# Implementation of Image Classification Using Wavelet Based Method for Eye Detection and Neural Networks

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***Abstract-*** **The aim of this paper eye detection with software simulation packages such as wavelet and NN ', such as the Matlab 7.0 toolbox to verify the specificity of the human eye and its performance as a biometric. A sequential feature selection algorithm is then used to select the most appropriate features for classification. The classification is performed using neural networks that provide high accuracy. The eye detection system includes an automated segmentation system based on wavelet transform, and then wavelet analysis is used as a pre-processor for a posterior diffusion neural network with conjugate gradient learning. Inputs of neural networks are the waveform maxima neighborhood coefficients of facial images on a particular scale. The output of a neural network is the classification of inputs into an eye or non-eye region. The program code is generated using Matlab and the results are analyzed. The output is such that it classifies the dataset into normal and image classifications, using wavelet based methods for eye detection. Datasets are categorized using neural networks. The main objective is to examine the image compression of a gray scale image using wave theory. It is implemented in software using MATLAB wavelet toolbox and 2D-DWT technology. Experiments and results are performed on .jpg format images. These results provide a good reference for application developers to choose a good waveform compression system for their application.**

***Index terms-*** **ANN, Image, Eye Detection, Wavelet**

## I.INTRODUCTION

The operating system used is Windows XP and the tool used is Matlab of version 7.0. MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation. Matlab is a data analysis and visualization tool designed with powerful support for matrices and matrix operations. In addition, Matlab has excellent graphics capabilities, and has its own powerful programming language. One of the reasons that Matlab has become such an important tool is to use sets of mean programs designed to support a particular task. Accuracy of 80% is observed for test images in various environmental conditions not included during training. [1] Eye examination systems are being used extensively in biometrics security solutions by the US Department of Defense (DoD), including access control to physical facilities, security systems, or information databases. A biometric system provides the correct identification of a person based on a specific biological feature or characteristic that the person possesses such as fingerprints, handwriting, heartbeat, facial recognition, and eye recognition. Among them, eye detection is a better approach because the human eye does not change throughout a person's life. It is considered the most reliable and accurate biometric detection system available [2]. The recognition of human faces out of still images or image sequences is an actively developing research area. There are many different applications for systems faced with the problem of face localization and recognition viz. Model based video coding, face recognition for security systems, gaze detection and human computer interaction. Facial detection and location as well as extraction of facial features from images are important. The problem is complicated due to differences in illumination, background, visual angles and facial expressions. In the first stage of facial recognition, facial features such as eyes, nose, and mouth are detected after localization of facial regions within the facial figure 1.1 [3].

## II. RELATED WORK

Lee et al. [1] Create a fuzzy template that is based on the border of the piece. The eye or non-eye is judged according to the similarity between the input image and the eye template. In the template, the eyelid is formed by a region of proximal segments, with a laminate border. Each segment in the fuzzy template is filled with the deepest intensity values within this segment.

Huang, J., C. Liu et al. [2] Genetic algorithms have been exploited for eye recognition by fitting image distributions (mean, entropy and standard deviation) between training and probe image. Using evolutionary computation-based methods most likely the location of the eye is searched and a model-based eye recognition component examines the suggested locations for real eye detection.

Bala et al. [3] Use genetic algorithms for feature selection. Bases represent visual routines for feature representation and scene recognition as decision trees evolve. The proposed technique uses the inclusion of decision trees in the hybrid architecture for the evaluation function.

Koch et al. [4] Use a neural network to scan an input window of pixels across the image, where each gray value in the input window serves as an input to the neural network. Neural networks are then trained to respond high when the input window is focused on the eye.

Nazzal, M.; Ozkaramanli [5] In the wave-based SISR, the main thing to note is that they consider the LR image as the level-1 approximation image of the valet-decomposition. Here, to recover the HR image, the task is to approximate the wavelet sub-band images, which represent this approximation image, and finally one-level inverse wave transforms. By doing this, the authors induce compactness as well as rarity and directionality in the algorithm, which helps to boost the performance of the algorithms as well as improve their convergence speed.

## III. PROPOSED METHODS

The system mainly consists of two phase training and detection phase. A block diagram of these two steps is shown in Figure 1.1.

