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Reconstructing the Path of the Object Based on Time and Date OCR in Surveillance System

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ABSTRACT

The inclusion of time-based queries in video indexing application is enables by the recognition of time and date stamps in CCTV video. In this paper, we propose the system for reconstructing the path of the object in surveillance cameras based on time and date optical character recognition system. Since there is no boundary in region for time and date, Discrete Cosine Transform (DCT) method is applied in order to locate the region area. After the region for time and date is located, it is segmented and then features for the symbols of the time and date are extracted. Back propagation neural network is used for recognition of the features and then stores the result in the database. By using the resulted database, the system reconstructs the path for the object based on time. The proposed system will be implemented in MATLAB.

KEYWORDS: *Localization, Character Segmentation, Character Recognition, Back Propagation Neural Network*

INTRODUCTION

In the last few years, optical character recognition in digital video has received an increasing interest [1]. It is widely used in many applications such as security control, supermarkets, banks, traffic monitoring, and etc... Some approaches exist and have been described in literature. They are mainly based on pattern matching and normalized correlations with a large database of stored templates [3, 4]. The aim of the system is to recognize time and date stamps for allowing time-based queries and for reconstructing the path of the object.

Because the two main problems in video OCR are complex background and low resolution, it is widely accepted [1, 2]. The text to recognize is not a mere sequence of characters, but a valid date and time. Different format of time and date have to be considered. The format includes time and date in one or two lines; date above or below; numeric or alphabetic month representation; seconds with one decimal digit; order of day and month in the date; different separators, etc.

This learning approach has been shown to guarantee high rate of convergence and properties of stability and robustness of the solution. The recognition process starts with the search and the extraction of the portion of the original image. The characters contained in the plate region are localized by a robust processing using a non-traditional Discrete Cosine Transform (DCT) and subsequently segmented by applying low pass filtering on the plate region image and convert the gray scale plate region image into by using histogram-based shareholding method. After labeling, object with small area, which might be noise, are moved. From this segmented image we need to recognize the actual characters and numbers. Back propagation neural network is used for character recognition.

PROPOSED SYSTEM

In this study, the proposed system is based on the localization of time and date region and camera number, segmentation of these characters and recognition of characters and store these characters in the database. And then the system reconstructs the path of the object based on time.

3.1 Localization of the Time and Date Region

In the localization part, the entire image is input, and then the time and date region is localized by using block-based DCT (Discrete Cosine Transform). DCT transforms the spatial domain image into the frequency domain one. So, we can localize the time and date region from the DCT image because the numbers or characters on the region usually have high frequency. We detect the time and date region by scanning a window on the DCT image. If the number of horizontal, vertical and diagonal edges in the window is above a threshold value, then we assume that position is the region.

Fig 1 Example Input Image

3.2 Segmentation

In the segmentation part, we segment each number or character from the plate area image. First we apply low-pass filtering in the plate area image 3x3 averaging operator in

order to remove noise, then we convert the grey scale plate area image into binary image by using histogram-based shareholding method. The image size 640x480 pixels is used for input. First of all, all program read image file and find some information from that need to handle image. While reading processing ends, image data will be row image. And it is necessary to get only brightness information. After that image was converted into YCbCr color system and adopt only Y image. Interval of the window's movement is 4 pixels in row and column in order to reduce processing time. When we get plate image, which sized 170 x 90 to reduce error (each 10 more pixels in 4 directions).

It is required to know more about exact location of letters in plate so that some pre-processing steps have to be implemented. The first processing is 'binarization'. We used general binarization. The threshold value is very important thing. Next the extracted characters are converted into black and white characters represented by using binarization. To get a more accurate binarization results, this process uses several local threshold values since illumination of the plates, in general, is not uniform.

Next to extract the plate characters and then proceeds to their identification, a labeling process is applied to the binary image, which is a very useful technique to segment characters with some inclination and different sizes. The labeling process allows the segmentation of the plate characters. After labeling, objects with small area, which might be noise, are removed.

3.3 Feature Extraction

The obtained characters were separately saved as an image file in feature extraction. A feature extraction process plays an important role in content based image classification. Back propagation ANN classifies the numbers and the letters for increasing the success rate of the recognition phase. The character images should be extracted as features before classification. These extracted features provide us to obtain the most discriminating information of an image. This information can be presented as a feature vector. The comparison between characters can be made when a feature vector that includes global and local features of a character should be encoded. In this system, the feature vector of an image was encoded by using Average Absolute Deviation algorithm [5]. This algorithm is defined as:

$$V = \frac{1}{N}(\Sigma_N |f(x,y) - m|) \qquad (1)$$

Where N is the number of pixels in the image, m is the mean of the image and f (x, y) is the value at point (x, y). The feature vectors with the length of 49 bytes for numbers and 48 bytes for letters are obtained. Back propagation ANN uses the entire feature vectors as an input for classification of the characters.

3.3 Recognition of the Characters

Once each individual digit and/or character is extracted, it must be identified in some way. This process is called Optical Character Recognition, and there are several different solutions to this problem. The output of a generic OCR would basically consist of taking the characters that produce the highest matching for every segment in string. An interpretation of the result as a valid time and date is required. The numbers and the letters were classified by using back propagation ANN for increasing the success rate of the recognition phase.

