Indonesian Journal of Electrical Engineering and Computer Science
Vol. 30, No. 1, April 2023, pp. 614~624
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v30.i1.pp614-624

Sophisticated CPBIS methods applied for FBISODATA clustering algorithm using with real time image database

[1]Muniappan Ramaraj, [1]Dhandapani Sabareeswaran, [2]V. Vijayalakshmi, [2]Chembath Jothish, [3]N. Thangarasu, [4]Govindaraj Manivasagam

[1]Department of Computer Science, Rathinam College of Arts and Science, Coimbatore, India
[2]Department of Computer Science, Christ College of Science and Management, Malur, India
[3]Department of Computer Science, Karpagam Academy of Higher Education, Coimbatore, India
[4]Department of Computer Science, KL University, Vaddeswaram, India

Article Info

Article history:

Received Sep 7, 2022
Revised Dec 17, 2022
Accepted Dec 23, 2022

Keywords:

Classification
Clustering
Color spaces
Data mining methods
Image enhancement method
Result analysis

ABSTRACT

Data mining is a process of mining hidden information to the previously unknown data and theoretically useful unknown information from a large amount of genuine data to be stored in a database. Image mining is a part of data mining with used as a predictive measure to identify with the age of the tiger. This research work is mainly focused on, to identify with the age of the Tiger using data mining techniques. This research work incorporates with which those domains of image processing and data mining to predict the age of the tiger using different kinds of color images are used. The fuzzy iterative self-organizing data analysis (FISODATA) clustering method requires more predefined parameters tofind the maximum number of iterations, the minimum number of points in the cluster, and smallest amount of distance with the centers of the clusters. The key undertaking of the studies of diverse colors mechanism is to decide the age of the tiger; the usage of shade action pixel primarily based on image segmentation; the usage of facts that are used in the mining techniques. However, the more matrix components to be measuring the processing time, retrieval time, accuracy, and blunders fee with the aid of using producing better performance.

Corresponding Author:

Muniappan Ramaraj
Department of Computer Science, Rathinam College of Arts and Science
Coimbatore, India
Email: ramaraj.phdcs@gmail.com

1. INTRODUCTION

Excavating is the process of extracting unknown information from previously unknown data and hypothetically significant knowledge from a large amount of concrete data to be stored in a database by Mahmud *et al.* [1]. Many data mining techniques are available, such as clustering, classification, association, regression and evaluation by Chakrabortya *et al.* [2]. To get access from this scenario, too many strategies are demonstrated, such as Pattern recognition, time series, OLAP, visualization, and other techniques are all significant by Kumudham and Rajendran [3]. Advances in image acquisition and storage technologies have led to a tremendous growth in very broad and informative image databases. Analysis of images will reveal useful information to the human users by Caponetti *et al*. [4]. Image mining deals with the ancestry of inferable acquaintance to the image data relationships that are different trims not explicitly embedded in the image database stored in the images by Sudana *et al.* [5]. ISODATA is defined as iterative self-organizing data analysis technique. ISODATA is an unsupervised arrangement technique. There has been no way to make a decision for how many clusters there are. Fuzzy control is based on fuzzy logic, which is a logical system that

is far closer to scientific rationality with including the natural language in the meaning than conventional logical systems that has to be used by Dubey *et al*. 2018 [6]. The fuzzy logic controller (FLC) uses fuzzy logic to transform a linguistic control strategy based on expert knowledge into a fuzzy logic controller (FLC). ISODATA Algorithm enables the measurement of bunches to be balanced naturally amid the emphasis by Ramaraj and Niraimathi [7]. The ISODATA clustering algorithm is based on the ISODATA clustering algorithm to transform the modified data clustering algorithm for fuzzy based modified iterative self organizing data analysis technique (FMISODATA) clustering algorithm, that is used to support the tiger image database proposed by Adeh and Dehnavi [8]. The main objective of this method is to predict the age of the tiger.

2. REVIEW OF LITERATURE

The entirely unconventional works to be carried out that the realm of the image process, as image segmentation has revealed victimization some different approaches and lots of those works square measure focused on the assorted technologies of image segmentation. The existing clustering algorithm becomes one of the most fundamental clustering algorithms, with many different implementations that are differentiated in the method used to be activated. ISODATA technique was announced by Ball and Hall, and others in the 1960s. Ramaraj and Niraimathi [9], has proposed the algorithm towards assessing the well initial centroids are generated based on the optimization approach. The proposed clustering algorithm generates the highly accurate clusters while reducing computational time.

Alkhalid [10] has described the image segmentation approach based on image pixel categorization was introduced by using for quality control implementation of proposed clustering algorithm and matrix to be predicted and calculate with clustering process to be used with given dataset. Ramaraj and Niraimathi [11] to presented with the clustering techniques in color image segmentation have managed to five clustering techniques as K-means, ISODATA, mean shift, splitting and merging techniques for use in the color image segmentation are presented. Gautam and Singhai [12] an automatic detection of route rumble strips, which are important for many applications, including lane level navigation and lane departure warning, has been introduced. Khan *et al.* [13], had proposed a new spectral-spatial classification scheme for hyper spectral images.

The optimizing of the techniques is to incorporating the performance of image classification and grouping as well as the segmentation of map produced by region-based segmentation to the number of clusters into the different classifiers [14], had proposed an advanced fuzzy based iterative self organizing data analysis technique (AF- ISODATA) clustering algorithm for applying on color isolated sensing image segmentation. Yang *et al*. [15], described a color style transfer by constraint locally linear embedding. Abbas *et al.* [16], had presented with a state based modified modified expectation maximization (MEM) algorithm for region image segmentation. The proposed method will use and decrease the number of iterations for the segmented image to converge rapidly and center at a low time.

