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EFFICIENT FEATURE EXTRACTION WITH NEURO FUZZY CLASSIFICATION APPROACH FOR OBJECT DETECTION

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ABSTRACT

Images are used in many applications, where the decision is done on the basis of the scanned images. In such applications, first of all the image processing techniques are applied to enhance the quality of the image. Object segmentation is also a part of image enhancement process. There are multiple object segmentation technique. This study also introduces a novel object segmentation technique. The proposed ANFIS based object segmentation technique is developed with an objective to differentiate multiple objects with similar color and shape in an image. For this purpose, Gabor Wavelet technique is applied for extracting the objects. The proposed work is simulated on various types of images such as face images, image of leaves, image of hands. The proposed work is simulated in MATLAB and it is observed that it outperforms the traditional technique in terms of accuracy, stability, precision and recall.

Keywords: *Image segmentation, object Segmentation, Artificial Neural network, Fuzzy Inference System, Gabor Wavelet, Laplacian Pyramid.*

I. INTRODUCTION

Object segmentation plays important role in various domain where the decision making process relies upon the observations that are derived from images [1]. Medical image diagnosis is best example of this where the disease of the patient is assured on the basis of the images such a MRI, CT Scan, X Rays. The process of extracting the features from images is done by using various image processing techniques. The object segmentation is also a part of the image processing or enhancement [2]. This study develops an algorithm Gabor-ANFIS for object segmentation in images. The motive of this development is to differentiate between the two different objects in the image which have similar features [3].

II. TECHNIQUES USED

In order to achieve the best suitable or reliable results, the present study considers the following defined mechanism:

2.1 Fuzzy Logics

The Fuzzy logic concept firstly was given by LoftiZadeh and they presented the fuzzy logic not as a control methodology but they represented the data as a membership function. Zadeh told the people about the adaptability of this logic that it does not need exact numerical information as a input as it is capable of adaptive control [4].

On the whole, we can say that fuzzy logic is a problem solving technique that range from simple embedded system to multi network workstations. Moreover it can be planted in software as well as in hardware or both [5]. Fuzzy logic gives a definite output in respect of the input whether it is noisy or missing. It gives the exact conclusions which are based on vagueness. Following figure 1 explains the working process of fuzzy system in brief. Firstly a

crisp value is added to the fuzzy system as an input. Then Fuzzification process is applied to the crisp fuzzy values [6]. Fuzzification is a process which converts the crisp values into fuzzy sets.

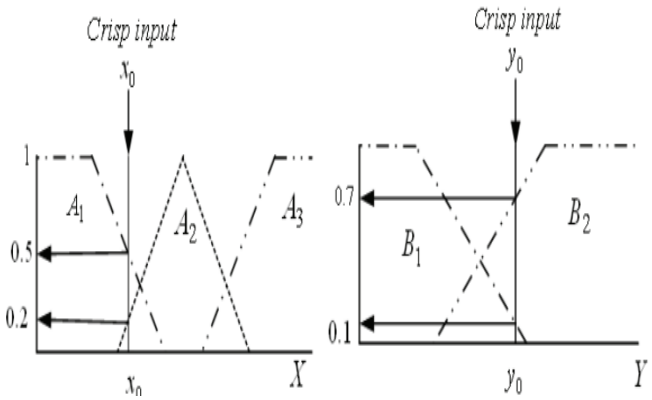

Figure1. Fuzzification[6]

Then defined rules are applied to the fuzzy input set driven by applying fuzzification. On the basis of rules an intelligent decision is taken and then the fuzzy sets are converted to the crisp values back by applying the Defuzzification [7].

2.2 ANN

In the artificial intelligence neural network term is associated from the discovery that is used to recognize and represent human brain functionality [8]. The artificial intelligence is an edition of computer science that centers to the conception of intelligent component as the methods that function and perform such as humans [9]. The main three layers of the Artificial Neural Network are Input layer, hidden layers and output layer. For pattern appreciation applications, effectiveness of neural network based on the learning paradigm implemented [10].