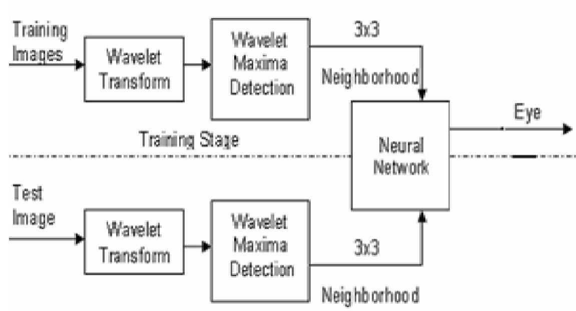



Figure 1.1 - Block Diagram

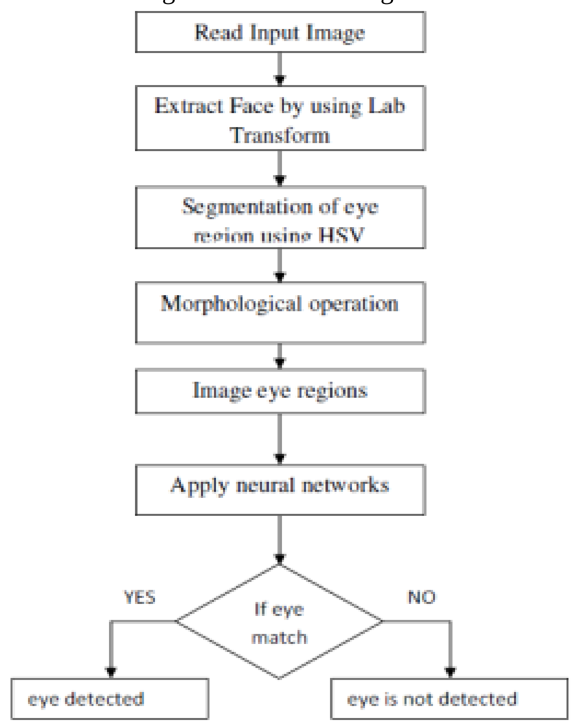


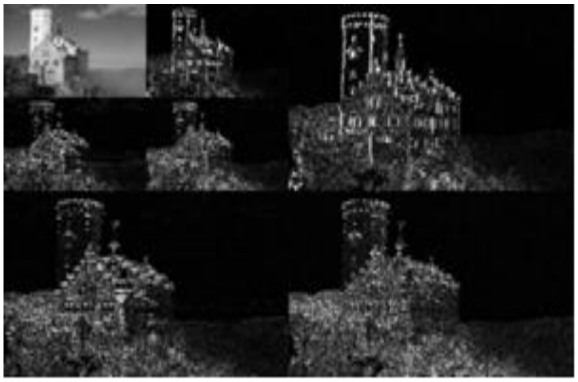

Figure 1.3: Proposed Algorithm

## IV. ACQUISITION OF TRAINING DATA

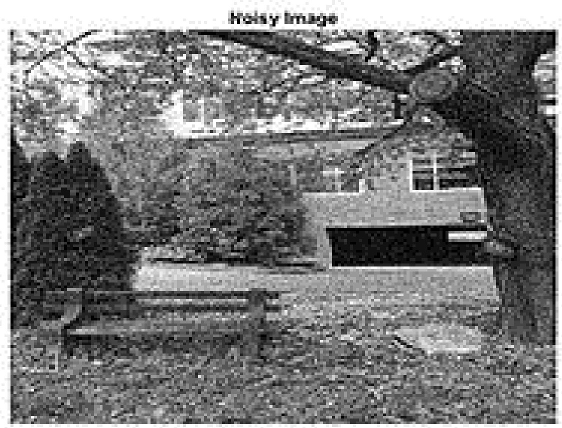
Training data typically consists of 50 images of different individuals with different hairstyles, different illumination conditions, and facial expressions. Some images have different eye conditions, such as closed eyes. Images vary in size from 64x64 to 256x256.

## V. DISCRETE WAVELET TRANSFORM

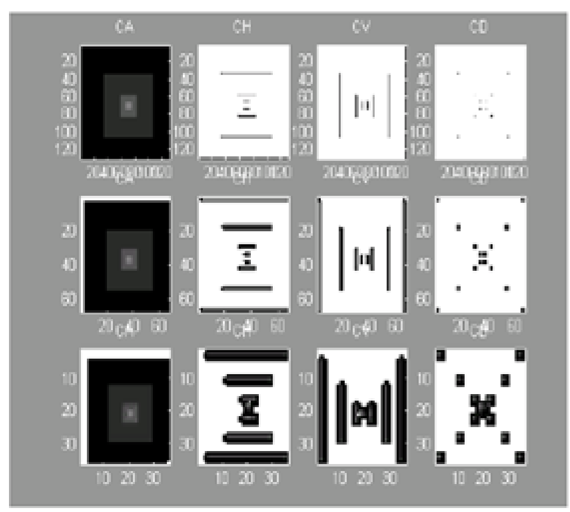
In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are heavily sampled. As with other wavelet adaptations, one major advantage of this over Fourier transforms is temporal resolution: it captures both frequency and location information [6,7].