Wang and Wang [17], a new approach based on an unsupervised image segmentation algorithm clustering technique will be introduced that determines the best clustering of an image data set with less user intervention. Ramaraj and Niraimathi [18], it can be recognized that segmentation is individually dependent on either pixel-based or texture-based optimization algorithms and does not contribute to the classification of remote sensing images with high spatial resolution since it includes textured and non-textured regions [19].

Dhanachandra *et al.* [20], had analyzed that the presentation of unsupervised classification algorithms is called as ISODATA and to test statistically by iterative approaches to automatically group pixels with identical spectral characteristics into unique clusters, K-means in remote sensing. Dhanachandra and Chanu [21], has presented with the fast and efficient method for color image segmentation [22]. In addition, the computing time has been drastically reduced, allowing extremely large images to be processed in a reasonable time [23].

3. METHOD

The fuzzy based iterative self organizing data analysis technique (FBISODATA) clustering algorithm's unsupervised classification calculates the class, which means that it is presumed to be uniform in the data liberty. Then, using smallest amount reserve functions or techniques, the remaining pixels are clustered iteratively. Each iteration to be followed in the relationship to the new properties, recalculates means and reclassifies pixels [24]. The FBISODATA clustering algorithms are divide into two iterative classes such as splitting and merging is done based on the input threshold parameter. Because, if a standard deviation or distance threshold is to be established with the all color pixels that are grouped into the nearest color classes. When some color pixels may be classified into other nearest cluster groups [25]. However, if they do cannot an implementation of threshold value to be found [26]. The procedure was repeated until the number of pixels in each class falls below a certain threshold, or until the maximum number of iterations for the selected two pixels has been obtained. FBISODATA clustering uses two-parameter sets, the first parameter sets do not change during the clustering

process [27]. Another parameter that which can be interactively adjusted until an acceptable clustering result is to be obtained. Found the unique attribute indicators matrix U^* that illustrates each attribute of any object within investigation and reference samples U_{ij}^* is on behalf of the characteristic indicators j of object i. homogenize data of the unique characteristic and that indicators matrix is $U*$ and by assortment of process to be get U, and describable equation as followed by $Mj = max\ (U_{1j}^*, U_{2j}^*, \dots, U_{nj}^*), mj = min\ (U_{1j}^*, U_{2j}^*, \dots, U_{nj}^*)$ for column j of $U*$, estimate u_{ij} using formula:

$$U_{ij}^* = \frac{U_{ij}^* - m_j}{M_j - m_j} \tag{1}$$

start an incremental process to be based on the unique core matrix of the cluster $V^{(0)}$ of reference sample system compute fuzzy confidential matrix $r_{ij}^{(i)}$ using formula as:

$$r_{ij}^{(l)} = \left[\sum_{j=1}^{c} \left(\frac{||U_k^i - V^{(L)}i||}{||U_k^i - V^{(l)}j||}\right)\right]^{-2}, \tag{2}$$

therefore, c defines the number of cluster categories. Then amend bunch core matrix for $r^{(l)}$,

$$V_i^{(l+1)} = \frac{\sum_{k=1}^{n}(r_{ij}^{(l)})^2 u_k}{\sum_{k=1}^{n}(r_{ij}^{(l)})^2}. \text{ Here,} \tag{3}$$

$V^{(l+1)} = (V_1^{(l+i)}, V_2^{(l+i)}, \dots V_c^{(l+i)})^T$, Repeat step 2), when evaluate the given matrix is $r^{(l)}$ *and* $r^{(l+i)}$ *for a given* precision $\varepsilon > 0$, if $\max\left\{r_{ik}^{(l)} - r_{ik}^{(l+i)}\right\} \leq \varepsilon$, iterative operation should be stopped and $r^{(l+1)}$ $V^{(l+1)}$ should be outputted. In parallel stipulation as followed by the equation as $i = i + 1$, and repeat step 3). Obtain a fuzzy set bunch using the better nearest cluster matrix segregation of the basic concept to the better cluster center matrix, $V^* = (V_1^*, V_2^*, \dots V_c^*)^T$, $\forall u_k \in U$, object U_k should be confidential to class i.

The Figure 1 is illustrated with the modified ISODATA clustering algorithm with fuzzy logic method applied for the real time image. Once the tiger image database is loaded then create the original characteristic indicators matrix U* that descript color feature value of all examined tiger image object and locus samples of tiger images is on behalf of the color characteristic pointers j of tiger object i. Normalize the original color value of the tigers to fall under the specified range which is denoted as matrix U* to get U. Then begin the process of iterative which frames the cluster center matrix $V^{(0)}$ of the reference sample system of tiger images. Then compute the fuzzy classified matrix with a reference sample of tiger and new incoming image of the tiger. Modify the cluster center matrix for $R^{(l)}$, depending on the new arrival of the tiger to re-cluster them by determining the optimal cluster center. Finally, the fuzzy ISODATA cluster performs optimal cluster center matrix discrimination principle in which the tiger's with same age group are clustered with the color characteristics.