2.3 ANFIS

The ANFIS can estimate every plant by using effective parameter training and the sufficient number of rules [11]. On the basis of count of parameters the training cost exists however the Gaussian membership function is utilized as it is applied only two parameters. ANFIS is a structure of neuro-fuzzy model that can put together human proficiency with improving itself by learning. In its design it contains a couple of kind of nodes that are fixed nodes and the adaptable nodes [12].

2.4 Gabor Wavelet

Gabor wavelet technique is used in image processing where it is separated into two series of one- dimensional ones. This technique is basically used to detect the edges, corners and blobs of the face image. Gabor functions helps to extract the features especially in texture-based image analysis [13]. The two approaches i.e. edge detection that is done from the feature image and corner detection with the help of combination of responses to several filters with a different orientation [14].

III. PROBLEM FORMULATION

In traditional work, the object segmentation was done by extracting the features from the input images and then these features were processed by using artificial neural network. The backlog of the traditional work was that the features were extracted on the basis of the color. For this purpose, various color models like RGB, YCbCr, HSV and YIQ was used. The hindrance of using only color as a parameter for feature extracting is that it only extracts the features on the basis of the color and was not able to perform differentiation among the object of the same color. The use of ANN is another complication of the traditional work, as ANN is a machine learning based mechanism. Thus it is quite efficient to generate the results on the basis of the trained dataset and fails to perform operations

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when the variation in the datasets takes place. Thus, it is concluded that there is a crucial requirement to develop a system which can perform feature extraction efficiently and also able to handle the variations in the datasets.

IV. PROPOSED WORK

The proposed work updates the list of parameters for extracting the features by adding the texture as a major parameter. For the purpose of texture based feature extraction, the proposed work implements the Gabor wavelet mechanism. On the basis of the texture it is possible for the system to perform recognition between the object of same colors which also makes the classification of the objects quite easy. Another improvement that is done by the proposed work is to replace the existing ANN technique with advanced Neuro-fuzzy technique.

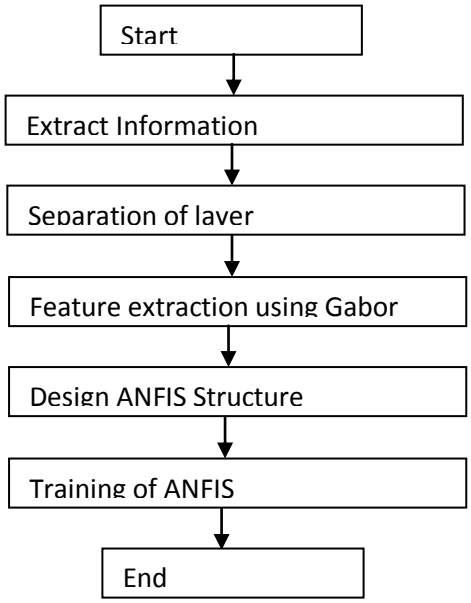

Figure 2 Block diagram for training of the proposed work

Once the features are extracted, the training of ANFIS starts. The training is performed on the basis of the features extracted using Gabor Wavelet approach.

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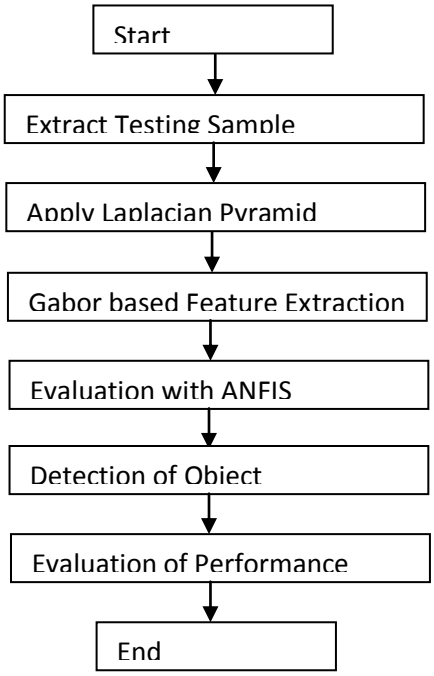

Figure 3 Block diagram for testing of the proposed work

After the training of the ANFIS, testing is performed in which different samples are taken and the features are extracted. Accordingly, the evaluation is performed.