3.3.1 Back Propagation Neural Network

In this approach, back propagation neural network is used. To improve the network until it is able to perform the task for which it is being trained, its iterative, recursive and efficient method for calculating the weights updates are used as main features of back propagation. Fig 2 is shown for a general block diagram of back propagation neural network. Firstly, the training parameters are defined:

- Initial Conditions
- Number of iterations
- Number of hidden layer

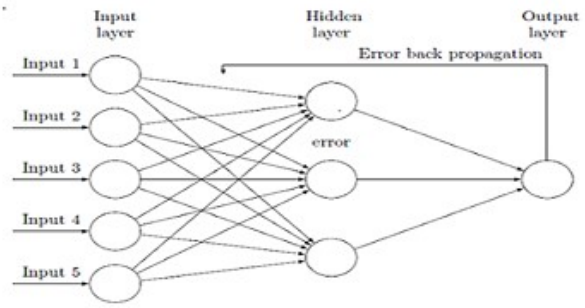

Fig 2 Back Propagation Neural Network

Multilayer Neural Network which is based upon back propagation algorithm for training is a Back Propagation Neural Network (BPNN). This neural network is based upon extended gradient descent based Delta learning rule which is known as Back Propagation rule. We must adjust the weights of each unit in such a way that the error between the desired output and the actual output is reduced to train a neural network to perform some task. This process requires that the neural network computes the error derivative of the weights. In other words, it must calculate how the error changes as each weight is increased or decreased slightly. The back propagation algorithm is the most widely used method for determining the derivative of Weight. If all the units in the network are linear, the back propagation algorithm is easiest to understand. In backward direction from output to hidden layer in this network to input layer in order to train the network, error signal between desired output and actual output is being propagated.

Input layer, hidden layer and output layer are included in artificial neural network. Initially, training data are placed into the input layer. This is transmitted to the hidden layer and the output layer. The process is known as forward pass. The appropriate weight between nodes and generate output value of the resulting sum are computed and adjusted by each node in the input layer, hidden layer and output layer. After that the actual output values will be compared with the target output values. In order to update the weight of each node again, the error between these outputs will be calculated and propagated back to hidden layer. The error calculated is shown as in equation (2).

$$E = \tfrac{1}{2}[dk-yk]^2 \qquad (2)$$

Where dk is the output for neural network.

Until the error is acceptable, the network will iterate over many cycles. For any new input data, the trained network is ready to use after the training step is done. The input for testing is placed into the input layer and results based on its knowledge from trained network will be generated by the feed forward network. The algorithm calculates each derivative of error by first calculating the rate at which the

error changes as the activity level of a unit is changed. For output units, the difference between the actual and the desired output is the error. We first identify all the weights between that hidden unit and the output units to which it is connected to compute the error for a hidden unit in the layer just before the output layer. Then, we multiply the error of those output units by those weights and add the products. The error for the chosen hidden unit is equal to this sum. Moving from layer to layer in a direction opposite to the way activities propagate through the network, we can compute the EAs for other layers after calculating all the errors in the hidden layer just before the output layer. It is straight forward to compute the derivative of error for each incoming connection of the unit once the error has been computed for a unit. In neural network, back propagation algorithm is most generally used. The input for testing is given to input layer and it will provide results according to knowledge it gets from training.

After the recognition phase, the result of date and time and camera number are stored in the database. Finally, the system arranges the camera information based on time and date for the object that passed the cameras. In table 1, the object passed through GA-2030, GF-3065, GF1020, GF-2451, GA-2076 and so on. The flow chart of the proposed system is shown in fig 3.

Point No	Extracted Video Frame						Camera Information	Point and Place
	Year	Month	Day	Hours	Min	Sec		
1	2019	3	15	12	26	6	GA-2030	Gate Point
2	2019	3	15	1	30	34	GA-2076	Gate Point
3	2019	3	15	12	45	12	GF-3065	Front of Building
4	2019	3	15	12	56	23	GF-1020	Mid of Building
5	2019	3	15	1	20	5	GF-2451	End of Building
...	...	...	...	...	...	...	...	...

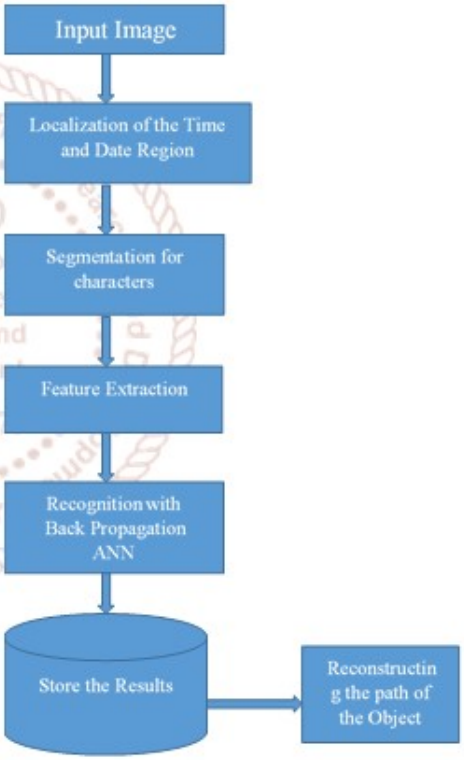

Fig 3 System Flow Diagram

CONCLUSIONS

In this paper, we proposed the system for reconstructing the path of the object based on time and date OCR in surveillance camera. Time and date OCR in surveillance system provides useful information. The integration of the proposed system in a bigger application will offer the ability of performing time-based queries.

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