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Enhancement of the Satellite Images using ACO and DNN Approach

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Abstract: ***Image classification is a vital technique used to remote-sensing for the pattern identification and design analysis of the satellite information in the form of images. Recent years, several kinds of classification methods like as a minimum distance, SVM and ANN etc. Image Segmentation performs in segmenting the satellite images into sub-clusters which of our interest which could be studied individually. Satellite images is one of the world wide fields in segmentation. Image Segmentation provides in extract the same features from the images depends on their shape, color , intensity and clusters then together using several segmentation methods. Before evaluating the segmentation on satellite images, sometimes image blurring must be remove the interference from the images and certain edge detection are Sobel and canny etc are in use. In prior work, using hybrid method and clustering approach for land cover mapping for trees, building and roads etc. It works with the help phase is pre-processing process to create the image the satellite image suitable for segmentation. The image is process for segmentation using the genetic algorithm (GABC) method that is developed by crossbreed method the GA and ABC to obtain the efficient segmentation in satellite image and classified using NN. In research work implemented the new methods to classify and perform the segmentation of the satellite image in reduce the time interval rate and computation the better accuracy rate based on DNN (Deep Neural Network). We design a framework in satellite land images classifies using MATLAB 2016a simulation tool. Computing the metrics are MSE (mean Square Error Rate), DB-Index , Accuracy , RMSE and compared with the existing metrics (MSE, DBI and XDBI).***

Keywords- Image Segmentation, DNN, ACO algorithm and Satellite Images.

I. INTRODUCTION

Image segmentation is a critical step of image analysis. The task of image segmentation can be stated as the clustering of a digital image into multiple meaningful non-overlapping regions with homogenous characteristics according to some discontinuity or similarity features like intensity, colour or texture.[1] Usually, remote sensing mentions to the activities of recording/observing/observing (sensing) substances or events at far away (remote) places. In remote sensing, the sensors are not in direct contact with the objects or events being observed. The information needs a physical carrier to travel from the objects/events to the sensors through an intervening medium. The electromagnetic radiation is normally used as an info carrier in remote sensing. The production of a remote sensing system is usually an image representing the scene being observed. A further step of image analysis and interpretation is required in order to extract useful information from the image. The hominid visual system is an example of a remote sensing structure in this general sense [2].

These remote sensing satellites are equipped with sensors looking down to the earth. They are the "eyes in the sky" constantly observing the earth as they go round in predictable orbits [3].

A. Image classification in Remote Sensing

Digital image classification techniques group pixels to represent land cover features. Land cover could be forested, urban, agricultural and other types of features. There are three main image classification techniques.[4]

1) Image Classification Techniques in Remote Sensing:

a) Unsupervised image classification
b) Supervised image classification
c) Object-based image analysis [5]

Pixels are the smallest unit represented in an image. Image classification uses the reflectance statistics for individual pixels. Unsupervised & supervised image classification methods are the two most common approaches. However, object-based classification has been breaking more ground as of late [6].

B. Applications in Image Segmentation

There are probably hundreds of applications - these are typical: [7]

1) *Meteorology* - Study of atmospheric temperature, pressure, water vapor, and wind velocity.
2) *Oceanography:* Measuring sea surface temp mapping ocean currents, & wave energy spectra & depth sounding of coastal and ocean depths
3) *Glaciology*- Measuring ice cap volumes, ice stream velocity, and sea ice distribution. (Glacial)
4) *Geology*- Identification of rock type, mapping faults and structure.
5) *Geodesy*- Measuring the figure of the Earth and its gravity field.
6) *To*pography and cartography - Improving digital elevation models.
7) *Agriculture* Monitoring the biomass of land vegetation. [8]

In this proposed work, we will be implementing the FCM-mean Clustering Algorithm for divide the data in the form of clusters and divide data in different cluster identify the unique properties calculate using Feature Extraction algorithm i.e. SIFT (Scale Invariant Feature Transformation).In our proposed work we will be proposing an ant colony optimization approach. Optimization method is met heuristic Swarm intelligence relevant search optimization procedures which impersonate as the representation of natural biological development as well as social activities of the specific species. The satellite image classification method will be used in artificial intelligence, learning algorithm(DNN) which is to enhance the accuracy with classification approach and optimization approach and minimize the error rate.