V. RESULTS AND DISCUSSION

The object segmentation is inseparable part of image segmentation. It is a complete topic for research work research work in itself. The present study analyzes that the traditional or classical object segmentation techniques was failed to recognize two different objects having similar properties like color or shape. Thus to overcome this backlog, the present work creates a novel mechanism which is quite capable to differentiate two different objects with same features. For this purpose the Artificial Neuro system based Fuzzy Inference System is implemented in this. The major role of this system is to test the sample sets as per the trained sample data sets. The [proposed work is simulated in MATLAB simulation platform. This section delineates the results that are obtained after implementing it. The performance of the proposed work is measured in the terms of accuracy.

In order to implement the ANFIS object detection system, we need to train some sample data sets. The proposed work comprised of three different data sets that are comprised of various kinds of images in each. Out of these three datasets, the first dataset is comprised of facial images, second data set is comprised of images of leaves and third dataset is comprised of images of hands.

The image shown in figure 4 depicts the dataset of facial images. The figure 4 comprised of 6 images, out of which first one is original image, second one is image enhanced image, 3rd, 4th and 5th image represents the different layers of original image and last image depicts the extracted feature from the image.

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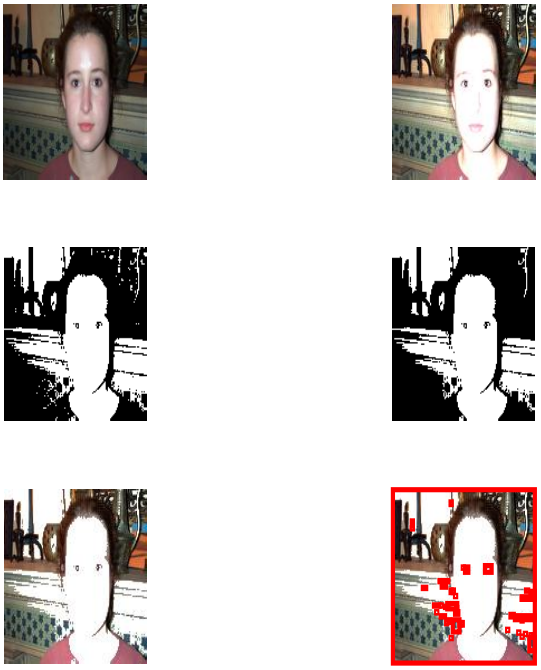

Figure 4 Sample Dataset for Facial images

The images in figure 5 represent the sample of datasets which is comprised of images on hand. The feature extraction is done by using Gabor wavelet technique**.**

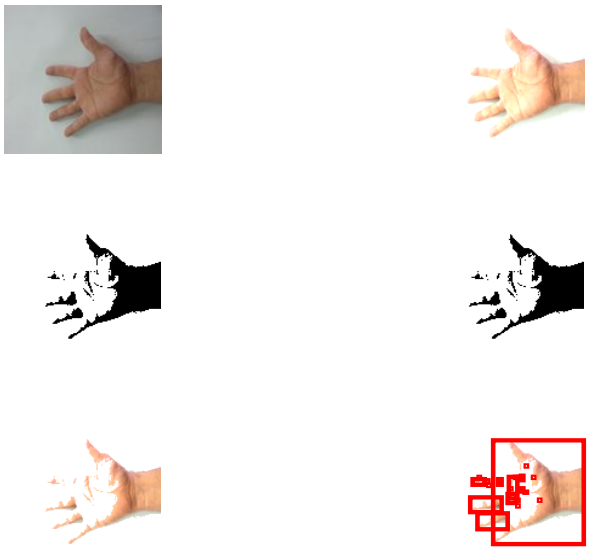

Figure 5 Sample Dataset for images of hands

Similarly, the images in figure 6 represent the dataset of leaves. The processing applied on three of the datasets are same. The reason behind implementing the proposed work with respect to different kind of images is to prove the accuracy and precision of the proposed work.

