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# Content based Image Retrieval using Firefly algorithm and Neural Network

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***Abstract:*** Extensive digitization of images, paintings, diagrams and explosion of World Wide Web (www), has made traditional keyword based search for image, an inefficient method for retrieval of required image data. Content-Based Image Retrieval (CBIR) system retrieves the similar images from a large database for a given input query image. Today, various methods for implementation of CBIR which uses low-level image features like color, texture and shape are being found out. In this thesis, global image properties based CBIR using a Firefly algorithm and neural network is proposed. At first, the image is trained with firefly about the features of images in the database. The image features considered here are color histogram. The training is carried out using neural network algorithm. Information retrieval is an information request to a meaningful set of references in the process. Therefore, this problem can be solved by using various algorithms. This work has made several recent works to perform image segmentation based on local information into an image representation. But radon transform and Firefly algorithm has been proposed to improve the retrieval rate. This trained network when presented with a query image retrieves and displays the images which are relevant and similar to query from the database. The results show a considerable improvement in terms of precision and recall of image retrieval. The proposed method is applied on the different Datasets.

***Keywords***: *CBIR; Firefly; Neural Network*

## I. INTRODUCTION

Content-Based Image Retrieval (CBIR) [1] aims to construct meaningful descriptors of physical properties from images to facilitate efficient and efficient retrieval. CBIR research activities are performed in three main directions: based on global image attributes, based on region-level features and based on relevant feedback [2]. The image segmentation method of image retrieval based on region tries to pass at the object level to overcome the shortcomings of global features of the image. However, these methods mainly depend on the segment result. Firefly is an interactive process, by which the user feedback on the previous search results to optimize the retrieval of a particular query. In this work, an integrated CBIR systems [3] is proposed, which is based on the global image properties and help using neural networks [4] for effective and efficient image retrieval. Three Visual features in the proposed method are used, namely, color, texture, and the edges of the image [5]. Nature of much of this work is different from other CBIR identified as defined below:

- Low-level image features- color space, the color histogram, normalized R2 side flap in the color mode used in our method [6].
- Search technology (training and testing)-training is on Neural Network, understand images in the database attributes and characteristics, in order to render queries image that can be used on the image about the search process. Neural networks are used to study methods of surveillance, used to train the network. And test using a previously trained network to retrieve association with queries image and similar images [7].
- In historical research, image databases are created for archives in areas that include arts, sociology, and medicine. In a small collection of images, simple browsing can identify an image. This is not the case for large and varied collection of images, where the user encounters the image retrieval problem. An image retrieval problem is the problem encountered when searching and retrieving images that are relevant to a user's request from a database. To solve this problem, text-based and content-based are the two techniques adopted for search and retrieval in an image database [8].

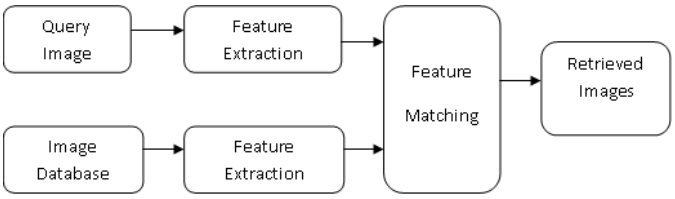


Figure.1 CBIR image retrieval

Text-based retrieval [9] is non-standardized, because different users use different keywords for comments. Textual descriptions are sometimes subjective and incomplete because they do not represent well the complex image features. The main goal of CBIR [10] is the efficiency of the image indexing and retrieval, thereby, reducing the need for manual intervention during the indexing process.

We are not aware of any deterministic way of saying what kind of query the user may present to the image database system. However, using common sense, we may list some uses of still images as below [11]:

- Illustrations of text documents
- Fingerprint and face recognition for secure applications
- Military applications, such as target recognition
- Display detailed data for analysis, for example. Medical image
- Official record of design data for future use, such as architectural design
- Remote sensing, looking for unusual systems, for example. Space Technology
- View images for online shopping

- Help artists seek inspiration

As we can imagine, the needs of a user of CBIR system may vary a lot.

