

Automatic Number Plate Recognition Using Haar Wavelet

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Abstract: The tenacity of this paper is logical investigation of prevailing ANPR system research by cataloguing existing methods analyzing and equate old and new techniques. Automatic number plate recognition is a technique to read character from image and isolate number using various processes and practices. Automatic number plate credit is a image processing techniques. In this paper we used efficient approach for extract the countryside of number plate using haar wavelet and compare Haar wavelet with old technology .Haar wavelet reduce intensity and noise from signal and takes less time for training.

Keyword: ANPR System, Haar Wavelet, Acquisition, Detection, Segmentation, Recognition.

I.INTRODUCRION

Image Processing:- It is the process of image convert original image into digital image using mathematical operation. Apply signal processing on image for extract information about original image. The cardinal image use innumerable algorithm for processing. It is related to computer graphic and computer vision. In image processing captured the image using high resolution camera and import using optical scanner, analyses and manipulate for find out characteristics of image. In this processing used two types methods for processing one is analog that is used for analyses hard copy printout image and second is digital that is used for analyses on computer .Vehicle is increase day to day problem of crimes, stealing increase repeatedly. Convicts uses vehicle in crimes, people not follow circulation rule, due to many inadvertent cases happens. To resolve such types of problem used various techniques to read number plate and identify vehicle number. Identify number plate of vehicle encompass in criminality can help to find out prisoners. Goal of ANPR system is to identify vehicle number and reduce the intensity. There are prevailing some solution for number plate identification like template matching, innovative adapting, DWT, CWT and various wavelet transform but some problem in existing system. They are very raucous, so to resolve such types of problem use haar wavelet. Haar wavelet is the orthogonal wavelet that has symmetric examination and separation filters. It is also known as haar transform for the mathematical operation. It has two version 1D and 2D. 1D haar wavelet is used for find average value of image pixel and detail of signal and 2D haar wavelet decompose image into orthogonal sub bands with LL, LH, HL, HH parallel to approximation, horizontal, vertical, diagonal. It is used for detection and feature abstraction of number plate characters. It reduce the noise from signal so it is better technique as compare to template matching technique. It takes least time for character exposure, eccentric segmentation, feature extraction and for training. Abstract article from image using haar wavelet and diagnose image, after abstraction details of image detect the character of image, normalize the image after standardization screening the region using refining filter and detect value of edge component using sobel operational. After detection segment the image, in segmented phase decompose the character exclusively and bounded by box. After dissection appreciation the image and identify gratitude rate and training time of various image using database.

II FINDING OF REVIEW

Recent Reacher state that, Image is capture using cardinal camera then after convert to gray color apply preprocessing techniques. Antenna system [1] used for adding processing unit used as a convention high end antenna camera. Sensor camera attaining the images at the required rate and pass to the pyramid analysis tasks. Pyramid Handler work as a interface between the sensor mount storage and the image processing and on the other analysis the software using sensor system. Image processing is composed of three motherboards daisy bound. Acquisition of image used Vision Subordinate & Labview software [2] to find greatness of image use inception function, calculate upper and lower inception value, and find more contract image, brightness and more efficient process. Extract characters [3] without preceding acquaintance of their position and size in the image. Proposed technique based on scale shape analysis, which in turn is based on the assumption. Morphology [4] used for find out image locality, during preprocessing used stationary wavelet and detect edge, to find out edge vertex value use structural element. They use two algorithms, opening and closing for make image smooth binary, Morphology operation is the process in which get gloomy image from original image. Wavelet transform module maxima methods [5] used for number plate recognition, detect the edge from image using module maxima, then after extract feature from image. Feature of color extracted by histogram, distance method, Centre moment. Segment the character [6] accurately from the plate image using two steps: vertical cut and horizontal cut that are used with some image dispensation, for recognition a novel [7] based adaptive techniques used for concentrate the character, NTSE standard method for convert RGB image into gray color image. Template matching [8] involves the use of a database of charismas or prototypes. The character is withered to be the same size with the template in database. The shrunk character compare to the all templates in database to find out the best from all. Template matching is the major method in number plate acknowledgment, used an approach for using simple image monograms [9] which can be rapidly derived and compared against a set of monograms. Signatures must be capable of being derived quickly and must be much smaller than the instigating images. Histogram [10] for character recognition, the Histogram of Oriented Gradients feature descriptors to represent the image as a feature vector. HOG computes histogram of ascent coordination on a dense lattice of uniformly spaced chambers and uses local contrast normalization in overlay blocks for improved accuracy. Discrete Wavelet Transform [11] is widely used to transform an image from the spatial domain to frequency domain. For segmentation [12] used cord video to digital signal, bundling approach for segmentation. Researcher used template matching for character recognition. Template matching is an effective algorithm for recognition of element in the administered learning mode. The character is minimized to be the same size with the template in database. The minimized eccentric compare to the all templates in database to find the best. A multiple layer perception [13] neural network was used for recognition, for calculate recognition rate and training time used back propagation neural network.