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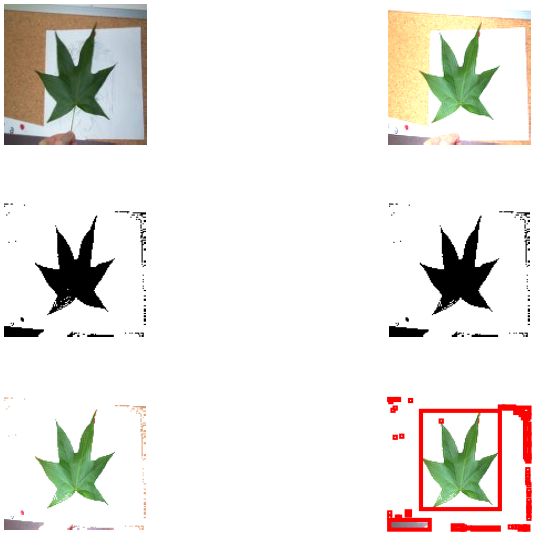

Figure 6 Sample Dataset for images of Leaves

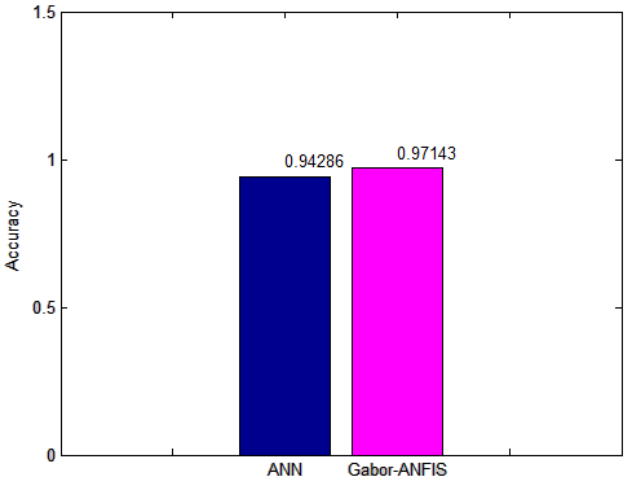

Figure 7 Comparison of ANFIS and ANN using Accuracy Parameter

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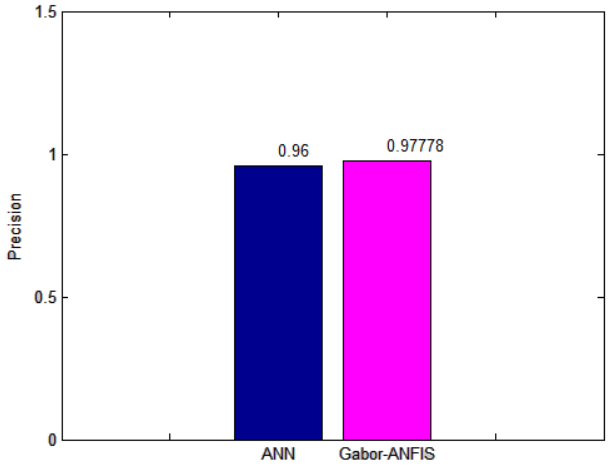

Figure 8 Comparison of ANFIS and ANN using Precision Parameter

The graph in figure 7 and 8 shows the performance of the proposed Gabor-ANFIS technique and ANN on the basis of the various performance parameters. The parameters shown in the graphs are Accuracy and Precision. The Accuracy of proposed wok is 0.97143 and Precision is 0.97 The bar in pink depicts the proposed results and bar in blue shows the results of ANN object segmentation technique. The Gabor-ANFIS outstands in each and every aspect.

VI. CONCLUSION

Object detection is a part of image enhancement. As the object detection is also done with an motive to enhance the image removing its dullness, and extracting the meaningful features from it. From results it is concluded that proposed method is best and efficient than the traditional method of objet segmentation. In our proposed work we implement the proposed technique on various images. It is concluded on the As a future scope further enhancement can be done in this method by using any trending optimization mechanism so that more optimized results can be obtained.

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