During the past decade, remarkable progress has been made in both theoretical research and system development. However, there remain many challenging research problems that continue to attract researchers from multiple disciplines. Information retrieval [12] is the process of converting a request for information into a meaningful set of references. So, this problem can be solved by using various algorithms. Several recent works have been proposed to carry out image segmentation for integrating local information into the representation of the image [13]. But utilization of radon transform with firefly optimization algorithm has not been introduced yet to enhance the retrieval rate. So, this scheme is opted in proposed work using combination of AI (Artificial Intelligence) as well as swarm optimization method.

## II. RELATED WORK

Kommineni Jenni et.al [2015] explained Content-based image retrieval (CBIR) as a technique that enables users to extract images from queries based on a database that contains a large number of images. . The image database used in the experiment containing 1,800 color images from Corel photo galleries. This CBIR method significantly improves the accuracy of the retrieval results. Apurva Sharma et.al[2014] clarified a capable calculation rely on upon SURF, colour histogram, SVM and NN. Author has proposed a strategy for figure Matching relied on SURF Algorithm utilizing SVM Classifier, NN nourish forward and colour histogram. CBIR alone with Surf and SVM Method couldn't give better results. Consequently, utilizing CBIR with Surf, SVM, NN and colour histogram has given improved results. A. N. Ganar. et.al [2014] proposed image Retrieval system by Using Colour, Texture and Shape Features. This research shows the consolidation of the colour, shape, and surface data in CBIR to accomplish effective improved results. Prof. C. S. Gode et.al [2014] proposed image retrieval based on color, texture and shape as an extensive research area. In this paper, the authors has proposed a framework for combining all three, color, texture, and shape information, and achieve higher retrieval efficiency. The image and its complement are divided into non-overlapping tiles of equal size. Suraya Abu Bakar et.al [2013] introduced an option approach for Content Based Image Retrieval (CBIR) utilizing Scale Invariant Feature Transform (SIFT) calculation for parallel and dim scale pictures. The inspiration to utilize SIFT calculation for CBIR was because of the way that SIFT was invariant to scale, revolution and interpretation and in addition, is a part of the way invariant to relative bending and light changes. T. Dharani et al.[2013]gives the review by considering Content Based Image Retrieval viz. marked and unlabelled pictures for investigating productive picture for diverse picture recovery process viz. D-EM, SVM, RF, and so on. Nidhi Singh et.al [2012] has solved the problem of content-based image retrieval in dynamic environment. This is not feasible for systems that analyze images in real time, where images are stored or added continuously.

## III. SIMULATION MODEL

In this research work, the features are extracted of the image sets using radon transform method algorithm, feature reduction using firefly algorithm [14] and train the Neural Network [15] on the basis of the features extracted [16] and also to test the image on the basis of the features at the database and the features extracted of the image to be tested [17]. Three matrices have been used for simulating, nam16ely, FAR (False Acceptance Rate), FRR (False Rejection Rate) and Accuracy [18].

Following are the steps used for explaining the execution the overall proposed system.

**Step 1 :** Start

**Step 2 :** Upload the given dataset that is collected in the database. Database can be in form of the image, text etc but in this work images are taken as database. In the database, there are number of images that are in different size and each with different number of pixels [19].

**Step 3 :** After uploading the database, features are extracted from the image and in this work, feature extraction is done using radon transform in which various features are extracted from the image [20] and train the features of image.

**Step 4 :** In the next step, features are reduced using some algorithm .In this work feature reduction is done using the firefly algorithm. Firefly algorithm as an optimization algorithm for various applications [21]. In the design of real-world engineering problems, multimodal optimization problems has been proved that can be efficiently designed and solved by firefly algorithm.

**Step 5 :** The neural network is implemented for the classification purpose. It has basically two steps:

- Training phase and,
- Testing Phase

**Step 6 :** The classification of images will be done using NN. Neural network is a network of “neuron like” units entitled as nodes. This neural evaluating method is utilized in fields of optimization, classification, as well as control theory and also for solving regression problems [22]. NN are very effective in case of classification problems where detection and recognition of target is required. NN is preferred over other techniques due to its active nature. This active nature is attained via amending the weights according to final output and also to applied input information. This amendment of weights takes place iteratively until desired output is obtained. And this weight adjustment of network is known as “learning” of neural system.

