ISSN: 2277-9655
Impact Factor: 4.116

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DEVELOPMENT OF CONTENT BASED IMAGE RETRIEVAL SYSTEM USING NEURAL NETWORK & MULTI-RESOLUTION ANALYSIS

Jitendra Singh*, Prof. Kailash Patidar, Mr. Gaurav Saxena
M.Tech Scholar, Dept. of SE, SSSUTMS, Sehore, M.P., India[1]
Professor& Head, Dept. of CSE, SSSUTMS, Sehore, M.P., India[2]
Assistant Professor, Dept. of CSE, SSSUTMS, Sehore, M.P., India[3]

DOI: 10.5281/zenodo.61481

ABSTRACT

In a content-based image retrieval system, the image features that effectively represent the image contents in a database. CBIR is the technique which uses visual contents to search images from large scale image databases according to the user's interest. In the term content refers to shape, texture color, that can be derived from the image. In this paper an image retrieval technique using neural network (NN) in MATLAB with the help of Wavelet transform and Gabor filter features is contemplated. In the proposed system, mean and standard deviation of the images are calculated later to the filtering process of the images using Gabor filter.

KEYWORDS: Content based image retrieval (CBIR), Neural Network Wavelet transform (WT), Gabor feature, etc.

INTRODUCTION

The Image Processing involves changing the nature of an image in order to progress its pictorial information for human interpretation and render it additional suitable for autonomous machine perception. The advantage of image processing machines above humans is that they cover almost the entire electromagnetic spectrum scheme, ranging from gamma to radio waves as human eye is limited to the visual band of the electromagnetic spectrum. Thus image processing has an enormous range of applications and almost all area of science and technology such as medicine, industry and law enforcement make use of these technique.

Content Based Image Retrieval is a scheme which uses visual contents to search images from an image database. Content Based Image Retrieval, visual features such as texture and colour are extracted to characterize images. CBIR method draws many of its methods from the field of image processing and computer vision, is regarded as a subset of that field. In Content Based Image Retrieval, visual contents are extracted and described through multidimensional feature vectors. The system changes them into internal representation of feature vectors. The similarities or differences among feature vectors of the query examples and those of the images in the database are calculated and retrieval performed with an indexing. The indexing technique is an efficient way to search for image database. Recent retrieval systems have incorporated user's relevance feedback to modify the retrieval process.

ISSN: 2277-9655
Impact Factor: 4.116

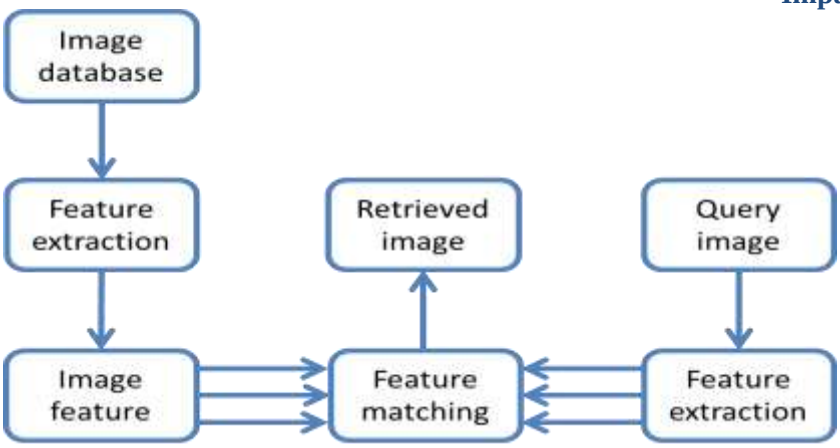

Fig. 1 Block diagram of CBIR system

RELATED REVIEW

Researchers have proposed various methods to improve the system of content based image retrieval.

Manimala Singha and K. Hemachandran [1],In the paper they presented a novel approach for Content Based Image Retrieval by combining the color and texture features called Wavelet method based Color Histogram Image Retrieval (WBCHIR). Similarity between the images is ascertained by means of a distance function. The experimental result shows that the proposed method outperforms the other retrieval methods in terms of Average Precision.

