VEHICLE LICENSE PLATE RECOGNITION SYSTEMS

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ABSTRACT

The purpose of the vehicle license plate recognition project is to recognize or identify vehicles. Vehicle license plates are meant to be recognized by people, especially government officials such as policemen and transport personnel. In current situation, we can identify all the information's related to the drivers from plate number. Vehicle's license plates that are authorized are allowed to enter the campus premises. In this project, a database of vehicle license plate numbers that are authorized to enter the university grounds has been compiled. Only these vehicles are allowed to enter the campus.

Keywords: Fuzzy Logic, Vehicle Plate Recognition System

INTRODUCTION

Monitoring vehicles in Malaysia is vast becoming an increasingly difficult task. This is due to the rapid growth in the number of vehicles on our roads today. This calls for the need to improvise our current systems in vehicle identification. For example, it is time consuming for an officer to manually check the license plate of every vehicle and it is also not feasible to employ a number of police officers to act as full time license plate inspectors. As a solution, many systems have been implemented to extract the license plate number of a vehicle from an image and by further processing of this license plate this system is able to recognize the vehicle.

This paper has been organized as follows. First a brief overview on vehicle license plate recognition systems. Then, the methods of investigation is discussed which includes some of the main algorithm used in image processing and recognition part. The algorithm are numbers (0 - 9).

The fundamental steps in digital image processing are shown as in figure below.

VEHICLE LICENSE PLATE RECOGNITION

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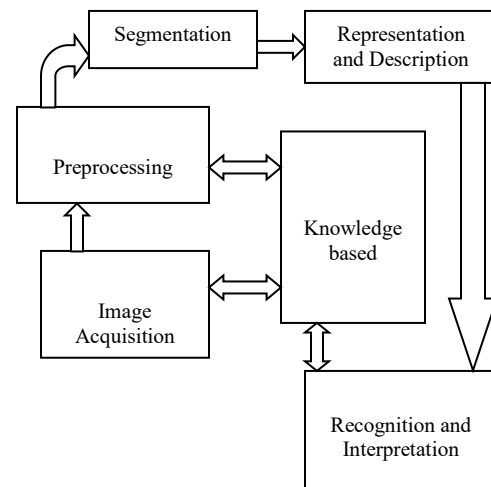
First step in the process is image acquisition that is to acquire a digital image. Two elements are required to acquire digital images. The first is physical device that is sensitive to a band in the electromagnetic energy spectrum and that produces an electrical signal output proportional to the level of energy sensed. The other device, called the digitizer, are used to convert electrical output of the physical sensing device into digital form.

To acquire a digital image, it requires an imaging sensor and the capability to digitize the signal produce by the sensor. The imaging sensor could also be a line – scan camera that produces a single image at a time. The nature of the sensor and the image it produces are determined by the application. In this project, the applications are relying on the usage of a digital camera.

Preprocessing

Preprocessing is the key function to improve the image ways to increase the chances for success of the other process. For preprocessing, it will typically deals with techniques for enhancing image, removing noise and isolating regions.

The objective of image enhancement is to improve the image lookout so that it will be suitable for vehicle license plate recognition process. Image enhancement is divided into two categories: spatial domain methods and frequency domain methods. The spatial domain refers to the image plane itself and approaches in this category are based on the direct manipulation of pixels in the image. Frequency domain processing techniques are based on modifying the Fourier Transform of an image.

Recognition and Interpretation

Image recognition consists of several processes that are described in Figure 2.1. The input of the process is the image captured. The image is segmentation and feature extraction using Mathlab program. The image is classified based on the object type whether it is number or alphabet.
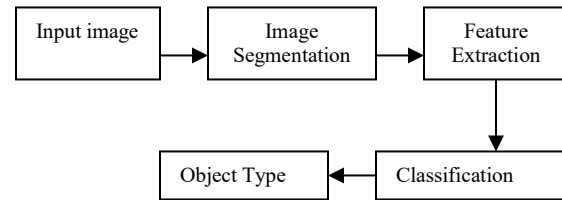

Figure 2.1 –Image Recognition Process

Segmentation

First step in image recognition is to segment the image. Segmentation subdivides an image into its constituent part or objects. As for the case in this project, it will segment and isolate each character in the vehicle license plate number. The level to which this subdivision is carried depends on the problem being solved. Segmentation should stop when the characters in the vehicle license plate had been isolated. There are many types of segmentation where one of them will be chosen to apply in the project.

