FUZZY GENETIC BASED GLOBAL OPTIMIZATION WITH REFERENCE TO DYNAMIC CLUSTERING FOR MULTIPLE APPLICATIONS

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ABSTRACT

Clustering is the social event of a specific set of articles in context of their qualities, totaling them as exhibited by their similarities. With respect to information mining, this strategy parcels the information understanding a particular join calculation, most sensible for the longed for data examination. This clustering examination permits a test not to be somewhat of a package, or absolutely have a place with it, calling this sort of amassing hard isolating. In the other hand, delicate isolating states that each dispute has a place with a package in a picked degree. More particular divisions can be conceivable to make like things having a place with different packs, to urge a question take part in just a lone assembling or even frame diverse leveled trees on get-together affiliations. There are two or three different approaches to manage understand this assigning, in light of unmistakable models. Particular calculations are related with each model, disconnecting it's properties and results. Since this is an enormously basic information examination technique, it has several unmistakable applications in the sciences world. Each boundless instructive record of data can be dealt with by this sort of examination, passing on uncommon outcomes with different particular sorts of information. A champion among the most fundamental applications is identified with picture arranging. recognizing unmistakable sorts of case in picture information. This can be extraordinarily viable in science dissect, seeing items and perceiving plans. The individual information joined with shopping, run, intrigue, practices and a wearisome number of pointers, can be dismantled with this method, giving essential data and cases. Cases of this are the genuine considering, showing strategy, web examination, and a great deal of others. Different sorts of jobs in light of clustering numbers are climatology, mechanical self-administration, recommender frameworks, logical and quantifiable examination, giving a wide extent of usage. Fuzzy mathematics diagrams a branch of mathematics identified with fuzzy set theory and fuzzy logic. In fuzzy sets, a membership function is a generalization of a characteristic function or an indicator function of a subset defined for L = {0,1}. More generally, one can use a complete lattice L in a definition of a fuzzy subset A. In this research work, the fuzzy genetic optimization based approach is implemented for the performance enhancement of clustering in assorted applications.

Keywords : Fuzzy Logic, Fuzzy Sets, Dynamic Clustering

INTRODUCTION

Cluster analysis or clustering is the errand of grouping a method of articles in a way that things in an adjacent get-together (called a pack) are more relative (in some sense or another) to each other than to those in various parties (Clusters). It is a standard undertaking of exploratory data mining, and a customary method for quantifiable data examination, used as a touch of many fields, including machine learning, organize approval, picture examination, data recuperation,

bioinformatics, data compression and many others.

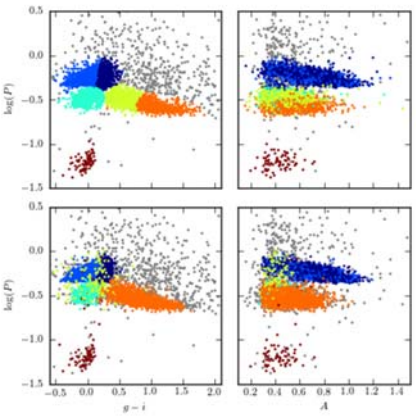


Figure 1.1: Clustering of Linear Data

Cluster examination itself is not one specific algorithm, yet rather the general task to be expelled up. It can be master by various algorithms that waver basically in their considered what constitutes a gathering and how to limit find them. Unavoidable thoughts of clusters join parties with little sections among the social gathering people, thick degrees of the data space, between times or particular quantifiable movements. Clustering can along these lines be brilliant as a multi-target progression issue. The fitting clustering algorithm and parameter settings (checking qualities, for instance, the section ability to use, a thickness edge or the measure of expected packs) depend on upon the individual data set and proposed utilization of the results. Cluster examination in light of current conditions is not a balanced undertaking, yet rather an iterative framework for data presentation or reliable multi-target progression that wires trial and dissatisfaction. It is an immense bit of the time fundamental to change data preprocessing and model parameters until the result fulfills the fancied properties.

Other than the term clustering, there are unmistakable terms with indistinguishable results, including changed approach, numerical honest to goodness delineation, botryology and typological examination. The unnoticeable complexities are routinely in the usage of the results: while in data mining, the subsequent parties are the matter of hugeness, in changed request the following discriminative power is of interest.

Assemble examination was started in humanities by Driver and Kroeber in 1932 and familiar with mind investigate by Zubin in 1938 and Robert Tryon in 1939 and completely used by Cattell beginning in 1943 for quality speculation build in character cerebrum science.