Load the image database

Initialize the input parameter as indicate U^* and object reference samples U_{IJ}^*

Set the data points and calculate the min and max value of U_{IJ}^*

Initialize the cluster center $V^{(0)}$ and reference samples of $R^{(I)}$

Modify the cluster matrix of $R_{ij}^{(i)}$

Compare the value of U_{IJ}^* and $R^{(I)}$

To find the precision and recall value of ε

Update the cluster center V^*

End

Figure 1. Proposed FBISODATA clustering algorithm

Illustrate on the Figure 2 is shows that the architecture diagram for the predictable clustering method as FBISODATA. This process is used on two-stage, one is split and merge function. The first process is used on split function is called classify the pixels of an image, and another function is merge is called cluster the pixels of the image to retrieve the age of the tiger image from the image database. To enhance the segmentation accuracy and loyalty, and collective characteristics to be described the over-segmentation regions. These features incorporate both color-textures in sequence with the intention effectiveness values in the colors.

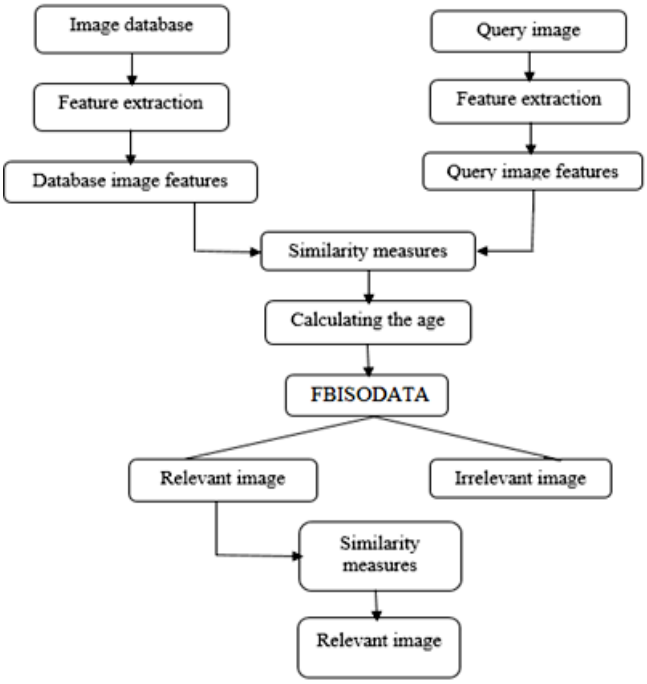

Figure 2. Architecture of the proposed FBISODATA clustering algorithm

3.1. Splitting algorithm

The algorithms for splitting and merging are segment the image into a particular region. The basic framework of representation is pyramidal. The algorithm generally starts from the initial assumption that a single region is the whole image, and then computes the criterion of homogeneity.

- Initialize the k centroid value.
- Assign the splitting function of the membership process.
- Search an entire color in the image line by line expect first to last line.
- Find the pattern of each color and split into m*n.
- Calculate the fuzzy classifier. Following the (2).
- If a mismatch between assigned label value $r^{(i)}$ and $r^{(i+1)}$.
- Assign labels to unsigned pixels in the block.
- Remove small regions if necessary.

3.2. Merging algorithm

For hierarchical segmentation, reliable regions are merging and this performance is very effective. Based on the color-texture improves and artifacts of the image, the correspondence dimension of regions and consequent stopping criterion are anticipated. The process of merging starts with the image's primitive color pixels before the termination criterion is reached and the segmentation is finished [18].

The above pixel class transforms right into a histogram characteristic to incorporate color records and nearby color distribution function of the pixels that show in the Figure 3. As high-degree visible records, is the object's fee or chance of a vicinity belonging to an identifiable object. The maximum plant-based approach to neighborhood fusion is to begin the boom with the inside unprocessed data, each color component representing a multiple color neighborhood. These regions almost certainly do not satisfy the condition $H(R_i \cup R_j)$.

For each N node in G, R_i is neighbor region of N

if dis $H(R_i \cup R_j)$ <T then

Merge the all regions satisfying the merging criterion.

Change the region of label value $R^{(i+1)}$

Modify the cluster object $R^{(i)}$

Update the similarity function G

end if

if no regions are satisfied

End the merge process, otherwise, go to previews process is begin.

End if.

Figure 3. Merging algorithm

3.3. Neighbours of pixel

A pixel p has four horizontal and vertical neighbors coordinate as (x, y), and this synchronize are given$by\ (x+1,y),(x-1,y),(x,y+1),(x,y+1)(x,y-1).(x,y-1)$. This pixel set, referred to as N's 4-neighbors, and is N 4 Denoted (p). Each pixel is the distance of a unit from (x, y), and some of N's neighbors be positioned. If (x, y) is on the boundary of the file, it is outside the digital image. N's four diagonal neighbors have coordinated $(x+1,y+1),(x+1,y-1),(x-1,y+1),(x-1,y-1)$ and are denoted by N_D (p). The value *m* reins the amount of clustering with core clustering at *m=l* and more and more fuzzy clustering at largest amount of *m*, *V* is the set of c-cluster centers and $r_{ik}^{(l)}$ is the fuzzy separation of the image [25].

3.4. Finding the nearest color

This part of the study can explain the method of preventing an image's and number of colors by identifying the closest match to an image's available color. This object, just for simplicity, implies it will operate with a pre-defined image spectrum assigned to several colors such as, RGB colors and other combination of RGB colors. By analyzing the relationship between the separate RGB values of the actual color and each of the colors available from the palette, the Euclidean distance is one of the best methods for finding the distance. A simple way to ensure that negative and positive values are adapted together to create the distance is to square the differences. The nearest color might be the one that has the maximum distance from the actual color. When applied the rule is based on the color classification of the RGB pixel. The first stage of this obvious process is to load an image. For example, it will use the original tiger images which are standard images to test the different image processing techniques. The second stage sequentially takes each color pixel of the image and replaces it with the color that most closely matches the available spectrum of the image. Then update or replace the position of the pixels and find out the correct color pixel of an image of the particular position and it stores the values of the RGB pixel in the database. Euclidean distance is one of the best practices to find the distance by calculating the individual RGB values of the actual colors and the difference between each color available in the palette. Then square the difference, make sure there are negative and positive values, and sum them up to get the distance.