III PROPOSED WORK

Haar wavelet is the symmetric orthogonal wavelet. It is used for find out the details of original image work flow shown in fig. 1 and extracts the numerical feature of image. It takes least time for recognition. In this proposed work Image is captured of vehicle from front end and rear end using cardinal camera and fed that image for input in the software for identification. Software check details about image from central database and find out information about image. Preprocessing is done on input image using various techniques and algothrims.

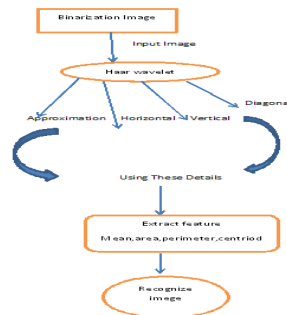


Fig.1Haar wavelet working

In the image acquisition phase original image convert into gray color and apply preprocessing, apply filtering to remove the noise from image and makes free from noise. After that detect the character of image using image detection phase, in this phase find out edge component value using sobel operator and extract the details of image using haar wavelet. Haar wavelet decompose the image into four parts such that approximation, horizontal, vertical, diagonal ,after extraction segment the character. In the segmentation phase separate each character using boundary box and extract feature like mean, variance, blob, area, perimeter, centroid then after recognition the character and using neural network calculate recognition rate and training time. When the number of images increase recognition rateandtrainingtime also increase .

A. Acquisition

It is the process in which image is captured using the cardinal camera shown in fig 2 and fig.3 .Convert original image into digital image using mathematical operation and apply preprocessed to remove noise from image to make suitable image for next process. When an image is achieved, there may be noises present in an image, noises affect the recognition rate greatly so it is remove apply various process, which are following:-

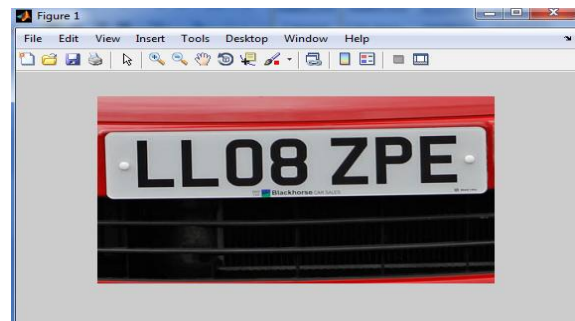


Fig. 2 Original image Fig.3 original image

(i) **Gray Image Processing-** In this process convert color image into a gray image using two methods, one is average methods and second method is weighted method. Weighted method is best for brightness as compare to average method after conversion remove the noise from image using threshold function and make suitable noise freeimage. Output of original image after conversion into gray color is shown in Fig. 4 and Fig. 5.

