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Image Classification by Combining Wavelet Transform and Neural Network

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Abstract

In this paper, we propose a method of classification of image by combining wavelet transform and neural network. Our main objective in this work is to achieve an optimal approach of classification by combining wavelet transform and neural network. The proposed scheme for successful classification is combination of a wavelet domain feature extractor and back propagation neural networks (BPNN) classifier [6]. This new approach of classification of image is based on the texture, information of colour and shape. For achieving a suitable way for classification of image here we first use wavelet transform which will decompose our main image into sub image [10] and after that this decomposed image are in turn analyzed and finally features are extracted. In this proposed method of image classification first we divide all given image into six parts. For obtaining the necessary and required information from each part of the given divided image we use first order movements of colour [9] and daubechies 4 types of wavelet transform. This proposed method for classification of image is fully based on back propagation neural network. The highly adaptive and parallel processing ability of back propagation neural network make it widely used classifiers. The RGB colour movement and decomposition coefficient which obtained from each The highly adaptive and parallel processing ability of back propagation neural network make it widely used classifiers. The RGB colour movement and decomposition coefficient which obtained from each parts of image by using wavelet decomposer is used as input vector for neural network [9].170 aircraft colour image were used for training and 200 for testing. Resulting data consist of 98% and 90% efficiency for training and testing respectively.

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Keywords

Back propagation, Colour moment, Wavelet Transform Neural Network

1. Introduction

All manuscripts must be in English. These guidelines include complete descriptions of the fonts, spacing, and related information for producing your proceedings manuscripts. All the heading is to be in fully justified in 12-point Times New Roman, boldface type, initially capitalized. Subheading is to be in fully justified in 10-point Times New Roman, boldface type, initially capitalized. The easiest way to do this is simply to download the template, and replace the content with your own material. Multi class image classification plays an important role in many computer vision applications such as biomedical image processing, automated visual inspection, content based image retrieval, and remote sensing applications. Image classification algorithms can be designed by finding essential features which have strong discriminating power, and training the classifier to classify the image. But particularly it is very difficult to classify given image from a data base by using traditional machine learning algorithms [1], [2], [3], [4], [5] because of high number of images and many details that describe an image. Due to this reason traditional machine is unsuitable for classification of an image from given database. Another disadvantage of this traditional machine is that is taking a very long time for classification. Previous image storing systems like QBIC and Visual SEEK which is also based on colour information, texture, or shape features limit classification mechanism to describe an image, one of the most powerful methods for retrieval, reorganisation and classification of images is based on Neural Networks (NN). Our Images in this paper consist of 35,000 RGB pixels. For suitable classification we refused this original image which consisting of 35,000 pixel. Because if we use such an image as a input to neural network the input unit of neural network are going to increase and this increased input unit directly increase the size of NN.Due to the large number of image for classification the input unit for NN is very high, perfectly understanding and learning such NN

without a lot of effort is not practically possible. For handling this difficulty, proposed image classification system refers a most powerful pre processing steps which successfully reduce the information of existing image. Now we can use this new reduced set of information as input to NN. So many types of technique are used for pre processing steps but most powerful method for describe pre processing steps is based on wavelet transform. In present day wavelet transform is widely used and most popular method which takes given image, analysis this image and gives information about texture and shape from given image. Information about the colour movement is used as a first input for NN and a second input is a Deubechies transform of wavelet is used for NN.Final step of classification is base on back propagation neural network (BPNN) with one hidden layer. In this paper we determine an aircraft photo which present in any one category out of six categories of aircraft which show in figure 1.

Figure 1: Six categories of plane for classification. (1) Commercial plane in land (2) commercial plane in air (3) war plane in land (4) war plane in air (5)Helicopter in land and (Class6) helicopter in air.

2. Related Work

In this section, we describe about previous works for classification of image was based on wavelet transform and neural network. In this previous work back propagation neural network was based on Harr wavelet transform for classification of 600 image (image for testing is 300 and image for training is 300).81.7% efficiency is recorded for training and efficiency for testing was 79.6%. In our proposed method we use a Daubechies wavelet transform in place of Harr for increasing classification efficiency 98%(for training) and 90%(testing) respectively. Our proposed method is based on deubechies wavelet transform with back propagation neural network.