The probability of a "clustering" can't be accurately delineated, which is one motivation driving why there are such a blend of clustering algorithms. There is a typical area: a get-together of data articles. Regardless, remarkable directors use unmistakable social event models, and for each of these gathering models again novel algorithms can be given. The probability of a cluster, as found by different algorithms, disengages on an amazingly noteworthy level in its properties.

Understanding these "amass models" is essential to information the differentiations between the different algorithms. Essential pack models join:-

- Connectivity models: for example, amazing leveled clustering produces models in light of Cluster openness.
- Centroid models: for example, the k-reasons algorithm addresses each cluster by a specific mean vector.
- Distribution models: social events are modeled using quantifiable transports, for instance, multivariate standard spreads used by the Expectation-refresh algorithm.
- Density models: for example, DBSCAN and OPTICS depicts secures as related thick ranges in the data space.
- Subspace models: in Biclustering (all around called Co-clustering or two-mode-clustering), social affairs are modeled with both Cluster people and fitting qualities.
- Group models: two or three algorithms don't give a refined model to their results and essentially give the grouping data.
- Graph-based models: an inner circle, that is, a subset of center obsessions in a format with a persuading focus on that every two concentration centers in the subset are connected by an edge can be considered as a prototypical kind of pack. Relaxations of the aggregate structure key (a little measure of the edges can

miss) are known as semi inside circles, as in the HCS clustering algorithm.

A "clustering" is on a to an extraordinary degree focal level a course of action of such social gatherings, if all else fails containing all things in the data set. Likewise, it may pick the relationship of the gatherings to each other, for example, a chain of centrality of clusters displayed in each other.

Clustering can consider all things saw as:-

- Hard clustering: each question has a place with a get-together or not.
- Soft clustering (in like way: sensitive clustering): each question has a place with each Cluster to a particular degree (for example, a likelihood of having a place with the get-together).

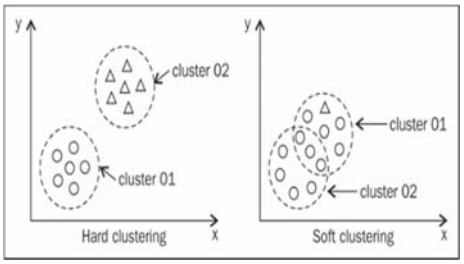


Figure 2: Hard and Soft Clustering

There are other than better points of confinement possible, for example:-

- Strict isolating: here each question has a place with precisely one party.
- Strict disengaging clustering with rejections: things can in like way have a place with no get-together, and are considered variations from the norm.
- Overlapping clustering (other than: elective clustering, multi-see clustering): while all around a hard clustering, articles may have a place with more than one pack.
- Hierarchical clustering: challenges that have a place with a young Cluster in like way have a place with the parent demonstrate.
- Subspace clustering: while a covering clustering, inside a strikingly depicted subspace, social occasions are not expected that would cover.

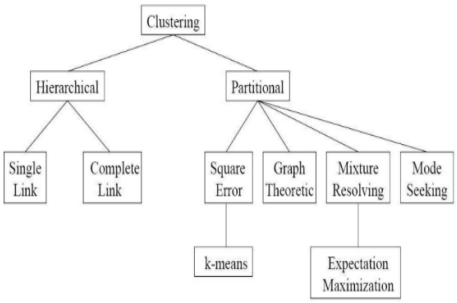


Figure 3: Taxonomy of Clustering

Clustering Algorithms

Clustering algorithms can be asked for in light of their pack model, as recorded early. The running with graph will essentially summation the most prominent occurrences of clustering algorithms, as there are conceivably more than 100 scattered clustering algorithms. Not each and every offer model to their gatherings and can thusly not sensibly be sorted.

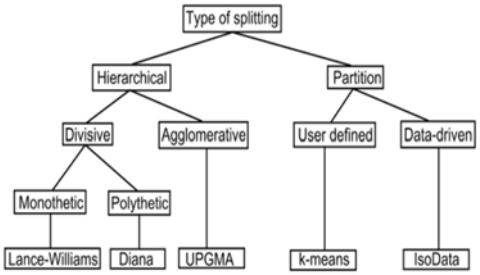


Figure 4: Type of Clustering

There is no reasonably "conform" clustering algorithm, however as it was noted, "clustering is in the eye of the beholder." The most sensible clustering algorithm for a particular issue continually ought to be picked likely, unless there is a numerical inspiration to slant toward one get-together model over another. It should be seen that an algorithm that is set up for one kind of model has no believability to get on a data set that contains a basically enchanting kind of model. For example, k-supports can't find non-raised clusters.

