AN EFFICIENT APPROACH FOR CONTENT-BASED IMAGE RETRIEVAL USING LION OPTIMIZATION

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Abstract: There is increase in size of image acquisition and data storage methods and also there is increase in database of images. Earlier textual description and manual annotation of images were used for retrieval of images that was a time consuming task. The need of the hour is to manage the large collections through efficient systems called content-based image retrieval systems. In this case visual contents of the image like shape, arrangement and colour of the objects is present in the images are also considered along with the associated data with the image. As compared to other conventional method of image retrieval these systems are more efficient and fast. In this paper we have proposed a new system in which features are extracted using Gabor filtering which are further optimized using lion optimization. In the end the classification is done using decision tree method. The proposed method is tested in terms of various parameters that show improved results as compared to other existing approach used for same purpose.

Keywords: **Content based image retrieval, Gabor filter, Lion optimization, Decision tree, Image retrieval**

I. INTRODUCTION

Now a days there is increase in size of image database by the development in technology. Development in image retrieval systems comes in existence by increase in various storage devices, high speed internet and increase in capacity [1]. Earlier the images were manually annotated and tags, keywords and texts were used to describe it that is known as metadata. In case of large datasets manual annotation is cumbersome that makes it expensive, time consuming and there is need of huge amount of manual labour. To describe the characteristics of image different choice of words can be used by two different users that results in irrelevant retrieval results [2]. Due to all of these shortcomings content-based image retrieval (CBIR) has been developed.

Visual contents present in the image are used to search the images in case of content based methods. Spatial, shapes, texture and colour information present in the image is included in visual contents. On the basis of present visual information images in a large database images are searched using CBIR system. CBIR systems are efficient, fast and cost effective for browsing.

First commercial CBIR was IBM's Query by Image Content (QBIC). VisualSEEk, Vhoto, Excalibur, WebSEEk, Virage, Photobook and Berkeley's Blobworld are other developed systems [3]. Followed by feature extraction methods other various segmentation techniques incorporated with content based retrieval. After that from extracted features the best possible matches is find out between the images is computed. To get the maximum efficiency various researchers have started implemented a neural network [4].

Animal species multitude is endowed by earth in which dimensions, spaces and colours are used to uniquely identified each species [5]. It is challenging task to extract the above mentioned features. Animals have different attributes such as number of horns, stripes, spots. These are the attributes that differentiate them from each other. So, a single technique does not work to accomplish this work [6]. Various methods advantages are combined to diverse this scheme that gives best possible results.

This complete paper is divided into different sections. The first section gives the detail introduction about CBIR and the problem in existing work due to which there is need to propose a new approach. The second section gives review of existing work done by various researchers. The third section covers the brief details about various approaches used in this work and results obtained using existing and propose approach is given in the fourth section of this paper. In the end we have given short summary of what concluded from results.

II. EXISTING WORK

There is increase in size of image database due to advancement in methods of data storage and image acquisition. The earlier used methods for image retrieval are manual annotation of textual and images description. Content-based image retrieval efficient systems are used to manage large collections. In this case visual contents like shape, arrangement and colour of the objects are analyzed instead of associated data with the image. As compared to conventional image retrieval method use of this system will give more efficient output. **Sneha Jain, et.al, (2016) [7],** have explained the neural network based image retrieval of species. For retrieval of images feature extraction techniques have been implemented and morphological operations like segmentation techniques have been performed on the images. In number of computer vision problems, neural networks have been

used as a solution and in their case they have used neural network to train the extracted features. Then comparison is performed on feature vectors of database images and query image. On the basis of similarity measurement between them images retrieved are indexed.

Another one is Thepade's Sorted Ternary Block Truncation Coding (TSTBTC) which is the improvement to BTC technique. For extraction of features for video another technique is transform feature extraction. The transform and color features of a video cannot be exposed by existing methods. So, Vector quantization is considered as popular technique for lossy data. Both transform and color features can be extracted using TSTBTC and VQ as hybrid features can be operated by VQ. In 2016 VQ was first time used in CBVR. **Prof. Rahul Gaikwad, et.al, (2016) [8],** have also described the accuracy and efficiency of this technique with different color spaces.