Md. Iqbal Hasan Sarker [2], proposed that using only a single feature for image retrieval may be inefficient. In used color moments and texture features and their experiment results demonstrated that the proposed algorithm has higher retrieval accuracy than the other methods based on single feature extraction.
The many researchers have been done significant work in the field of Content-based Image Retrievalproblem some of the work is described in this paper.

GABOR FILTER

The Gabor filter is a linear filter whose impulse response is defined through a harmonic function multiplied by a Gaussian function. Since of the multiplication-convolution property, in the fourier transform method of a Gabor filter's impulse response is the convolution of the Fourier transform method of the harmonic function and the Fourier transform of the Gaussian function. The Gabor filter is a linear filter used for edge detection in human image processing which is named after Dennis Gabor filter. Gabor filter frequency and orientation demonstrations are similar to those of human visual technique, for texture representation and discrimination process, it has been found to be remarkably suitable. A sinusoidal plane wave has been modulating a 2D Gabor transform which is a Gaussian kernel function method in the spatial domain. In the one parent wavelet all filters can be generated through dilation and rotation, Gabor filters are self-similar. The eight different orientations of Gabor filter, features based of the fingerprint are extracting feature and are combined feature. Where f represents the ridge frequency and the choice of $\delta x2$ and $\delta y2$in determines the shape of the gabor filter envelope and also the trade of among enhancement and spurious artifacts. This is through far, the most popular approach for fingerprint enhancement.
The Gabor transform can serve as excellent band-pass filters for unidimensional signals. A complex Gabor filter is defined as the product of a Gaussian kernel times a complex sinusoid.

$$g(t) = ke^{j\theta}\omega(at)(st) \quad (1)$$

Where

$$W(t) = e^{-\pi t^2} \quad (2)$$

$$s(t) = e^{j(2\pi f_0 t)} \quad (3)$$

$$e^{j\theta}s(t)e^{j(2\pi f_0 t+\theta)} = \left(\sin(2\pi f_0 t + \theta), j\cos(2\pi f_0 t + \theta)\right) \quad (4)$$

Here k, θ, fo are filter parameters. We can think of the complex Gabor filter as two out of phase filters continently allocated in the real and complex part of a complex function, the real part holds the filter

$$G_r(t) = w(t)\sin(2\pi f_0 t + \theta) \quad (5)$$

And the imaginary part holds the filter

$$G_r(t) = w(t)\cos(2\pi f_0 t + \theta) \quad (6)$$

Frequency Response

Taking the Fourier transform

$$\hat{g}(f) = ke^{j\theta}\int_{\infty}^{-\infty} e^{-j2\pi ft}\omega(at)s(t)dt = ke^{j\theta}\int_{\infty}^{-\infty} e^{-j2\pi(f-f_0)t}\omega(at)dt = \frac{k}{a}e^{j\theta}\hat{\omega}\frac{f-f_0}{a} \quad (7)$$

$$\hat{\omega}(f) = \frac{k}{a}\hat{\omega}\frac{f-f_0}{a} \quad (8)$$

HAAR WAVELET TRANSFORM

Haar wavelet is one of the oldest and simplest wavelet. Thus, any discussion of wavelets starts with the Haar wavelet transform. Daubechies wavelets are the most popular wavelets transform. They have represented the foundations of wavelet signal processing system and are used in numerous applications. These are also called Maxflat wavelets transform as their frequency responses have maximum flatness at frequencies 0 and R. This is a very desirable property in some applications. Haar wavelet transform, Daubechies transform, Symlets and Coiflets are compactly supported orthogonal wavelets. These wavelets along with Meyer wavelets are capable of perfect reconstruction. The Meyer, Morlet and Mexican Hat wavelets transform are symmetric in shape. In the wavelets are chosen based on their shape and their ability to analyze the signal in a particular application. Haar wavelet is discontinuous, and resembles a step function.

