The Machine Learning based Content Based Image Retrieval using optimized Feed Forward Neural Network

Nashiman Nazir[1] ,Kantesh Kumar Gaurav[2] ,Heena Gupta[3]
Panchkula Engineering College(PEC) Panchkula, India

Abstract-The currently, individuals have huge image dataset used due to the study of multi-media and storage devices available. Furthermore, the accessibility to high speed internet has increased the multi-media replaced by consumers across cyber-space every second. Accordingly, it has maximized the requirement for search for huge dataset of images. The main issues in content based image retrieval are regarded to new research that is often impossible due to human requirement of images being subjective and due to size of the information that requires indexing. To reduce such limitations, CBIR systems have been implemented. We implemented the inverse filtration approach to optimize the attacker effects and remove the distortion in the original image. We resolve the some issues in CBIR with PCA algorithm. In PCA algorithm used for extract the image features in the form of Eigen Values (E) and Eigen Vectors (V). After feature extraction, we implemented the optimization algorithm in genetic algorithm. In Genetic algorithm, used in three operator i.e. Selection, Crossover and Mutation. We improve the performance of the retrieve the content image based with
the fitness function. The CBIR image retrieves then performance evaluation based on Feed Forward Neural
Then train feature saved in matrix file, then pass the testing Phase to simulate the features and to compare the feature in training phase. The whole implementation used taken place in MATLAB 2016a environment. Then evaluate the performance based on FAR, FRR, Accuracy, Precision and Recall.

Keywords-CBIR (Content-Based Image Retrieval), Image Retrieve, FFNN Algorithm, Matlab.

I. INTRODUCTION

Information technology in our society expands day by day. For that reason, digital images and videos or visual objects are becoming very important, like as traditional textual based information. With thehuge development in the amount of visual information available, there exists a real need for systems to make theindex and provide retrieval from thedigital image and video libraries.[1]. Content-Based Image Retrieval (CBIR) is a technique of getting images from the large image databases as per the request. There are some specific types of CBIR.These CBIR fundamentals divided into three parts, suchas feature extraction, Retrieval system architectureand multidimensional indexing [2]. In Content-Based Image Retrieval, an image or portion of an image is a request; significant images are getting based on the match of the features of the query and the structure of the individual image in the database. Therefore images will be indexed according to their own visual content such as color, texture, shape [3]. In CBIR, visual contents are extracted and described by multidimensional feature vectors. The system changes images into aninternaldemonstration of feature vectors[4].Throughout theprocedure, the system routes less compact feature vectors rather than the huge size image data thus giving CBIR is contemptible, speedy and proficient benefits over text-based retrieval. There are two ways of using CBIR system. First one is, specific image matching, that is matching two images, one an example image and another image in related image database. Second one isestimated image matching which is finding very intimately match images to a query image[5].

Table 1. Difference between CBIR and TBIR

CBIR	TBIR
The Content Based Image Retrieval (CBIR) technique uses text embedded on images to search and retrieve advanced pictures	In text based image retrieval images are searched out using strings

There are twotypes of CBIR methods:

A. *Text-Based Approach*:Text based technique used the keywords explanations as an input and gets the wanted output in the form of related types of images.Example: - Google.
B. *Content*-Based Approach:Content-basedmethodology using image as an input query and it generate the output of similar types of images[6].

We implemented the optimization algorithm in genetic algorithm. In Genetic algorithm, used in three operators i.e. Selection, Crossover and Mutation. We improve the performance of the retrieve the content image based with the fitness function. The CBIR image retrieves then performance evaluation based on Feed Forward Neural Network. In FFNN used for two phase to retrieve the image using Training Phase and Testing Phase. In Training phase to implement the algorithm to enhance the performance of the approaches in CBIR. Then train feature saved in matrix file, then pass the testing Phase to simulate the features and to compare the feature in training phase.