An example of 2D discrete waveform transformations that are used in JPEG2000. The original image is high-pass filtered, yielding three larger images, each describing local changes in brightness (detail) in the original image. It is then low-pass filtered and downscaled, which produces an approximation image; This image is high-pass filtered to produce three small detail images, and low-pass filtered to produce the final approximation image in the upper-left [8].




## VI. DETECTION OF WAVELET MAXIMA



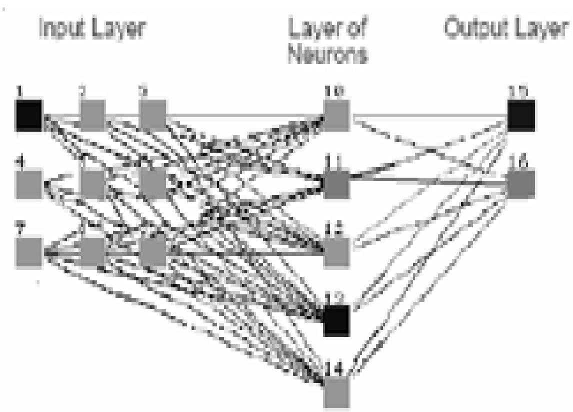

Our approach to eye detection is based on the observation that, in intensity images, the eyes differ from the rest of the face due to their low intensity. Even if the eyes are closed, the dark of the eye socket is sufficient to remove the eye areas [9]. These intensity peaks are well captured by the wavelet coefficient. Thus, the wavelet coefficient has a higher value in the coordinates around the eye. We then detect wavelet maxima or wavelet peaks in this LH subband of 32x32 resolution. Note that many such peaks have been detected, which may be possible locations of the eyes [9,10].

## VII. EYE DETECTION METHODS USING WAVELET TRANSFORM

The Eye Detection Methods Using Wavelet Transform with several methods of eye detection using wave transforms. MRI images were described by methods. Image thresholding and mean filtering were used Prefabricated images. The Daubechies, Symlet and Coiflet function families were studied in the treatment of real pictures [11].

VIII. NEURAL NETWORK TRAINING

The network will receive 960 real values as a 960-pixel input image (image size ~ 32 x 20). It will then be necessary to identify the eye by reacting with the output vector [25]. Output vectors represent one eye or non-eye. To operate correctly the network must respond with 1 If the eye is presented to the network the output vector must be 0 [2]. In addition, the network must be capable of handling non-eyes. In practice the network will not obtain an ideal image of the eye represented by a vector as an input. In the




first phase a large number of eye and non-eye images are required to train the neural network. Approximately 50 eyes from different face instances were collected from the face database on cropped VTS and from the GATV face database. Wavy peaks have been detected that are the focus of potential eye windows. We then feed the 3x3 neighborhood wavelet coefficients of each of these local maxima into the 32x32 LH subband of all training images for a neural network for training. The neural network consists of 9 input nodes, 4 hidden nodes and 2 output nodes. A diagram of the neural network architecture is shown in Fig. A (1, -1) at the output of the neural network indicates an eye in place of the wavelet maxima while (-1, 1) indicates a non-eye. Two output nodes were taken instead of one to improve the performance of the neural network. MATLAB's neural network toolbox was used to simulate posterior diffusion neural networks. A combined gradient learning rate of 0.4 was chosen during training. This neural network completes the training steps for the back propagation model. Here we have used the MLP (multi-layer assumption) back-diffusion model for neural network training. It consists of 9 neurons in the input layer. The hidden layer or the second layer has 5 neurons for processing. The third or output layer has two nodes to show the output. We have urged two output nodes of one to achieve better accuracy for eye detection [14]. Next you need to find the eye part and the non-eye part in the figure from the neural network model. Where the output of (1, -1) represents the presence of the eye and the output of (-1,1) indicates the presence of the non-eye. Some examples of non-eyes that are collected during training are shown in Fig. Note that some examples resemble the eye, although they are not very close to the positive examples shown in the picture. The presence of these examples forces the neural network to learn the precise boundary between eye and non-eye images. We used sequences of 50 images to collect negative examples in the manner described above. The eye and non-eye images used for training neural networks appear in the figure below

