Numbers Recognition Techniques for Achieving Images

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Abstract: *Modern technologies resolve many difficulties through submitting magic solutions characterized by the speed and accuracy in the completion of the work. The development of the solid components of digital electronic had given way to open the door to the evolution of modern software on the throne of the management of knowledge and modern technology. It must be ensure in contributing to making the process of dealing with the old data easy and efficient. The old data often had been stored as images in order to preserve it from loss and damage. Most of the old image archives have been handle manually. This process is boring and met the error. All of that enforce us to propose and design a system discriminate by simplicity, accuracy and speed is capable of detecting the numbers in these pictures in order to retrieve the record information. The system proposed several ways adopted the principle of comparative and the use of matching criteria as well as enter many improvements such as handle the individual numbers, apply shifting, scaling, and rotation for each in as attempt to overcome the obstacle resulted from variable scanned devices used to get the images and also the environment noise. Also an attempt of use some mechanisms of artificial intelligence, back propagation to detect the number. Finally, I should mention that excellent results through accuracy and speed have been* obtained.

Keywords: Image Processing, Pattern Recognition, Correlation, Image Scaling, Back Propagation

1. Introduction

Due to the rabid need for the pattern recognition in many modern applications, the field of pattern recognition has witness a great deal of improvement. The research is vital and offers a great service, especially to conduct a search operation in the pictures on the archives, which is stored as images in the early stages and then try to prevent damage and loss of these archives, which was prior to that store it in the paper, claiming that the search process to locate the record in any image and then the ability to return the information for this record.

There are many obstacles and we are trying to overcome such as varied fonts script used to write the text, also the old document that were stored, as well as the large distortion in some images. After studying this area and details for handling digital images, a planning to walk in different paths in order to achieve the goal obtaining great result through number detection and fast processing. In order to achieve the goal many improvement and corrections was implement on the work path and the classical detection method. Its smaller calculation largely reduces the time of recognition, with high accuracy and precision rate at the same time. [1]

2. Review Papers

There is a lot of work near our fields. Text Detection and Character Recognition in Sensing morphological algorithm[2,3], Automatic Number Plate Recognition System[4], Recognition of numbers and position using image processing techniques for solving Sudoku Puzzles[5], Automatic Target Recognition by Matching Oriented Edge Pixels[6], Other paper cover the subject of vehicle plate number recognition using OCR module implemented by Hidden Markov Model.[7]. Another paper for use convolution neural network in deep that directly operates on the pixels of the adopted picture also is used for multi digit number recognition. [8]

The Image Correlation Criteria

Variance in likelihood hypothesis and insights is the desire of the squared deviation of an irregular variable from its mean, and it casually measures how far an arrangement of (arbitrary) numbers are spread out from their mean. The fluctuation has a focal part in insights. It is utilized as a part of illustrative measurements, factual deduction, theory testing, integrity of fit, and Monte Carlo inspecting, among numerous others. This makes it a focal amount in various fields, for example, material science, science, science, cryptography, financial aspects, and fund. The fluctuation is the square of the standard deviation, the second focal snapshot of a conveyance, and the covariance of the irregular variable with itself.

Covariance in likelihood hypothesis and insights is a measure of the joint inconstancy of two irregular factors. In the event that the more noteworthy estimations of one variable mostly compare with the more prominent estimations of the other variable, and similar holds for the lesser qualities, i.e., the factors tend to indicate comparative conduct, the covariance is certain. In the inverse case, when the more prominent estimations of one variable essentially compare to the lesser estimations of the other, i.e., the factors tend to appear inverse conduct, the covariance is negative. The indication of the covariance subsequently demonstrates the inclination in the direct relationship between the factors. The extent of the covariance is difficult to decipher. The standardized adaptation of the covariance, the connection coefficient, notwithstanding, appears by its greatness the quality of the straight connection.