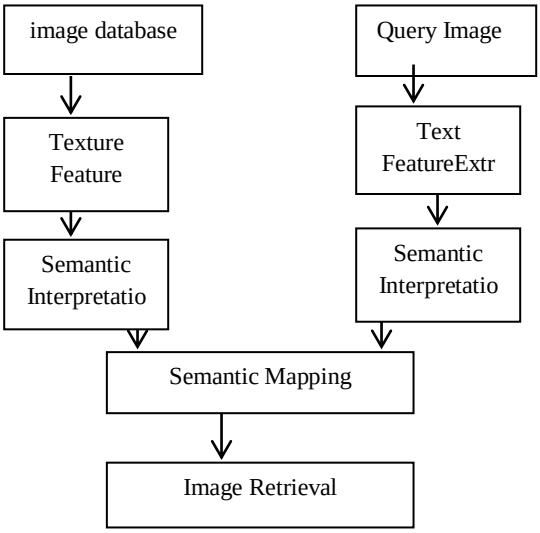

Fig.1: Block Diagram of Semantic Image Retrieval

II. RELATED WORK

Deepak S. Shete et al.,2012[1]Author described that there were many types of different techniques in content-based image retrieval. The author firstly discussed the importantfeatures of CBIR.The features of Image Retrieval like color, texture and shape were discussed next. The author discussedin short the similarity measured based on which matches were made and images were regained. Effective indexing and fast searching of images based on visual features were the major issues in content based image retrieval. There were also discussed dimension reduction and indexing schemes. For content-based image retrieval, user interaction was crucial in retrieval system since by involving the user in the retrieval procedure, flexible formation and modification of queries could only be obtained. At lastfor improving the performance of a CBIR system, relevance response was discussed.Gaurav Jaswal et al., 2009[7] author described that there was a technique for retrieving the images from the large collection of image database on the basis of their own visual content known asContent based image retrieval (CBIR)technique. the large collection of image database. The survey made by author onprocedural achievements in the research region of image retrieval, especially content based image retrieval (CBIR) provided by the author. at the end of nineteenth century , the research in this field way began way back but this hadexpandedimpulse from 1970 onwards with the plunge from two major research communities, database management and computer vision. The author proposed that an effort had been made to show the chronological progress in this field. Meenakshi Shruti Pal et al., 2013[8]author defined that in the recent years, when the internet established, there had been large amount of data resides on the web. Therefore it became necessity for fast retrieval search engines that retrieved documents and images. The author tried to provide a complete review and considered the various problems of image retrial techniques. The author presented a survey of the most popular image retrieval procedure with their merits and demerits. Content Based Image Retrieval was the latest technique for image retrieval.Researcher were moved towards Association based image retrieval,In order to made image retrieval more effective that was new direction of CBIR. Finally, based on existing methods and the demand from real-world applications, a few promising future research directions weresuggested.Prof. Vikram M Kakade et al., 2017[9]the author defined thatIn digital image processing the main task was finding or searching a image in huge database of digital images. This wasa big task for designingmore efficient image and shape matching algorithm. for data storage and image attainment,the author created a e image datasets. In this type, it was compulsory to developed appropriate information systems to effectively manage all these collections. The mutualmethodologies use the so-called Content-Based Image Retrieval (CBIR) systems. Basically, these systems tried to retrieve images similar to a user-defined specification or pattern (e.g., shape sketch, image example). The author saw the dissimilar type of procedures of content based image retrieval for different request purpose.Ritendra Datta et al.,2005[10] the author defined that , from last few years researchers had a lot of interest in research on content-based image retrieval. This had concreted the way for a great number of new procedures and systems, and was growing interest in associated fields to support that system. Similarly, digital imagery had also expanded its limit in so many directions, as a result, an explosion in the volume of image data required to be organized. The author discussed some of the key contributions in thatyears related to image retrieval and automated image annotation, spanning 120 references. The author also discussed some of the major challenges elaborated in the edition of existing image retrieval procedures to build beneficialmethods that could handle real-world data. Authoraccomplished study on the trends in volume and impact of publications in the field with respect to sub-topics, venues and journals.