Various communities of scientists, engineers and radiologists has gained interest in new ways to index, process and retrieve medical images by the huge growth of medical imaging data produced in the past few years. In medical imaging archives use of content based image retrieval is considered as best by researchers and practitioners. An overview of multimodal information retrieval for medical imaging studies has been presented by **Eduardo Pinho, et.al, (2016) [9]**. Along with it they have also given the architecture of a solution for automatic medical image classification and retrieval using combination of image and text queries. Over extensible open source medical imaging archive software is used to implement and design the complete solution. Due to availability of explosion of storage and multimedia devices individuals and corporations have large image databases. This leads to increase in the demand for searching among large databases of images. Major problem of text-based image retrieval is related to annotation. Due to size of the information that needs indexing and subjective human perception of images the problems are often impossible. To remove these problems F. Sabahi, et.al, (2016) [10], have proposed content-based image retrieval systems. In order to overcome the gap between low level and perception features there is need to match the human visual system as a key hindrance. So Hopfield neural networks based new unsupervised method is proposed by them that seeks to model the visual memory of human that results in increase of retrieval efficiency and semantic gap reduction. The comparison results show that use of proposed method gives better results as compared to boltzman deep learning and feed forward backpropogation neural network based methods.

For computer aided diagnosis of lung cancer discriminating the lung nodules malignant and benign is an important task. Malignancy of the nodules is divided into five levels by the use of Lung Image Database Consortium (LIDC) database. **Guohui Wei, et.al, (2017) [12],** have proposed the content-based image retrieval (CBIR) scheme for classification of the nodules with different ratings. From LIDC lung CT database a lung nodule dataset is assembled and then each nodule are depicted by calculating the two nodule density dependent features. Then ten most similar reference nodules are searched using CBIR scheme for each queried nodule. Lung nodules malignancy is predicted by computing the malignancy probability. When classifying nodules moderately suspicious for cancer and highly suspicious the area under the curve (AUC) obtained was 0.6901 and 0.6655 is accuracy. On other hand 0.8659 of accuracy and 0.9231 of AUC is achieved using proposed approach on differentiating malignant and benign cases. Due to development of information security there is increase in demand of image retrieval as it has become part of everyone's daily life. In research field content based image retrieval has become an important concept in which there is need of feature extraction of images and image feature descriptors are used to extract the visual feature of image. Shreela Pareek, et.al, (2017) [13], have given the review on various image feature descriptors and compared them on the basis of recall and precision. Descriptors comparison results are evaluated using corel dataset and as compared to other the retrieval accuracy of waveform transform is higher. A novel content-based remote sensing (RS) image retrieval system has been presented by Osman Emre Dai, et.al, (2018) [14]. Following things consists are:

- RS image both spectral and spatial information is characterizes using image description method.
- RS image descriptors effectively exploit the sparsity using supervised retrieval method.

Three different novel spectral descriptors characterizes by proposed image description method are:

- Raw pixel values
- Simple bag of spectral values
- Extended bag of spectral values descriptors

Bag of visual words approach based on well-known scale invariant feature transform is considered to model the spatial content of RS images. Use of RS image retrieval based novel sparse reconstruction method helps in achieving the conjunction of spectral and spatial descriptors. In the framework of classifier based on sparse reconstruction a novel measure of label likelihood is considered in proposed method that generalizes the original sparse classifier to the case both multilabel and single label RS image retrieval problems. In the end a strategy is introduced to improve the performance of retrieval. This strategy exploits the sensitivity of the sparse reconstruction based method to different dictionary words. Then conventional global image representation based effective image retrieval method is proposed by **Keundong Lee, et.al, (2018) [15].** This helps in improving the retrieval accuracy by constructing the multi-stage image retrieval pipeline with feature augmentation. The relevant images are boosted by suppressing the irrelevant images and feature augmentation is done by introducing the novel weighting scheme. Then re-rank or update the shortlisted retrieved images by leveraged the relationship between database images. Google-landmarks dataset is used to evaluate the proposed method and its results shows that proposed method is effective as compared to other existing methods used for same work.

III. VARIOUS APPROACHES

3.1 CLAHE (Contrast Level Adaptive Histogram Equalization)

This is a computer image processing technique used for improving the images contrast [16]. Several histograms are computed by adaptive method that makes CLAHE different from ordinary histogram equalization method. The distinct section of the image is used to redistribute the lightness values of the image. All these things make it suitable for improving local contrast in each region of an image and also enhance the definitions of edges.