3. Colour Moment

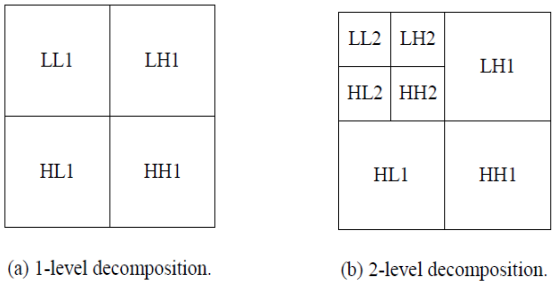
Colour moments [2] are measures that can be used differentiate images based on their features of colour. Once calculated, these moments provide a measurement for colour similarity between images [7]. These values of similarity can then be compared to the values of images indexed in a database for tasks like image retrieval Sticker and Orengo use three central moments of a image's colour distribution. They are Mean (first order), Standard deviation (second order) and Skewness (third order).here we use Mean (first order colour moment) as input of a neural network.

4. Wavelet Transform

A number of classification techniques based on spectral data representation are available. These methods provide appropriate results but require a lot of computation. On the other hand, wavelet transform is a well-known tool for signal/image analysis [5],[8],[10].

It provides a time–frequency representation of the data as well. In this paper, we propose to solve the feature extraction problem by the use of the discrete wavelet transform (DWT) expecting to obtain good image retrieval results at a low computational cost. Varying window size which is the main advantage of wavelets transform, being narrow for the fast ones and wide for slow frequencies, thus leading to an optimal time frequency resolution in all the frequency ranges. Recursive filtering is involves for computation of the wavelet transform of a 2D signal.

In this recursive filtering the signal, At each level the rows and columns of an image are processed separately and down sampled by a factor of 2 in each direction, resulting in one low pass image LL and three detail images HL, LH, and HH. The one-level decomposition is show in Figure 1(a). Low horizontal frequency information of an image is present in LH channel and HL channel contain information about high vertical frequency, and the HH channel contains high horizontal and high vertical frequencies. The frequency decomposition is shown in Figure 1(b).



(a) 1-level decomposition. (b) 2-level decomposition.

Figure 2: Wavelet Decomposition (a) 1-Level decomposition (b) 2-level decomposition

5. Proposed Method

Our objective is classification of an image from a large data base by using the information of shape and colour. For obtaining mention goal we use wavelet transform, Mean (first order colour moment) and neural networks [7], [8].there are so many types of neural network method are available for image classification. One is the most widely used neural network method is Back propagation neural network. Our proposed paper is based on Back propagation Neural network (BPNN) with one hidden layer. This method is very practical in image classification. In our starting work first we define the number of input for neural network as a first step. The pixel size is 700*500 hence number of input unit is very large for neural network so first we reduce the image size by down sampling and convert 700*500 pixels image into 256*256 pixel. Now we convert our new reduced image into three primary colour bands (RGB).in nest step we get six equal parts of 128*128 pixel from each colour band. by using this six parts of each band we get input for neural network in following steps.

1. We first calculate Mean (first order colour moment) from six parts of each R G, B band and get 18 inputs. This 18 input contain perfect colour information of an image and use as neural network input.
2. In next step for getting horizontal vertical and diagonal detail of six decomposed part of each primary R,G,B band a well define db4 wavelet transform is used .which gives 72 input for neural network(24 input from each six parts).this 72 neural network input consist of information about texture and shape of given image.
3. In third step we get the information about the energy of horizontal, vertical, and diagonal components of each three R, G, and B primary component. in this third step we get 9 more neural network input,3 from each band.Fianly we get total 99 input unit for neural network.

6. Architecture of Neural Network

The neural network node provides a variety of feed forward networks that are commonly called back propagation networks. Back-propagation refers to the method for computing the error gradient for a feed-forward network, a straightforward application of the chain rule of elementary calculus.

By further Extension, a back-propagation network is a feed-forward network trained by any of various gradient-descent techniques. There are numerous algorithms available for training neural network models; most of them can be viewed as a straightforward application of optimization theory and statistical estimation.

In our proposed method a back propagation neural network for classification is used with one hidden. This back propagation method consist of 90 input unit which is from x=1 to x=90 and also consist of 64 hidden unit and y1 to y6 which is six output unit. The proposed architecture of Neural Network is show in Figure 3.