Segmentation algorithm for monochrome images are generally are based on one of two basic properties of gray scale values:
1. discontinuity – the approach is to partition an image based on abrupt changes in gray scale. The principle areas of interest within this category are detection of isolated points and detection of lines and edges in an image.
2. similarity - the principal approach are based on threshold, region growing and region splitting and merging.

Feature Extraction

The segmented images need to be in the proper form suitable for computer processing. It involves two choices; represent the region in terms of its external characteristics (its boundary) or represent it in terms of its internal characteristics.

Techniques that are useful would either be boundary extraction, skeleton or region filling.

Morphology is a tool for extracting image components that are useful in representing describing region shapes. It is used to extract the boundaries. The basic techniques that can be used are:

1) dilation and erosion

2) opening and closing

3) hit or miss transform

Program for preprocessing data :

```
%1-read JPEG image with RGB color
format.
%  resize original image to 50% size.
RGB = imread('ima1.jpg');
RGB = imresize(RGB,0.5);
%2-call for function 'quantize'.Function
returns logical double
%  array class matices,Bi_1 and Bi_2.
[Bi_1, Bi_2] = quantize (RGB);
%3-perform filtering on image and returns a
logical double array
%  class, Bi.
[Bi] = filterAll(Bi_1,Bi_2);
%4-crop image matrice by region of interest.
Bi_cropped = cropPlate(Bi);
%5-segment the cropped image matrice.
Bi_seg = SingleRowPlate(Bi_cropped);
```

DATABASE

A database system is a program that organizes, manipulates, retrieves and report data. By using database applications, we'll be able to write a Visual Basic application that accesses the data within the database without resorting to the file related command. In this project, the database that will be use is Microsoft Access

The function of database is to list out all the vehicle plate number. A list of vehicle's plate number with the information about the owner is stored in the Microsoft Access database.   With the usage of Visual Basic's Data control, we can easily access the database from the database applications.

When the image of the plate number had gone through the processes needed for recognition, the neural network will identify the image. After the image had been identified, it will search in the database to look for the profile of the owner. A window will appear in the main computer at the guard post that will give the details about the owner of the car. If the owner of the vehicle is not a UiTM staff, the image won't have a match in the database that will indicate that he or she is not a UiTM staff.

SCOPE OF WORK

1) In this first stage, the license plate number of the vehicle has been captured by using a digital camera from a certain angle to enhance the picture. Figure 2.2 shows an example of a typical Malaysian license plate.

Figure 2.2 – Example of a typical Malaysian License Plate

2) Segmentation was done using Math lab. Figure 2.3.1shows the original license plate before and after it was segmented. Figure 2.3.2 and Figure 2.3.3 shows the both image in bigger size.
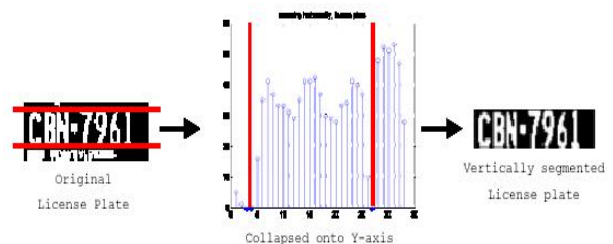

Figure 2.3.1 – Example of License Plate That Have Been Segmented

3

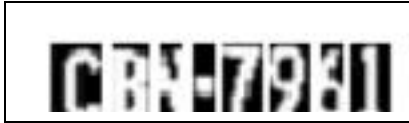Figure 2.3.2 - Image of Plate Number

Figure 2.3.3 - Plate Number That Have

Been Segmented

(3) A data system was created using Visual Basic application that access data from database. A list of vehicle's plate number with the information about the owner is stored in the Microsoft Access database. The function of database is to list out all the vehicle plate number. A list of vehicle's plate number with the information about the owner is stored in the Microsoft Access database. With the usage of Visual Basic's Data control, we can easily access the database from the database applications.