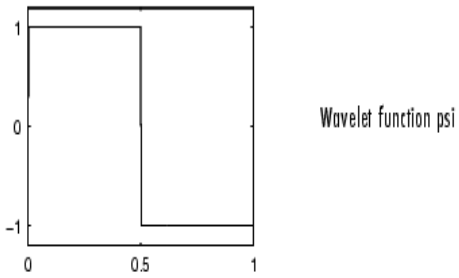

Fig. 2 Haar wavelet

TRAINING ALGORITHMS

There are many different algorithms that can be used to train a neural network. All of the training algorithms that follow are back propagation algorithms that implement batch training.

Training algorithms that use back propagation begin by calculating the changes in the weights of the final layer before proceeding to compute the weights for the previous layer. They continue in this backwards fashion until reaching the input layer. The procedure used to compute the changes in the input weights for each node is specific to each algorithm, and there are there are various trade-offs in speed, memory consumption, and accuracy associated with each algorithm.

Algorithms that implement batch training wait until each input is present at the input layer before making any changes to the network weights. Once all of the inputs have been presented, the training algorithm modifies the weights according to its procedure. Each iteration of these algorithms is called an epoch.

Levenberg-Marquardt Training Algorithm

This training algorithm is another algorithm that approximates Newton's method by updating network weights and biases in the following manner:

$x_{k+1} = x_k - [J^TJ + \mu I]^{-1}J^Te$

Where **J** is a matrix, known as the Jacobian matrix, that contains the first derivatives of the network errors with respect to the weights and biases, **e** is a vector of network errors, and μ is a scalar that determines how close of an

approximation to Newton's method this is. When μ is zero, then the above function becomes Newton's method. When μ is large, then it becomes gradient descent with a small step size.

train :- The train command will automatically configure the network and initialize the weights.

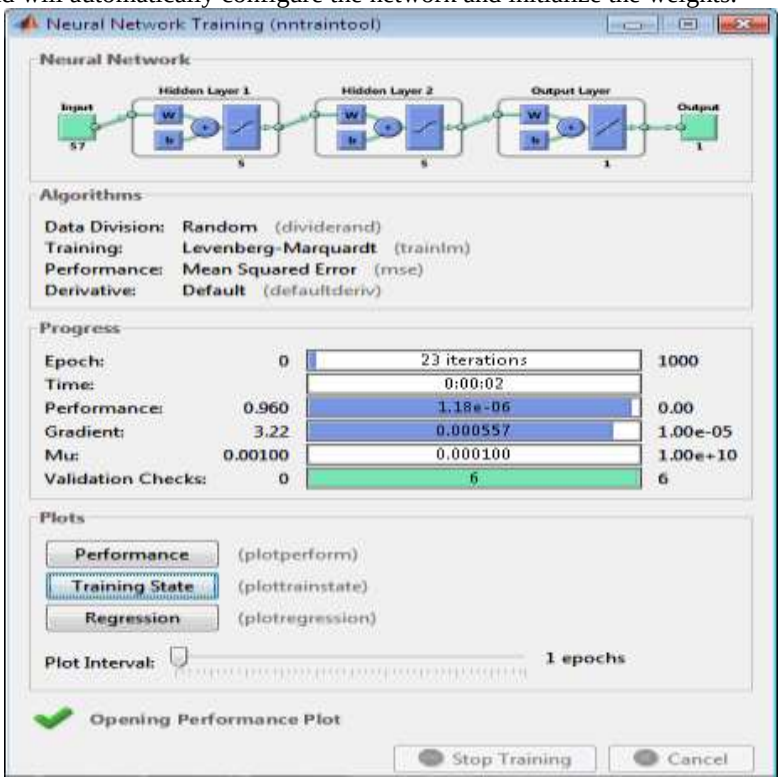

Fig. 3 Neural network training

COMBINING THE FEATURES

The image retrieval using only single feature such as color moment or color histogram may be inefficient. It may either retrieve images not similar to query image or may fail to retrieve images similar to query image. To produce efficient results, we use combination of color and texture features. The similarity between query and target image is measured from two types of characteristic features which includes color and texture features. Two types of characteristics of images represent different aspects of property. While calculating similarity measure, appropriate weights are considered to combine the features. The distance between the query image and the image in the database is calculated as follows:

