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NUMBER PLATE RECOGNITION BY USING ANN

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Abstract: Number Plate Recognition (ANPR) became a very important tool in our daily life because of the unlimited increase of cars and transportation systems, which make it impossible to be fully managed and monitored by humans. Examples are so many, like traffic monitoring, tracking stolen cars, managing parking toll, red-light violation enforcement, border and customs checkpoints. Yet, it's a very challenging problem, dueto the diversity of plate formats, different scales, rotations and non- uniform illumination conditions during image acquisition. The objective of this paper is to provide a novel algorithm for license plate recognition in complex scenes, particularly for the all-day traffic surveillance environment. This is achieved using mathematical morphology and artificial neural network (ANN). A pre-processing step is applied to improve the performance of license plate localization and character segmentation in case of severe imaging conditions. The first and second stages utilize edge detection and mathematical morphology followed by connected component analysis. ANN is employed in the last stage to construct a classifier to categorize the input numbers of the license plate. The average accuracy of the license plate localization is 97.06%, 95.10% for license plate segmentation, and 94.12% for character recognition. The experimental results show the outstanding detection performance of the proposed method comparing with traditional algorithms.

Keywords: *Number plate Recognition; CCA; ANN; image processing.*

Introduction: Number plate recognition (NPR), as an important research field used in computer vision, pattern recognition, image processing and artificial intelligence, is one of the most important aspects of the intelligent transportation system of human society in the 21st century. Number Plate Recognition is comprised of four main sections: imagepreprocessing, number (license) plate extraction (localization), character segmentation and character recognition.NPR can be used to store the images captured by the cameras as well as the text from the license plate, with someconfigurable memory. NPR technology tends to be region-specific, owing to plate variation from place to place. The objective of the research is to successfully locate vehicle number plate, segment characters and recognizethem given a car image.

Pre-Processing Steps: Pre-processing of an input image includes various processes like converting an image from RGB to grayscale image, removing noise from the image, binarization, enhancing an image etc. Images are often corrupted by random variations in intensity values, called noise. Some common types of noise are salt and pepper noise, impulse noise and Gaussian noise. Salt and pepper noise contains random occurrences of both black and white intensity values.

Pre-processing steps are necessary to obtain characters effectively in number plate. This section is subdivided into 3 phases.

1. Median Filter
2. Histogram Equalisation
3. Binarization

Morphological operations

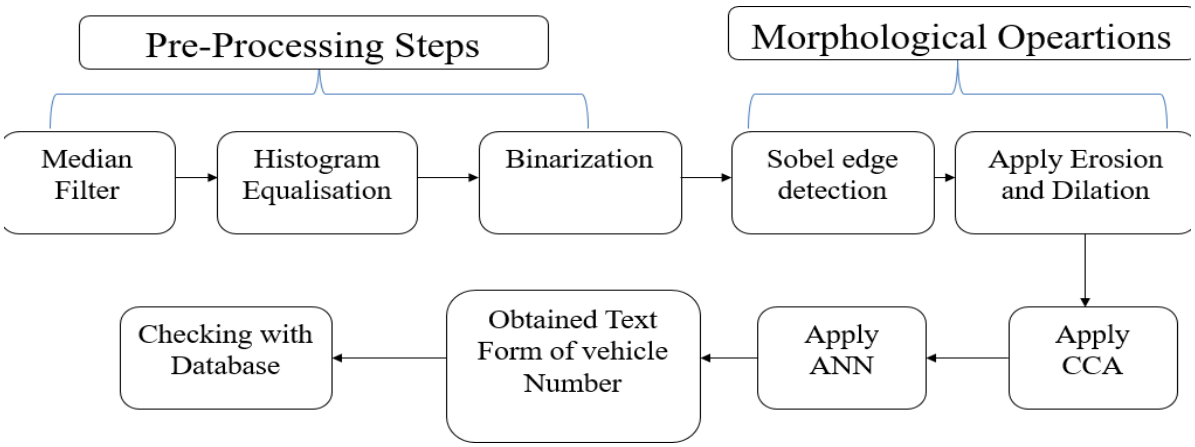
This section is subdivided into 2 Techniques.

1. Sobel Edge detection technique.
2. Erosion and Dilation.

Previous work:

The existing system to determine the details of a vehicle requires a lot of human interaction which also leads to human errors. For example, the e-challan fined by the traffic officials is as follows. A CCTV camera continuouslyrecords footage of the ongoing traffic. If a motorist breaks any traffic rule, the act will be recorded in the footage.The police will try to extract the number from the vehicle's screen- shot captured from the CCTV footage and theoffense will be registered in the records. This process requires a lot of human resource which can be reduced by using the following algorithm to recognize the registered vehicle number.

Proposed System:



Pre-Processing Steps

Pre-processing of an input image includes various processes like converting an image from RGB to grayscale image, removing noise from the image, binarization, enhancing an image etc. Images are often corrupted by random variations in intensity values, called noise. Some common types of noise are salt and pepper noise, impulse noise and Gaussian noise. Salt and pepper noise contains random occurrences of both black and white intensity values.