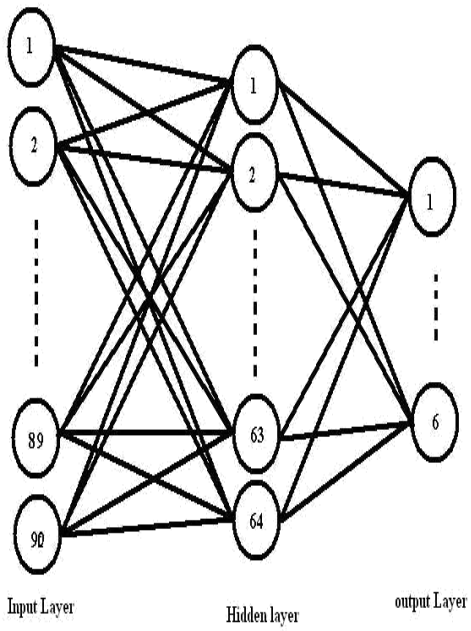


Figure 3: Architecture of Neural Network

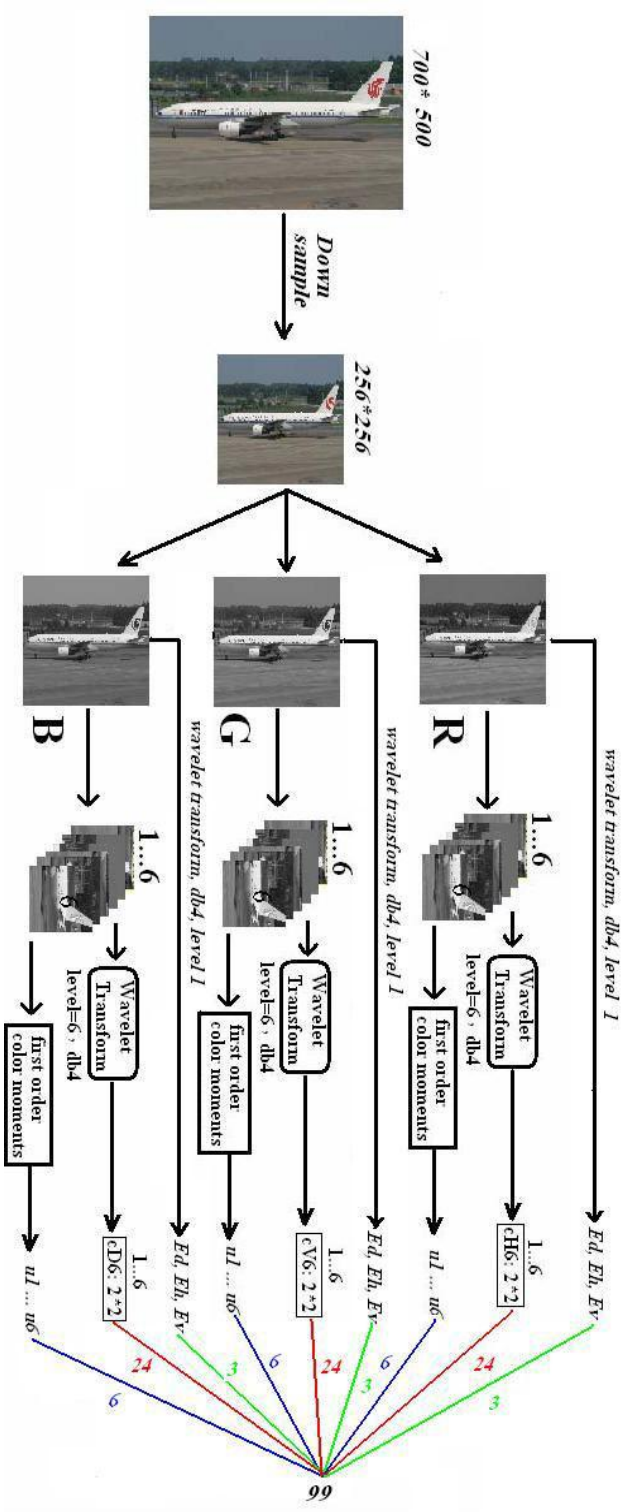


Figure 4: Proposed method for Neural Network

7. Experimental Result

These parts of paper show the testing outcomes of described method. 250 colour aircrafts image is select for testing purpose and 150 aircraft image is use for training. This entire image is taken from http://www.airplane-pictures.net.

The Overall Efficiency for training is 93 % and for Testing is 89%. This Result is compare with Harr wavelet based Neural Network classification technique and non –linear wavelet filter method.