LITERATURE SURVEY

To propose and defend the research work, a number of research papers are analyzed. Following are the excerpts from the different research work performed by number of academicians and researchers.

Author (Year)	Key Points of the Research Work
Wu, D. et. al. (2013).	Novel approach using fuzzy logic systems Reducing the computational cost of interval type-2
Melin, P. et. al. (2013)	Deep review on the applications of type-2 fuzzy logic in classification and pattern recognition.
Cingolani, P. et. al. (2013).	Development of novel jFuzzyLogic: a java library to design fuzzy logic controllers According to the standard for fuzzy control programming
Chen, S. X. et. al. (2013).	Solar radiation forecast Using fuzzy logic and neural networks. Application domain on Renewable Energy
AbdulAlim, M. A., et. al. (2013).	New fuzzy based clustering protocol and approach Energy-efficient wireless sensor networks
Zrar Ghafoor, K. et. al. (2013).	Fuzzy logic approach Beaconing for vehicular ad hoc networks Application domain of Telecommunication Systems
Benaichouche, A. N. et. al. (2013).	Improved spatial fuzzy c-means clustering Using PSO initialization, Mahalanobis distance and post-segmentation correction.
Honda, K. et. al. (2013).	FCM-type cluster validation in fuzzy co-clustering and collaborative filtering applicability
Lu, Y. et. al. (2013).	Implementation of the fuzzy C-means clustering algorithm Implementation dataset of meteorological data
Mukhopadhyay, et. al. (2013)	Survey of multiobjective evolutionary algorithms For data mining problems. Multiobjective evolutionary algorithms used for feature selection and classification Different multiobjective evolutionary algorithms used for clustering, association rule mining, and other data mining tasks are surveyed.
Mukhopadhyay, A. et. al. (2014).	Build an efficient predictive or descriptive model of a large amount of data. Surveyed different multiobjective evolutionary algorithms for clustering, association rule mining, and several other data mining tasks
Hong, T. P. et. al. (2014).	Propose a parallel genetic-fuzzy mining algorithm Based on the master–slave architecture to extract both

	association rules and membership functions
Zheng, B. et. al. (2014).	Hybrid of K-means and support vector machine (K-SVM) algorithms is developed.
Menendez, H. D. et. al. (2014).	The new algorithm, named genetic graph-based clustering (GGC), takes an evolutionary approach introducing a genetic algorithm (GA) to cluster the similarity graph. The experimental validation shows GGC increases robustness
Peña-Ayala, A. et. al. (2014).	Preserve and enhance the chronicles of recent educational data mining (EDM) advances development Organize, analyze, and discuss the content of the review based on the outcomes produced by a data mining (DM) approach.
Rahman et. al. (2014).	Propose a novel GA based clustering technique Capable of automatically finding the right number of clusters and identifying the right genes
Izakian, H. et. al. (2014).	Propose an extended version of the FCM Composite distance function is endowed with
	adjustable weights (parameters) behavior of the proposed method is effective
Kaur, B. et. al. (2014).	Survey different papers in which one or more algorithms of data mining used for the prediction of heart disease.
Krishnasamy, G. et. al. (2014).	present an efficient hybrid evolutionary data clustering algorithm referred to as K-MCI
Izakian, H. et. al. (2015).	Alternatives for fuzzy clustering of time series using DTW distance are proposed. DTW-based averaging technique Fuzzy C-Medoids clustering Hybrid technique, which exploits the advantages of both the Fuzzy C-Means and Fuzzy C-Medoids when clustering time series.
Nguyen, T. et. al. (2015).	Proposes an integration of fuzzy standard additive model (SAM) with genetic algorithm (GA), called GSAM deal with uncertainty and computational challenges.
Yang, C. L. et. al. (2015).	Proposed non-dominated sorting genetic algorithm-fuzzy membership chromosome (NSGA-FMC) K-modes method fuzzy genetic algorithm and