Correlation is Compute the two-dimensional relationship coefficient between two grids could be registered as

$$r = \frac{\sum_m \sum_n (A_{mn} - \overline{A})(B_{mn} - \overline{B})}{\sqrt{\left(\sum_m \sum_n (A_{mn} - \overline{A})^2\right)\left(\sum_m \sum_n (B_{mn} - \overline{B})^2\right)}}$$

where $\overline{A}$ = mean2(A), and $\overline{B}$ = mean2(B).

3. The Proposed Model

The technique was implemented on real document consists of photos contain the record for students as shown in fig(1). The general step for our model could be the block diagram in fig(2). The first step is to load the picture which is true color and convert it to black and white picture as shown in fig(3).
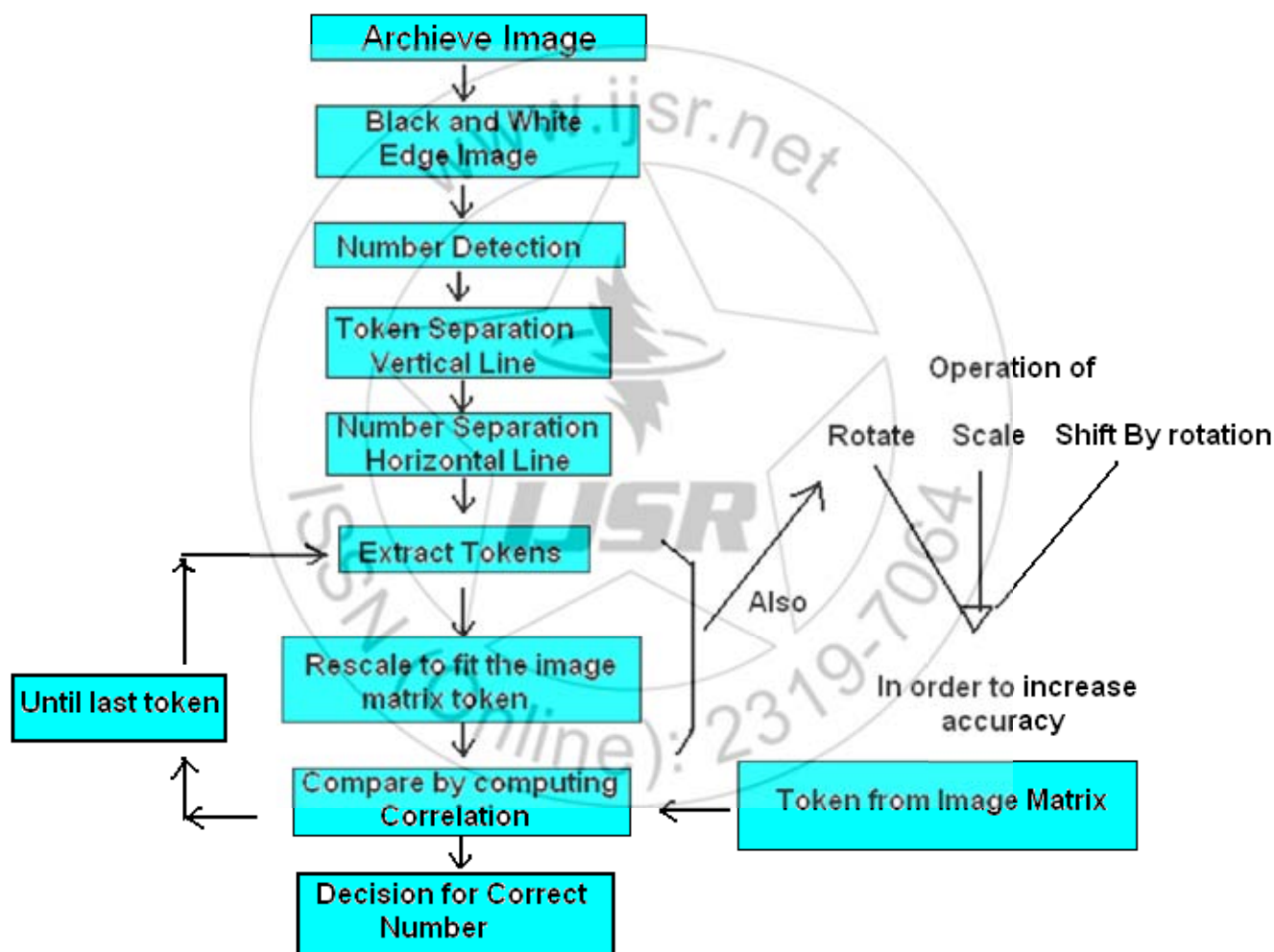