**Step 7 :** Stop.

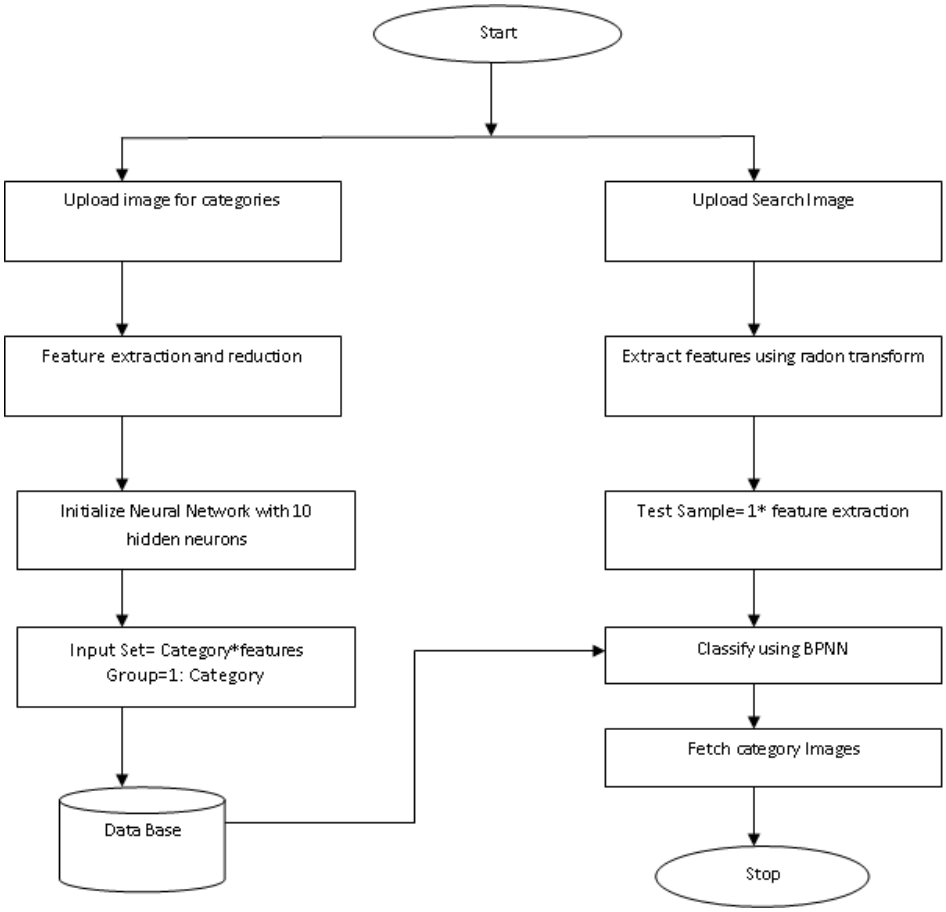


Figure 2. Proposed Flowchart

## IV. SIMULATION RESULTS

This section shows the results obtained after simulating the work that is proposing a novel algorithm based on AI as well as swarm optimization method for feature extraction and feature reduction, and neural network which is utilized as classification method.

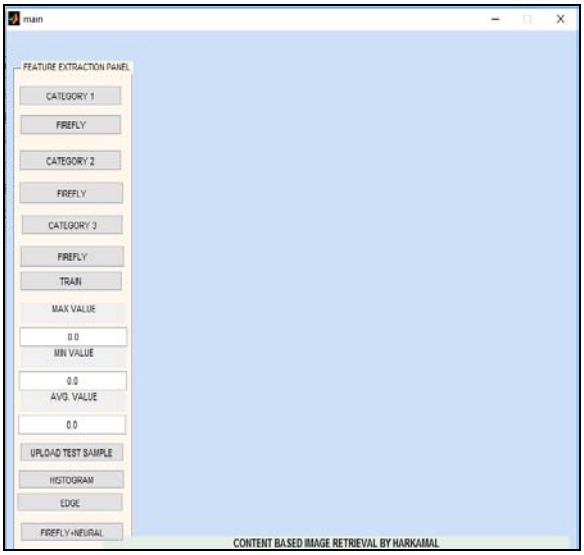


Figure 3. GUI interface

The figure above shows the main graphic user interface where database is stored. In this, there is one feature extraction panel from where we can extract different number of images