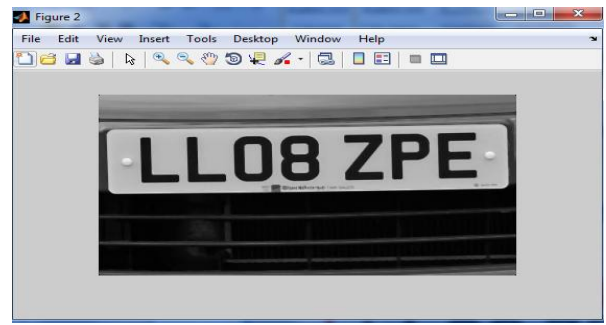


Fig. 4 Gray scale image Fig. 5 Gray scale image

(ii) **Median Filtering**-It is the process in which used two types of filter(low pass and high pass) filter for remove noise from image.After filtering masking the character region using OCR techniques. Masking also known as spatial filter, filtering also known as convolving mask.

(iii) **Image Binarization**-It is the process in which image pixels are eminent into two kinds of color according to certain benchmarks. Image is divided into obscure and graying based on the value of gray image. It shows image into two colors black and white shown in fig.6 and fig. 7 so that image is fully clear and without any kind of noise. Output of gray image after conversion into binary are shown in following fig.

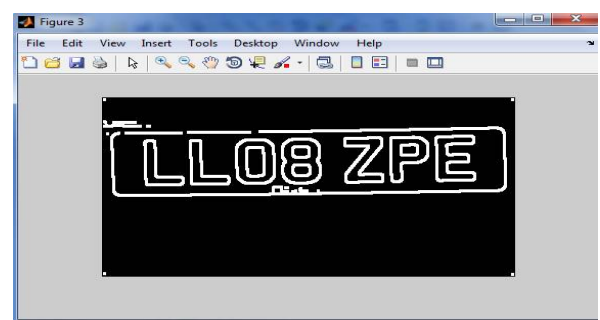
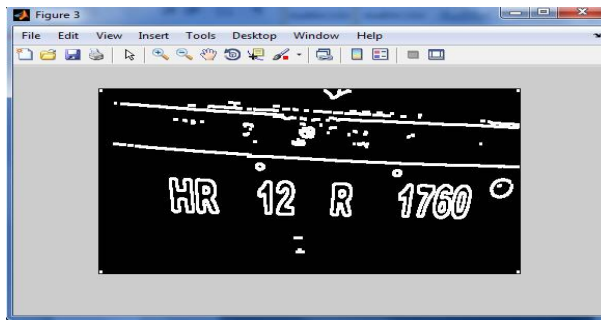


Fig. 6 Binary Image Fig.7 Binary Image

B. Extraction

It is the process in which extract the image using haar wavelet, find the locality of image and feature ratio, spoil the image into components such i.e. Estimate, straight, perpendicular, oblique shown in fig.8 and fig.9 Haar wavelet is the orthogonal wavelet that has symmetric analysis and separation filters. Haar wavelet reduce the noise from signal using median filtering, apply filtering on matrix (low pass, high pass) filter to calculate appropriate coefficient such as horizontal, vertical, diagonal ,so it is better technique as compare to template matching technique.Output of original image using input image recognize character and get details of image using haar wavelet i.e. Approximation, Horizontal, Vertical ,Diagonal shown in following fig

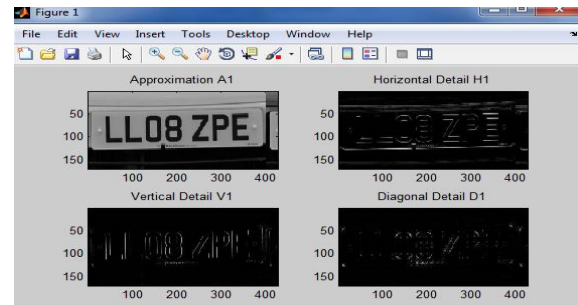
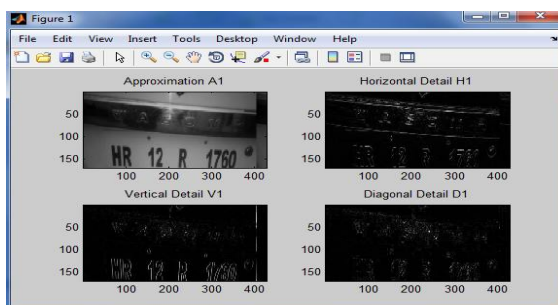