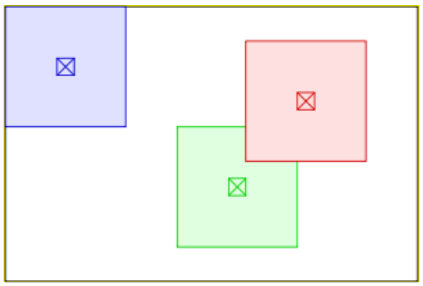

Fig 1: Neighbourhood pixel illustrations

Due to neighbourhood the pixels near to the boundary of the image have to be treated specially that would not lie within the image. Above blue pixel in the figure and image is extended by mirroring pixel lines and columns with respect to the boundary of the image [17].

3.2 Independent Component Analysis

Independent Component Analysis (ICA) is a computational method to get hidden values of random variables. ICA basically designed for multivariate data. ICA is somewhat related to Principal Component Analysis (PCA). But it is capable when PCA fails [18]. Document databases, digital images and economics fields are originated by analyzing the data used.

ICA Algorithm Steps:

1. *Make data to mean zero*
2. *Choose the number of components.*
3. *Whiten the data.*
4. *Choose random matrix.*
5. *Orthogonalised the matrix.*
6. *Do converged.*
7. *Repeat again.*
8. *Stop.*

3.3 Cuckoo Search

In intelligent research, cuckoo search deals with the optimization algorithm which is inspired by the brood parasitism of various cuckoo species using lying of their spawns in the shells of other species or birds. Some birds can involve direct struggle with the interfering cuckoos. For instance, if a crowd bird determines the spawns are not their individually, it will throw these eggs far away or simply unrestraint its house and build a new house away. Some species have changed in such a method that female cuckoos are often actual specialized in the imitation in standards and decoration of the spawns of a few selected host species. Cuckoo search flawless like breeding behaviour which can be functional for numerous optimization difficulties.

Three idealized rules are used by CS in which first one was that only one egg is lays by cuckoo and its egg is dumps in randomly chosen nest. Then high quality of eggs with best nests is carry over to the next generation. The third one is that there is fixed number of available host nests and host bird discover the cuckoo laid egg with the probability between 0 and 1. Some set of worst nests is the basis of discovering operates and then it is dumped from farther calculations.

3.4 Lion Optimization

Lions acts as a very socially persuaded of all harsh species which are having high planes of collaboration and antipathy. Lions are the particular concentration because of their durable erotic dimorphism in both community behavior and presence. The lion belongs to the wild felid having two kinds of social body. The very first is the residents and migrants. Residents always acts in groups which is called as pride. For every lion, the finest obtained clarification in approved iterations which is called greatest visited location, and throughout the optimization procedure is updated gradually. A pride ground is the zone that contains of each associate best stayed position. In every pride, particular females which are designated aimlessly go stalking. Hunters move near the prey to enclose and clasp it. The rest females change toward dissimilar positions of terrain [19]. Male lions in arrogance, wander in area. Females mate with some resident males lions. In every pride, new males are excepted from their parental pride and develop nomad when they spread maturity and also the power is less than local males. The algorithm steps are given below.

Step 1: Initialization of the random populations
Step 2: Intialization of the prodes and lions
Step 3: For each lion particle
Do select the random emale lion for the hunting
Each female lion select the best position in the pride
Weakest lion pride out from the population and become the nomad

Step 4: Each pride evaluate the imigration rate and become the nomad
Step 5: Evaluate the fitness function to select the best females and fill the mepty places which of the female lions which are migrated from the territory.

3.5 Decision Tree

A decision tree deals with the classification tool which deals with the tree-like graph structure of assessments and their possible evaluations includes unplanned events, resource costs, utility. It is an efficient way to display a procedure that only comprises conditional control declarations. Decision trees are normally used in operations study, specifically in conclusion analysis, to help identify an approach most likely to spread a goal, but are also a prevalent apparatus in machine learning field.
This type of process is a flowchart structure which is having internal node signifies a "test" on the feature such as whether a currency flip shows heads or tails and branch characterizes the consequence of the test, and each node characterizes a class such as decision occupied after calculating all characteristics. In decision exploration, a decision analysis and the carefully related effect diagram are castoff as a visual and logical decision support instrument, where the expected values of challenging alternatives are intended.

