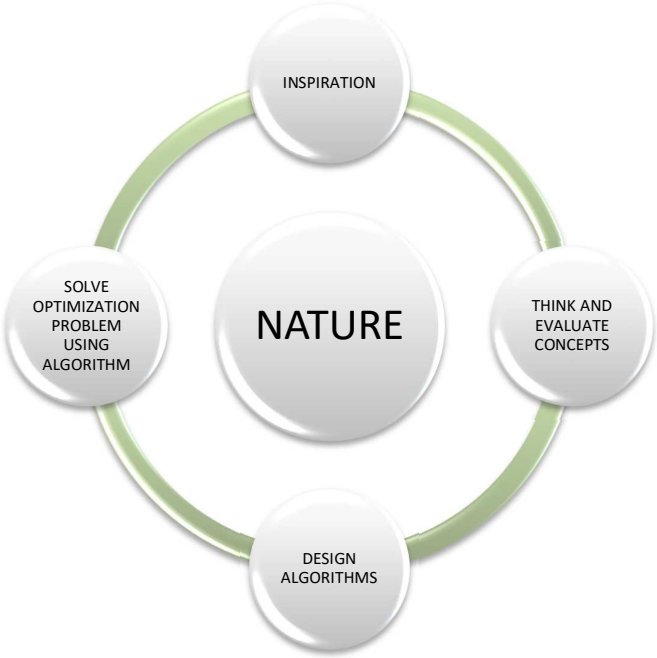
KEYWORDS

K-means, ant algorithm, bee algorithm, firefly algorithm**,** cuckoo search algorithm nature inspired algorithm.

1. INTRODUCTION

Nature inspired computing is the computing which has its foundation in the biological components of nature i.e., humans and animals. Nature has four powerful features which are basic building blocks are the self-optimization, self-healing, self-learning, and self-processing. Nature as the self-optimizer is that it can automatically manage its resources in an efficient manner to meet enterprise need. Nature as a self-healer is as the components of nature on seeing any problem finds a solution and come out of it. Self-learning and self-processing are two related terms. They go hand in hand and moved together. Nature and its components self-processes the changing conditions in the environment learn from the past and present conditions to evolve in the changed environment in natural evolution. as the individuals of nature have the capability to evolve according to the changing environment so in present scenario it is indeed required that computers and their intelligence to learn and involve as per changing conditions and solve highly complex problems as nature does to fulfill this desire, we want our algorithms to adopt the techniques and features from nature and become more effective as shown in the below figure:

FIG. 1: NATURE INSPIRED OF FLOW CYCLE



A convergence to an optimal solution usually depends on the starting solution. Most algorithms tend to get stuck to a locally optimal solution. An algorithm efficient in solving one class of optimization problem may not be efficient in solving others. Algorithms cannot be easily parallelized. Convergence to an optimal solution is designed to be independent of initial population. Nature inspired algorithm in search based algorithm. Population helps not to get stuck to a locally optimal solution can be applied to the wide class of problems without a major change in algorithm. Used can be easily parallelized. The algorithm used for nature optimal solution to the find the value based on the optimal solution in nature-inspired algorithm, efficient manner to meet enterprise need. Nature as a self-healer

is as the components of nature on seeing any problem finds a solution and come out of it. Self-learning and self-processing are two related terms. To an optimal solution is designed to be independent of initial population. Nature inspired algorithm in search based algorithm.

2. EVOLUTIONARY ALGORITHMS

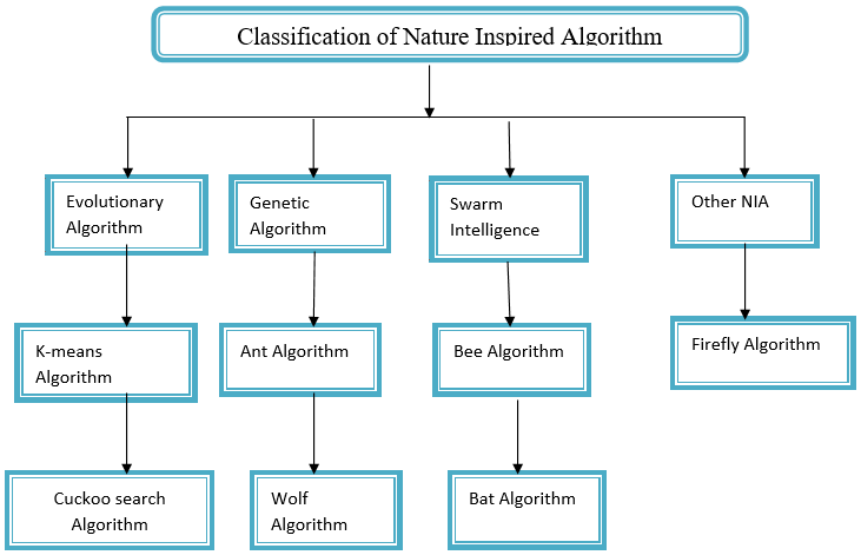
In the origin of species, Charles Darwin stated the theory of natural evolution. Over many stages of life, biological organisms develop according to the principles of natural selection like survival of attaining some astounding form of accomplishment. The best example of natural evolution can be seen in the generation of human beings. So if it works so admirably in nature, it should be interesting to imitate natural evolution and try to procure a technique which may solve existing search and optimization problems. In computer science, evolutionary computation had its foundation in natural evolution. Evolution computing is the common term for a domain of problem-solving techniques based on principles of biological evolution. Evolutionary algorithms are well known and successful algorithms among nature-inspired algorithms. The algorithm nature evolutionary finds the optimization algorithm and problem to solve the efficient and effective the value.