Pre-processing steps are necessary to obtain characters effectively in number plate. This section is subdivided into3 phases.

1. Median Filter
2. Histogram Equalisation
3. Binarization

Median Filter: Median filter is used to remove the noise in number plate. The Median Filter is a nonlinear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-

processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges whileremoving noise, also having applications in signal processing.

Original Image Median Filter

Histogram Equalization: Histogram Equalization is used enhance the characters in number plate. It is used to improve the qualityof the image. This method usually increases the global contrast of many images, especially when the usable data ofthe image is represented by close contrast values. Through this adjustment, the intensities can be better distributedon the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values.

Median Filter Histogram Equalization

Binarization: Binarization technique is used to obtain the digital image. In order to extract the characters from number plate, binary image is very suitable. In this phase, we convert color image into binary image. Typically, the two colors used for a binary image are black and white. In this figure the color image is converted into black and whiteimage. This technique is known as "Binarization".

Morphological operations:

This section is subdivided into 2 Techniques.

1. Sobel Edge detection technique.
2. Erosion and Dilation.

Sobel Edge detection technique: Sobel Edge detection technique is used to obtain the edge information of the vehicle image. In this sobeledge detection technique, the boundary lines may be damaged, so to enhance the edge imagewe use Erosion & Dilation concept.

Dilation: Dilation adds the pixels at break point of edges. Dilation is one of the basic operations in mathematical morphology. Originally developed for binary images, it has been expanded first to gray scale images, and thento complete lattices. The dilation operation usually uses a structuring element for probing and expanding the shapes

contained in the input image.

Erosion: Erosion removes the redundant pixels at edge points. Erosion is one of two fundamental operations (the other being dilation) in morphological image processing from which all other morphological operations arebased.It was originally defined for binary images, later being extended to grayscale images, and subsequently to complete lattices.

Hole filling: In this hole filling concept, the inside part of the boundary is filled with white area pixels. Connectedcomponent analysis (CCA) can be achieved by using this hole filling concept.

Connected Component Analysis: This Technique Is used to Fill the inner area of the edge part of the character in number plate. It is oneof the segmentation technique which is used to separate the characters from the image. It makes convenient to separate the characters from the number plate. The output characters of this technique is in the form of image format. In this CCA technique, each connected component of white pixel is check with border pixels. If all border pixels are adjacent to the same connected components of white pixel, then these components can be treated as a one character. By using this technique, we obtain characters which are in the form of images.

Fig. 3. Hole filling image

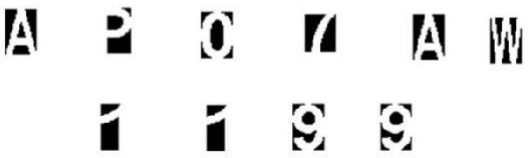


Fig. 4. Characters are separated in vehicle image

Artificial Neural Network Algorithm:

- Create the normalized matrix (I) as 12×8 by perform the normalization technique to the each character image .
- Create the weight matrix (W) to the normalized image. The weight matrix values can betaken 3 for 1and -3 for 0
- Find out the weighted sum (WS) by using following formula.

$$WS_i = \sum_{c=0}^{95} I_c W_{rc} \quad \text{.....(1)}$$

where i=0,1, ...35, 'r' and 'c' indicates the correspondent row and column.

- Measure the sum of positive weight (SWS_i) to the weight matrix.
- Measure the neuron fires (O_i) by using the following formula.

$$O_i = WS_i / SWS_i \quad (2)$$

- where WS_i is the weighted sum (WS) and SPW_i is the sum of positive weight to the weightmatrix

- Take the O_j maximum.
- The respective neuron fire is checked. The weight matrix is saved after the neuron firing takesplace.
- Same steps are repeated from 1 to 8 to recognize the other characters.