3.6 Gabor Filtering

In this approach the features are extracted using Gabor filtering. The Gabor filters are band pass filters which are used in image processing for various purposes like feature extraction, texture analysis, and stereo disparity estimation. In Gabor filters, the image is accessed and the magnitude as well as the direction of each component is filtered for optimization. After using Gabor filter we get a filter bank that will store the values of real parts of the images obtained. The direction of the picture of medical image obtained can change every time when the scaling and magnitude of the uploaded image is processed. Therefore the real values are preferred over complex values so obtained. So the images are divided into number of segments of real and complex samples as the magnitude of the image which must be high for the high contrast of the image.

IV. RESULTS AND SIMULATION

4.1 Results using CLAHE and SVM

Fig 2: GUI panel

The above figure shows the GUI panel in which the user interface controls are used and also the user is able to attract the machine. In the above figure two main buttons are used one for testing and one for training. Firstly the user will click on the training button to train all the categories.

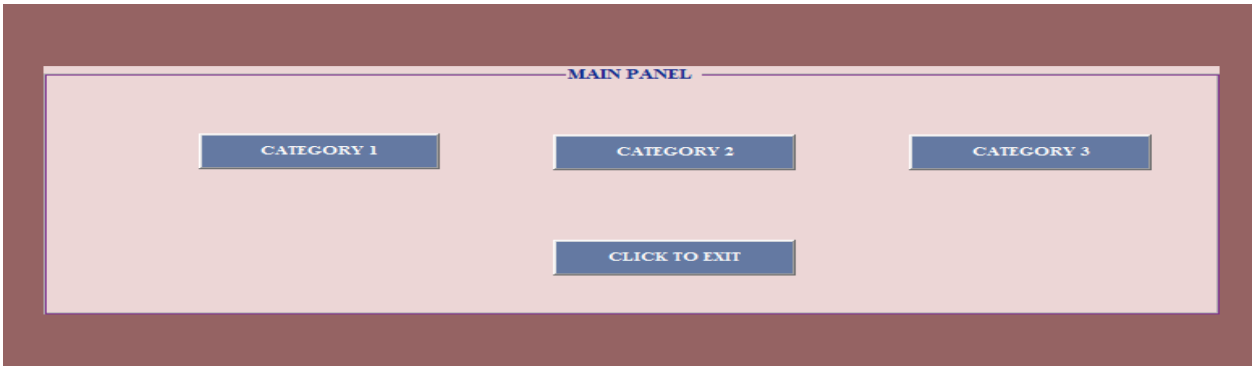

Fig 3: Training panel

The above figure shows the training panel in which the various pushbuttons are used and also the uploading of the categories are taken place. Each pushbutton consists of the training of the category which deals with the extraction and uploading of the input samples and also the feature optimization using cuckoo search.

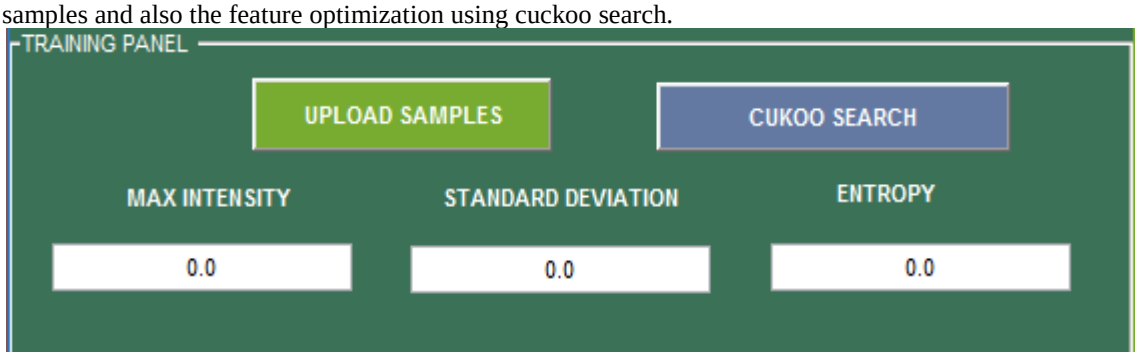

Fig 4: Operative Buttons

The above figure shows the operative buttons which will give the events scenarios while clicking on the above given buttons to see the resultant of the operations applied.

