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An Efficient Way Of Detecting Numbers In Car License Plate Using Neural Network Training With GA

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***Abstract*— Numbers in vehicle license plate LP is unique and essential. The genetic algorithm is (GA) which is a new algorithm for detecting the car name plate. And the dynamic changes of illumination conditions can be overcome by an adaptive threshold method which is used during the process of converting images into binary. It can uses either temporarily or spatially illuminate the binary image through the plate area. The unknown image in inside the object area can be detected by the connected component analysis technique (CCAT). In any License plate the layout of the symbol can be modeled by the scale-invariant geometric relationship matrix in different countries. And this proposed system is developed by implementing the MATLAB where various image samples are experimented in this system. This system also introduces the convergence speed of the system can be improved by the two new crossover operators which is fully based on sorting. The touching or broken bodies are the mostly occurred problem in CCAT and these problems are also minimized by modifying the GA algorithm. This system is developed by implementing the MATLAB where various image samples are experimented. And this proposed system produces 98.4 percent of result with defined accuracy. The car license plate numbers are detected using neural network with GA.**

***Index Terms*—Genetics algorithm, Component Analysis Technique, License Plate**

I. INTRODUCTION

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. As such they represent an intelligent exploitation of a random search used to solve optimization problems. Although randomized, GAs are by no means random, instead they exploit historical information to direct the search into the region of better performance within the search space. The basic techniques of the GAs are designed to simulate processes in natural systems. A population of individuals is maintained within search space for a GA, each representing a possible solution to a given problem. Each individual is coded as a finite length vector of components, or variables, in terms of some alphabet, usually the binary alphabet {0, 1}. To continue the genetic analogy these individuals are like end to chromosomes and the variables are analogous.

First the Image processing is carried out in this project to prepare for the GA phase. Basically an image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. The analysis of a picture using technique that can identify shades, colors and relationships that cannot be perceived by the human eye. Image processing is used to solve identification problems. Analyzing and manipulating images with a computer is defined as image processing. An input color image is exposed to a sequence of processes to extract the relevant 2-D objects that may represent the symbols constituting the LP in that image processing steps. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be processed optically or digitally with a computer. Its main components are importing, in which an image is captured through scanning or digital photography. An analysis and manipulation of the image, accomplished using various specialized software applications. And the image processing is basically classified into analog image processing and digital image processing. In this project the image processing steps are carried out for the color image.

In an automatic vehicle identification system the identification of license plate is the most common problem. The system uses illumination (such as Infra-red) and a camera to take the image of the front or rear of the vehicle, then image-processing software analyzes the images and extracts the plate information. In this paper using a color plate which is identified by the color-based system. And the license plates are rectangular in shape in which the shape of the plate is detected by the external-shape-based techniques. In LP detection stage the closing operation is performed such like dilation followed by erosion which is used to fill noisy holes inside candidate objects and to connect broken symbols. The objects that are thinner than the LP symbols is removed by applying opening operation such that the erosion followed by dilation. The detection of license plate is detected by those two operations. The closing operation is reverse process of opening operation and vice versa.

Main goal on this work is to detect the locations of license plate (LP) symbols in a car and the convergence speed of the system is increased which plays a vital goal in this proposed system and the dynamic changes of illumination conditions are to overcome in this paper. The proposed system model the layout of symbols in any LP. The system adaptability is also simplified in the proposed system. Machine vision is the technology and methods used to applications as automatic inspection, process control, and robot guidance in industry in addition to reading barcodes and optical characters. And it creates the model for real world from images.