4) Recognition Image recognition consists of several processes that are described as below. Multi Layered Perceptron (MLP) network trained using Levenberg-Marquardt algorithm has been used to recognize noisy number 0 to 9.The recognition performance of the MLP network will highly depend on the structure of the network and training algorithm. In the current study, Levenberg-Marquardt (LM) algorithm has been selected to train the network. The numeral images were divided into 5×7 segments as in Figure (3), where each segment consists of 10×10 pixels. The mean of the grey level for each segment were then used as input data to train MLP network. Therefore, the network would have 35 input nodes (one for each segment) and 10 output nodes, where each output node represents one numeral.

Figure 3: Numeral image is divided into 5×7

RESULTS

The current study explores the capability of neural network to recognize noisy numerals. Noisy numeral or character is the common problem in vehicle registration plate recognition where the characters captured by the camera may be noisy due to dirt, rain, reflection and so on. In this analysis, the activation functions for hidden and output nodes have been selected as in previous section. The target MSE was set to 1.0 x 10-11 and the maximum training epoch was set to 50 epochs. However, some training processes have been stopped before 50 epochs because minimum gradient of the learning rate has been reached. Epochs are the training degree of the network.

The sufficient number of epochs is the number that will satisfy the aims of training. Mean squared error (MSE) is the performance index that was used in this study to determine the training degree of the network. In general, the lower the value of MSE the better the network has been trained.. The final value of MSE is very small which indicates that the network is capable of mapping the input and output accurately. Figure 4.1 shows the output of train data and Figure 4.2 shows the output of the exact data. The graph is exactly the same.
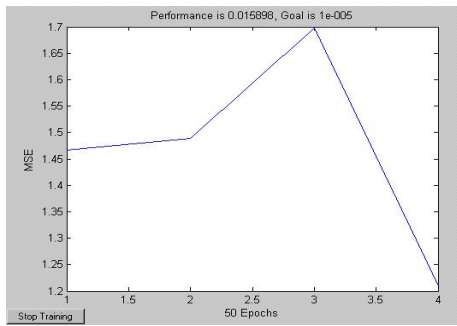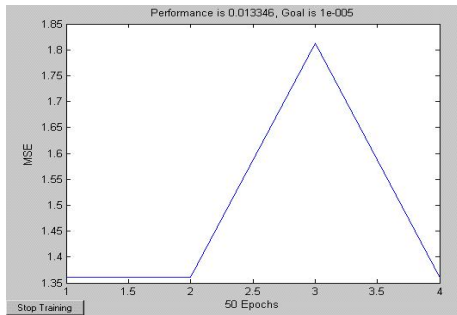
Figure 4.1

Figure 4.2

CONCLUSION

Malaysia is a fast developing country and number of vehicles on our roads today increases by the day. Therefore an effective and efficient vehicle license plate recognition systems needs to be developed in order to cater for the numerous companies, which are adopting these modern systems to reduce their dependency on manual labor. Processing algorithm is the key function to improve the image to increase the chances for success of other process.

Database system was used to organizes, manipulates, retrieves and report data. With the usage of Visual Basic's Data control, it is easily access the database from the database applications.

MLP network trained using Levenberg-Marquardt algorithm was used to recognize noisy numerals. The appropriate training epochs was found to be 50 epochs in order to achieve the required gold.

While undergoing this project, the image ha been captured using digital cameras. The image was been segmented using Mathlab. Multi Layered Perceptron (MLP)network has been trained to recognize number 0. It also can recognize alphabets.

Future Development

• Training of the neural network essentially involves feeding training samples as input vectors through the neural network.
• Temporal information analysis
Based on the number plates detected from previous frames, search space required to find number plate in current frame can be reduce to improve accuracy and speed up computational time.
• Vehicle makes and colour detection
By finding the shape, colour and logo of the vehicle, a full vehicle identification system can be built
• Speed detection
Speed of a vehicle can be calculated from the temporal information gathered from the previous images. Direction of the vehicle is traveling in can also be determined.
• Custom camera
A custom build camera allow higher quality images to be taken with good shutter and focusing speed. Modified camera with infra red filter removed, allows video to be taken at night without the need of any strong visible light.
• Multi-treading
If the structure of the software can be redesign to cater for multi-treading purposes, work for multi-lane vehicle detection will be made simpler without the need to rebuild the entire system from scratch

ACKNOWLEDGMENTS

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