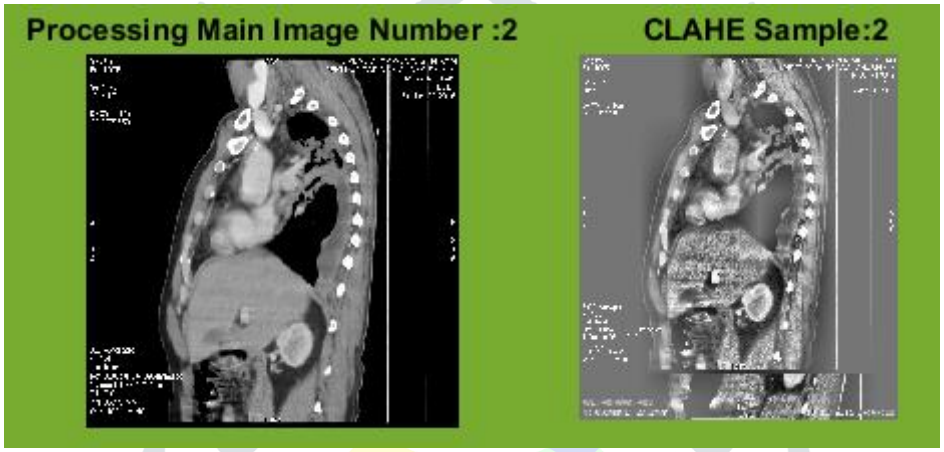

Fig 5: Uploading Panel

The above figure shows the category uploading and its resultant image as CLAHE which is named as contrast level image enhancement which deals with the adaptive equalization which will enhance the contrast levels of the image and equalize the neighborhood pixels of the uploaded image.

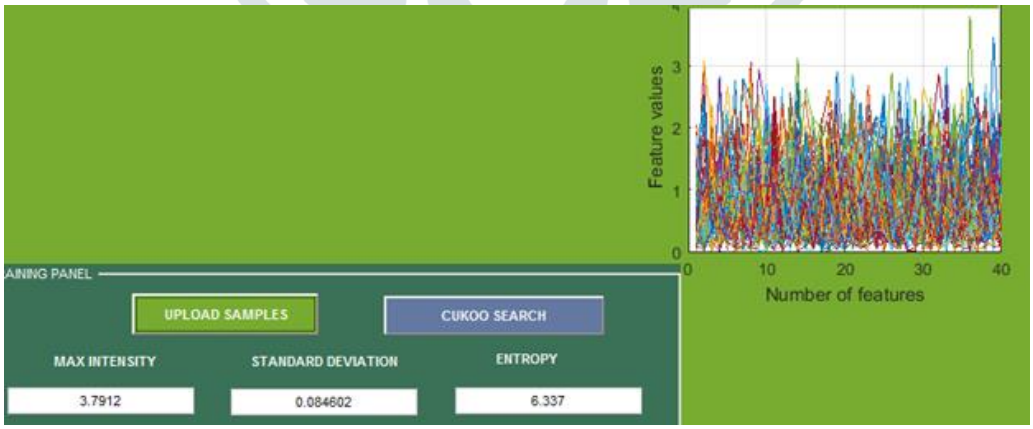

Fig 6: Extraction process

The above figure shows the extraction of the image which is based on feature extraction process using independent component analysis and also the feature vector is obtained which is shown in the graphical manner. Also the characteristics of the image will be evaluated in terms of maximum intensity of the image, standard deviations and entropy of the image.

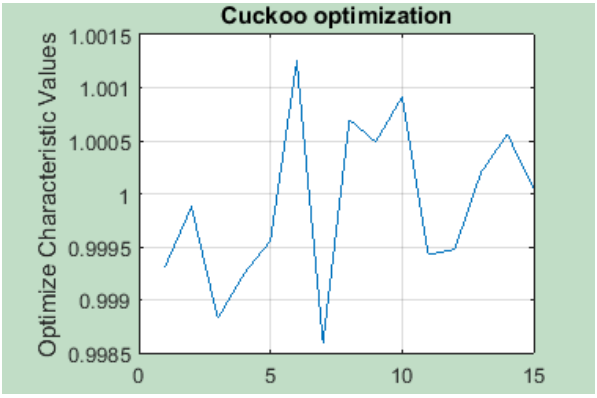

Fig 7: Optimization process

The above figure shows the optimization of the features using instance selection approach and also the relevant feature vector which is extracted from the feature vector. This completes the training process and now the next step is to move to the testing phase.

