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Reduction of Confusing-Pair Effect in Car Registration Plate Identification

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***Abstract*—Vehicle License Plate Recognition is a very significant & complex area of Image processing which has various applications. In situations where no standard number plate format and font is maintained, identification becomes difficult. But more important task is to identify the characters which is very similar to their structure such as 2-Z, B-8, S-5 etc which is termed as "Confusing Pair" in this paper. In this approach, ANN is used for character recognition on identification of Vehicle Registration Plates with various types of fonts. Experimental results show that the performance of the proposed method is simple and satisfactory, which can provide very high percentage of accuracy most of the time.**

Keywords: Character Recognition, Segmentation, Artificial Neural Network, Confusing Pair

INTRODUCTION

Vehicle License Plate Recognition (LPR) has become a significant application in the transportation system. It can be used in many applications such as entrance admission, security, parking control, and road traffic control, and speed control. However, when no standard font style and size is maintained in different Vehicle Number Plates, identification of characters in a Number Plate becomes difficult .Detection of location of the Number Plate from image is also difficult task. All these problems restrict the use of automated Vehicle Number Plates Identification System in various complex situations and places. The basic idea behind our work is to use morphological edge detection method and simple character recognition technique in a complex scenario to find if the results are satisfactory. ANN is regarded as a common methodology for identification of characters from an image. When the characters are of predefined font this produces very satisfactory result. However in complex situation like Vehicle License Plate Recognition where the images are noisy and fonts may not be of a same type, applying this methodology and obtaining a significant successful outcome is challenging. In our proposed technique we have experimented on all these possibilities and displayed the results, which are satisfactory.

This paper is organized as follows. 1. The proposed model and steps of the system are explained in section 2. Experimental results and analysis are presented in section 3. The conclusions and the further work are summarized in section 4.

PROPOSED MODEL

Our proposed model consists of Digitization of image, Separation of character, Character Identification and Experimental Result.

A. Digitization

In this process, the input image is sampled into a binary window, which forms the input to the recognition system. In the above figure, the alphabet A has been digitized into digital cells, each having a single color, either black or white. It becomes important for us to encode this information in a form meaningful to a computer. For this, we assign a value +1 to each black pixel and 0 to each white pixel and create the binary image matrix, which is shown in the Fig. A. Digitization of an image into a binary matrix of specified dimensions makes the input image invariant of its actual dimensions. Hence an image of whatever size gets transformed into a binary matrix of fixed pre-determined dimensions. This establishes uniformity in the dimensions of the input and stored patterns as they move through the recognition system.

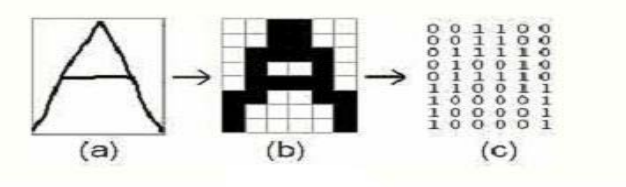

Fig 1

B. Separation of Character

After identifying the corner locations we extract the Vehicle Number Plate image section from the original image. Separation of character has been done in two phases, namely, Horizontal Segmentation and Vertical segmentation. At first, the image is processed row-wise to separate useful information. After this phase we have been able to identify the series of characters sequentially arranged from a Number plate image. Following Vertical segmentation, which is column-wise operation to separate information, we finally have characters totally separated from an input Number Plate image. This process is explained in Figure D.

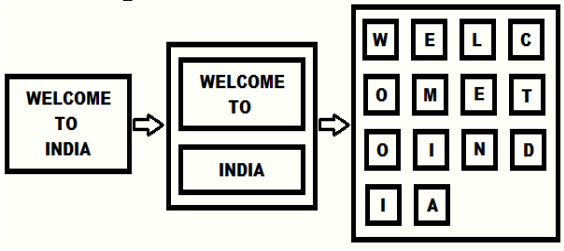

Fig 2

C. Confusing pair effect reduction

As long as the picture quality is excellent the OCR method provides results with minimum deviation. But in real life picture quality can never be guaranteed to be excellent at every instance. When this does not happen, a result varies significantly as observed in this paper.