II. LITERATURE REVIEW

Ghasemi, F. et.al; 2017 [11] the Invasive plant species was identified as major threats to biodiversity and the survival of native species and ecosystems. This study is to effectively identify the invasive weed, namely African Olives, within the Hawkesbury Nepean catchment in Sydney's west. Spectral analysis using airborne hyper spectral imagery and polar metric COSMOSKYMED X-band data are utilized in this study to monitor the occurrence of an invasive weed species. LIU Chang bing et .al; 2014 [12] discussed the potential and problem of applying remote sensing technique on monitoring remediation of temporary land use (tLU) in road construction project, based on two case studies which are 'Cao-Nan' and 'Chao-Hei' highways in Liaoning province. In either case, the combined three (before, during, and after construction) medium resolution satellite images (Landsat5-TM or HJ-CCD, abbreviated as 'TM/HJ') and one high resolution satellite image (abbreviated as 'HR'). Liu Dechang et.al 2014[13] The Libyan area in Gansu Province is an important part of the Beishanmetallogenic belt, where many polymetallic deposits are developed. This paper studies the metallogenic conditions and setting in the Liuyuan area using airborne hyper spectral remote sensing technique, and constructs its structural framework. NurAishahSulaiman et.al 2013 [14] the changes detection was a method use in remote sensing technique in monitoring and managing the natural resources such as vegetation and the urban development. It can provide the researcher with the quantitative analysis of spatial distribution in the area of interest. This method can be used to determine the changes that occur in a particular area at different periods of time. PratimaPandey et.al, 2011 [15]the glacier study was important in the sense that it a very direct relation with climate change. Any change in the climate can be read through glacier response. A number of Himalayan glaciers are reported to be shrinking. The retreat of Hamtah glacier in Chandra sub-basin was studied by interpreting time series optical satellite images obtained from Landsat, ASTER and IRS LISS III sensors. The change of terminus position was measured and retreat was monitored with respect to the terminus position in a topographical map. Juan C et.al; 2005[16] the aim of this article was to illustrate forest practitioners the business opportunities brought by remote sensing in terms of data capture and monitoring forest resources in Britain. Some of these technologies are now mature tools ready for business use & may offer a cost-efficient source of information to address specific forest management issues. Some examples taken from our own experience at Forest Research are also included as showcases to exemplify these opportunities.

III. ISSUES SATELLITE IMAGES AND SEGMENTATION

Satellite Image classification is a procedure of collecting pixels into meaningful categories. It is a multi-phase work flow. It can also refine as extracting information from satellite images. It is not difficult, but the study has to take several decisions and selections in satellite image classification procedure. It involves in interpretation of remote-sensing images, data mining and analyzing several vegetation kinds such as foresters and agriculture images etc.[9,10]

Various type of methods for satellite image classifications i.e. automated, manual and hybrid. Automated method further categorize into two forms: (i) supervised and un-supervised algorithm. It deals with various kinds of similarity matching techniques. Manual

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method is robust, effective and efficient methods. But manual methods consume more time. Hybrid approach is combination of the automated and manual method.

We found a problem of this work; we want to make a classification i.e. to assign a label to each pixel. The classification we expect has to lead a partition compound of same regions or classes with regular boundaries or minimal length. Segmentation is given a number of regions is a problem with a large number of possible solutions.[17]

VI. PROPOSED PLAN WORK

Step 1: Upload the dataset satellite image and save pixel in the database in the workspace. To convert the original image to the black white image cause to optimize the image pixel size.

Step 2: Apply the Marr -Hildreth Algorithm to detecting edges in digital images that is continuous curves wherever there are well-built and fast variations in picture brightness. It is an easy & it operates by convolving the image with the LoG function, or, as a quick approximation by DoGs.

Step 3: Apply the Fuzzy C-Mean Clustering algorithm for divide the data in the form of groups. This is membership value is assigned to each data point corresponding to each cluster centroid on the basis of distance between the cluster centre and the data point.

Step 4: Feature Extraction using Scale Invariant Feature Transformation. This approach identifies the original feature of the image in the form of key points.