- Genetic algorithms
- Genetic programming
- Evolutionary strategies

3. TERMINOLOGIES

- **Individual** - carrier of the genetic information (chromosome). It is characterized by the state in the search space, its fitness (objective function value).
- **Population** - a pool of individuals which allows the application of genetic operators.
- **Fitness function** - The term "fitness function" is often used as a synonym for objective function.
- **Generation** - (natural) time unit of the EA, an iteration step of an evolutionary algorithm.

FIG. 2: CLASSIFICATION OF NATURE INSPIRED ALGORITHM



4. APPLICATIONS

Biologically inspired algorithms which exhibit the behavior of various social animals are widely used to solve various problems belonging to diverse domains. These algorithms can be used to solve various benchmark problems such as routing problems, np-hard problems, graph coloring problems, resource constrained and scheduling problems. also these nature inspired algorithms have been proposed in the field of medicine for detection of tumor, cancer or other diseases which gives better results in comparison to traditional methods. An algorithm which is inspired algorithm by the centroid point algorithm. In the algorithm anything objects taken from the values and the find attribute values used for the attribute values the randomly select the values and find value. Nature inspired algorithm which is inspired algorithm by the centroid point algorithm. In the algorithm anything objects taken from the value in the nature algorithm.

4.1 APPLICATIONS ON ALGORITHM INSPIRED BY K-MEANS ALGORITHM

An algorithm, which is, inspired algorithm by the centroid point algorithm. in the algorithm anything objects taken from the values and the find attribute values. Used for the attribute values the randomly select the values and find value. Subdivided point values input the values and next find the formula and find the values. The value finding processed by the attribute values. The centroid values and find experiment value. Last only for clustering is done and the new centroid is obtained. The probability of transition of a virtual and from the node I to the node k. experiment, we used the problem of in Slovakia. The final result differs from optimal. An algorithm which is inspired algorithm by the centroid point algorithm.

4.2 APPLICATIONS ON ALGORITHM INSPIRED BY ANT COLONY ALGORITHM

An ant algorithm which is inspired by the behavior of ants in colonies is used to solve various kinds of distributed control problems and difficult optimization. For the segmenting the ant colony optimization used for anything the image for detecting of a tumor. And solving the discrete optimization problems. For improving the efficiency of ant colony optimization an approach is proposed for getting better results in of brain. To optimizing the traveling salesman problem, ant system has been utilized, feature extraction from the mammogram images can be easily done by using the nature of ant colonies while searching for food. it can also be implemented for extraction of suspicious regions using an approach which is asymmetric. This algorithm can also be utilized for search procedure and for implementing feature subset selections. Example to solve problems in an efficient & effective manner. During the past few decades, the ant colony optimization is a problem to find the algorithm.

4.3 APPLICATIONS ON ALGORITHM INSPIRED BY BEE COLONY ALGORITHM

An algorithm is a path while providing robotic navigation to external vehicles. as the proposed algorithm is derived from the bee colony algorithm and it extracts the best path. This best path is used for retrieving best image from the pool of satellite images so this noisy images and also makes the process more efficient. These approaches are categorized to ant colony optimization particle swarm optimization (PSO), and artificial bee colony approaches for optimization and optimal features subsets. The hybridization of ABC and Quantum Evolutionary Algorithm (QEA) was proposed for solving continuous optimization problems. The experimental results demonstrated that the hybrid (QEA) based on ABC was suitable to solve the problem.

