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Image Classification By Combining Wavelet Transform And Neural Network

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Abstract : *In present-day classification of multi-class image play an important role in engineering and computer vision application like image processing in biomedical, retrieval of content based image. From some past years researchers and scientists have made a lot of efforts in the implementation of an advanced image classification approaches. Image classification is one of the classical problems of concern in image processing. Image classification is both challenging as well as important task. There are various approaches for solving this problem. In this proposed method our objective is to successfully classify an image from given large image database. Image features which contained most important information for successful classification are extracted by using Haar wavelet and Daubechies wavelet (db4) wavelet discrete Mayer wavelet (demy).In this proposed method received image features are first used with ANN for training and testing and then used same image features of different wavelet transform for KNN training testing. Finally, we evaluate the performance of both ANN and KNN classifier with different wavelet Features. Highest classification efficiency is received by Dmey based ANN classifier.*

Keywords: *ANN(Artificial neural network),Image classification, KNN(K Nearest neighbours),wavelet transform*

I. Introduction

Classification of the image from given database by using traditional machine learning algorithms is a very complicated task because of many numbers of details that describe an image and the large size image database. For these reasons, this learning algorithm is not suitable for image classification especially when the database is very large. Another limitation of mention traditional machine algorithm is a longtime requirement for classification. These papers compare the classification result of two most important method of image classification. These are Artificial Neural Network (ANN) and K Nearest Neighbors (KNN) classifiers. Present days these two methods are widely used in image classification, pattern recognition and retrieval of images. Images that we use in this paper have very large pixels size. If such large size image is used as an input of any network, the number of input unit is going to increase and causes the network size to increase. To handle this high dimensionality, image classification systems usually rely on some preprocessing of images. One of the pre-processing steps is based on wavelet transform. In present-day wavelet transform is widely used in digital image analysis. Nowadays wavelet transforms is the most popular method for analysis of images and gives information from an image such as a shape and texture. In this paper, we use the Haar, Daubechies and discrete Mayer wavelet transform coefficients. Image features are obtained from mention wavelet families and this features to use as input for both classifier.

II. Literature Review

In this paper, they have used wavelet features and three machine learning algorithm is used for image classification using same wavelet transform and performance for result is evaluated.[I]

In this paper a comparative result analysis of SVM, DT and KNN classification for image classification is performed. They have used SVM classifier because DT and KNN is not as good as SVM and it lacks several features. SVM classifier performs better result in comparisons of other technique. But SVM also suffered from features outlier problem and core problem.[2] In this proposed work Db4 wavelet transform and back propagation neural network is used for image classification.[3]

III. Iamge Features

Extraction of image features plays a very important role in classification problem because this image features contained most important information about the image. There are number of classification techniques present based on spectral data representation. 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. 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. So many futures extraction techniques are used in past our proposed method for

features extraction is just like same as the only difference is that we used three wavelets transform i.e.haar, db4, dmey Wavelet transform.

IV. K Nearest Neighbor

In present days K Nearest Neighbour method is widely used method for regression and classification of the multiclass image. Classification of an object is totally based on the distance from its neighbours. If k == 1, the algorithm becomes nearest neighbour algorithm and the object is classified to the class of its nearest neighbour. Distance is a keyword in this algorithm, each object in the space is represented by position vectors in a multi-dimensional feature space. The KNN classification method is based on the nearest distance of neighbour classes. It selects only k-nearest neighbour classes depending upon distance. So that majority vote is then taken to predict the best-fit class for a point. That means if the distance is k== 5 algorithm will give a maximum vote to its 5 nearest neighbours. Following example can explain this principle, consider Fig 4(a) where k == 1 point X, belongs to class 3 (green circles). If k== 5 as in Fig.4 (b) the point X will be best classified in class 1 (blue circles) according to a majority vote of the five nearest points. The most common method of measuring distance is Euclidean. Euclidean squared, city-block, Hamming, Chebyshev are some distance measuring methods used in k -nearest-neighbour. The Euclidean distance is used for measuring the distance between the test point and cases from the example classes. If 'r' and 's' are two points in Euclidean space and it is assumed that

r = (rl, r2, r3 r4.....rn) and s = (s 1, s2, s3, s4....Sn), then the Euclidean distance of line segment rs is given as:

$$d(r,s) = \sqrt{(r_1 - s_1)^2 + (r_2 - s_2)^2 + \cdots + (r_n - s_n)^2}$$
$$= \sqrt{\sum_{i=1}^{n}(r_i - s_i)^2}$$