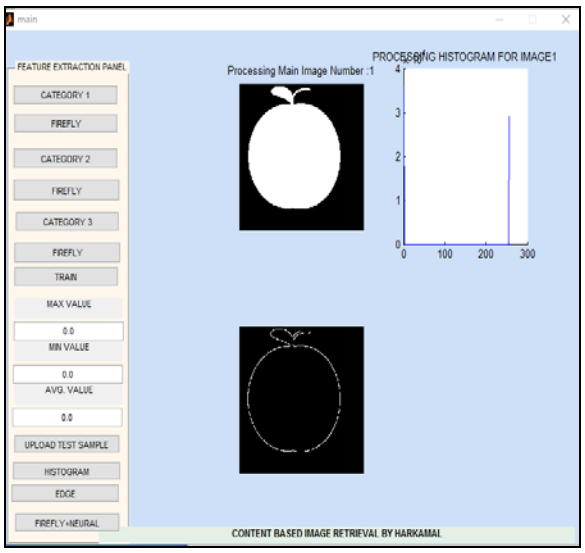


Figure 4. Select category 1

Above figure shows the number of categories in which any image from the database can be selected and then extract the image features in category 1 and same process will be continued for category 2 and category3 and later histogram is created after the feature extraction.

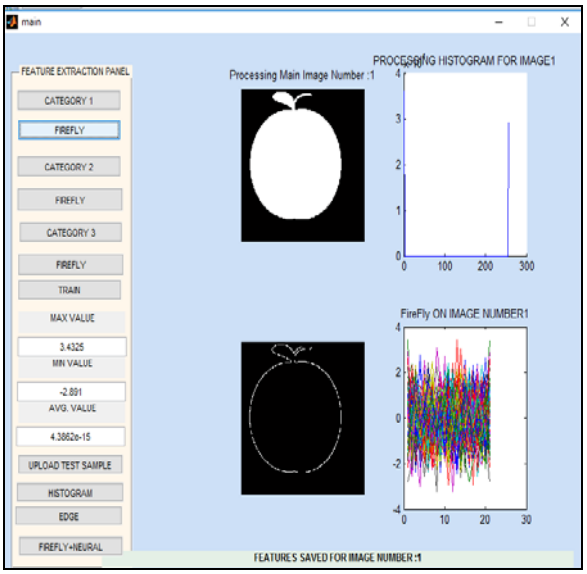


Figure 5. Select image category1 and apply firefly algorithm

After that, we have to select the firefly algorithm and the result in image1 is shown in figure and in this, three values are being found, where max value=3.4325,min value=-2.891 and average vale= 4.38625

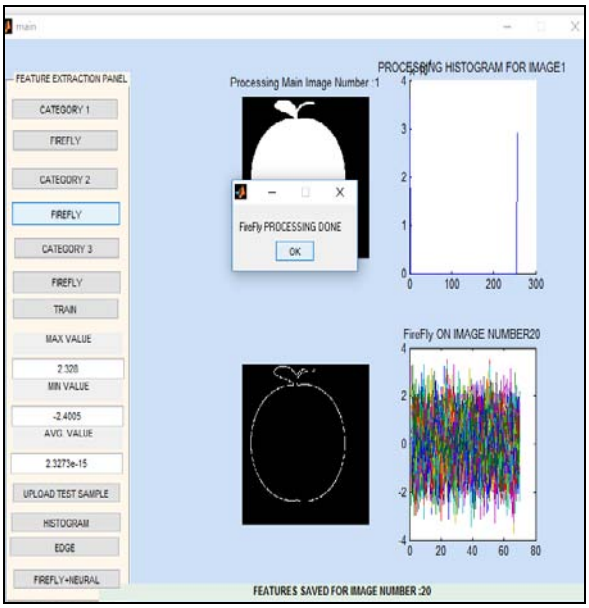


Figure 6.Apply firefly algorithm on category 2

The figure shows the firefly result on category 2 where three values outcome shows the max value=2.328 min value= -2.4995 and average value =2.327e-15.