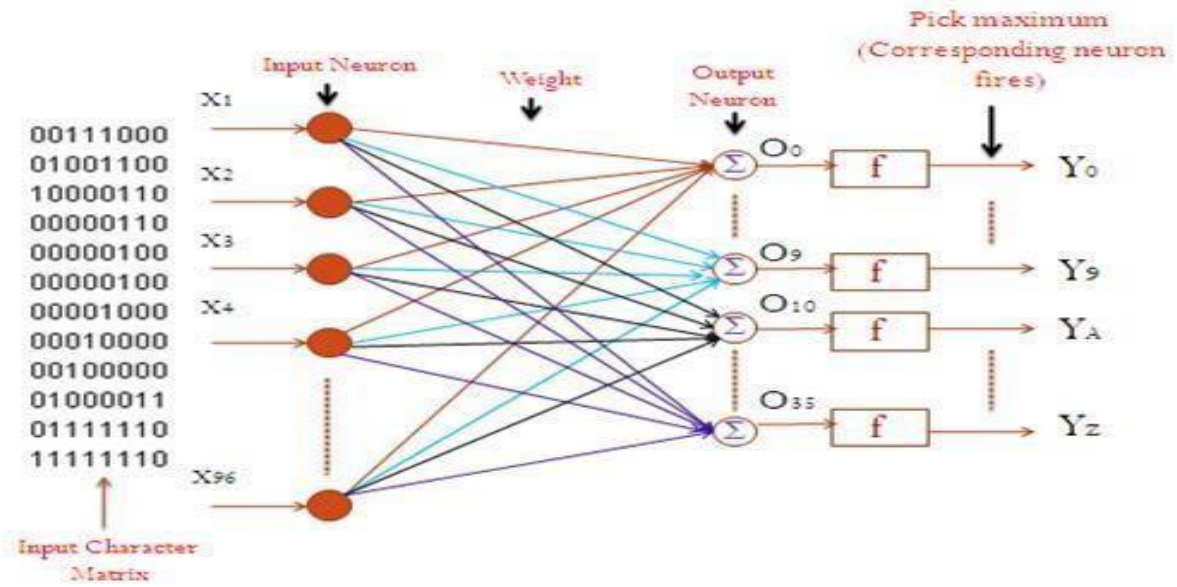


Fig. 5. Feed forward artificial neural network

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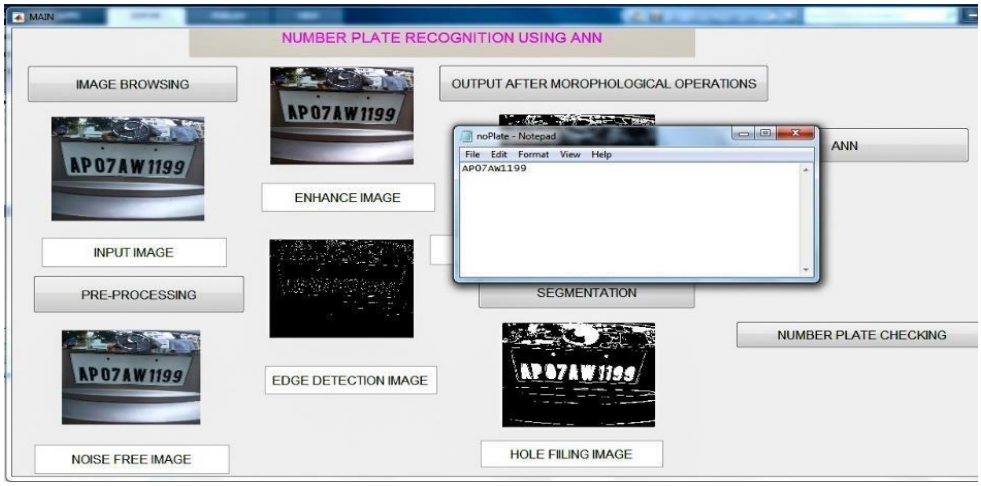

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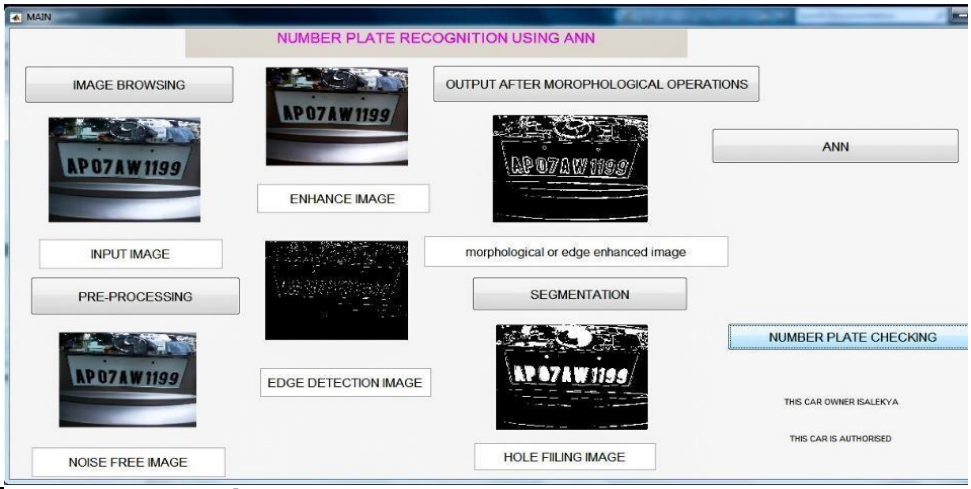

Advantages:

- Identify the traffic violating persons.
- Less persons are required.
- Cost effective
- Accuracy is high than manual.
- Easily allotted fines

Future scope:

- Video based ANPR systems
- Multi-plates ANPR systems
- Car manufacturer and model recognition

Conclusion: This paper is flexible and reliable for detecting the characters in the number plate and also checks it with database. There after it displays the authentication and owner of the vehicle. AutomaticNumber Plate Recognition is a rapidly evolving area of research and development in the field of Intelligent Transportation System. Different researchers have provided different methods and techniques for this system. However, every technique has its own advantages and disadvantages. This paper presented a detailed explanation of the proposed ANPR system by categorizing it according to the features used in each stage. We have used morphological operations for extracting the LP from the image. We have successfully extracted the number plate from most of the images and performed segmentation. The feed forward back propagation neural network gives an excellent recognition rate of 94.12% along with acceptable processing time (400ms) which makes it suitable for real time applications.

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