Figure 1.3: Samples of eye patterns from the training and test sets

IX EXPERIMENTAL RESULTS

Comparison of eye detection methods is not easy due to the hard eye determination in the image. There is a lot of texture in the image background, particularly in medical images, which makes this task unclear. The rating of each method is attitudinal. The methods outlined in Part 2 were tested in a set of MR images using different wave functions [13].

The proposed algorithm has been tested on VITS and GATV databases. The algorithm is tested on 100 images in the phase of automatic extraction of the eye field. Figure shows that eye images have been successfully detected. On the other hand, in Figure we have examples of images for which detection failed. We noticed that most of the errors were caused by the position of the face, especially when the face was turning to one side, closing the eye and distance. The efficiency of the proposed algorithm has been evaluated at 100 images, which succeeded in detecting the area of the eye. The test results are with a sensitivity rate of 88.6%, specificity of 95.2% and accuracy of 89.2%. The figure shows the eye area that was classified as non-eye. It is noted that the error occurred in images whose eye areas had turned black, becoming similar to eyebrow, hair, or background areas. Several experiments were conducted to test the robustness of the algorithm and to increase the accuracy of eye recognition. Different architectures of neural networks with different learning rates were tried and it was found that back propagation with conjugate gradient learning seemed the best option. A very high learning rate of 0.7 was chosen because the learning algorithm was getting stuck in the local minima while training the network. The final graph was stopped when the error graph, as shown in the figure, showed no significant fluctuations [15]. Conjugate training error curve An experiment was performed in which the face was analyzed using wave packets and it was found that most of the information was retained by the low frequency subband and no information of high frequency packets . Images with different states of the eye (closed, open, half open, sideways, head tilted) and different eye widths were chosen. The detected eye positions were compared with the positions that were manually indicated. The eyes were positioned correctly when its location is within two pixels, in both the x and y directions, at a manually assigned point. A 2-pixel variation is deliberately allowed to compensate for inaccuracies in the eye space during training. The final spot of the eye saw an accuracy of 88%. A database of 75 test images was evaluated for performance. All these test images were captured in completely different environmental conditions and were not included when training the neural network. Most error cases occurred in images with complex backgrounds. There was also an error in correctly determining the exact location of the eye since a 1 pixel shift at a resolution of 32x32, which corresponded to a large shift at the exact location of the eye. In some cases neural networks have classified only 1 peak as one eye, despite the presence of 2 eyes in the image. In some cases observations were made as to which areas of the face that did not belong to the eyes were detected as eyes. In other cases more than 2 eyes were indicated in the image.

The signal to be analyzed is passed through filters with different cut-off frequencies at different scales. It is easy to implement and reduces the calculation of time and resources required [9]. 2-D DWT can be seen as a 1-D wavelet scheme that converges along the rows and then transforms the 1-D wavelet along the columns. 2-D DWT operates in a straight forward manner by placing array transposition between two 1-D DWTs. The rows of the array are first processed with only one level of decomposition. This essentially divides the array into two vertical halves, keeping the average coefficient in the first half, while the second vertical half stores the expansion coefficient [12].