Table 1: Comparison Chart

Method	Haar Wavelet [10]	Non liner filter based wavelet [5]	Proposed method
Training Image Number	120	300	250
Testing Image Number	120	300	150
Classification percentage (%)	89	89	93

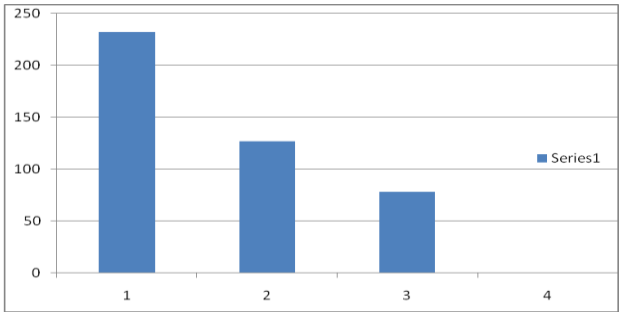


Fig.5: Testing Classification Result Chart- 1) Prosed method, 2)Haar Wavelet based NN 3) Non linear filter based wavelet Transform

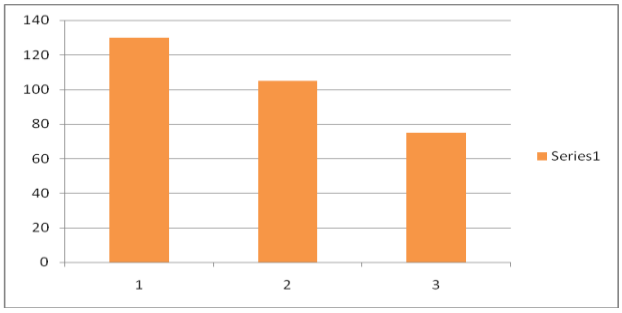


Fig.6: Testing Classification Result Chart- 1) Proposed method, 2)Haar Wavelet based NN 3) Non linear filter based wavelet Transform

8. Conclusion

In our proposed paper we mention an new idea for classification of an image from a large database by using wavelet transform and back propagation Neural network (BPNN).by using colour moment ,entropy, and daubechies wavelet transform, the input for neural network is generated. Finally we get 95% efficiency for training set and 93 % efficiency for testing set of data.

References

[1] W. Niblack, R. Barber, W. Equitz, M. Flickner, E. Glasman, D. Petkovic, P. Yanker, C. Faloutsos, G. Taubin, "The QBIC Project: Querying Images by Content Using Color, Texture, and Shape", Proc. Int. Conf. on Storage and Retrieval for Image and Video Databases, Bellingham, pp. 173-187, 1993.

[2] J. R. Smith, S. F. Chang, "Tools and Techniques for Color Image Retrieval", Proc. Int. Conf. on Symposium on Electronic Imaging: Science and Technology Storage and Retrieval forImage and Video Databases IV, San Jose, pp. 426-437, 1996.

[3] S. B. Park, J. W. Lee and S. K. Kim, "Contentbased image classification using a neural network", Pattern Recognition Letters, Vol. 25, No. 3, pp. 287-300, 2004.

[4] J. Pakkanen and J. Iivarinen, "A Novel Self Organizing Neural Network for Defect Image Classification", Proc. Int. Conf. on Neural Networks, Hungary, pp. 2553-2556, 2004.

[5] S. Zhang and E. Salari, "Image denoising using a neural network based on non-linear filter in wavelet domain", Proc. Int. Conf. on Acoustics, Speech, and Signal Processing, Genova, pp. 989-992, 2005.

[6] P. McGuire and G. M. T. D`Eleuterio, "Eigenpaxels and a Neural-Network Approach to Image Classification", IEEE Trans. Neural Networks, Vol.12, No.3, pp. 625-635, 2001.

[7] M. J. Swain, D. H. Ballard, "Color Indexing", International Journal of Computer Vision, Vol. 7, No. 1, pp. 11-32.

[8] Structure Based Neural Network Classification of Images Using Wavelet Coefficients, J.Wanget al .(Eds): INSS 2006, LNCS 3972, pp 311-336, 2006.

[9] Color Texture Classification using Wavelet Transform and Neural Network Ensembles, The Arabian Journal for Science and Engineering, Volume 34, 2009.

[10] Wavelet Features Based War Scenc Classification using Artificial Neural Neteork , International Journal on Computer Science and Engineering, Vol 02, N0. 09, 2010, 3033-3037.

[11] A Novel Approach to Image Segmentation using Artificial Neural Network And K- mean Clustering, IJERA, Vol. 2,pp 274-279,2012.

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