Fig. 8 Details Using Haar Wavelet Fig.9 Details Using Haar Wavelet

C. Detection

In this phase detect the character of image .Detection determine the speed and accuracy of image .First of all gray scale image regularization is done then after masking the image region using Sharpening filter and apply Wavelet revolution to find details of image. Edge detection is done using sobel operator to extract the edges value of the original image. The sobel method finds edges using the sobel approximation. It returns edges at those points where the gradient of I is maximum. The sobel edge filter used to detect edges using horizontal and vertical filter in sequence. Vertical edge-intensive plate province has been effectually increased after vertical edge extraction, and its computation is efficient easy to implement and can obtain a clear edge of number plate image. After that connected component analysis is done and regions are found, but we only require high intensity regions. In this way connected components are calculated and number plate is detected and regions of number are shown by different colors shown in fig.10 and fig.11.

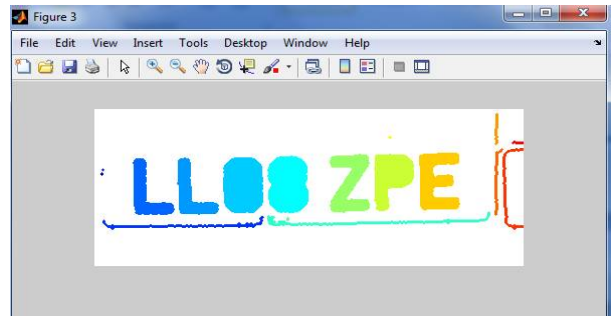
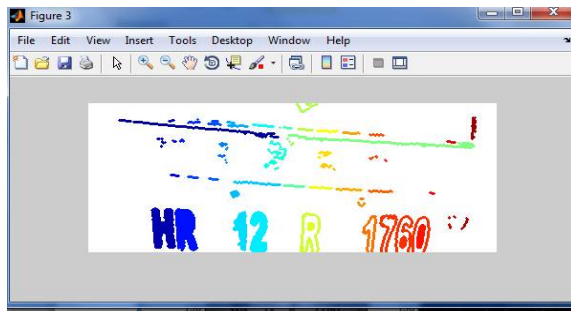


Fig. 10 Number Plate Detection Fig.11 Number Plate Detection

D. Segmentation

In this phase feature removed of image using haarwavelet ,character segmented individually in boundary box, each character separate to each other having separate box shown in fig.12 and fig.13.

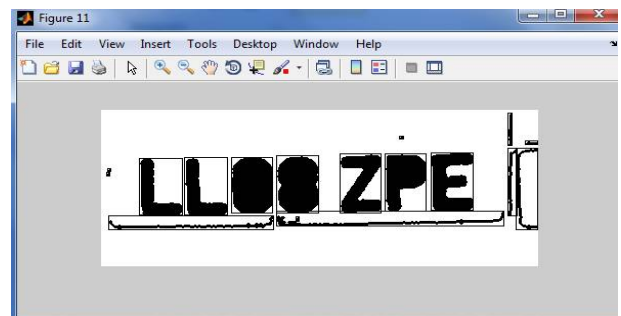
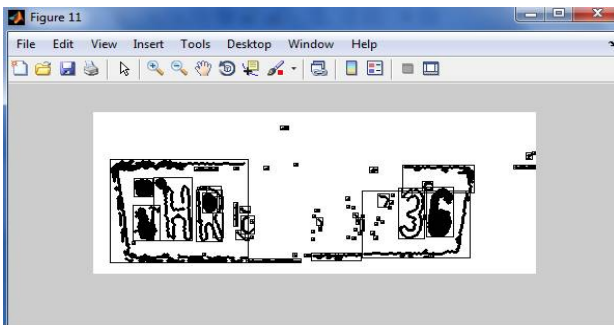