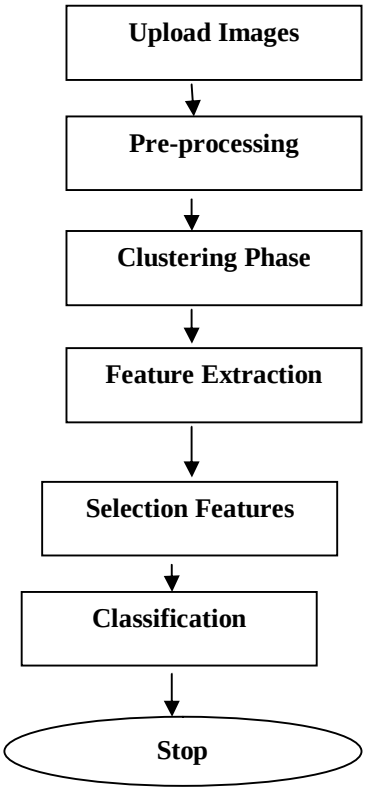

Figure 1 . Proposed Plan Work

Step 5:Optimize the features using the Ant Colony Optimization Technique definite number of complete ants, the better halves of the inhabitants undergo the original and eliminate the rest of the population. In order to escape local optima, a removal dispersal event is accepted out where some bacteria are liquidate at random with a very small chance and the new replacement are initialized at random locations of the look for space.

Step 6:Classification of the support vector machine using ARTIFICIAL INTELLIGENCE algorithm. Examine data and recognize patterns. DNN modules represent examples as the point in space mapped in method that separate grouping examples are divided by a gap thereby performing linear organization.

Step 7: To evaluate the performance parameters i.eFalse acceptance, rejection rate, accuracy and error rate and compare previous one.

VII. SIMULATION RESULTS

In this section, we simulation tool used in MATLAB.MATLAB is a high appearance language for technological computing. It incorporates calculation, apparition, and programmed environment. In addition, MATLAB is modern programming language surroundings: it has complex data structures, contains built-in editing and debugs tools, and supports object oriented programming. These factors make MATLAB a commendable tool for teaching and research.The evaluated results of the proposed image processing concept for Satellite Image classification. Also the percentage of classified the satellite images determined with the overall accuracy of the concept is evaluated. The proposed image processing concept is implemented in MATLAB with GUI (Graphical User Interface). The considered GUI is shown in figure 2. Here, the considered buttons. It defines that the start, refresh and exit button design in the GUI page. To click start button then move the main training and testing phase. To click the refresh button the main gui page is renew. And last exit button click to close all the running windows**.** It defines that the training phase and testing phase. In training phase collect the raw data using satellite image database. This is downloading by the UCI machine repository site. The testing phase to compare the image in train dataset then classifies the satellite images.

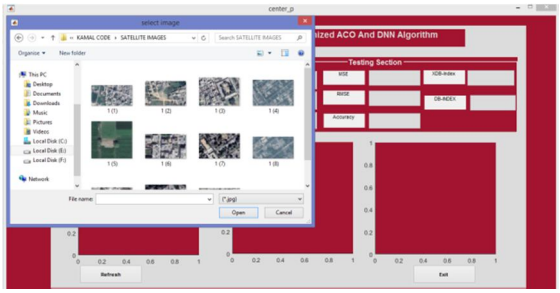

Figure2. Select image from database

The figure 2. Defines that the clicks the upload button then search the pathname and filename from the dataset. Upload the image in satellite images in dataset.

Figure 3. Image Uploading

Figure 3 , upload the original image from the dataset. Second one convert the original image to gray scale form cause of reduce the image pixel size in the original image. In gray scale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total non-appearance of communicated or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelengths.

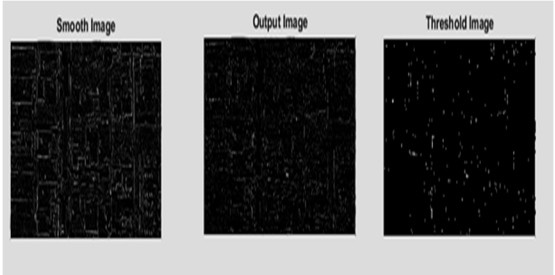

Figure 4. Edge Detection Image

The above figure 4. shows edge detection technique is a method of detecting edges in digital images that is continuous curves wherever there are well-built and fast variations in picture brightness. It is a easy & it operates by convolving the image with the

LoG function, or, as a quick approximation by DoGs. Subsequently the zero-crossings are discovered in the filtered result to find the edges. Edge detection means to detect the single edges in the gray scale image. It is uses a multi-stage technique to detect a wide range of edges in images.