$$d = w1*d1 + w2*d2. \quad (10)$$

Here, w1 is the weight of the color features, w2 is the weight of the texture features and d1 and d2 are the distances calculated using color features and texture features respectively. The distance d is calculated for each query image with all images in the database. The image that has a lower distance value is considered the similar image and the results are ranked in the ascending order of d. From the studies, It is seen that the value of the average precisions based on single features i.e. only Gabor texture features or only Color moments are less than the average precisions of combined features of color moments and Gabor texture features. This shows that there is considerable increase in retrieval efficiency when both color and texture features are combined for CBIR. Also it is found that the texture and color features are extracted through wavelet transformation and color histogram and the combination of these features is a faster retrieval method which is robust to scaling and translation of objects in an image.

Results

The performance of CRIB technique using Wavelet, Gabor and ANN, and "feature extraction" are used to test the system and extracted feature are classify by using ANN classification button. In the results are saved in output files. Figure shows the testing module. Here calculate number of testing images and matching accuracy.

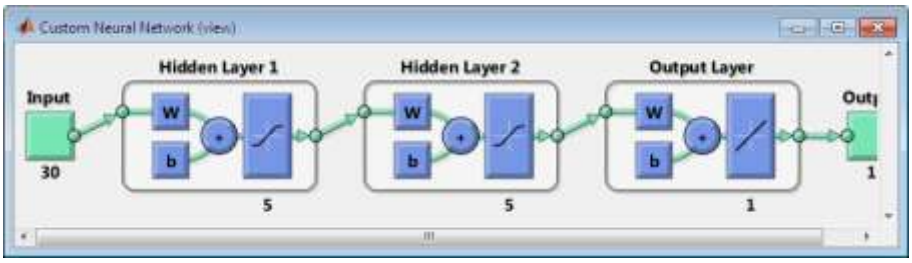

Fig. 4 Wavelet training dx

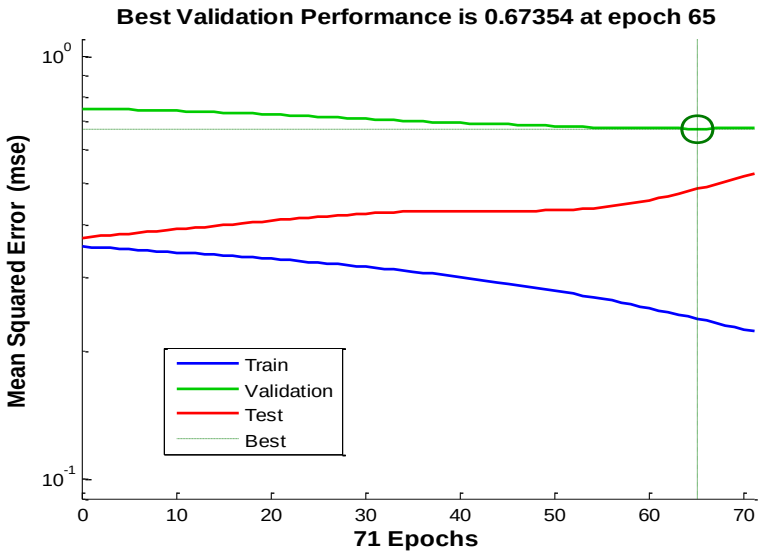

Fig. 5 Performance of MSE Vs Epochs

Wavelet LM

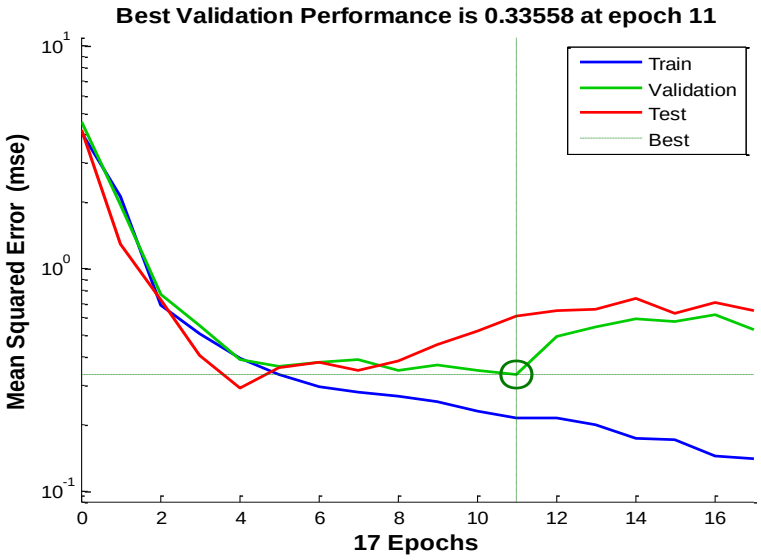

Fig. 6 Performance of MSE Vs Epochs 11

Gabor LM training

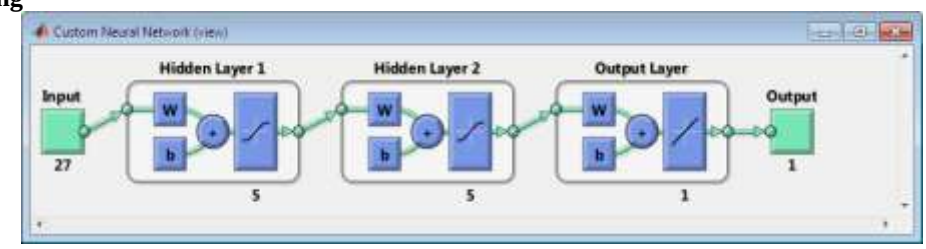

Fig. 7 Performance of Gabor LM training

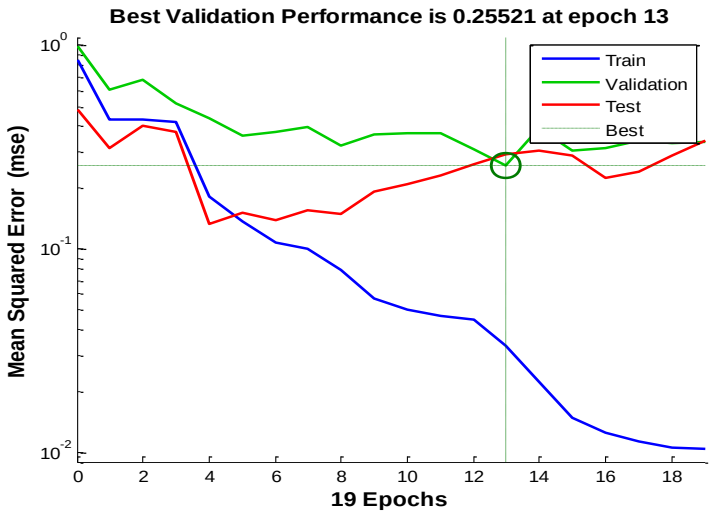

Fig. 8 Performance of MSE Vs Epochs 13 (Gabor GD)

Mixed method

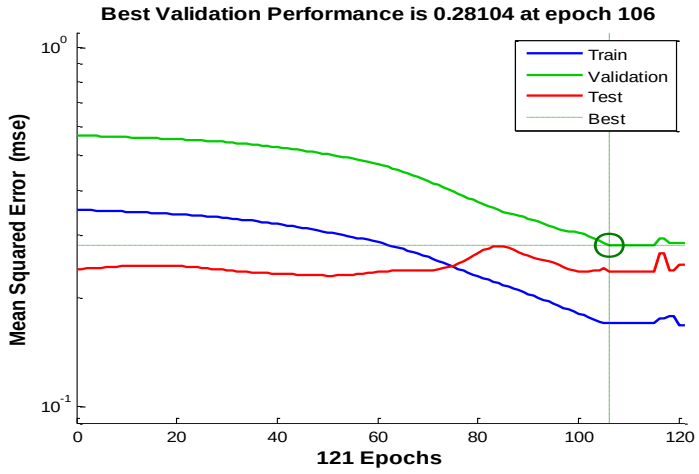

Fig. 9 Performance of MSE Vs Epochs 106 (Mixed method)