	multi-objective optimization improve the clustering quality on categorical data. uses fuzzy membership value as chromosome.
Elhag, S., Fernández et. al. (2015).	consider the use of Genetic Fuzzy Systems within a pairwise learning framework
Nayak, J. et. al. (2015).	comprehensive survey on FCM show the efficiency and applicability in a mixture of domains.
Riza, L. S. et. al. (2015).	frbs: Fuzzy rule-based systems for classification and regression in R.
Triguero, I. et. al. (2015).	MapReduce-based framework distribute the functioning of algorithms through a cluster of computing elements, several algorithmic strategies to integrate multiple partial solutions into a single one. enables prototype reduction algorithms to be applied over big data classification problems no significant accuracy loss.
Tang, J. et. al. (2015).	a hybrid approach integrating the Fuzzy C-Means (FCM)-based imputation method with the Genetic Algorithm (GA) developed
	for missing traffic volume data estimation based on inductance loop detector outputs.
Capozzoli, A. et. al. (2015).	automatically detect anomalies in building energy consumption based on actual recorded data of active electrical power for lighting and total active electrical power of a cluster of eight buildings is presented. uses statistical pattern recognition techniques and artificial neural ensembling networks coupled with outliers detection methods for fault detection.
Ozturk, C. et. al. (2015).	new solution generation mechanism of the discrete artificial bee colony is enhanced using all similarity cases through the genetically inspired components.
Sajana, T. et. al. (2016).	This paper focuses on a keen study of different clustering algorithms highlighting the characteristics of big data. various clustering algorithms underlined
Kumar, G. et. al. (2016).	Intrusion Detection is one of major threats for organization. The approach of intrusion detection using text

	processing has been one of research interests which is gaining significant importance from researchers. In text mining based approach for intrusion detection, system calls serve as source for mining and predicting possibility of intrusion or attack. When an application runs, there might be several system calls which are initiated in the background. These system calls form the strong basis and the deciding factor for intrusion detection. In this paper, we mainly discuss the approach for intrusion detection by designing a distance measure which is designed by taking into consideration the conventional Gaussian function and modified to suit the need for similarity function. A Framework for intrusion detection is also discussed as part of this research.
Ansari, A. et. al. (2016).	This study intends to combine the fuzzy c-means clustering and genetic algorithms to cluster the customers of steel industry.
Peng, H. et. al. (2016).	focuses automatic fuzzy clustering problem proposes a novel automatic fuzzy clustering method employs an extended membrane system
Buczak, A. L. et. al. (2016).	Survey paper Describes a focused literature survey of machine learning (ML) and data mining (DM) methods for cyber analytics
Verma, A. et. al. (2016).	Improve information retrieval activities to a higher level. Involves use of Fuzzy Ontology Generation framework (FOGA) framework along with Formal Concept Analysis (FCA) based clustering and keyword matching approach.
Verma, A. et. al. (2016).	evolution of data processing adroitness to advanced data processing taxonomy from Mesolithic to recent years comparative study of prevailing tools/techniques which are useful for mainly the analysis of the bulky data.
Štěpnička, M. et. al. (2016).	employ the so-called Fuzzy Rule-Based Ensemble

	constructed as a linear combination of a small number of forecasting methods weights of the combination are determined by fuzzy rule bases based on time series features
Fernández, A. et. al. (2016).	view on design of methods based on fuzzy sets
Lucas, P. et. al. (2017).	Human–Machine Musical Composition Real-Time Based on Emotions Through a Fuzzy Logic Approach.
Marques, N. R. et. al. (2017).	Automated closed-loop resuscitation multiple hemorrhages comparison between fuzzy logic and decision table controllers Uses sheep model.

Research Objectives

1. To devise a new approach for clustering using advance genetic algorithm
2. To evaluate the performance of novel approach on assorted parameters
3. To evaluate and devise the factors affecting cluster formation and outlier analysis
4. To investigate the performance of approach based on outliers detection aspects.
5. Testing and Evaluation of approach on assorted datasets

Research Gaps

1. To devise and implement a novel and efficient technique for dynamic as well as effective cluster formation.
2. To apply and fetch the meaningful records in form of the aggregate values or clusters for intelligence and predictions.
3. To analyze the proposed cluster formation algorithm with the existing technique and to prove the effectiveness of the proposed work.
4. To devise a novel fitness function to the transactional data so that the eligibility or relevance of the record can be analyzed.

4.1 Methodology

- Deep Literature Review on Fuzzy Sets and Fuzzy Logic
- Building association between fuzzy genetic approach and clustering for data mining and machine intelligence.
- The predictive approach mining for dynamic cluster formation for assorted datasets
- Implementation of the proposed approach in suitable simulation tool

Clustering is a well-studied data mining problem that has found applications in many areas. For example, clustering can be applied to a document collection to reveal which documents are about the same topic. The objective in any clustering application is to minimize the inter-cluster similarities and maximize the intra-cluster similarities. There are different clustering algorithms each of which may or may not be suited to a particular application. The traditional clustering paradigm pertains to a single dataset. Recently, attention has been drawn to the problem of clustering multiple heterogeneous datasets where the datasets are related but may contain information about different types of objects and the attributes of the objects in the datasets may differ significantly. A clustering based on related but different object sets may reveal significant information that cannot be obtained by clustering a single dataset.