II. MODUELS

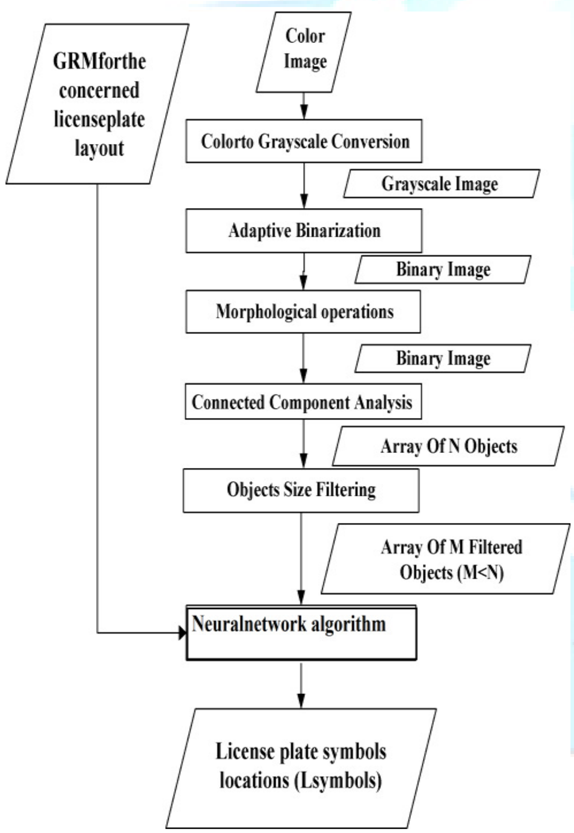

Fig. 1. Module Section

A. *Gray Scale Conversion*

The input is given to gray scale conversion applied in the form of color image and it extracts other information from it. Here this is taking color image into account. The standard
NTSC method is applied to the gray scale conversion and it eliminates the hue and saturation information. Because it obtaining the luminance information. Grayscale is a range of monochromatic shades from black to white. Therefore, a grayscale image contains only shades of gray and no color.

This is because each pixel has a luminance value, regardless of its color. Luminance can also be described as brightness or intensity, which can be measured on a scale from black (zero intensity) to white (full intensity). Most image file formats support a minimum of 8-bit grayscale. This process removes all color information, leaving only the luminance of each pixel. Here the output of this output stage that will be used as input to the next stage.

B. *Adaptive Thresholds*

An Adaptive threshold is the simplest method of image segmentation. From a grayscale image the threshold can be used to create binary images. Adaptive threshold at a pixel level (in comparison with neighboring pixels) can yield highly superior results compared to global threshold. Particularly for images it can with varying levels of regional contrast differences. Adaptive threshold also called dynamic or local threshold. It establishes the threshold level for determining whether to convert to white or black at a regional level. Adaptive threshold typically takes a grayscale or color image as input and, in the simplest implementation, outputs a binary image representing the segmentation. The output getting from the gray scale conversion stage is used as an input for the adaptive threshold. The adaptive threshold converts the black and white color image into the binary image. It is one of the most sensitive stages in localizing LPs. Because it encountered the environment around it and the spatial and temporal variations in the license plate it only. The threshold at each pixel dynamically depending on the average gray level in the neighborhood of the pixel is determined in this project result. The background and foreground pixels are differentiated by adopting the effective rule. According to the image resolution and the expected size of the license symbols the size of the window used to calculate the threshold for each pixel is selected. A high accuracy rate in different illumination conditions are provided as a result.

C. *Morphological Process*

After completing the task of adaptive threshold that output is given to the input for the morphological process. The identification of objects within an image can be a very difficult task. One way to simplify the problem is to change the grayscale image into a binary image, in which each pixel is restricted to a value of either 0 or 1. The techniques used on these binary images go by such names as: blob analysis, connectivity analysis, and morphological image processing. A morphological process is a means of changing a stem to adjust its meaning to fit its syntactic and communicational context.

The most pattern recognition systems need the morphological process. The noisy objects are eliminated by the morphological process and retain only objects expected to represent the targeted patterns. The operations of morphological process include the dilation and erosion. The noisy holes inside candidate objects are filled and the broken symbols are connected by using the closing operation (dilation followed by erosion) in LP detection process and where a light gray watermark is used for authentication purposes. The objects that are thinner than the LP symbols are removed by the opening operation (erosion followed by dilation). In the size filtering stage removal of thin objects is performed. Here the closing operation is defined as dilation followed by erosion and the opening operation is defined as erosion followed by dilation and vice versa.

D. Connected Component Analysis

CCA is a well-known technique in image processing that an image and groups pixels in labeled components are scanned based on pixel connectivity. An eight-point CCA stage is performed to locate all the objects inside the binary image produced from the previous stage. The output produced from this stage is an array of N objects. Once region boundaries have been detected, it is often useful to extract regions which are not separated by a boundary. It takes as input a binary image and label image structure. Any set of pixels which is not separated by a boundary is call connected. Each maximal region of connected pixels is called a connected component. The set of connected components are partition an image into segments. Image segmentation is a useful operation in many image processing applications.

E. Genetic Algorithm Process

The arrays of N objects are given to the input for the genetic algorithm process. The objects from the CCA stage are filtered on the basis of their widths and heights are extracted in this stage. The genetic process produces the array of m objects as the result. The image width is divided into a number of symbols in license number. The ranges of the value and speed of the process can be calculated by the movement of the camera.

The genetic algorithm process can be carried into the following steps:

1) Chromosome Encoding
2) Defining the Fitness Function
3) Selection Method
4) Mutation Operators
5) Crossover Operator
6) Replacement Strategy
7) Stopping Criteria
8) Parameters Setting

F. Neural Network

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

Neural network simulations appear to be a recent development. However, this field was established before the advent of computers, and has survived at least one major setback and several eras.