Fig.12 Character Segmentation Fig.13 Character Segmentation

Uses of haar wavelet evaluate arithmetical quantity that quantity used a input to neural network, some arithmetical quantity are malicious, spot analysis, concentration, limit, centroid, inconsistency, customary deviation, rate count, wavelet transform, Hough information, flashes. Malicious is the average of image pixel .Inconsistency is defined as the recall expected value of random variable, by total mass is known as central mass, Flashes is quantative measure of statics for set point of image, for point mass is malicious second flash known as variance and third moment known as skewness. Skewness is known as normalization of 3rd moments. Zeros of total mass, first moment divide first moment known as malicious. Remove noise from image using median filtering because noise direct affect recognition rate.

E. Recognition

After feature mining of image recognize the eccentric using neural network. In number plate recognition system ,template identical delicate to sound, in place of template use neural network as learning based.

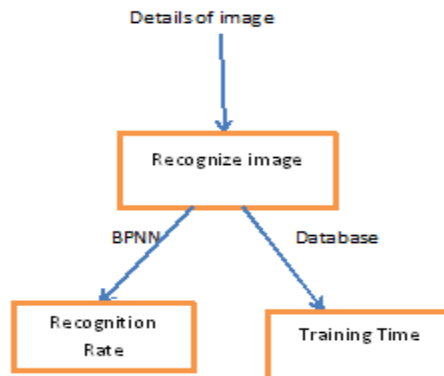


Fig. 14 Image Recognition

Extracted piece of image using haar wavelet fed that input to neural network and generate output shown in fig.14. Learning of neural networks is done by loading targets and features removed from number plate appeals. This phase contain high degree of accurate, noise free ,Testing of neural network is done and parameters used for performance evaluation. Gratitude rate and training time is computed for different wavelets and calculate recognition rate using BPNN and training time using database ,taking various images test the software.

IV. PARAMETERS

Recognition Rate:- Recognition rate is calculated by using mined article by haar wavelet used as a input to neural network and apply back propagation for err detection and calculate recognition rate. Its increase with increase number of images It is calculated using confusion matrix and following formula used.

$$\text{Recognition rate} = \frac{(TP + TN)}{(TP + TN + FP + FN)}$$

Where TP is True Positive ,TN is True Negative ,FP is False Positive ,FN is False Negatives .

Training Time:- Training time is computed for different wavelets using database, as the number of image increase training time increase, harr wavelet tales less time as compare to other wavelets. Training time is the time that is figured for detection, character segmentation and feature

extraction of number plate. Total time is figured by taking synopsis of time taken for detection, character segmentation, feature extraction of automatic number plate and training time required for training of neural networks.

Blob Analysis:- It is the constellation of pixel that form a unique shape, find extricate from rest part of image, it is used in search engine and computed for find properties of image color, shape and size.

Aspect Ratio:- Bounding box of blob analysis of the extracted feature of the image..

Mean:- In measurements mean is referred as average, method for calculate central propensity of space.

Average $B = \text{mean2}(A)$.

Intensity:- Intensity of the image is average of the intensity of all pixel in an image.

$$I = P/A$$

Where I= intensity, P=power and A= area

Area:- Total= $\text{bwarea}(BW)$. BW is numeric or logical value, area of the object in binary image is total is of scalar value.

Perimeter:- Find the boundary value of label component and distance between adjoin image object.

$$\sqrt{(\alpha_2 - \alpha_1)^2 + (\beta_2 - \beta_1)^2}$$

$\beta_1, \alpha_1, \beta_2, \alpha_2$ are co-ordinate of image.

Centriod:- It is the centre of the blob, used for finding row and column having pixel value one.