4.4 APPLICATIONS ON ALGORITHM INSPIRED BY FIREFLY ALGORITHM

Firefly algorithm is also a population-based algorithm that evaluates the exploratory behavior of fireflies for finding the optimum of target functions. This algorithm can be efficiently used in biometric technology for personal authentication and identification like dorsal hand vein recognition that gives better results when compared with other algorithms. An algorithm based on firefly uses least computation time in compressing the digital images. it produces consistent and more

accurate performance in terms of time and optimality for feature selection. for solving highly nonlinear, multimodal design firefly algorithm provides the best efficiency also have been applied for the optimum design of antenna and shows better performance than other artificial design algorithms. NP-hard problems, multi-objective load dispatch problems, scheduling problems etc. can be easily solved, has better performance and efficiency when solved with firefly algorithm. Also, Firefly algorithms solve the scheduling problems in permutation flow shops and traveling salesman problem in a very promising way. by optimizing the network parameters we can use the firefly algorithm to improve the performance of local linear wavelet neural network for classifying the breast cancer. The firefly used for significant the firefly used the network.

4.5 APPLICATIONS ON ALGORITHM INSPIRED BY CUCKOO SEARCH ALGORITHM

The nature in itself is the best example to solve problems in an efficient & effective manner. During the past few decades, researchers are trying methods that can help human to solve the problems. Applications and to show how traditional methods and nature optimizations the algorithms work in this area. In some of the other aspect, these algorithms have enhanced the performance of each image processing. Multi-objective load dispatch problems, scheduling problems etc. can be easily solved, has better performance and efficiency when solved with firefly algorithm. Also, Firefly algorithms solve the scheduling problems in permutation flow shops and cuckoo search algorithm to find the optimal solution.

5. LITERATURE REVIEW

TABLE 1

S.no	Application	Algorithm	Experiments	Authors
1	Comparative analysis of k-means and genetic Algorithm-based data clustering.	Data clustering, k-means, genetic algorithm.	A comparative study made on k-means and GA. data objects and 2 variables have been taken for the GA based data clustering, initially with k =2, 4 chromosomes are chosen randomly from the dataset. Clustering is done and the new centroid is obtained	Dash and Rasmita Dash
2	Integrating nature-inspired optimization algorithms to k-means clustering	k-means clustering algorithm, firefly optimization, cuckoo optimization, bat optimization, ant colony optimization	The purpose of the experiment is conducted. Six datasets downloaded from the UCI machine-learning repository. The experimental processed ten times to measure the average CPU time was taken and best objective function value best fitness values.	Rui Tang, Fong, Xin-She Yang, Suash Dab
3	Ant colony optimization algorithms for traveling salesman problem.	Ant colony optimization	The probability pi k of transition of a virtual ant from the node i to the node k. experiment, we used the problem of 32cities in Slovakia. The final result differs from optimal exact methods is that ACO algorithm provides relatively good results.	Vorigo M, Stutzle T.
4	Improving ant colony optimization for brain image segmentation and brain tumor diagnosis.	Ant colony optimization	The proposed algorithm has two main parts. In the first part, the pheromone matrix is made and the second part includes analyzing and converting this matrix to a binary image. Applying a median filter for eliminating also the too proposed algorithm.	Vincheh,
5	Ant colony system a co-operative learning approach to traveling salesman problem.	Ant colony optimization	The experiments on ATSP problems presented in this section have been executed while experiments on tsp problems using only a single processor due to the sequential implementation.	Dorigo m, Gambardella m.
6	Embedded feature selection using PSO-KNN: shape-based diagnosis of micro calcification clusters in mammography.	Particle swarm optimization algorithm	The proposed PSO- KNN feature selection scheme has been tested using clusters for the cluster extracted 27 malignant clusters and 30 are benign. This dataset clusters extracted from 20 digitized results mammograms from a mini-mias database [20] clusters that are obtained from 30 digital.	Imadzyouta, Ikhlas Abdel-Qaderb, Qhristina Jacob, et.al
7	Lion optimization algorithm (loa): a nature-inspired metaheuristic algorithm	Nature inspired algorithm, ant colony optimization.	To evaluate the performance of lion optimization algorithm, a comprehensive set of 30 benchmark optimization standard benchmark functions. Provide superior results in fast convergence and global optima achievement, and in all case comparable with other metaheuristics.	Maziar Yazdani & Fairborz Jolai.
8	Nature-inspired algorithms: state-of-art, Problems, and prospects.	Nature inspired algorithm, bat algorithm, ant colony algorithm, firefly algorithm, cuckoo search algorithm.	Various studies have been performed to estimate the efficiency of nature-inspired algorithms benchmark test problems in order to solve the "curse dimensionality" problem. Table that most of the basic in best experimental in the result.	Parul Agarwalshikha Mehta.
9	A review of nature-inspired algorithms for clustering	Cuckoo search, firefly algorithm, bat search algorithm.	The search of the solution space is started from a more proper area through cuckoo algorithms independent of initial solutions, and the clustering accuracy. Firefly is used for an algorithm in determines input parameters, ability to deal with noise and outliers.	Radha A. Pimpale, P.K. Butey.
10	A review on generation of automatic fuzzy rule base from numerical data using nature-inspired approach	Cuckoo search algorithm.	The fuzzy rule base from numerical data using nature-inspired approach can be improved algorithm. Fuzzy systems are gaining widespread acceptance in a large variety of fields. Automatic control strategy.	Aditi Mittal
11	Artificial bee colony algorithm, its variants, and applications.	Bee colony algorithms; nature-inspired algorithm.	The hybridization of ABC and quantum evolutionary algorithm (QEA) was proposed for solving continuous optimization problems. The experimental results demonstrated that the hybrid QEA based on ABC was suitable to solve the problem.	Arobolaji et al.
12	An efficient dorsal hand vein recognition based on firefly algorithm.	Firefly algorithm	In this experiment, the pictures of dorsal hand veins will be tested under the noise and light conditions method, on the other hand, consists of features extraction of dorsal intersections. The firefly clustering algorithm (fa) positions veins features in related class.	Zahra Honarpisheh, Karimfaez.
13	Energy-aware model for sensor network: A nature inspired algorithm approach	Ant colony optimization, bees colony optimization.	The authors implemented the proposed model using research lab dataset for the experiment purposes. This dataset consists of three tables namely location table aggregate connectivity strength table, and sensor data.	Dore swami and Srinivas Narasegouda. .