4. RESULTS AND DISCUSSION

The tiger image database is included with the proposed model, and it facilitates the execution of the MATLAB tool. This database contains over the 500+ above camera trap images from different formats and sizes. There will be only one class, which encompasses the several age collections of tiger has been illustrations. The proposed method's retrieval accuracy would be assessed in a specific class using a different age group category. The proposed clustering methods ways to perform the square measures are used on the color performs for an extract to get values to the vector in RGB is concentrated on a virtual machine, and the formula for a similarity metric is used to measure the greatest distance. The accuracy, recall, and F-measure is used to determine performance while retrieving images from the image database by generation.

4.1. Computational complexity

The computational intricacy of poles apart was cluster technique, when assessed to determine their virtual effectiveness, in the terms of time erudition analysis. Clustering with the fuzzy based ISODATA clustering algorithm requires better steps than other clustering techniques i.e.O (.). The ability of hierarchy in clustering methods was interpreted as computational convolution equation as given.

$$o((N - \sum_{t=0}^{m-1} N_r)^2) \tag{4}$$

Hence, N denotes the whole amount of color pixel, m stands for the extent of cluster, and r is number of iteration on *t.* The enhancement with the computational complexity of optimized modified MC algorithm is able to a vital consequence of extracting the clusters from the dataset, by separating themselves from the new-fangled tiger image, and thereby obtaining to reduced computational time for each successive region.

The grid plot of each database is based on the procedure values and the sample values denoted from $k = 2, k = 4, and\ k = 6$ clusters that are using the enhanced clustering algorithm to be executed. In the tiger image database is shown in Figure 4. The formation of $k = 2, 4, and\ 6$ clusters is shown on dissimilar colors in Figure 4 when every cluster is plotted in individualcolor patterns.

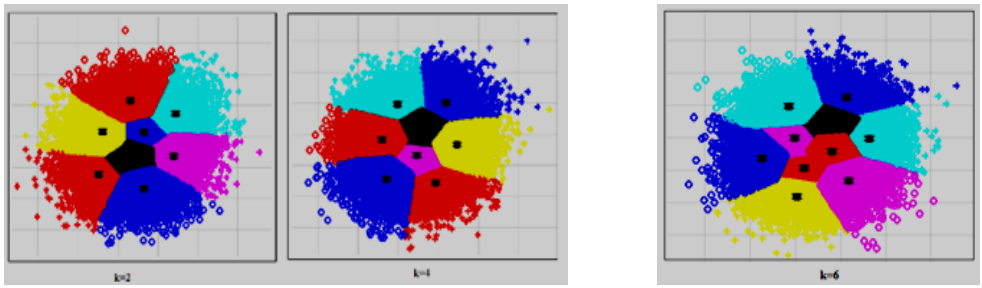

Figure 4. Illustrate the Plot diagram on FBIC in $k = 2, k = 4,$ and $k = 6$ cluster for tiger image database

4.2. Age prediction of the real time tiger image

That is the main distinction amid at both the actual value and the stand for value of the fundamental mechanism that generates the data is the accuracy of the proposed method. The number of appropriatelyto segment the current pixels is represented by the cells in either diagonal of the error matrices of (T_{ij}). The unit of measurement for overall segmentation precision can be generated from those kind of pixel value by measuring, and how many pixels in the tiger image database and the ground were classified as the same age ($\sum T_{ij}$), by separating this values on total number of pixels ($N = \sum R_i = \sum C_j$). The following equation is given [2].

$$a = \frac{\sum T_{ij}}{N} \tag{5}$$

Where: $\sum T_{ij}$becomes the whole amount of incidence was appropriately recognized, and N denotes the whole number of pixels in the error matrix. Fabricator performance has become a term referring to reliability that is widely used to measures and evaluate the percentage of correct predictions for a unit of pixels.

$$A = \frac{T_{ij}}{R_i} \tag{6}$$

Where T_{ij}denote the numeral of aptly classified pixels in row j, $R_i$denotes the overall pixels in row j. The candidate truthfulnessof the intrigue foundation accuracy that is calculated by analyzing a class's reference data and calculating the percentage of corrected predictions for this sample.

$$A = \frac{T_{ij}}{C_j} \tag{7}$$

Where T_{ij}denotes the number of appropriatelyconfidential pixels in column i, $R_i$has denotes the total number of pixels in column j.

$$Age = \sum T_{ijk} \quad Where\ 1: i = j = k, (0: i \neq j \neq k, i, j, k > 0.) \tag{8}$$

As a result, ethics of the thresholding integrity of color pixel based on image pixel classification with image pixel clustering and it is based on predicting the age of the tiger were used to envisage the Tiger's Age. These estimates are evaluated by using tiger image databases. Training datasets and compared to real-time camera trap image databases of a tiger in the wildlife forest.

$$d = \frac{N \sum_{i=1,j=1,k=1}^{m} T_{ijk} - \sum_{i=1,j=1,k=1}^{m} R_i \cdot C_j}{N^2 - \sum_{i=1,j=1,k=1}^{m} R_i \cdot C_j} \tag{9}$$

Therefore, d is denoted on basic Euclidean distance, N is evaluated for the total number of pixels in an image, m is a number of RGB classes. Here, $\sum T_{ijk}$is the total number of properlyclassify pixels in a tiger image. Moreover, when selecting the fastidious age of the tiger image, the threshold value of each color pixel was set to a specific tiger.R_i , $C_j$is represents with the number of pixels in the row and column.