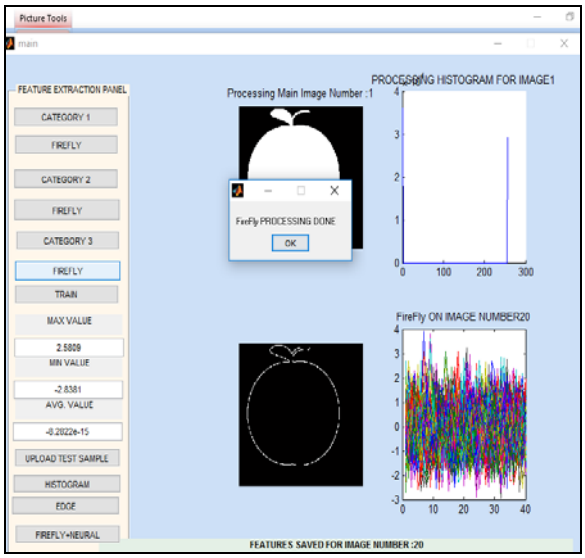


Figure 7. Select image category3 and apply firefly algorithm

The above figure shows the firefly result on category 3 where three values outcome shows the max value=2.5809 min value= -2.8381 and average value =-5.2822e-15. In each category the result is different.

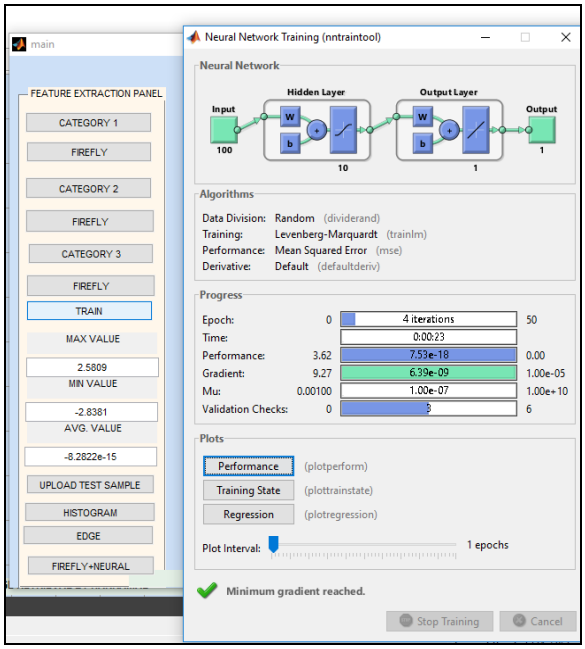


Figure 8.Train the image with neural network

After applying the firefly algorithm on each category, we train the extracted image using the neural network. In this, we train with the levenberg-marquardt algorithm and results will be shown in 4 iterations.

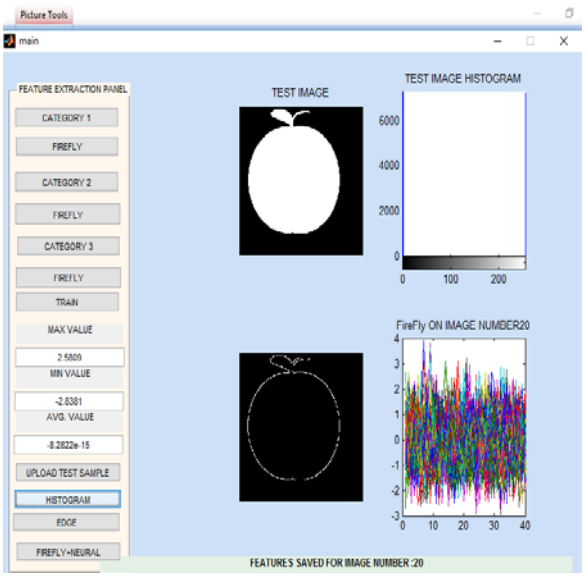


Figure 9. Histogram is created after extraction

In Above figure, after uploaded test sample the histogram is created in panel.