V. RESULT:

Automatic Number Plate Recognition system were implementing using haar wavelet and neural network in MAT LAB (2014) and acquired result. To evaluate the efficiency our proposed system software has been tested using MAT LAB over 150 color images having size 436*302 pixel and 150 dpi, images is captured using digital camera, detect the character of image, extract region of image in extraction find workspace area shown in fig.14 and this area having image area, height, width, boundary area of image, extract arithmetical feature of image using haar wavelet i.e. blobs, mean, intensity, area, perimeter, centroid, blob is constellation of pixel, mean is average of pixel, centroid is centre of pixel, intensity is average intensity of all pixel, perimeter is used for find distance between two object result shown in fig.16. Using these input recognize the image and using neural network calculate the recognition rate and training time using neural network and database result shown in table 1 and test the proposed system result shown in table 2.

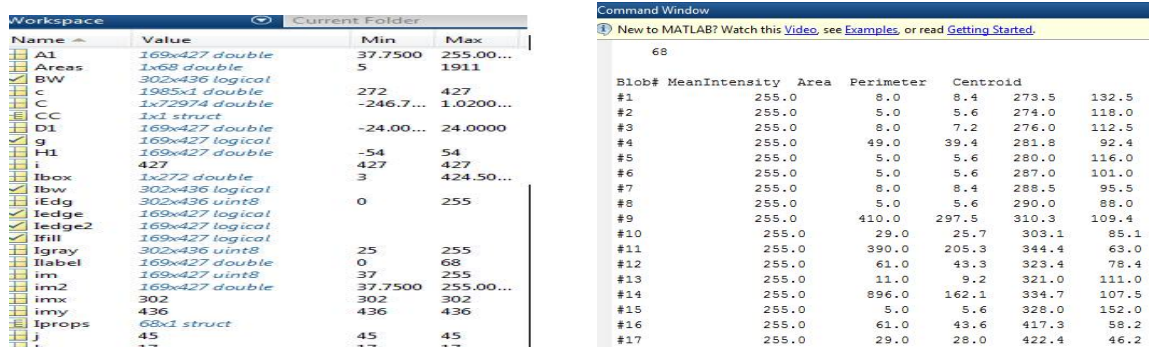


Fig . 15 Workspace Area of image Fig. 16 Extracted feature of image

| | | |
|------------------|----------|---------|
| Number of Images | Training | Time(in |
|------------------|----------|---------|

| | sec.)Haar |
|----|-----------|
| 10 | 30 |
| 15 | 34 |
| 20 | 37 |
| 25 | 39 |
| 30 | 41 |
| 35 | 43 |
| 40 | 46 |

Table 1. Training Time for Images

Proposed System Testing Result

Testing is done capturing different vehicle image approximate 150 images and give input in MAT LAB(2014), recognize the image get the output, some give accurate result , some not give accurate result.