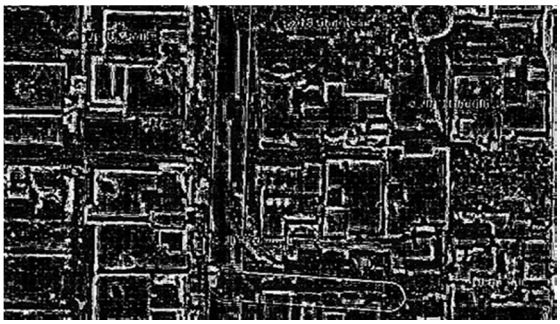

Figure 5. Segmented Image

The figure 5 segmentation of the contrast enhanced image is done Fuzzy C Means. The algorithms differ by their objective functions. All the algorithms, except fuzzy c means, incorporate the local and spatial information into their objective functions. The results of segmentation are compared with the manually segmented images from the Internet Brain Segmentation Repository. Segmentation is defined Fuzzy C means algorithm is an improvement over Hard C-Means clustering algorithm. In this a membership value is assigned to each data point corresponding to each cluster centroid on the basis of distance between the cluster center and the data point. The FCM algorithm receives the data in the form of matrix as n×m where n and m represents the number of data and number of parameters respectively, and c is the number of clusters , U is the assumption partition matrix , E is the convergence value.

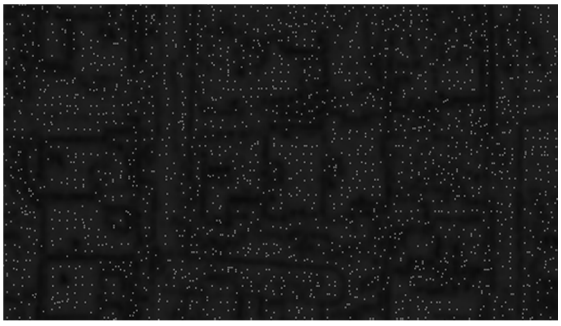

Figure 6. Feature Extracted Image

The figure 6 shows the extracted feature in this feature vector were statistically independent, one could simply eliminate the least discriminative features from this vector. The least discriminative features can be originate by various greedy feature selection methods. However, in practice, many features depend on each other or on an underlying unknown variable. A single feature could consequently represent a combination of multiple types of info by a single value. Removing such a feature would remove more information than needed. In the next sections, we introduce SIFT as a feature extraction solution to this problematic, and introduce its inner workings from two different perspectives.

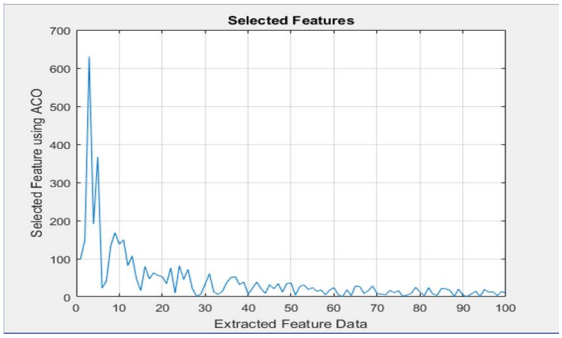

Figure 7 defined that the optimized features

Above fig 7 based on the Ant colony algorithm .Ant Colony optimization algorithm is computer programs that simulate the procedures of natural evolution in arranging to solve complex and to model evolutionary systems. An optimization process to remove redundancy and irrelevant features. The resulting feature subset is the most representative subset and is used to classify the satellite image from dataset.

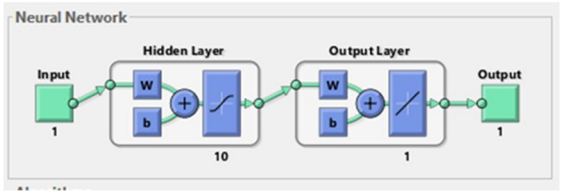

Figure 8 . Neural Network

Fig 8 represents that the Deep neural network, it is the classification technique to classify the Satellite image training state dataset. DNN is a new technique suitable for binary and layer wise classification tasks. DNNs are a set of supervised learning methods used for classification, regression and prediction detection. The DNN classifiers work for both lined and non-linear class of data through Levenberg algorithm.

