An Optimized Algorithm for Car Plate Recognition using Artificial Neural Network for a Mobile Application without Segmentation

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ABSTRACT— ***The main objective of this paper, to create a mobile application without segmentation using Intelligent Transport system. Today's we are living in the mobile world, anywhere and anytime with mobile application which is used mainly in transport mode especially in navigation. User can monitor their lane of transport, traffic and also many applications which make the user more safety and security. In paper, to develop , a simple algorithm is presented for Car Plate Recognition (CPR) system based on Artificial Neural Network. This is simulated mobile application without segmentation. This proposed optimized algorithm is a mainly categorized into four major parts: Plate Extraction, Digitalization, Character Recognition and Optimization. Plate Extraction is to extract the appropriate region, convert the given images into binary value in digitalization, Character recognition are performed from the weight matrix and optimization has been done to retrieve the exact data to mobile application. This new approach provides new trends in mobile application for CPR.***

Keywords— Intelligent Transport System (ITS), Car Plate Recognition (CPR), Artificial Neural Network (ANN)

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1. INTRODUCTION

Intelligent Transport System which mainly used in the transport system for navigation system for vehicle, control traffic in the metropolitan city, automatic car plate recognition in the toll gate and also monitor particular location from various place using mobile application with Intelligent Transport Systems. Many problems such as traffic control and congestion can be reduced with help of ITS. Yearly increase of transport increased motorization, urbanization, growth and changes in population density. ITS reduces effectiveness of transport infrastructure and reduce the time by analytic performance of ITS

CPR is the Subset of ITS, To avoid traffic congestion and monitoring, License plate recognition is mainly used for an Mobile application for road usage, security Systems for particular campus, Control Systems, etc., [1][2]. There are three main phases in Car Plate Recognition such as: a) License Plate Detection/Extraction, b) Character Segmentation c) Character Recognition.

The CPR is used in real-time systems; it should provide both accuracy and acceptable response time [3]. Most of the CPR systems are based on image processing techniques and character recognition systems [4, 5]. Each LPR system consists of three basic sections namely, image acquisition, License Plate Detection (LPD), and Optical Character Reader (OCR).

Artificial Neural Network is an information processing Paradigm that is inspired by the way biological nervous system. The Information Processing System plays vital role and act as the key element of novel structure.

An ANN is configured for specific applications, such as pattern recognition or data classification, through a learning process [6].The main characteristics of Neural Networks are the ability to learn complex nonlinear input-output relationships, use sequential training procedures, and adapt themselves to the data.

There are two types' modes in Artificial Neural Network. First one is supervised mode, any time the input can be applied and output will be fast response of the desired system by teacher. Students those are learning the subject with particular subject is called supervised mode. This Training set consists of input and output pattern

Second one is unsupervised mode, where it mainly focuses on raw data which had no label of particular class. Self-study is good example of unsupervised mode. This mode must discover by themselves with appropriate properties like network with existing pattern

Many researches of car identification have been approached by Car Plate Extraction and Recognition, some of the related work as follows: [4] proposed an algorithm for vehicle license plate identification on the basis of a novel adaptive Image segmentation technique and connected component analysis in conjunction with a character recognition neural network. [4] Formulated a license plate locating module by fuzzy disciplines while the license number identification module was conceptualized in terms of neural subjects. [7] Implemented LPR on an embedded DSP platform that processes a video stream in real time. Lloyd Alan Fletcher and Rangachar Kasturi developed an algorithm for automated text string separation which is relatively independent of changes in text font style and size, and of string orientation.

The main objective of this paper is to experiment and develop an algorithm for CPR using ANN for a mobile application without segmentations. This CPR app can be simulated via blackberry simulator called Blackberry Smartphone simulator v.5.0.0. This is used to run application on your computer. Blackberry app can able to write, load, save and run your own applications with blackberry smartphone simulator. Using this simulator, you can test the simulated app.

The BlackBerry MDS Simulator, E-mail Simulator, various services can be provided for this application. A powerful application can be designed in order to provide a various services which can emulate with simulator using Blackberry 8250 simulator. BlackBerry is known for its excellent messaging devices and the BlackBerry Curve 8520 may well be on the lower end of the pricing scale, but it's certainly one of the most accessible smartphones out there. The consumer-focused, low-cost handset doesn't feel low cost though.

Four Stages are identified in this application. First Stageis Car Plate Extraction to capture an image from a Mobile Camera and extract Car Plate Region. Second Stage is Image Digitalization, deals with conversion of images into a digital format. Third Stage is Character Recognition by applying ANN Concepts, Characters are recognized and the last stage is Optimization, algorithm used to optimized and extract the appropriate character and display the text in the mobile.