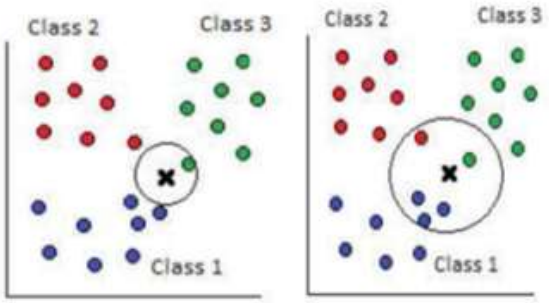


Fig 1: KNN classification (1)for K==1,i.e nearest neighbour (2)for K==5,i.e. 5 nearest neighbours

V. Artificial Neural Network

An ANN is most widely used image classification algorithm in many computer vision applications such as pattern recognition or data classification, image processing in biomedical, retrieval of content-based image through a learning process. This ANN is an information processing paradigm. This model is inspired by biological nervous systems, such as the brain, process information. The novel structure of the information processing system is the key element of this paradigm. This structure has a large number of information processing element called neurons. All these neurons are highly collected to each other and plays key role to solve classification. Backward propagation of errors or back propagation is a common method for training artificial neural networks. From the desired output, the network learns from many inputs. Back propagation is a supervised learning method. This method is based on the generalization of the delta rule. It requires a dataset of the desired output for many inputs, making up the training set.

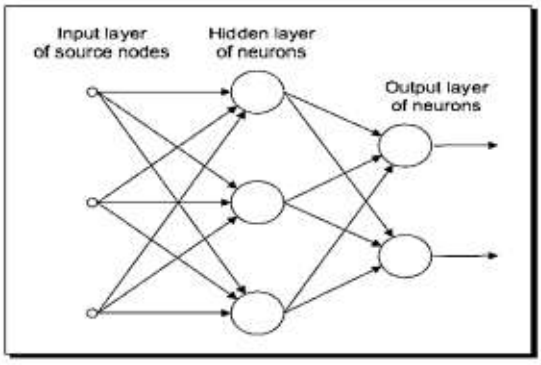


Fig 3: Artificial Neural Network Structure

VI. Proposed Method

1. To create database of training image of size 256 by 256. 5 test image would be taken Car, Child, Ship, Aero plane, flying bird. For each training image we store 20 images and also data base consist of 50 test images.
2. Training image of size 256 by 256 is read from created database.
3. The training image present in a database has very large pixel size, if such a large pixel size is given to input of network the number of unit is going to increase and result in increase in network size. To maintain network size pre processing of image is required. Preprocessing is done using Discrete wavelet transform (DWT). From input image first we extract RGB band, and then this band are decomposed into four decomposition level carrying. First level gives information about approximation of input image. Second give a horizontal component of image, third give vertical component and fourth the diagonal component of Image. This decomposition of image is achieved by using DWT classifier (haar, db2, morlet).
4. In this step from the from decomposed level obtained from DWT feature of the image is extracted. This feature of image is provided as input to the classifiers.
5. Classifiers are used for pattern matching between test image and trained image using this feature extraction is done from the set of test image. Classifiers build in this project is with the help of ANN and KNN algorithm.