Figure 1.4: Experimental results showing Original image & Eyes detected

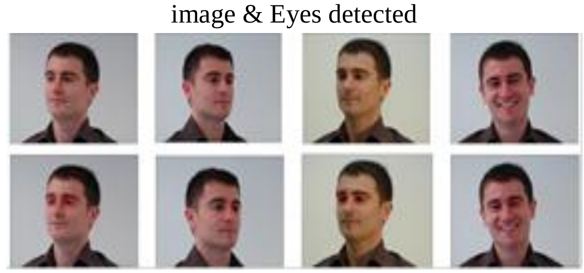


Figure 1.5: Images with failure in the location of the eyes

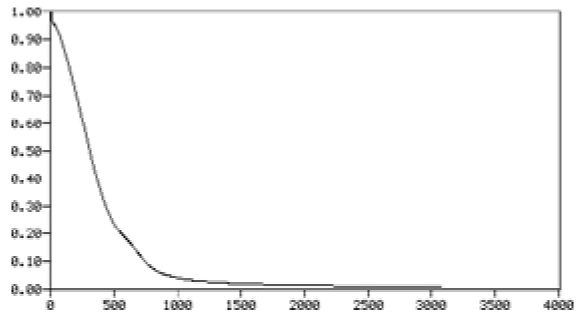
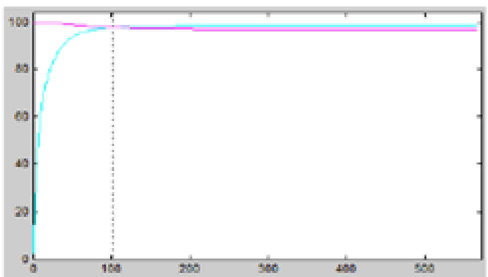
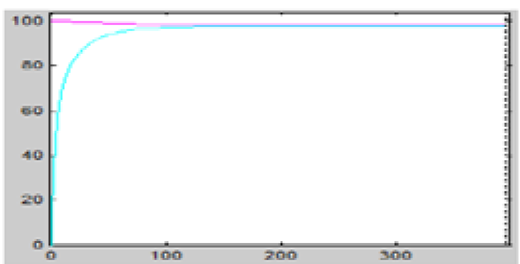


Figure 1.6- Conjugate Training Error Curve


(a)



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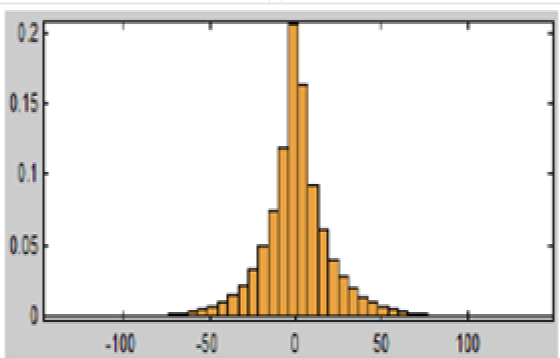


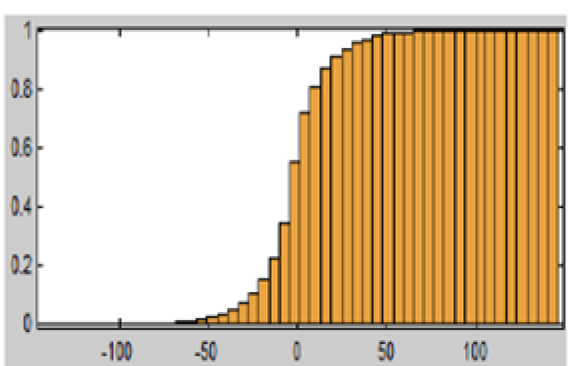


## VII. CONCLUSION

Eye screening has become an important issue for various applications. The eyes will be fragmented after eliminating all other parts such as the background, skin and other human parts in the image. Some of the techniques employed by various researches include template matching, eigenvectors and huff transforms. We have proposed a completely different technique that allows HSV as well as lab color spaces to remove all the unwanted pixels in the image specific eye and the left field in the image as SVM eye or non-eye Categorizes. This paper proposed a wavelet subband approach to use neural networks for eye screening. The wavelet transform is adopted to decompose an image into different subbands with different frequency components. A low frequency subband is selected for feature extraction. The proposed method is robust against changes in illumination, background, facial expression and also works for images of different sizes. However, better performance can be given by combining information or using multiple signals in different frequency bands at different scales. During the research work experiments were carried out using the standard database and 100 images of various key individuals obtained from the available VITS database. The success rate of the proposed algorithm is 98%, with a result of 2% failure due to head speed, background and improper training or neural network. The efficiency of the proposed algorithm can also be evaluated based on sensitivity, specificity, and accuracy, with the calculated values being 88.6%, 95.2% and 89.2%, respectively. The authors continue to work on this subject for further improvement. Such an approach gives a new dimension to existing eye detection algorithms. The current algorithm is robust and equal with other current methods, but there is still much room for improvement. This type of approach has a wavelet subband approach in using neural networks for eye recognition. The wavelet transform is adopted to decompose an image into different subbands with different frequency components. A low frequency subband is selected for feature extraction. The proposed method is robust against changes in illumination, background, facial expression and also works for images of different sizes. However, better performance can be given by combining information or using multiple signals in different frequency bands at different scales. Further studies in using fuzzy logic for data fusion of multiple signals will give better results.

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