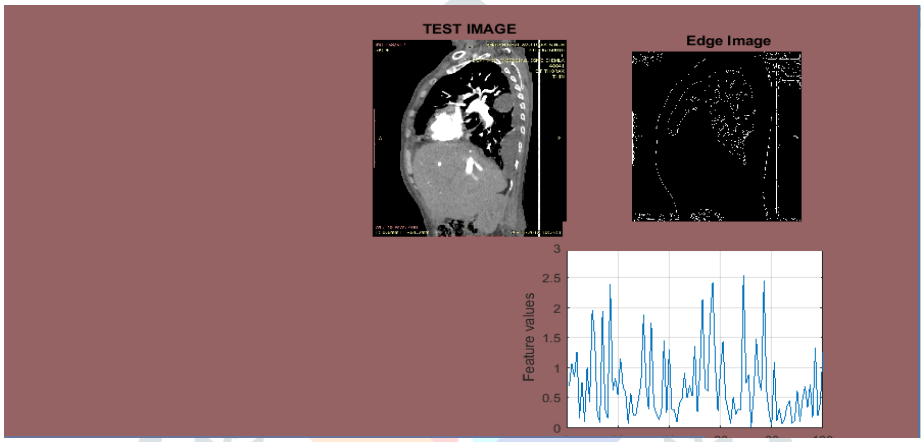

Fig 8: Testing panel

The above figure shows the testing panel in which the random test image is uploaded and the same training process is applied on the test image as applied on all the three categories which gives the high similarity matched to the category of the training images

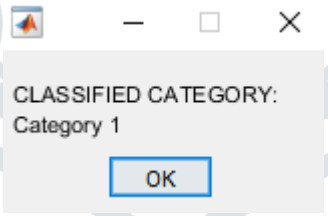

Fig 9: Classified Category

The above figure shows the testing result in terms of the classification which is done using Support vector machines and is able to perform the high classification results based on the training dataset.

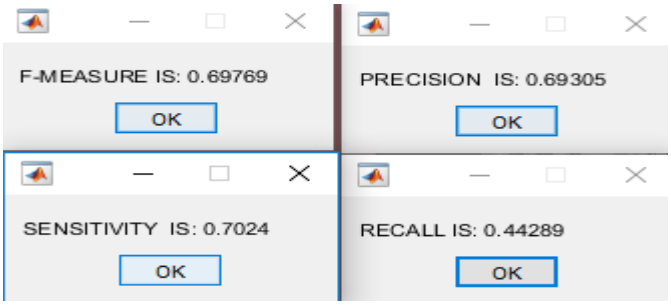

Fig 10: Performance Evaluations

The above figure shows the performance evaluations in terms of high sensitivity rate which shows the high true positive rate, high recall which is totally based on the recalling the training process to classify the things in the testing phase which also

must be high, high precision rate and high F-measure. If these evaluations are high then the performance will automatically increases with less error rate probabilities.