Problem Formulation

- There is need to develop a novel approach for dynamic clustering using metaheuristic algorithms
- The existing methods of clustering are not efficient as these approaches find out and group the data items in exact matching criteria
- There is need to design and implement the dynamic algorithmic approach that can cluster and display the data items so

that there is non-biased clustering of data items in multiple domains.

- The fuzzy implementation is required in the cluster formation so that the exact matching can be reduced to the fuzzy based matching. Using this methodology, the data items or elements or inputs can be placed using many to many relationship.

Research Process

Phase 1: Deep Analytics from Literature Review and Extraction of the Novel Approaches in Practice

Phase 2: Dataset formation and Extraction of Feature Points

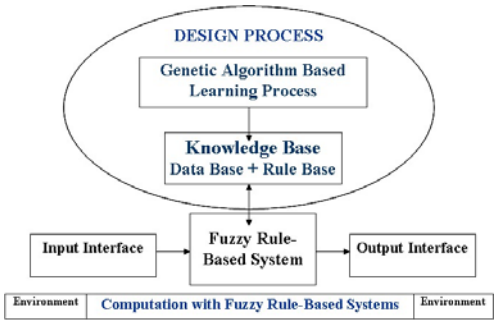
Phase 3: Extraction of results from Classical Approach and Proposed Approach

Phase 4: Analysis of the parameters from Classical and Proposed Approach in terms of multiple parameters

- Execution Time
- Turnaround Time
- Cost Factor
- Complexity
- Overall Efficiency and Performance
- Error Factors

PERSPECTIVES

- There is need to develop a novel approach for dynamic clustering using metaheuristic algorithms
- The existing methods of clustering are not efficient as these approaches find out and group the data items in exact matching criteria
- There is need to design and implement the dynamic algorithmic approach that can cluster and display the data items so that there is non-biased clustering of data items in multiple domains.
- The fuzzy implementation is required in the cluster formation so that the exact matching can be reduced to the fuzzy based matching. Using this methodology, the data items or elements or inputs can be placed using many to many relationship.



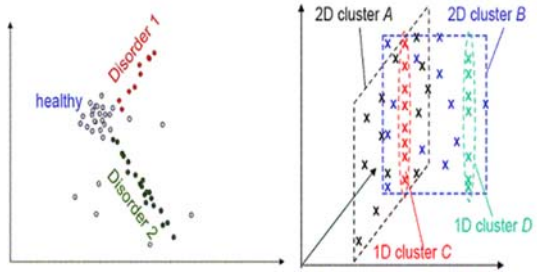


Figure 5: Design Process with Fuzzy Genetic

RESULTS AND DISCUSSION

Classical or Base Methodology

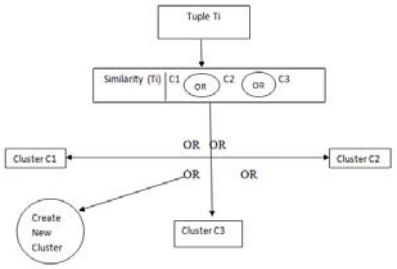
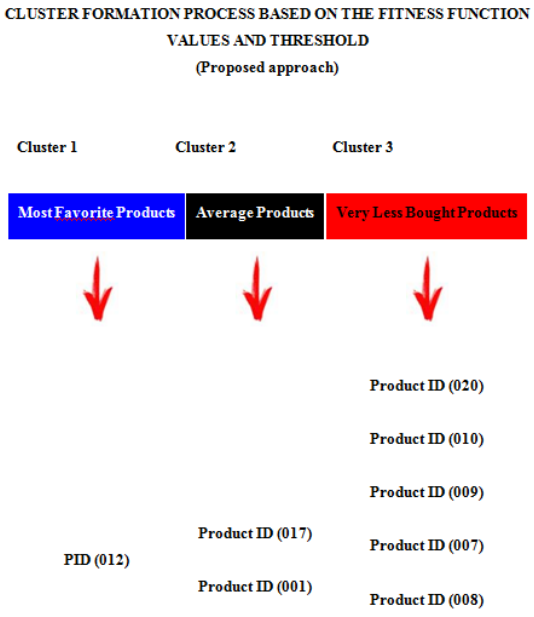


Figure 6: Classical or base Approach



THE BASE APPROACH

Execution Time of Proposed Approach= 2.32424 microseconds
Execution Time of Existing Approach = 5.09272 microseconds

Percentile based implementation (proposed) takes less execution time than existing based implementation.