Due to average or poor quality image, similar type of characters often takes each other's place in the output result while using OCR methodology. These similar types of characters are called Confusing Pair in this paper their appearance in the output result in each other's place is termed as **Confusing Pair Effect** in this paper. Below are the examples of confusing pair. -(S, 9), (5, S), (B, 8), (2, Z). Fig (4). There could be many confusing pair set of alpha bate and number. In this Work, around 5-6 confusing pair effect is observed and their effect is reduced to reasonable amount

Fig 3 (Confusing Pair Characters)

The proposed approach to deal with the problem is to train the network in supervised manner with this type registration plate images mostly. In this work various confusing pairs has been tested with positive result with this approach.

Proposed Algorithm

Step 1.Collect registration plate images having most confusing pairs.

Step 2.Train the network several times until satisfactory result is obtained.

Step 3. Run the system with new set of registration plate images.

E. Character Recognition

The most common neural network model is the multilayer perceptron (MLP). This type of neural network is known as a supervised network because it requires a desired output in order to learn. The goal of this type of network is to create a model that correctly maps the input to the output using historical data so that the model can then be used to produce the output when the desired output is unknown.

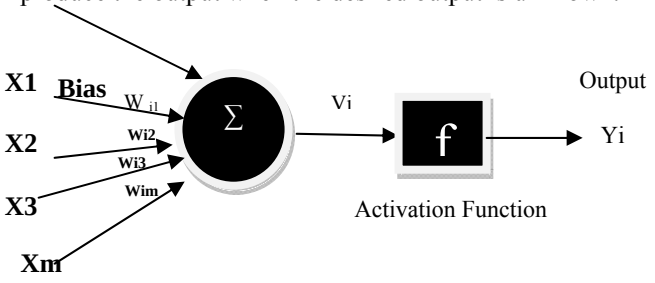

Fig 4 Block Diagram of an Artificial Neuron

A graphical representation of an MLP is shown below.

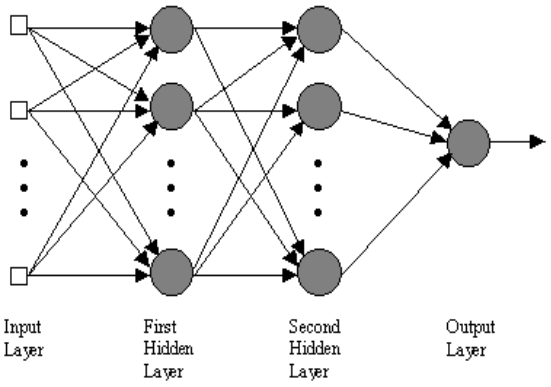

Fig 5 MLP

ANN is used for character recognition. We used a Multi-Layer Perception Neural Network (MLP NN) trained with the back-propagation algorithm. During learning phase, characters of the constituted database are successively presented at the input layer of MLP network and their corresponding outputs are compared to the desired outputs. Weights are iteratively modified in order to obtain, at the network outputs, responses which are as close as possible to the desired outputs.

EXPERIMENTAL RESULTS

From the shown Results in MATLAB environment it is evident that the system is capable of producing computer readable data from image containing text. In different cases fonts of character is different from each other but when ANN is applied on those input images, the output is quite accurate irrespective of the font's styles in image. The images contain noises, which have been removed during processing as pixel below a particular size was discarded.