4.2 Results using Gabor Filtering and Decision Trees

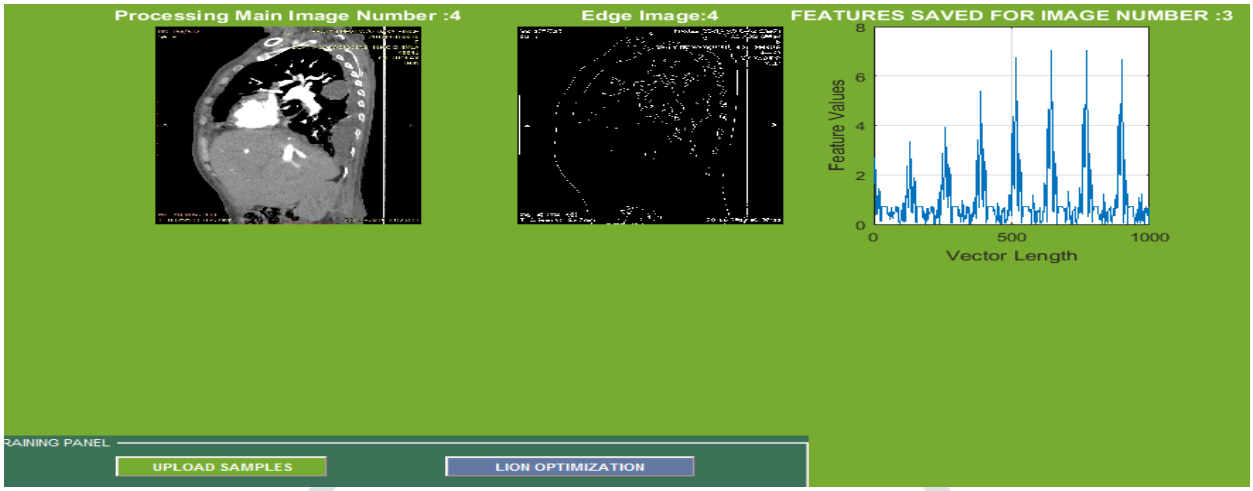

Fig 11: Training Panel

The fig 11 shows the training panel showing the uploaded original image, edge image and extracted feature vector using Gabor filtering and when the lion optimization button is clicked then we will get the optimized feature vector.

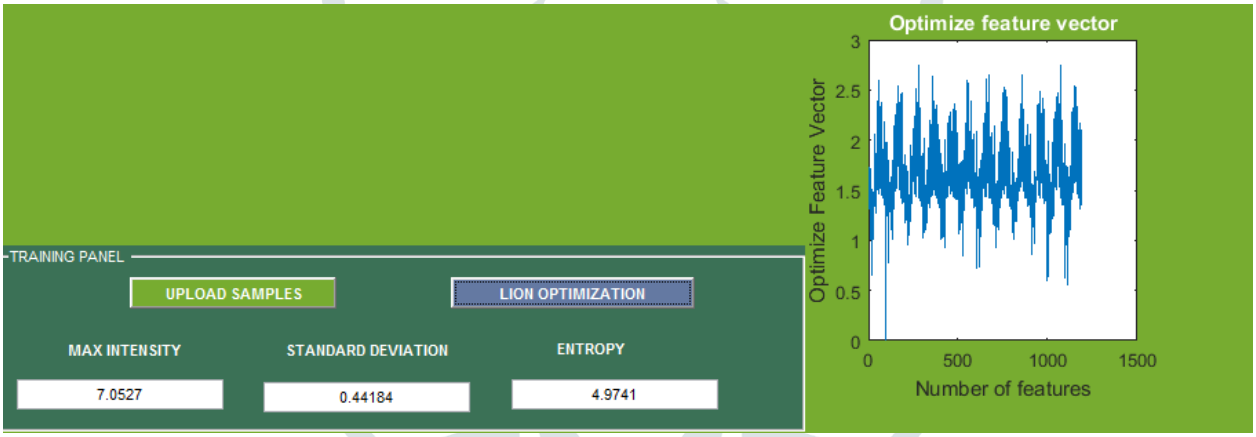

Fig 12: Optimize feature Set

The above figure shows the optimize feature vector using Lion optimization which is the dimension reduction process to make the processing of the vectors easy and reduces the complexity.