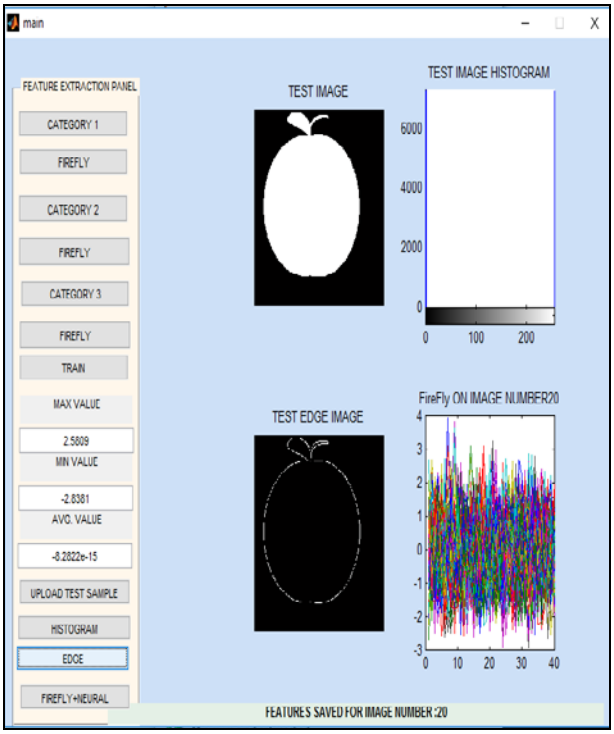


Fig.ure 10. Edge formation of image

After uploading of data test sample and histogram creation, the test edge image is formed and test is done on image that shows the result with histogram and applies the firefly algorithm on image which gives the number 20.

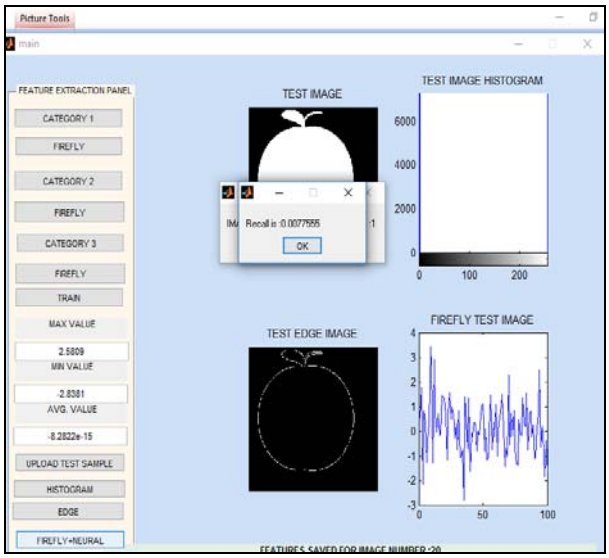


Figure 11. Applying firefly and neural network algorithm

In above figure after applying firefly and neural the recall rate =0.775555 by applying recall formula. Recall is defined as the division of relevant documents and retrieved documents with the relevant documents.

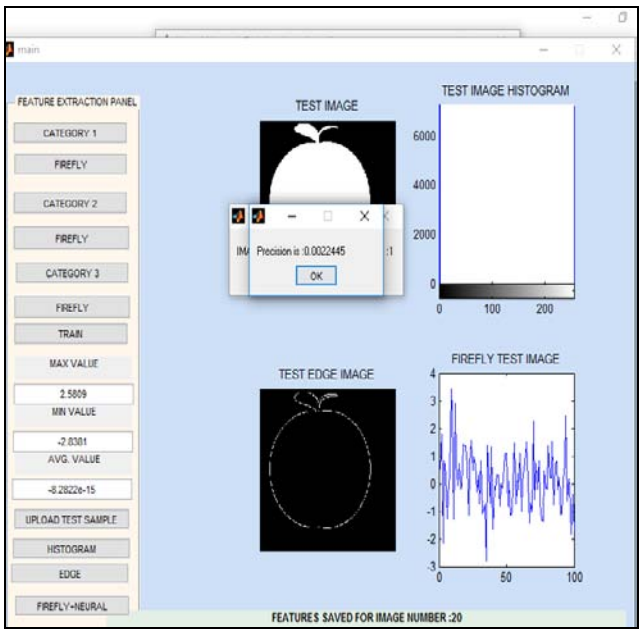


Figure 12. Applying firefly and neural network algorithm

In above figure after applying firefly and neural the precision=0.0022455 by applying recall formula. The recall is defined as the division of relevant documents and retrieved documents with relevant documents.