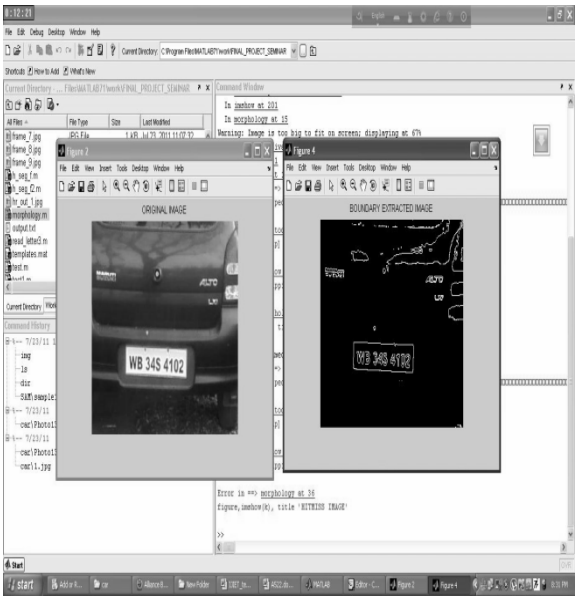

Fig 6 Detection of the Number Plate

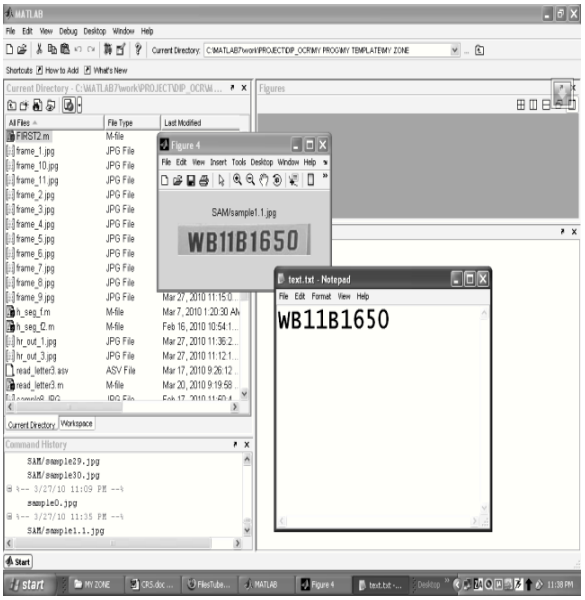

Fig 7 Character Separation

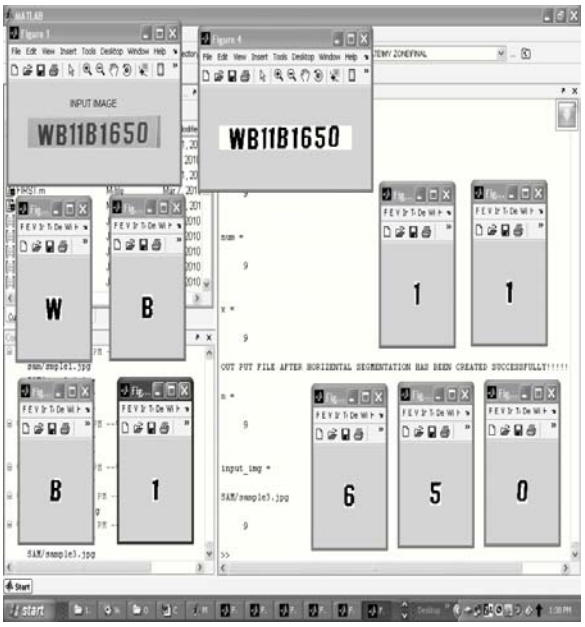

Fig 8 Character Identification

Table 1 Analysis of results

NO OF CAR PLATES	NUMBER OF CHARACTERS	IMAGE QUALITY	ACCURACY
10	90	Poor	69%
10	90	Average	81%
10	90	Good	95%

CONCLUSION

In this paper we overviewed the problem of Vehicle Number Plate recognition with various types of Number Plates. We proposed ANN based character recognition system, which provides result with significant accuracy, which is very simple to implement. The system has been tested on MATLAB environment with satisfactory results. Most of the time the input image taken from low-resolution mobile camera which does not have very good quality image output. Given a better device the result should increase in accuracy significantly.

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