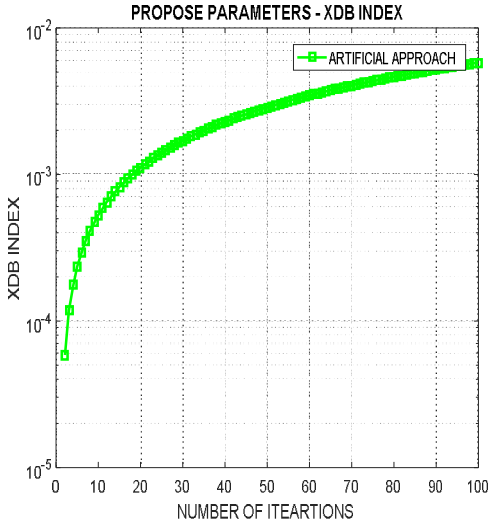

Figure 9 XDB-INDEX (Proposed Work)

The XB-Index is the ratio of within cluster compactness to the minimum separation of clusters.

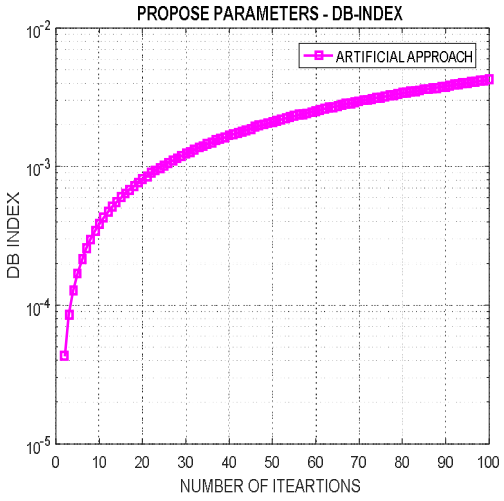

Figure 10. .DB-Index

The above figure shows that DB Index is a metric exploited to evaluate the clustering algorithm. The DB-Index is an internal evaluation scheme that validates how well the cluster is done based on the quantities and features inherent to the dataset.

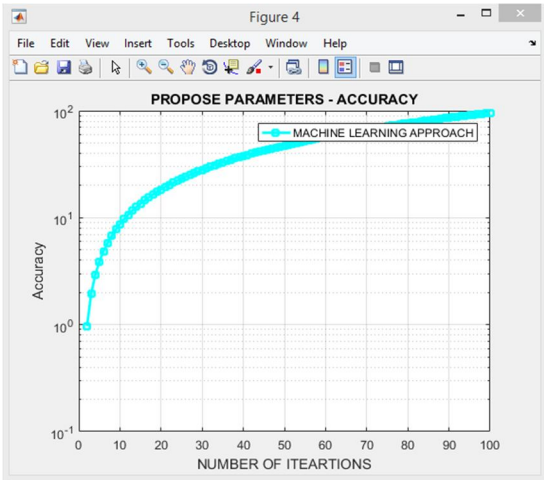

Figure 11. Accuracy

The accuracy of a test is its ability to differentiate the patient and healthy cases correctly. To estimate the accuracy of a test, we should calculate the proportion of true positive and true negative in all evaluated cases.

Table no. 1 Performance Parameters MSE proposed parameters

Parameters Metrics	Mean Square error rate	XDB-Index	DB-INDEX	Accuracy	RMSE
Values	0.022043	0.0057	0.0042	98	0.0648

Table 1 . Describes that the performance parameters in proposed work (Mean square error, XDB-index, DB-Index, and accuracy).

A. Comparisons With Other Techniques

To check the performance of our proposed algorithm, we have considered the concepts of NN and DNN . For comparison, an average value is considered by taking the mean of minimum possible and maximum value of the each concept.