III. VARIOUS TYPES OF PROPOSED TECHNIQUES

There are mainly three types of proposed techniques such as PCA,GA,FFNN[11]:

A.Principal component Analysis: -Principal component analysis (PCA for short) involves a arithmetical procedure that transforms a number of possibly correlated variables into a smaller figure of uncorrelated variables called main mechanism. The first principal component accounts for as much of the inconsistency in the information as probable, & every following component accounts for as much of the remaining variability as possible. For a data matrix , with zero mean, where each row represents a different repetition of the experiment, & every support gives the marks from an exacting investigate, the PCA transformation[12]

B.Genetic Algorithm: -Genetic algorithm(GA) in computer packages that simulant the procedures of natural evolution in arrange to solve complexity and to model evolutionary systems[13].

Different types of three operators [29]:

- The selection operator selects those chromosomes in the populace that will be allowable to replicate with better genes producing on average more spring than less ones.
- Crossover exchanges subparts of two chromosomes, roughly replicating organic re-combination among binary single gene organisms.
- Mutation casually changes the allele values of some positions in the chromosome; and transposal reverses the order of a connecting section of the chromosome, thus re-arranging the order in which genes are organized.

The evolution generally starts from a populace of randomly generated individuals, & is an iterative process, through the populace every repetition called a generation. In each collection, the fitness of every individual in the population is evaluated; the fitness is usually the value of the objective function in the optimization sticky being solved. The extra fit entities are stochastically selected from the current population, & each individual's genome is modified (recombined & possibly aimlessly mutated) to form a novel generation. The new generation of applicant solutions is then used in the next iteration of the algorithm. Normally, the algorithm terminates when either a maximum amount of generations has been produced, or a satisfactory fitness level has been reached for the population. A typical genetic algorithm requires:

1. A genetic representation of the solution domain,
2. A fitness procedure to evaluate the solution domain.

*C. Feed Forward Neural Network:*The Feed Forward neural Network is artificial neural network based on error multiple Neural Network algorithm. The Feed Forward neural Network model consists of an input layer, some hidden layers & an output layer. Each connection joining neurons has a distinctive weighting value. In training the network, the knobs in the Feed Forward neural Network system obtain input information from exterior sources, and then go by to hidden layer which is an interior info processing layer & is answerable [22] for the information conversion, and then the nodes in the production layer supply the required output substantial. After that, the anti-propagation of error is transported by distinct the authentic output with wanted output. Every weight is reviewed and back propagated layer by layer from output layer to hidden layer & input layer. This procedure will be sustained until the output error of network is reduced to an suitable level or the programmed time of learning is realized. The processing consequences of information are transferred by output layers to the external.

IV. SIMULATION MODEL

In this section, the datasets used in object classification are presented. The datasets can be divided in four groups: Facial images, Flowers images, Special Places images and animal images.

Fig. 2: Facial Images

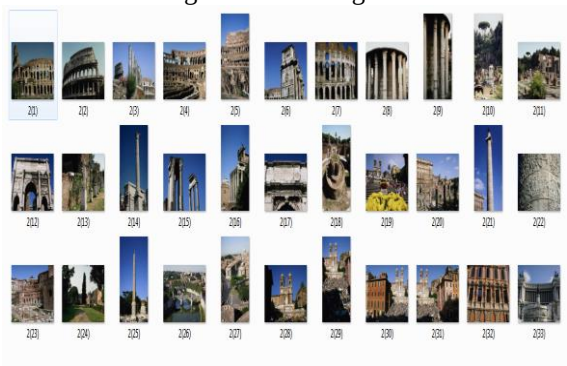

Fig. 3: Special Places Images

Fig. 4: Dianasoor Images

Fig. 5: Flower Images

A. Methodology

Phase 1: Initialize, to collect the data set from the UCI machine learning repository site with facial images, flowers, animals and butterfly, etc. To convert the original image to gray scale image

in content based image retrieval. We calculate the red, green and blue components based on the original image.

Phase 2: To identify the noise level that is salt and pepper attack in the original image. After noise level identify the image to filter the noise image using an inverse filter technique. In inverse filtration approach create a good model of the denoising function that corrupted an image, the easy path to recover that is by inverse filtering. The inverse filter is a form a high-pass filter , inverse filtering responds very bad way or noise that is recent in the image since noise tends to be high frequency.

Phase 3: The edge detection performs with the canny properties of the filtered image. We calculate the regions of the area i.e maximum, minimum and average value. In canny edge detection is called the multi-stage algorithm to detect a wide range of edges in images.