Many important advances have been boosted by the use of inexpensive computer emulations. Following an initial period of enthusiasm, the field survived a period of frustration and disrepute. During this period when funding and professional support was minimal, important advances were made by relatively few researchers. These pioneers were able to develop convincing technology which surpassed the limitations identified by Minsky and Papert. Minsky and Papert, published a book (in 1969) in which they summed up a general feeling of frustration (against neural networks) among researchers, and was thus accepted by most without further analysis. Currently, the neural network field enjoys a resurgence of interest and a corresponding increase in funding.

III. SYSTEM ANALYSIS

In existing system some kind of techniques are used to detect the numbers in the plate. The techniques are Edge based technique and External shape based technique. The external shape based technique was developed to detect the plate on its rectangular shape. Edge base technique was developed to detect the plate based on the high density of vertical edges inside it. This is mainly focused on the intensity distribution in the plate area with respect to its neighborhoods. The existing system did not provided the detection method for finding the location of the license plate symbols. And it did not provide the illusion condition on dynamic changes when the image is converted into binary values. And because of their high computational needs the existing system was rarely used a genetic algorithm. The existing system missed under different levels the search space of genetic algorithms (GAs) was not minimized.

All the technique used in the existing system lacks invariability to scaling. Because the size of the plate's area only used the fixed parameters for processing. The sensitivity is the major drawback of the existing system since the presence of model identification text or other objects above or below the vehicle that can disturbed the texture histogram. The difference between text and other image types were not manipulated from the texture perspective. The sensitivity to the presence of other text such as bumper stickers or model identification and also intensive computational demand were the main drawback of the segmentation technique in the existing system. And because of the difference in plate style or design the detection of license plate was not possible in different places or countries in the existing system. The detection algorithm was only according to the selected features and based on the type of the detection algorithm itself only.

In the existing system there is no general method that can be used in different places for detecting license plates. Because of the difference in plate style or design are not detected easily. The color-based system was deployed in the existing system that only detects the specific and fixed colors having the license plate. And all the research was based on the intensity distribution in the plate's area with respect to its neighborhood. Here maximally all the license plates considered as the stable region.

The genetic algorithm is rarely used in the existing system because all the detection algorithms used in it were ranged from window-based statistical matching methods to highly intelligent-based techniques that used only neural networks or fuzzy logic. All this logic was not handle the computational needs of the network. The fixed parameters are used in all the techniques which were used in the existing algorithm that lacks on the scaling invariability. The presence of other text such as bumper stickers or model identification was sensitive to the segmentation techniques. So, it also lack on the computational demand and sensitivity.