VII. Result

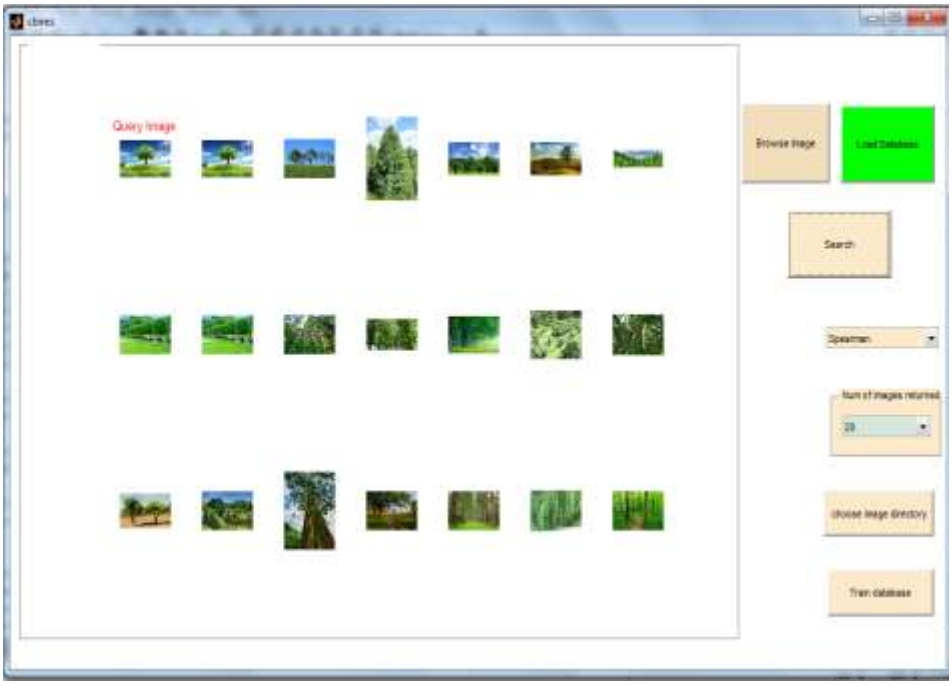


Image classification techniques are useful in many image-processing applications. Image classification systems work with whole images and the searching is based on comparison of the query. General techniques for image retrieval are color, shape and texture. These systems are connected to get a picture from the picture database. They are not worried about the different resolutions of the pictures, measure and spatial distribution.

Hence all these methods are not appropriate to the art image classification. Moreover shape based retrieval systems are useful only in limited domain. The substance and metadata based framework gives pictures utilizing a successful image recovery strategy. Numerous other image recovery frameworks utilize worldwide highlights like shading, shape and texture. But prior results say there are too many false positives while using those global features to search for similar images. Hence we give the new view of image classification system using both content and metadata.

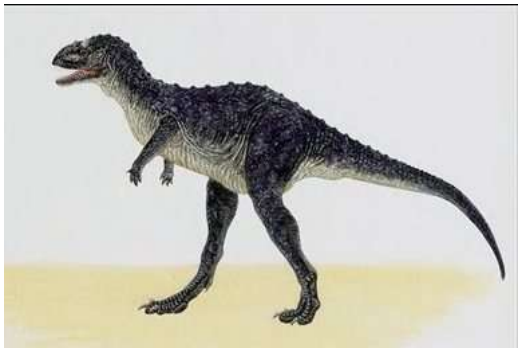
Database Images:

In database five classes are there and for each class 100 images are there..

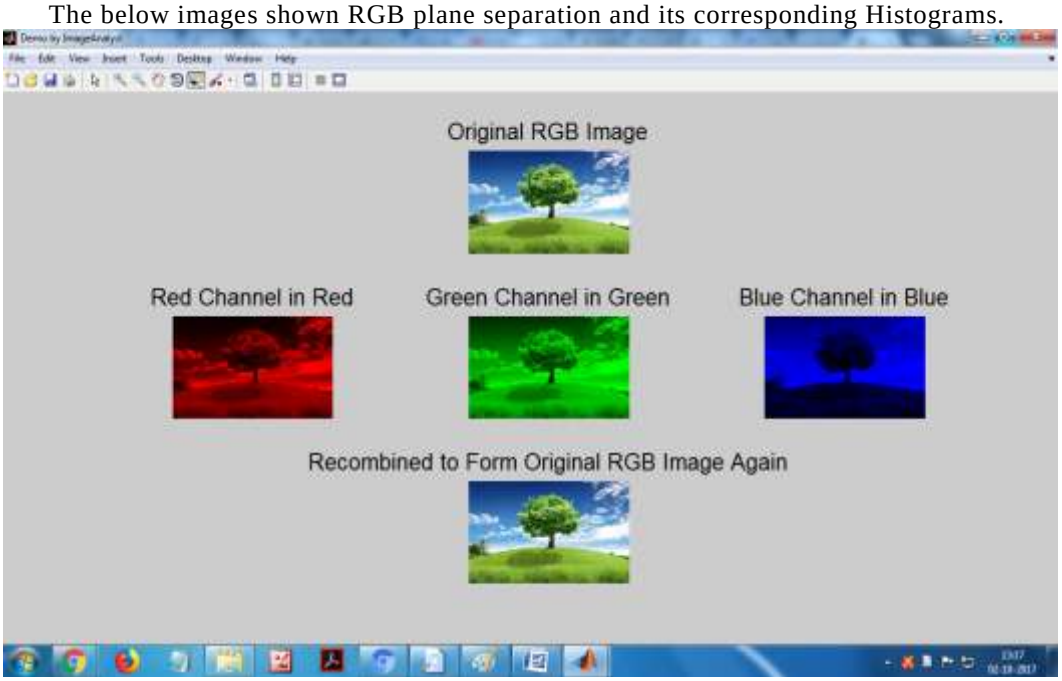
1. Tree
2. Beach
3. Monuments
4. Buses
5. Dinosaurs







The below images shown RGB plane separation and its corresponding Histograms.



VIII. Conclusion

In my research paper we observe that in image implementation from a large data base by using wavelet transform and back propagation Neural network (BPNN). The input is generated by using colour moment, wavelet transform and entropy.

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