Table 1: Comparison of Execution Time

Base Approach	Projected Effectual Approach
1.052060833	0.284016838
1.049060097	0.216011992
1.055061092	0.049003115
1.052061071	0.047003021
1.064062109	0.022001972
1.072062006	0.028002014
1.030060043	0.01600193
1.016058912	0.019001951
1.016059151	0.067003956
1.031299105	0.021000853
1.030383101	0.023002138
1.028235903	0.027002087
1.022170057	0.024002066

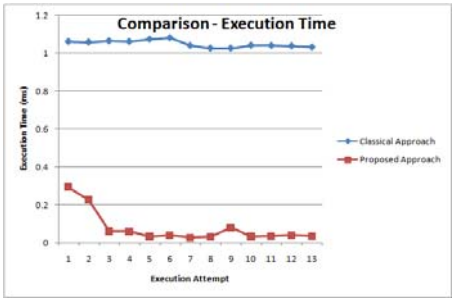


Figure 7: Comparison of Execution Time

Table 2: Comparative Evaluation

Classical Approach	Proposed Approach
84	90
86	92
88	96
85	90
90	91
81	90
82	90
91	96
84	96
91	94
90	96

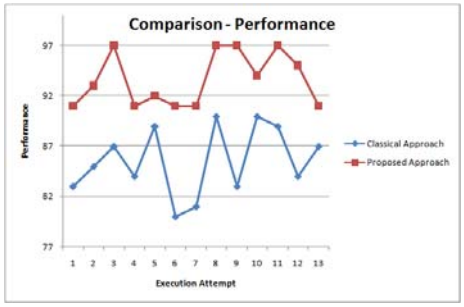


Figure 8: Comparison of Performance

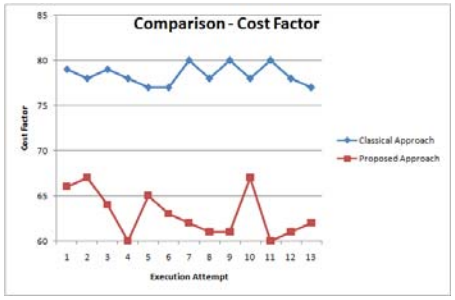


Figure 9: Comparison of Cost Factor

DATABASE STRUCTURES

Indexes

Key name	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	8	A	No	

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	4	A	No	

proposed

Column	Type
id *(Primary)*	int(11)
time	varchar(255)

shopping

Column	Type
id *(Primary)*	int(11)
product	varchar(255)
price	int(11)

Indexes

Keyname	Type	Uniqueue	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	8	A	No	

Indexes

Key name	Type	Uniqueue	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	5	A	No

Conclusion

Fuzzy Genetic based approach can be used for assorted applications and domains still there is huge scope of research in terms of strengthening the algorithms and multiple layers. Fuzzy logic is extremely useful for many people involved in research and development including engineers (electrical, mechanical, civil, chemical, aerospace, agricultural, biomedical, computer, environmental, geological, industrial, and mechatronics), mathematicians, computer software developers and researchers, natural scientists (biology, chemistry, earth science, and physics), medical researchers, social scientists (economics, management, political science, and psychology), public policy analysts, business analysts, and jurists.

Indeed, the applications of fuzzy logic, once thought to be an obscure mathematical curiosity, can be found in many engineering and scientific works. Fuzzy logic has been used in numerous applications such as facial pattern recognition, air conditioners, washing machines, vacuum cleaners, antiskid braking systems, transmission systems, control of subway systems and unmanned helicopters, knowledge-based systems for multiobjective optimization of power systems, weather forecasting systems, models for new product pricing or project risk assessment, medical diagnosis and treatment plans, and stock trading. Fuzzy logic has been successfully used in numerous fields such as control systems engineering, image processing, power engineering, industrial automation, robotics, consumer electronics, and optimization. This branch of mathematics has instilled new life into scientific fields that have been dormant for a long time.

For future scope of the work, following techniques can be used in hybrid approach to better and efficient results –

- Particle Swarm Optimization
- HoneyBee Algorithm
- Simulated Annealing
- Genetic Algorithmic Approaches

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