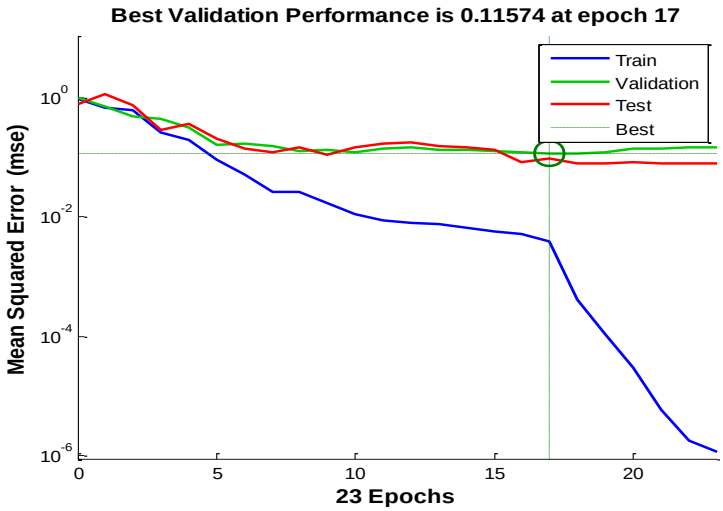

Fig. 10 Performance of MSE Vs Epochs 127

CONCLUSION

This project has presented a new approach for CBRI techniques using neural network with Gabor Filter and Wavelet Filter. The different color and texture features for image retrieval in CBIR is performed. Numerous methods are available for feature extraction in CBIR. They are identified and studied to understand the image retrieval process in the CBIR systems. Experiment results show that the method based on color and texture features has higher retrieval accuracy than the other methods based on single feature extraction.

Experimental results have demonstrated the feasibility of the proposed method for CBIR using neural network with different feature. Maximum accuracy of recognition has been achieved is 93%.

Table: 6.1 Performance of different method accuracy

Training Method	Wavelet Feature	Gabor Feature	Mixed Feature
LM	76.7	89	95.6
GD	53	57	78
GDX	72	73	72

REFERENCES

[1] Manimala Singha and K. Hemachandran(2012) "Content based image retrieval using color and texture "Signal & Image Processing : An International Journal (SIPIJ) Vol.3, No.1, pp.39-57.
[2] Md. Iqbal Hasan Sarker and Md. Shahed Iqbal (2013) "Content-based Image Retrieval Using Haar Wavelet Transform and Color Moment" Smart Computing Review, vol. 3, no. 3, pp.155-165.
[3] BonganiMalinga, Daniela Raicu, Jacob Frust, Local vs. Global Histogram-based Color Image Clustering, Technical Report TR06-010, School of Computer Science, DePaul University, USA, 2006.
[4] S. Mangijao Singh , K. Hemachandran, "Content-Based Image Retrieval using Color Moment and Gabor Texture Feature", International Journal of Computer Science Issues, Vol. 9, Issue 5, No 1, September 2012.
[5] Suchismita Das, ShrutiGarg, G. Sahoo, "Comparison of Content Based Image Retrieval Systems Using Wavelet and Curvelet Transform", International Journal of Multimedia & Its Applications (IJMA) Vol.4, No.4, August 2012.
[6] Yong-Hwan Lee and Sang-Burm Rhee, "Content-based Image Retrieval Using Wavelet Spatial-Color and Gabor Normalized Texture in Multi-resolution Database", International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, IEEE, 2012.
[7] Hamid A. Jalab, "Image Retrieval System Based on Color Layout Descriptor and Gabor Filters", IEEE, 2011.
[8] Shereena V.B. and Julie M. David, "Content Based Image Retrieval: Classification Using Neural Networks", International Journal of Multimedia & Its Applications (IJMA) Vol.6, No.5, October 2014.