According to the Table 1, data can be categorized into Age wise. The amount of clusters is uniformly set at three clusters. The highest precision is 96%, and the less precision is 91% in the first year. The recall is 96% for the highest and 91% for the less. The highest f-measure registered is 95.5%, while the lowest is 93%. Then all the measures are compared with each individual comparison procedures in the table is faintly excited. Euclidean distance measures do have the utmost precision level is 96% and recall 96%, and the maximum f-measure is 95.5%, whereas city block distance measures have the lowest.

Table 1. Applied fuzzy based iterative self organizing data analysis clustering technique (FBIC) with various similarity measures in one year tiger image

Age	SM	P	RC	FM	NC
1 Year	City Block	0.91	0.96	0.935	3
	ChebyChev	0.95	0.91	0.93	3
	Euclidean	0.96	0.95	0.955	3
	Minkowski	0.92	0.94	0.93	3

Note: SM-Similarity Measures, P-Precision, RC-Recall, FM-F-Measures, NC-Number of Clusters

Here, the Table 1 demonstrates that to envisage the age of a tiger image. While evaluating similarity-based clustering accuracy and determining the distinction functions such as a city block, Chebychev distance, Minkowski distance, and Euclidean distance using clustering metrics including precision, recall, and f-measure. The figure portrays the experimental effects that are shown in Figure 5.

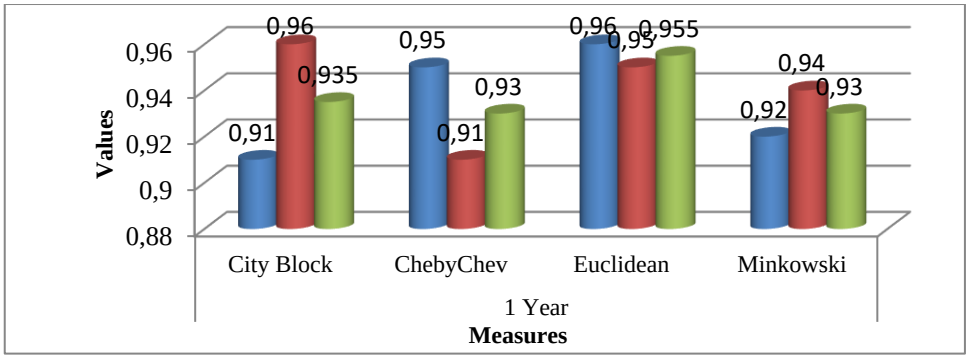

Figure 5. Demonstrate the various similarity metrics are used on FBIC with a sample one-year tiger image

According to the Table 2, data can be categorized into age wise. The amount of clusters is equally set at three clusters. The highest precision is 96%, and the lowly precision is 94% in the 2nd year. The recall is 97% for the highest and 94% for the lowest. The highest f-measure registered is 96.5%, while the lowest is 93%. Then all the procedures were evaluated in each individual comparison procedures in the table is faintly

excited. Euclidean distance measures do have the highest precision 96% and recall 97%, and the highest f-measure is 96.5%, whereas city block distance measures have the lowest.

Table 2 identifies the full participation of Tiger images, including city blocks, Chebychev distances, Minkowski distances, and Euclidean distances, and shows that similarity-based clustering can also be used to correctly predict the age of Tiger images. Analyze accuracy using clustering indicators Fit rate, recall, and F value. Figure 6 shows the experimental effect.

Table 2. Applied FBIC with different similarity measures using two year tiger image

Age	SM	P	RC	FM	NC
2 Year	City Block	0.94	0.95	0.945	3
	ChebyChev	0.95	0.94	0.945	3
	Euclidean	0.96	0.97	0.965	3
	Minkowski	0.95	0.96	0.955	3

Note: SM-Similarity Measures, P-Precision, RC-Recall, FM-F-Measures, NC-Number of Clusters

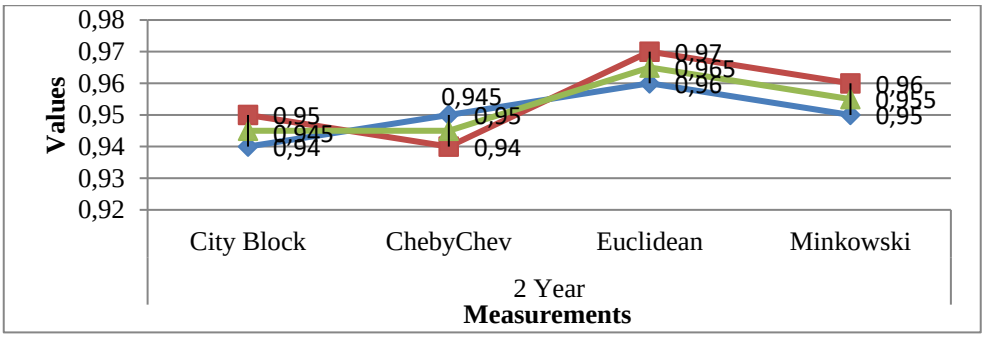

Figure 6. Illustrate on the verious kinds of metrics applied on FBIC is tested with two year tiger image

According to the Table 3, data can be categorized into age group wise. The number of clusters uniformly set at three clusters. The highest precision is 96%, and the lowest precision is 91% in the 15th year. The recall is 97% for the highest and 90 for the lowest. The highest f-measure registered is 96%, while the lowest is 92%. While lowest value is 93%. Then all the actions are measure up to each individual similarity procedures in the table is faintly excited. Chebyche distance measures do have the highest precision 96% and Euclidean distance of recall value is 97%, and the highest f-measure is 96.5%, whereas Minkowski distance measures have the lowest.