IV. SYSTEM ARCHITECTURE

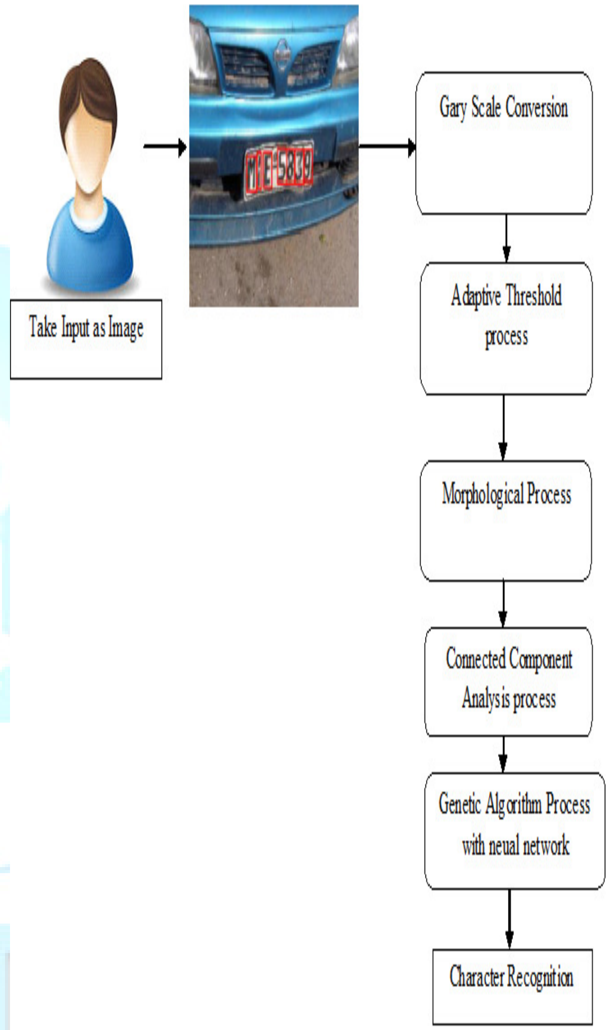

Fig. 2. System Architecture

V. DATAFLOW DIAGRAM

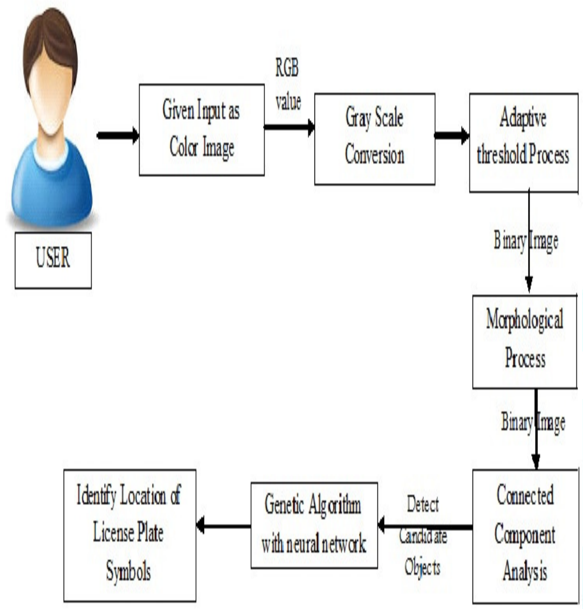

Fig. 3. Data flow diagram

Data flow diagrams illustrate how data is processed by a system in terms of inputs and outputs. A data-flow diagram (DFD) is a graphical representation of the "flow" of data through an information system. DFDs can also be used for the visualization of data processing (structured design).On a DFD, data items flow from an external data source or an internal data store to an internal data store or an external data sink, via an internal process.

A DFD provides no information about the timing or ordering of processes, or about whether processes will operate in sequence or in parallel. It is therefore quite different from a flowchart, which shows the flow of control through an algorithm, allowing a reader to determine what operations will be performed, in what order, and under what circumstances, but not what kinds of data will be input to and output from the system, nor where the data will come from and go to, nor where the data will be stored (all of which are shown on a DFD).

DFDs help system designers and others during initial analysis stages visualize a current system or one that may be necessary to meet new requirements. Systems analysts prefer working with DFDs, particularly when they require a clear understanding of the boundary between existing systems and postulated systems. DFDs represent the following:

1. External devices sending and receiving data
2. Processes that change that data
3. Data flows themselves
4. Data storage locations

TABLE I. THE RESULTS OF LICENSE PLATE EXTRACTION

Total Vehicles images	Extracted license plates	Unsuccessful extraction
180	177	3
Percentage	98.4%	2%

VI. EXPERIMENTAL RESULTS

This method has been tested over a large number of images with size of 368 x 254 pixels in order to analyze its performance. It segregates character in 98.4% accuracy. It is implemented in MATLAB. The performance of the test results demonstrate that the proposed method is efficient to be used for the license plate recognition system.

Fig. 4. Original Image

Fig. 5. Edge detected Image

Fig. 6. Binarized Image

Fig. 7. Candidate Region image

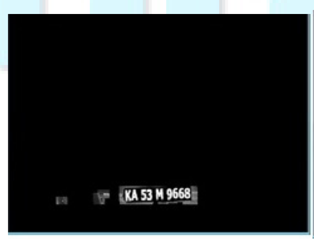

Fig. 8. Plate Localization

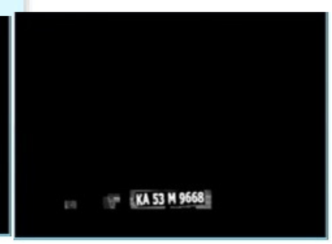

Fig. 9. Low frequency filter

Fig. 10. Binarization

Fig. 11. Final character segmentation

VII. CONCLUSION

We have accomplished a number of things with our work on using genetic algorithms to train feed forward networks. In the held of genetic algorithms, we have demonstrated a real-world application of a genetic algorithm to a large and complex problem. We have also shown how adding domain specific knowledge into the genetic algorithm can enhance its performance. In the held of neural networks, we have introduced a new type of training algorithm which on our data outperforms the back propagation algorithm. Our algorithm has the added advantage of being able to work on nodes with discontinuous transfer functions and discontinuous error criteria.

The work described here only touches the surface of the potential for using genetic algorithms to train neural networks. In the realm of feed forward networks, there are a host of other operators with which one might experiment. Perhaps most promising are ones which include back propagation as all or part of their operation. Another problem is how to modify the genetic algorithm so that it deals with a stream of continually changing training data instead of fixed training data. This requires modifying the genetic algorithm to handle a stochastic evaluation function.

Finally, as a general-purpose optimization tool, genetic algorithms should be applicable to any type of neural network (and not just feed forward networks whose nodes have smooth transfer functions) for which an evaluation function can be derived. The existence of genetic algorithms for training could aid in the development of other types of neural networks.

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