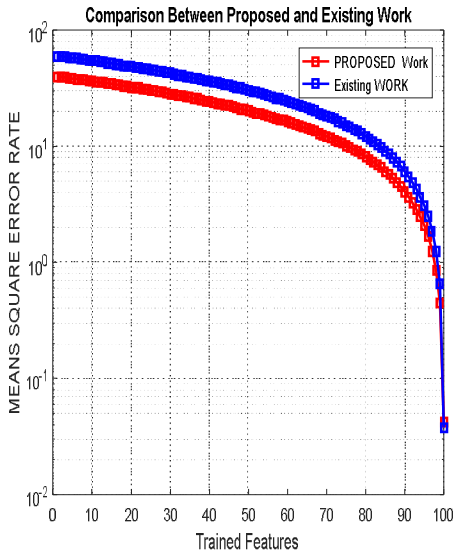

Figure12 Comparison between mean square error (Existing and Proposed Work)

The figure shows that the comparison between mse existing and proposed work in various types of datasets. We improve the performance parameters as compared to previous one.

Table no. 2 Comparison between MSE Proposed and existing work (ABC,GA and BFOA) Dataset

Parameters Metrics	MSE (Existing)	MSE(Proposed)
MSE (Mean Square Error Rate)	0.038	0.022043

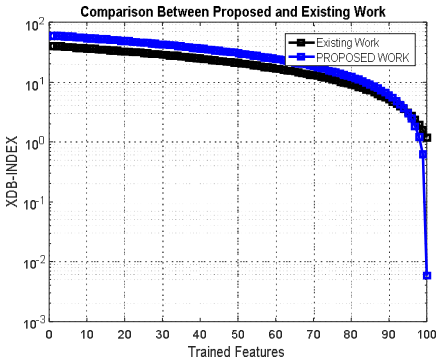

Figure 13. XDB-Index (Comparison between existing and proposed)

The figure defines that the comparisons between proposed and existing work. We improved the performance of the XDB-Index result using DNN and existing one is ABC and GA.

Table 3 Comparison between XDB-Index (proposed and Existing Work)

Parameters Metrics	Proposed Work	Existing Work
XDB-Index	0.0057	1.179

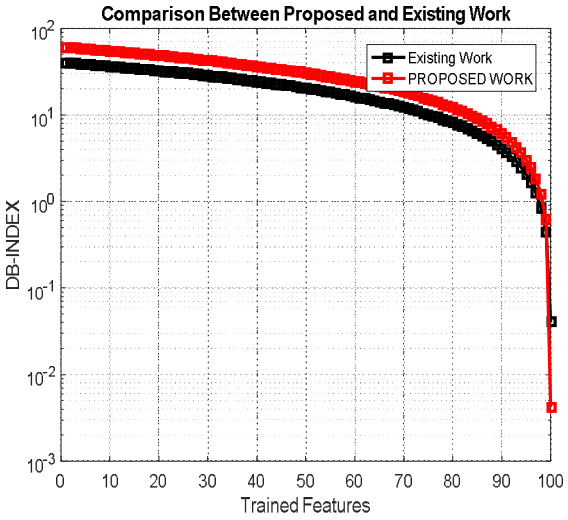

Figure 14. DB-Index (Comparison between existing and proposed)

The figure defines that the comparisons between proposed and existing work. We improved the performance of the DB-Index result using DNN and existing one is ABC and GA

Table 3 Comparison between DB-Index (proposed and Existing Work)

Performance Metrics	Proposed Work	Existing Work
DB-Index	0.004	0.0402

VIII. CONCLUSION AND FUTURE SCOPE

In this research work, explains the task of image clustering method is used to divide the data into clusters. The single step pre-processing of an image is done to make it suitable for segmentation. Marr-Hildreth algorithm used for detects the regions based in the satellite images. In clustering used for segmentation in this a membership value is assigned to each data point corresponding to each cluster centric on the basis of distance between the cluster center and the data point. The Segmentation algorithm receives the data in the form of matrix as n×m where n and m represents the number of data and number of parameters respectively. Feature extraction used for principle component we detect the text based features in the satellite images and reduce the features based on ACO algorithm. Classify the satellite images based on performance parameters.The presentations are associated in terms of external metrics and interior metrics. The external metric is accuracy performs the evaluations based on ground truth. The internal metrics are Davies-Bouldin (DB) index, Xie-Beni (XB) strength index and Mean Square Error (MSE) performs the evaluations without ground truth. In this research work, a new optimization algorithm for segmentation is proposed with the intention of improving the segmentation in satellite images using support vector machine. The overall steps involved in the proposed technique in three steps such as, i) Pre-processing, ii) segmentation using MHA-SIFT algorithm, and iii) classification using ACO and Deep Neural Network classifier. Classification accuracy of the proposed algorithm in satellite image classification is calculated and the performance is compared with various clustering algorithms. In future work, K- meanoid clustering can be used to divide the data into the cluster form. The hybrid approach (Component analysis and firefly) can be used to reduce the false acceptance, false rejection and mean square error rate.