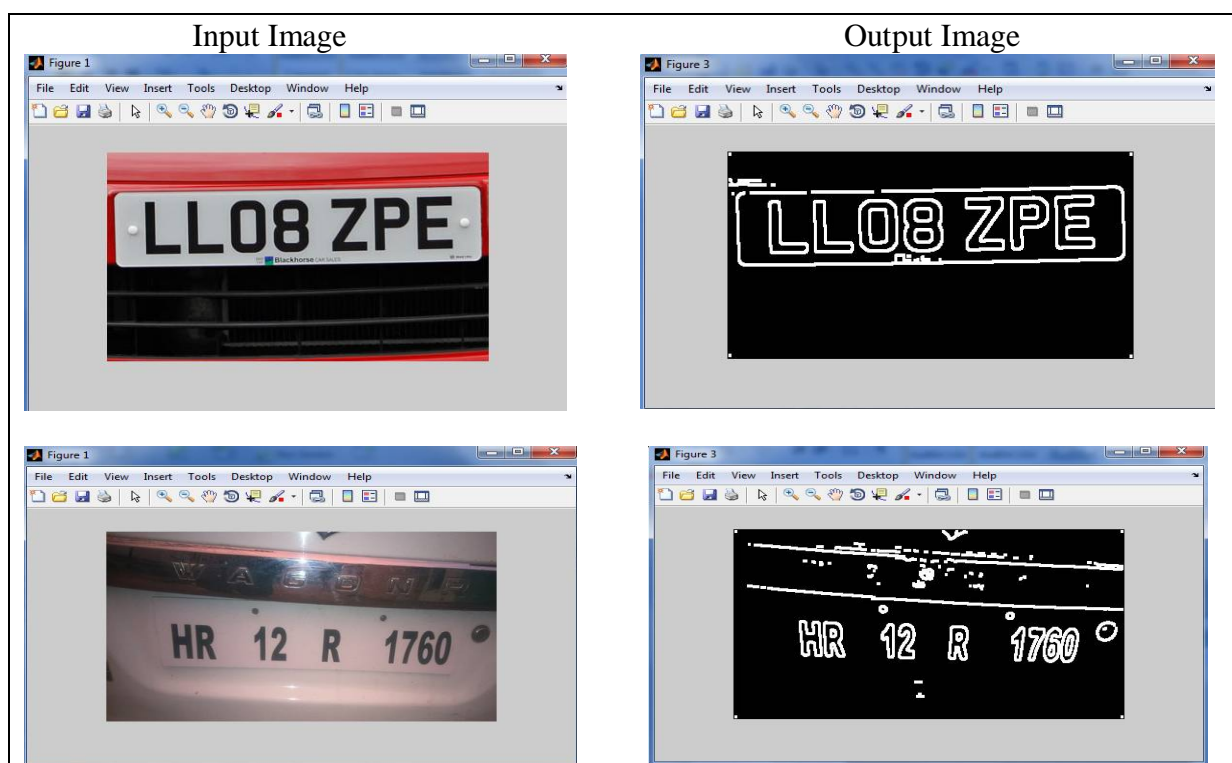


Table 2.Proposed System Testing

VI ANALYSIS

1. Haar wavelet is Continuous wavelet transform and sudden transitions.
2. In haar wavelet not used multiplication only used addition.
3. Haar wavelet takes short time for computation as compare to other wavelets.
4. In haar wavelet input and output length are same.
5. For elementary work used haar wavelet.
6. In all orthogonal wavelet haar wavelet is only symmetric all other ortogonal are asymmetric.
7. Haar wavelet need only two vanishing moment for filter the image.

Comparison between haarwavelet ,Template Matching and Daubechies wavelet

| HaarWavelet | Template matching | Daubechies Wavelets |
|---|--|--|
| It is simplest wavelet, it has only 2 taps | It is sensitive to noise and has 8 taps | It is family oh orthogonal and has 8 taps |
| It used 2 coefficient for median filter | It used more than 2 coefficient for median filtering | It used more than 2 coefficient for median filtering |
| It has one vanishing moment and one linear phase for segmentation | It has more than one vanishing moment | It has more than one vanishing moment |
| It is symmetric wavelet | It is asymmetric wavelet | It is asymmetric wavelet |
| It takes less time for training | It takes more training time as compare to haar wavelet | It takes more training time as compare to haar wavelet |
| Haar Wavelet does not have overlapping on window | It has overlapping on window | It has overlapping on window |
| Do the changing only adjacent pair of pixel | Changing all pixel and intensity | Changing all pixel and intensity |

VII. CONCLUSION

Number of vehicle increase day by day but technology also improve rapidly .In this paper, Haar wavelet is used for abstract piece of number plate of vehicles. Using haar wavelet extract the arithmetical feature of input image in neural network and evaluate work space area of segmented image and calculated recognition rate and training time for different types of wavelets, Haar wavelet reduce the intensity ,noise and takes less training time as compare to old technology. This technology is potentially significant, so our future work involve the implementation of ANPR system using new technology

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