Table 3. FBI clustering algorithm used with different clustering similarity approaches applied on 15th age of the tiger image

Age	SM	P	RC	FM	NC
15 Year	City Block	0.91	0.96	0.935	3
	ChebyChev	0.96	0.95	0.955	3
	Euclidean	0.95	0.97	0.96	3
	Minkowski	0.94	0.90	0.92	3

Note: SM-Similarity Measures, P-Precision, RC-Recall, FM-F-Measures, NC-Number of Clusters

Table 3 measures similarity-based clustering accuracy and uses clustering indicators such as precision, recall, and F-measure to generate similarity functions such as city block, Chebychev distance, Minkowski distance, and Euclidean distance. These are indicated by identification and correctly predict the age of the tiger image. Figure 7 shows the experimental effect.

Table 4 improves the consistency of each established and improved clustering matrix, including root mean square error (RMSE) values, predictable time, and image investigate time. Whenever the proposed algorithm used and produced the better results is much more accurate and effective, the clustering results are displayed in a graphical format. The results of the proposed method have the highest accuracy rating in fuzzy based ISODATA clustering. Figure 8 shows the results of the accuracy, RMSE, time and image search performance evaluations in the Tiger image database compared to the proposed and existing accuracy, RMSE, time and image search methods. The proposed method is shown in Table 4.

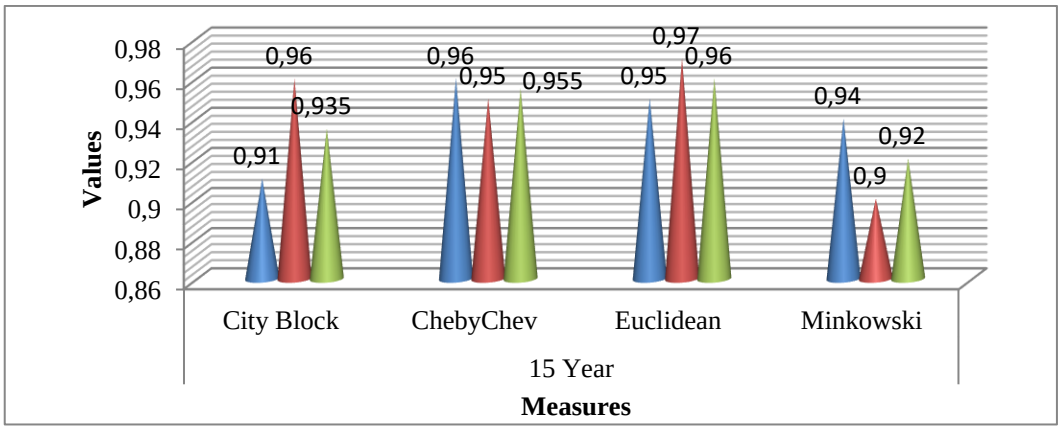

Figure 7. Illustrate on FBI clustering algorithm used with different clustering similarity methods applied on 15th age of the tiger image

Table 4. Comparison of proposed clustering metrics

Accuracy		RMSE		Time		Image retrieval	
Existing	87.77	Existing	0.646889	Existing	2.6	Existing	2.51
Proposed	93.36667	Proposed	0.515467	Proposed	2.0188889	Proposed	1.86

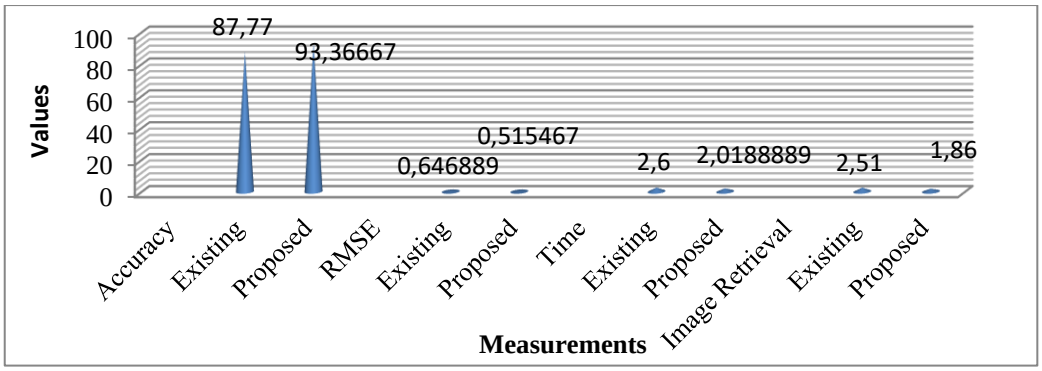

Figure 8. Comparison of overall performance measures

5. CONCLUSION

The primary aspiration of the progression is to acquire for granted the age of the tiger is based on the image databases. This research work is generally a focal point on the anticipated method that has composed the auxiliary of 500+ real-time tiger images is calm in the wildlife forest. The various types of images of adult tigers were truly tested. Colors are being used to separate the image. Clustering is accomplished with the different age group tiger images of various ages because of various colors and skin tones and stripes. It is also divided into several parts focused on the tiger's age and color. Each image is characterized based on its age and color differences. Mostly, in the age prediction of tigers based on the color of the image of tigers, fuzzy clustering models mentioned in the following sections are included. True image tests demonstrated that the proposed method is effective to the stipulations of exactness and execution time when those are compared to recent effective in elevated appearance to the new statistical approach was processed. The product of the clustering is very efficient and effective and is conversed in the consequences sector.