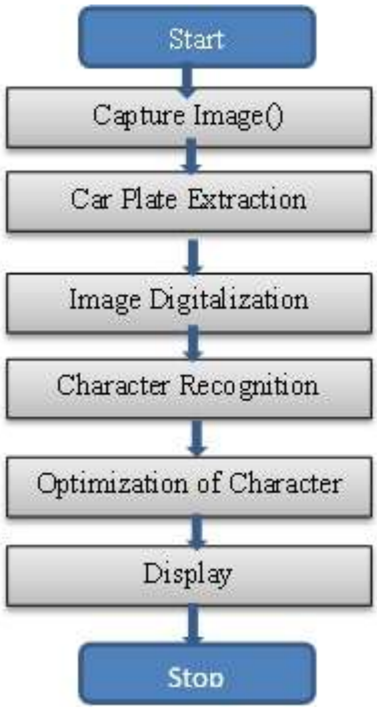

Figure 1: Flow Diagram- Process of CPR

2. CAR PLATE EXTRACTION

The proposed algorithm in this paper is designed to recognize a license plate of a car automatically. Input of the system, the image of a vehicle captured by a mobile camera [BlackBerry Smartphone Simulator v.5.0.0] with 2-5 Mega Pixel. The Captured Image[9,10,12,13,14] taken from 2-5 meters away is process through license plate extractor which gives output as a single image file.

Figure 2.1 Process of Image Capture

3. IMAGE DIGITALIZATION

The Process of Digitalization is an important part for the neural network used in the system [11]. In this process, A generated image file will act as an input and undergone three phases of Digitalization.

1. Conversion image into Byte Array
2. Conversion of Matrix Based on Image Size
3. Conversion of Byte Array to Binary Value

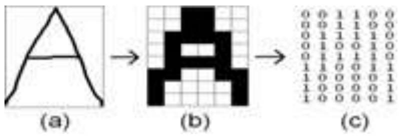

Figure 3.1 Process of Image Digitalization.

An input image file is encoded into Byte and store in an Array with a file name. In the next stage, Width and Height of Input image are stored in the Matrix Mij, where i is the number of rows and j is the number columns. i,j either increased or decreased depends upon the size of the images. Third Stage, Byte Array of Matrix are converted into binary image consisting of only 0's and 1's with help java packages , where 0's represent white pixel and 1 represent black pixel as shown in figure 3.1. Sample coding are given below:

```
for(int i=0;i<filetem.length;i++){
sb.append(Integer.toBinaryString(filetem[i] & 0xFF));
```

wheresb is the object of String buffer classs

Figure 3.2 Convert to Digital

4. CHARACTER RECOGNITION

The Input Matrix Mij, which consist of 0 's and 1's are fed as input to the neural network . It is typical for any neural network to learn in supervised or unsupervised manner by adjusting its weight

The Weight Matrix Wij is generated from the Input Matrix Mij as follows:

```
for(int i=0;i<bitmap.getWidth();i++){
for(int =0;j<bitmap.getHeight();j++){
M[i][j]=(char)sb.charAt(k++);
if(M[i][j]=='0'){
W[i][j]=-1;
}else{
            W[i][j]=1;
    }       }     }
```

Where W[i][j] are WeightMatrix generated from Input Matrix M[i][j]

Whenever a Character is to be taught to the network, an input pattern representing that character is submitted to the network. The network is then instructed to identify this pattern labeled as k. In accordance with this, the weight matrix Wk is updated in the following manner:

```
for(int i=0;i<bitmap.getWidth();i++){
for(int =0;j<bitmap.getHeight();j++){
          Wk[i][j]=W[i][j]+M[i][j];}
   //Weighted Matrix
}
```

$W_k = w[i][j]$

Let k be label as s then Weight M Matrix can be denoted as follows

$$W_s = \begin{vmatrix} 2 & 2 & 2 & 2 & 2 \\ 2 & -1 & -1 & -1 & -1 \\ 2 & 2 & 2 & 2 & 2 \\ -1 & -1 & -1 & -1 & 2 \\ 2 & 2 & 2 & 2 & 2 \end{vmatrix}$$

The Weight matrix is has been updated to learn any alphabet say S. It should be noted that this matrix is specific to the alphabet S alone. Other characters shall each have a corresponding weight matrix.

A close observation of the matrix would bring the following points to notice:

The matrix-elements with higher (positive) values are the ones which stand for the most commonly occurring image-pixels. The elements with lesser or negative values stand for pixels which appear less frequently in the images. Neural networks learn through such updating of their weights. Each time, the weights are adjusted in such a manner also give an output closer to the desired output than before.

5. OPTIMIZATION OF CHARACTER

The Final Stage of this application is optimization based on the Weight Matrix Wk. There are total n Weight Block for the totally n characters to be taught (fed) to the system. The Block M provides the input Matrix M to the Weight Block Wk for each k

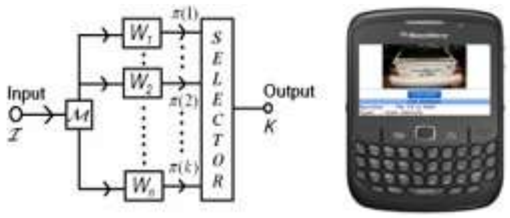

Figure 5.1 Optimization Process

The optimization techniques find out the feasible solution of all the Weight Matrix and identify an input pattern as a matching candidate forone (optimal solution) of its many learnt pattern. A Simplistic Approach for Car Plate Recognition using Artificial Network has been described using Mobile application where the contents have not been segmented. The Device used for this application is of low cost and portable compare to other applications.

6. CONCLUSION

In this paper, we presented simulated mobile application software designed for the Car Plate Recognition using Artificial Neural Networks. This system is designed for the identification of Indian Car Plate in any organization or an institution and tested over a large number of images. This system can be redesigned for multinational car license plate for future enhancements.

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