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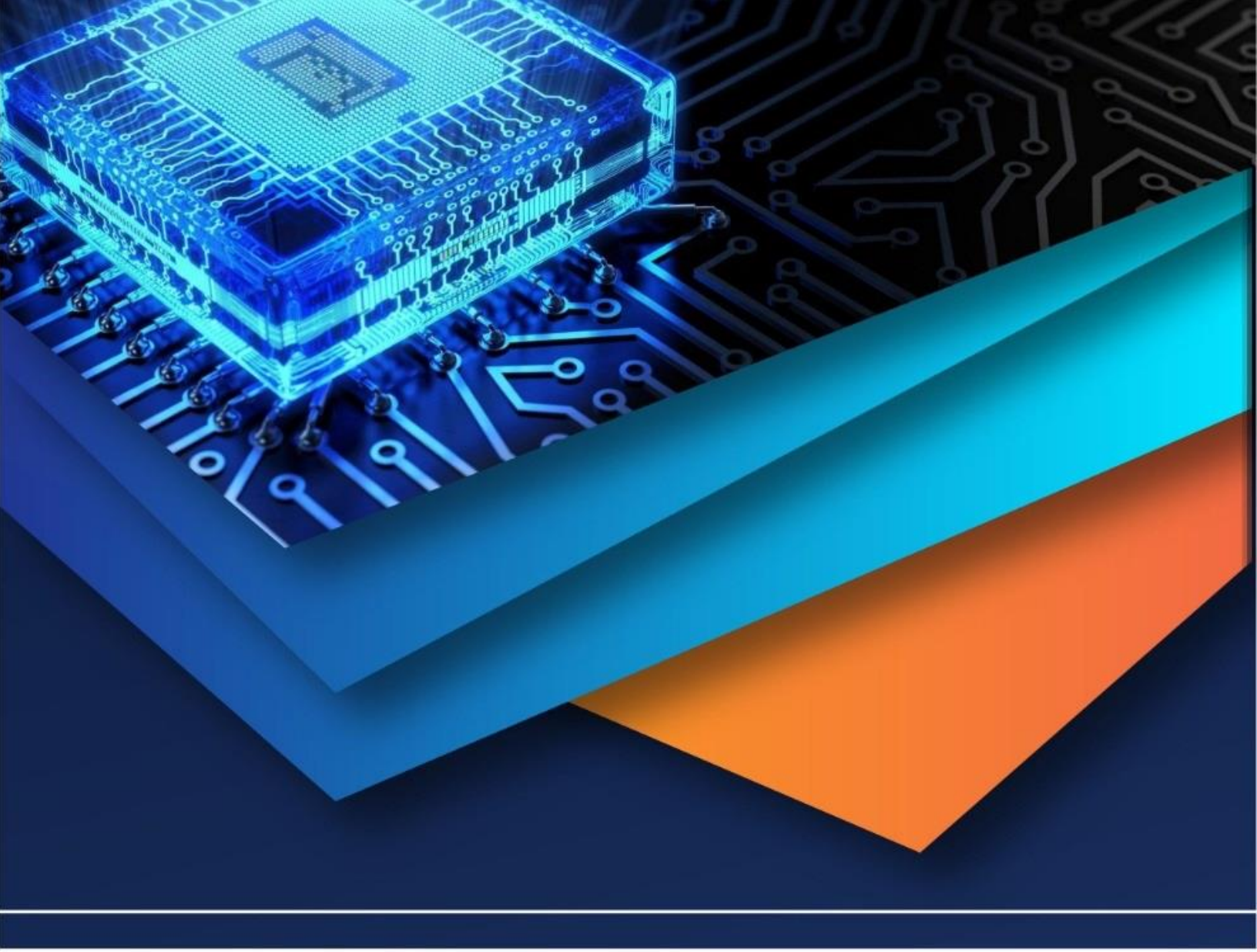

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