REFERENCES

[1] Md. S. Mahmud, Md. M. Rahman, and Md. N. Akhtar, "Improvement of K-means clustering algorithm with better initial centroids based on weighted average," *2012 7th International Conference on Electrical and Computer Engineering 20-22*, Dec. 2012, doi: 10.1109/ICECE.2012.6471633.

[2] D. Chakrabortya, S. Singhb, and D. Duttaa, "Segmentation and classification of high spatial resolution images based on hölder exponents and variance," *Geo-spatial Information Science*, vol. 20, no. 1, pp. 39–45, 2017, doi: 10.1080/10095020.2017.1307660.

[3] R. Kumudham and V. Rajendran, "Implementation of various segmentation algorithms on side scan sonar images and analysing its performance," *ARPN Journal of Engineering and Applied Sciences*, vol. 12, no 8, pp. 2396-2400, Apr. 2017.
[4] L. Caponetti, G. Castellano, and V. Corsini, "MR brain image segmentation: a framework to compare different clustering techniques," *Information*, no 8, pp. 1-21, Nov. 2017, doi: 10.3390/info8040138.
[5] O. Sudana, D. Putra, M. Sudarma, R. S. Hartati, and A. Wirdiani, "Image clustering of complex balinese character with DBSCAN algorithm," *Journal of Engineering Technology*, vol. 6, no. 1, pp. 548-558, Jan. 2018.
[6] S. K. Dubey, S. Vijay, and Pratibha, "A review of image segmentation using clustering methods," *International Journal of Applied Engineering Research, Research India Publications*, vol. 13, no. 5, pp. 2484-2489, 2018.
[7] M. Ramaraj and S. Niraimathi, "Design and implementations of color pixel based image segmentation using enhanced data clustering algorithms to applying on tiger image dataset," *International Journal of Pure and Applied Mathematics*, vol. 119, no. 18, pp. 2719-2739, 2018.
[8] O. S. Adeh and A. M. Dehnavi, "Nucleus and cytoplasm segmentation in microscopic images using K-means clustering and region growing," *Advanced Biomedical Research*, pp. 01-06, 2018.
[9] M. Ramaraj and S. Niraimathi, "Comparative analysis of proposed methods for analysing color pixel based image segmentation using tiger image dataset," *International Journal of Research*, vol. 7, no. 9, pp. 245-252, September 2018.
[10] F. F. Alkhalid "The effect of optimizers in fingerprint classification model utilizing deep learning," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 20, no. 2, pp. 1098-1102, Nov. 2020, doi: 10.11591/ijeecs.v20.i2.pp1098-1102.
[11] M. Ramaraj and S. Niraimathi, "Enhanced image segmentation to infer the age of the tiger using fuzzy modified k-means clustering algorithm (FMKMCA)," *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, vol. 10, no. 2, pp. 198-214, 2019.
[12] K. Gautam and R. Singhai, "Color image segmentation using particle swarm optimization in lab color space," *International Journal of Engineering Development and Research*, vol. 6, no. 1, pp. 373-377, 2018.
[13] Z. Khan, J. Ni, X. Fan, and P. Shi, "An improved k-means clustering algorithm based on an adaptive initial parameter estimation procedure for image segmentation," *International Journal of Innovative Computing, Information and Control*, vol. 13, no. 5, pp. 1509, Oct. 2017.
[14] M. Ramaraj and S. Niraimathi, "Color pixel based image classification and clustering using fuzzy methods," *International Journal for Research in Engineering Application & Management (IJREAM)*, vol. 04, no. 04, pp. 225-229, July 2018.
[15] S. Yang, P. Li, H. X. Wen, Y. Xie, and Z. He, "K-hyperline clustering-based color image segmentation robust to illumination changes," *Symmetry*, no. 10, pp. 1-11, 2018, doi: 10.3390/sym10110610.
[16] A. W. Abbas, N. Minallh, N. Ahmad, S. A. R. Abid, and M. A. A. Khan, "K-means and ISODATA clustering algorithms for landcover classification using remote sensing," *Sindh University Research Journal. (Sci. Ser.)*, vol. 48, no. 2, pp. 315-318, 2016.
[17] Y. Wang and C. Wang, "High resolution remote sensing image segmentation based on multi-features fusion," *Engineering Review*, vol. 37, no. 3, pp. 289-297, 2017.
[18] M. Ramaraj and S. Niraimathi, "Color pixel based image segmentation using enhanced data," *International Journal of Advance and Innovative Research*, vol. 5, no. 3, pp. 83-88, 2018.
[19] R. S. Raheem, M. Y. Hassan, and S. K. Kadhim "Particle swarm optimization based interval type 2 fuzzy logic control for motor rotor position control of artificial heart pump," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 25, no. 2, pp. 814-824, Feb. 2022, doi: 10.11591/ijeecs.v25.i2.pp814-824.
[20] N. Dhanachandra, K. Manglem, and Y. J. Chanu, "Image segmentation using K-Means clustering algorithm and subtractive clustering algorithm," *Procedia Computer Science*, (IMCIP-2015), pp. 764-771, 2015, doi: 10.1016/j.procs.2015.06.090.
[21] N. Dhanachandra and Y. J. Chanu, "Image segmentation method using K-means clustering algorithm for color image," *Advanced Research in Electrical and Electronic Engineering*, vol. 2, no. 11, pp. 68-72, 2015.
[22] N. Dhanachandra and Y. J. Chanu, "A survey on image segmentation methods using clustering techniques," *EJERS, European Journal of Engineering Research and Science*, vol. 2, no. 1, pp. 15-20, January 2017, doi: 10.24018/ejeng.2017.2.1.237.
[23] N. Dhanachandra and Y. J. Chanu, "A new approach of image segmentation method using k-means and kernel based subtractive clustering methods," *International Journal of Applied Engineering Research*, vol. 12, no. 20, pp. 10458-10464, 2017.
[24] O. O. Olugbara, E. Adetiba, and S. A. Oyewole, "Pixel intensity clustering algorithm for multilevel image segmentation," *Hindawi Publication in Mathematical Problems in Engineering*, pp. 01-19, 2015, doi: 10.1155/2015/649802.
[25] O. Sakarya, "Applying fuzzy clustering method to color image segmentation," *Proceedings of the Federated Conference on Computer Science and Information Systems*, ACSIS, vol. 5, 2015, pp. 1049–1054, doi: 10.15439/2015F222.
[26] P. Rani and R. Bhardwaj, "An approach of colour based image segmentation technique for differentiate objects using MATLAB simulation," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 5, no. 7, pp. 553-556, 2016.
[27] N. S. Binti Mat Said, H. Madzin, S. K. Ali, and N. S. Beng, "Comparison of color-based feature extraction methods in banana leaf diseases classification using SVM and K-NN," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 24, no. 3, pp. 1523-1533, Dec. 2022, doi: 10.11591/ijeecs.v24.i3.pp1523-1533.