14	A new population-based nature-inspired algorithm every month: is the current era coming to the end?	Nature-inspired algorithms, swarm intelligence.	The new population-Based nature-inspired algorithms are released every month and, basically, they have nothing special and no novel features for science. The newest population in counted by near feature.	iztokfisterjr., urošmlakar, Janez Brest, Iztokfister.
15	Nature inspired algorithm for reduction of co2 emission in thermal power station	Firefly algorithm.	The firefly algorithm has been applied for optimizing the economic dispatch problem for minimizing the emission level of the thermal power plants. The most simulations proposed firefly algorithm.	S.palaniyappan1, P. Anbalagan
16	A Reminiscent study of nature inspired computation	The nature-inspired algorithms, swarm intelligence, genetic algorithm.	The nature in itself is the best example to solve problems in an efficient & effective manner. During the past few decades, researchers are trying methods that can help human to solve the problems.	Shilpi V Gupta, Shweta Bhardwaj, Parul Kalra Bhatia
17	Nature inspired optimization algorithms: an insight to image processing applications	Swarm intelligence optimization algorithms	Applications and to show how traditional methods and nature optimizations the algorithms work in this area. In some of the other aspect, these algorithms have enhanced the performance of each image processing.	Manish Dixit Sanjay Silakari Nikita Upadhyay.
18	Analyses of nature-inspired intelligence in the domain of path planning and searching in cross country with consideration of various constrained parameters	Cuckoo search, firefly algorithm, bat algorithm.	The proposed best path while providing robotic navigation to external vehicles. As the proposed algorithm is derived from the Firefly and the cuckoo search algorithm and it extracts the best path. This best path is used for retrieving best image from the pool of satellite	Monica Sood, Dr. Ashish Kr Luhach Dr. Vinod Kr Panchal
19	Hybrid nature-inspired algorithms and rough set theory in feature selection for classification: a review	Nature-inspired algorithms, particle swarm optimization, ant colony optimization, bee colony algorithm.	These approaches are categorized to ant colony optimization particle swarm optimization (PSO), and artificial bee colony approaches for optimization and optimal features subsets.	Ahmed Alia, Adel Taweel

6. CONCLUSIONS

The difficult combinatorial optimization problems can be solved using several techniques, but these days, that algorithm that is inspired by the natural behavior gets special importance for their performance. The few of the things are solved in the above literature methods. We finally concluded that the literature review methods showcasing nature-inspired algorithms need improvement on efficiency.

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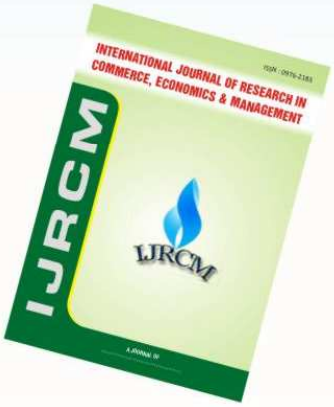
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