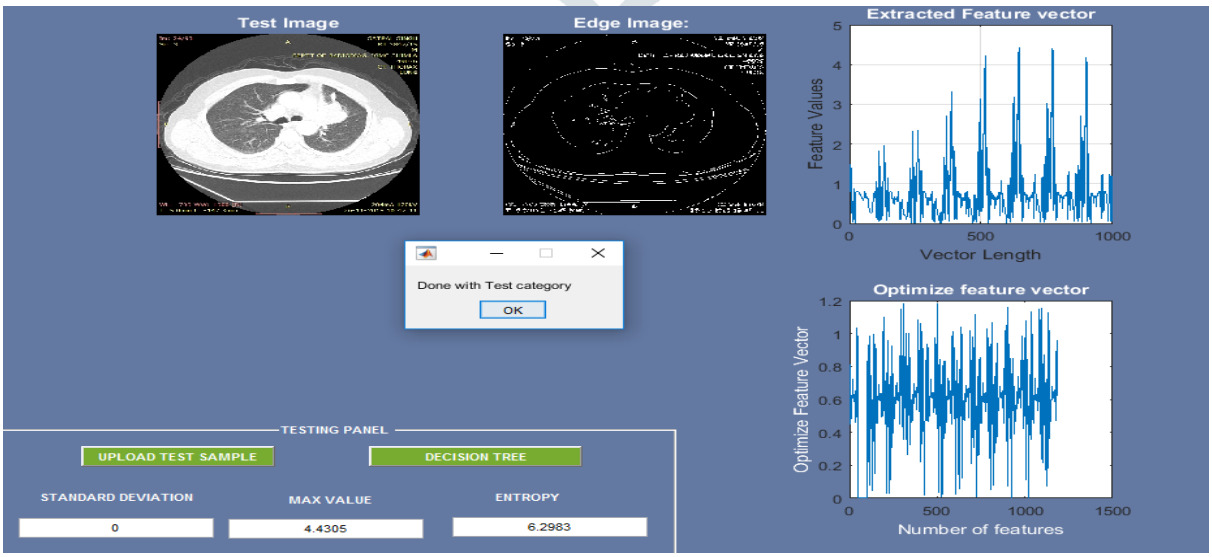

Fig 13: Testing Panel

The above figure shows the testing panel which deals with the classification of the category using decision trees. The figures shown are the uploaded test samples, edge detection and Gabor extracted feature vector. Also the optimize feature vector is extracted using lion optimization and the classification will be done using decision trees.

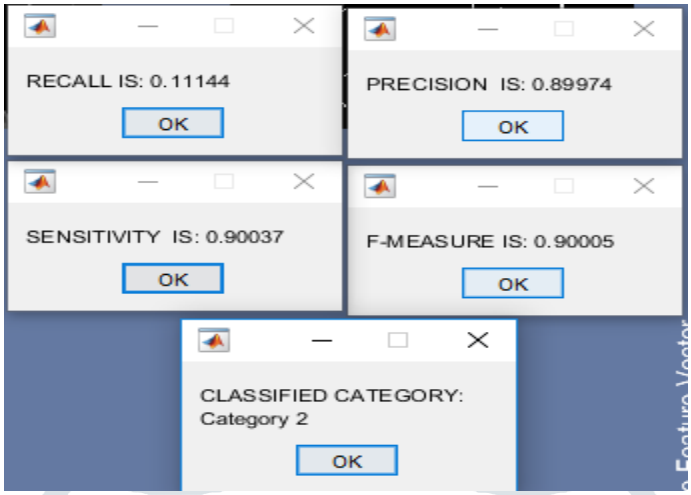

Fig 14: Performance Evaluations

The above figure shows the classification and the performance evaluations in terms of high sensitivity rate which shows the high true positive rate, high recall which is totally based on the recalling the training process. It also shows that the performance evaluation using Gabor and lion optimization with decision tree classification is somewhat better than the previous approach.

Table 1: Comparison table of results obtained using Cuckoo Search and Lion optimization

Parameter	Cuckoo Search optimization	Lion optimization
Recall	0.44289	0.11144
Precision	0.69305	0.89974
Sensitivity	0.7024	0.90037
F-Measure	0.69769	0.90005

The above given comparison table shows that the results obtained using lion optimizer are better than Cuckoo Search optimizer in terms of various parameters.

V. CONCLUSION

Now a days there is increase in size of image database by the development in technology. Development in image retrieval systems comes in existence by increase in various storage devices, high speed internet and increase in capacity. Earlier the images were manually annotated and tags, keywords and texts were used to describe it that is known as metadata. In case of large datasets manual annotation is cumbersome that makes it expensive, time consuming and there is need of huge amount of manual labour. The other disadvantage of text based retrieval system is that the description is available in one or two languages. To describe the characteristics of image different choice of words can be used by two different users that results in irrelevant retrieval results. The proposed approach is tested in terms of recall, precision, sensitivity and F-measure. The comparison table of results obtained using lion optimizer is better than Cuckoo Search optimizer. In future the results can be more improved by hybridization of two optimizers.

VI. ACKNOWLEDGEMENT

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