BIOGRAPHIES OF AUTHORS

Dr. Muniappan Ramaraj is working as an Assistnt Professor in the Department of Computer Science at Rathinam College of Arts and Science, Coimbatore. He holds a Ph.D., degree in computer science at Bharathiar University in the year of 2020 with specalization in Data Mining with Image Process and also Fuzzy logic in the image analysis. His research areas are Data Mining, Image Processing, Fuzzy Logic, Pattern Recognition and Deep Learning concept. He has published more research article in the reputed various national and international jourals and also filed the patents in the same field. He has a reviewer of many international journals including with IEEE, ASTESJ, and JERS. He can be contacted at email: ramaraj.phdcs@gmail.com, or ramaraj.phdcs123@gmail.com.

Dr. Dhandapani Sabareeswaran is working as an Assistnt Professor in the Department of Computer Science at Rathinam College of Arts and Science, Coimbatore. He holds a Ph.D., degree in computer science at Karpagam Academy of Higher Education in the year of 2020 with specalization in Data Mining. His research areas are Data Mining, Image Processing, Fuzzy Logic, Pattern Recognition. He has published more research article in the reputed various national and international jourals and also filed the patents in the same field. He can be contacted at email: sabaredhandapani@gmail.com.

Dr. V. Vijayalakshmi is currently serving as Assistant Professor in the Department of Computer Science at Christ College of Science and Management, Malur, Karnataka, Possesses M.Sc.,M.Phil., Ph.D and has a passion for Teaching. I have Teaching experience of more than 15 Years. I presented many papers in National / International Conference. I attended many Workshop and Seminars and had published many Journals and guided M.Sc., M. Phil Students for Project and Dissertation. My areas of Interest include Wireless Sensor Networks, Deep Learning, Data Mining, cloud computing and Grid Computing. My Research work Focuses on Efficient Data Transmision in Wireless Sensor Networks. She can be contacted at email: vijayalakshmiv@christcollegemalur.com.

Dr. Chembath Jothish completed his phd from Karpagam deemed to be University, Coimbatore, Tamilnadu in the year 2020, under the title "Next web page prediction using enhanced preprocessing and ensemble clusteringbased hybrid markov model using web log data". More than 15 research journalshave been published in reputed journals which are either Scopus indexed, Web of Science and International Journals of repute, which would help the Internet mechanism to predict the user's intention and interest, when Internet is browsed using mathematical model algorithms after cleaning the internet data, thereby giving accurate predictions using mathematical models. Author also has attended 3 international conferences held in the Sultanate of Oman, Malaysia and Cochin. Currently author is working in Presidency University, Bengaluru. The teaching and research experience is around two decades starting from 2003 to toll date. He can be contacted at email: jothishchembath12@gmail.com.

Dr. N. Thangarasu is currently working as an assistant professor in the department of Computer Science, at Karpagam Academy of Higher Education, Coimbatore. I am greatly fascinated with the advanced computing technology and research programs is Cluster Computing, Cryptography and Network Security, Cloud Computing, Artificial Intelligent System, Information Security in large Database and Data Mining as well as the strong teaching experience. My doctoral dissertation also focuses on advanced security systems with cloud computing, and I have published more than 13 publications in reputed journals, which I find would be a great addition to the success of your teaching and research department. He can be contacted at email: drthangarasu.n@kahedu.edu.in.

Dr. Govindaraj Manivasagam is an Associate Professor at KL University, has a significant experience of working for17 years in Academics and Research space. His specialised delivery expertise in her areasof interests such as Software Testing, Data Science. He has over 14 research publications in well-known journals, indexed in the Scopus, UGC Care List, and hasa few patents to his credentials. He has attended more than 5 international and 20 nationalconferences and organised a number of seminars as well as numerous FDPs & workshops. He is a strong education professional with numerous online certification courses from variousplatforms. He can be contacted at email: mani.mca.g@gmail.com.