Phase 4: Feature Extraction using PCA algorithm:After edge detection, we use the feature extraction algorithm using principle compoenent analysis.

Phase 5: Optimize the Feature: In this optimization approach used to Genetic Algorithm. In this algorithm to optimize the extracted features with the help of fitness function (FS,FT,E) and It helps three operator in Genetic algorithms:

i) Selection
ii) Crosssover and
iii) Mutation

Phase 6: Classification using Feed Forward Neural Network: The classification technique used for Feed Forward study of the training and testing section. In training section, calculate the reduce features passed in training set which is calculate based on the target. In testing phase, to identify the training set using deep neural network.

V. RESULT EXPLANATION

In this section, we discussed the proposed performance parameters and comparison between previous and proposed work.

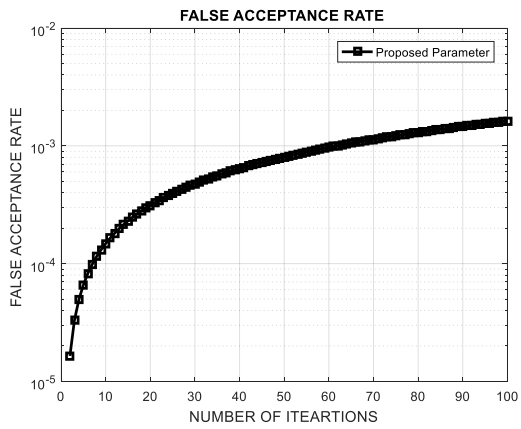

Fig. 6: False Acceptance Rate

The above figure defined that the false acceptance rate means how much wrong data acceptable in the original form.

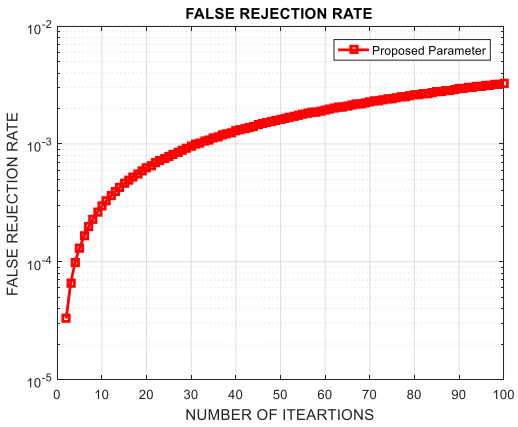

Fig. 7: False Rejection Rate

The above figure defines that the false rejection rate means how much wrong data reject able in the original data set.

Table 2 False Acceptance Rate and False Rejection Rate (Proposed work)

No of Images	FAR	FRR
Animal	0.0008065	0.001613
Special Places	0.0013	0.002304
Facial	0.001465	0.002897
Flower	0.00163	0.003259

Fig. 8: FAR and FRR

The above figure defined that the false acceptance rate means how much wrong data acceptable in the original form. The false rejection rate means how much wrong data reject able in the original data set.

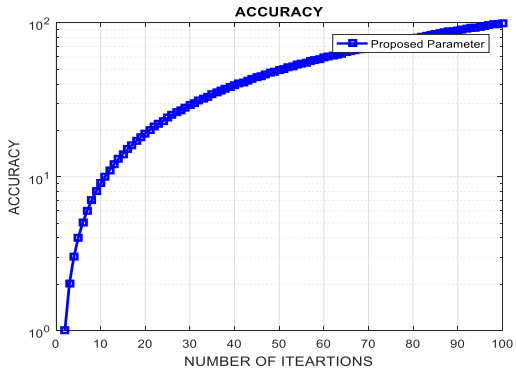

Fig. 9: Accuracy

The above figure defined that the accuracy means accurate the system based on DNN and False rejection Rate and False Rejection rate is less then improve the performance the image of the dataset.