The figure given above shows the results of diacom image. Below table shows the average performance parameters for proposed method Precision, Recall rates and accuracy are a standard way to evaluate retrieval results for information retrieval systems. In this work, there are number of images and each image is different in pixels. The values of precision, recall and accuracy comes from the various set of images that are in the database and neural network trained those images and calculates the values of the images and each value is different in terms of precision, recall and accuracy.

Table I. Performance table of Recall rate, Precision rate and Accuracy

| Recall rate | Precision Rate | Accracy |
|---|---|---|
| 0.007775555 | 0.0022445 | 97.06 |
| 0.007654515 | 0.0023245 | 98.51 |
| 0.007526125 | 0.0023225 | 97.22 |
| 0.007765455 | 0.0024245 | 98.55 |
| 0.007625555 | 0.0022435 | 95.22 |

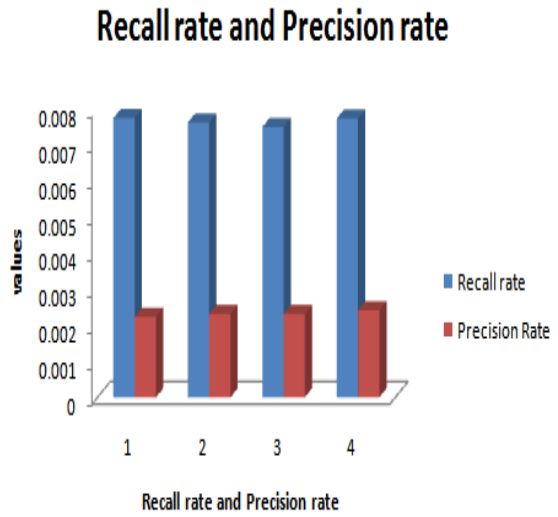


Figure 13. Performance classification with Recall and Precision

Above figure shows the comparison of recall rate and precision rate. X-axis demonstrating the parameters considered and the Y-axis is showing the values being obtained. The figure clearly depicts the value of recall rate is more that is 0.007775555 whereas the value of precision rate is less that is 0.002312.

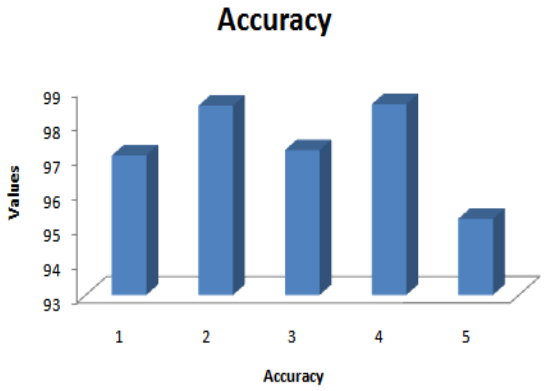


Figure 14. Performance classification with Accuracy

Above figure is for the accuracy performance metrics. X-axis shows the accuracy and Y-axis shows the values obtained. Average for accuracy is 97.312.

## V. CONCLUSION

In this thesis, different techniques are proposed for a CBIR system using neural network and firefly algorithm. The color distribution histograms are used as color information of an image. Also, normalized r2, rgb pattern are used to help for characterizing the images. The use of neural network has considerably improved the recall rate and also retrieval time, due to its highly efficient and accurate classification capability. Also, the levenberg-marquardt algorithm has increased the retrieval precision due to its capability of minimizing the error during training process itself. Future scope include implementing the CBIR system considering more low-level image descriptors and highly efficient deep learning neural network, which might prove to be very fast and precise one.

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