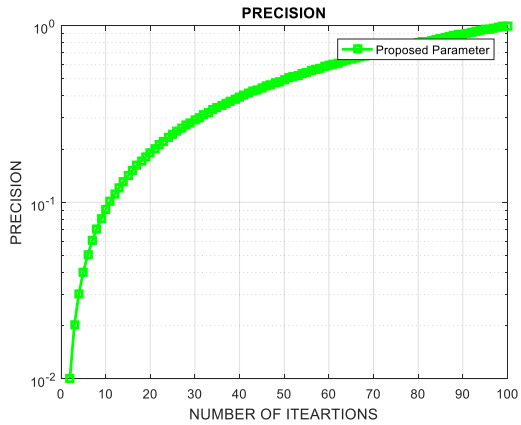

Fig. 9: Precision

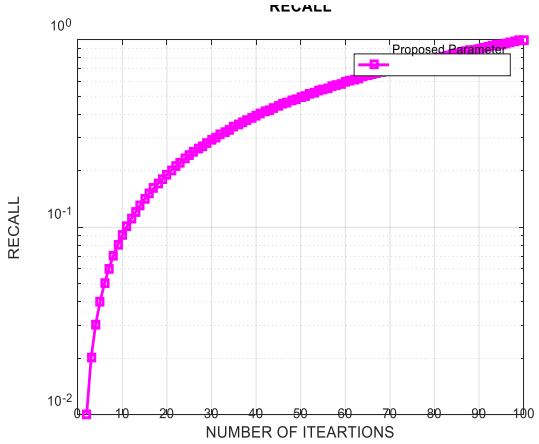

Fig. 10: Recall

Figure represents that the recall that the closest of two or more measurements to each other.

Table no.3. Comparison between Proposed and Existing Work Precision

No of Images	Precision (BP)	Precision (PP)
Animal	0.080	0.082
Special Places	0.3575	0.3657
Facial	0.6326	0.656
Flower	0.088	0.0999

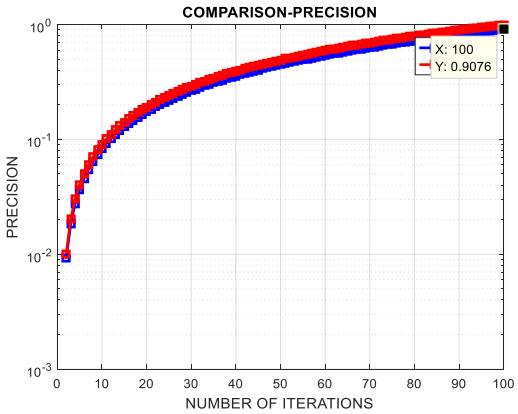

Fig. 11: Performance parameter Precision

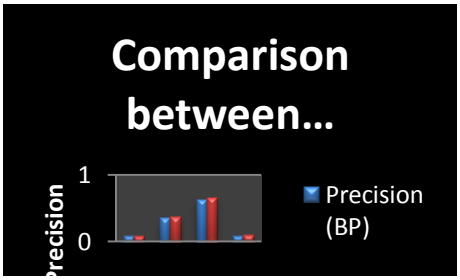

Fig. 12: Comparison between Proposed and exiting (Precision)

The above figure defined that the precision means accurate the system based on FFNN and False rejection Rate and False Rejection rate is less then improve the performance the image of the dataset. It represents that the precision that the nearest of two or more measurements to each other

Table 4: Comparison between Proposed and Existing Work Recall

No of Images	Recall (BP)	Recall (PP)
Animal	0.07048	0.0734
Special Places	0.28019	0.2901
Facial	0.6532	0.6678
Flower	0.9076	0.998

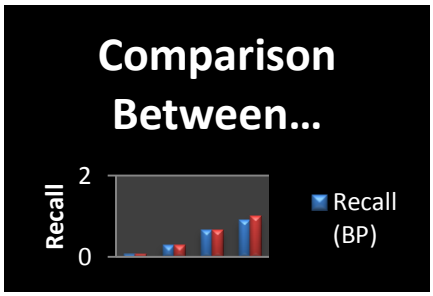

Fig. 13: Comparison between Proposed and existing work (recall)

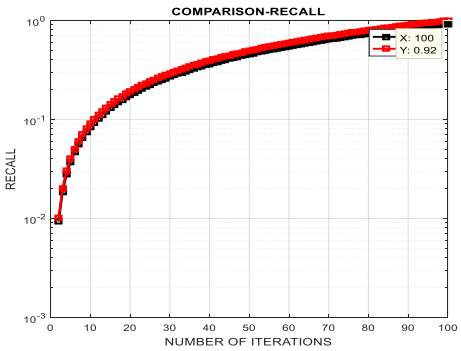

Fig. 14: Comparison in Proposed and existing work(Recall)

The above figure represents that the comparison between reccall, performanceparameters based on proposed and existing work). We improve theperformance of Recall with proposed (FFNN and GA).

VI. CONCLUSION AND FUTURE SCOPE

In conclusion , the major focus of our proposed method is to reduce the semantic and texture based gap between low level features and human-perception using FFNN and GAO. As above figure shows that the accuracy , precision and recall methods is on the whole constituent , compared with other methods based on HNN/ Moreover the proposed methods is more benefits in organization and currents and accurate results for complex situations. This creates the more vers research techniques more-versatile for large dataset in which there might be a wide variet of targets of images. Firstly feature removal will be complete by using PCA. Then, at first, the neural network is trained based on the features of images in the database. In GAO algorithm used to optimize the feature set. This algorithm is an initialize the set of size i.e., called population. Problem Solutions from individual population are used and reserved to new population. This is hope, that the novel population would be better than previous one. Results which are particular to form novel solution i.e. data stream bits are selected with the help of fittness function, the suitable phases they have to regenerate.

GAO techniques, to solve an optimization issue by repetition the following three Phases:

- Selection
- Crossover
- Mutation

The image features considered here are average value, min value and max Value. The training is carried out using FFNN algorithm. This trained 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 FRR, FAR , precision and recall and accuracy of image retrieval.

Future scope includes implementing the CBIR system considering more low-level image descriptors and highly efficient deep learning neural network, that may possibly verify to be quite fast as well as précised one. This work can be extended by integrating with Fuzzy C-means clustering algorithm for better efficiency.

VII. REFERENCES

[1]. 1.Shete, Deepak S., and M. S. Chavan. "Content based image retrieval: Review." International Journal of Emerging Technology and Advanced Engineering 2, no. 9 (2012): 85-90.

[2]. Giri, Aditi, and Yogesh Kumar Meena. "Review paper on content based image retrieval." The International Journal of Science and Technoledge 2, no. 4 (2014): 125.

[3]. Gurmeet Kaur, Er. Arshdeep Singh " A Review Paper on Content Based Image Retrieval",

[4]. International Journal of Advanced Research in Computer Science and Software Engineering,

[5]. 4.Neha,"Content Based Image Retrieval :a review", International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 5, May 2014

[6]. Volume 5, Issue 4, April 2015 ISSN: 2277 128X

[7]. 5.Shereena, V. B., and Julie M. David. "Content Based Image Retrieval: A Review." In First International Conference on Computer Science & Information Technology, COSIT. 2014.

[8]. Singh, Amit, Parag Sohoni, and Manoj Kumar. "A Review of Different Content Based Image Retrieval Techniques." International Journal of Engineering Research and General Science 2, no. 5 (2014).

[9]. Jaswal, Gaurav, and Amit Kaul. "Content Based Image Retrieval–A Literature Review." In National Conference on Computing Communication and Control. 2009.

[10]. Pal, Meenakshi Shruti. "Image retrieval: A literature review." International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) 1, no. 2 (2013): 2077-2080.

[11]. Kakade, Vikram M., and Ishwar A. Keche. "Review on Content Based Image Retrieval (CBIR) Technique.",International Journal Of Engineering And Computer Science ISSN: 2319-7242

[12]. Volume 6 Issue 3 March 2017, Page No. 20414-20416

[13]. Datta, Ritendra, Jia Li, and James Z. Wang. "Content-based image retrieval: approaches and trends of the new age." In Proceedings of the 7th ACM SIGMM international workshop on Multimedia information retrieval, pp. 253-262. ACM, 2005.

[14]. https://www.cse.msu.edu/~cse803/Lectures/week07-CBIR-LS.ppt.pdf
[15]. en.wikipedia.org/wiki/Content-based_image_retrieval
[16]. en.wikipedia.org/wiki/Content-based_image_retrieval#Techniques