Figure 1: Original image

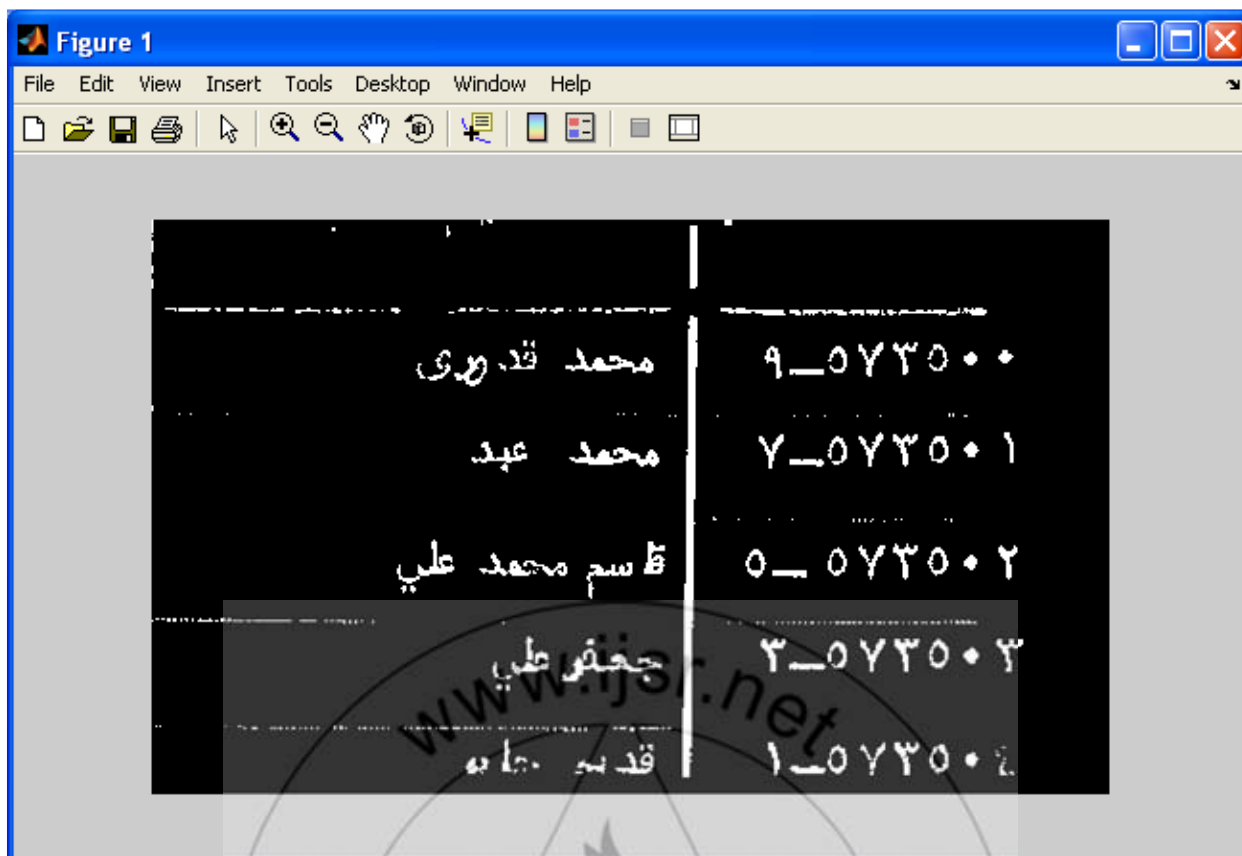

Figure 2: General Model Block Diagram

Figure 3: Black and white image

The next step is to shade the less intensity area as shown in Fig(4).
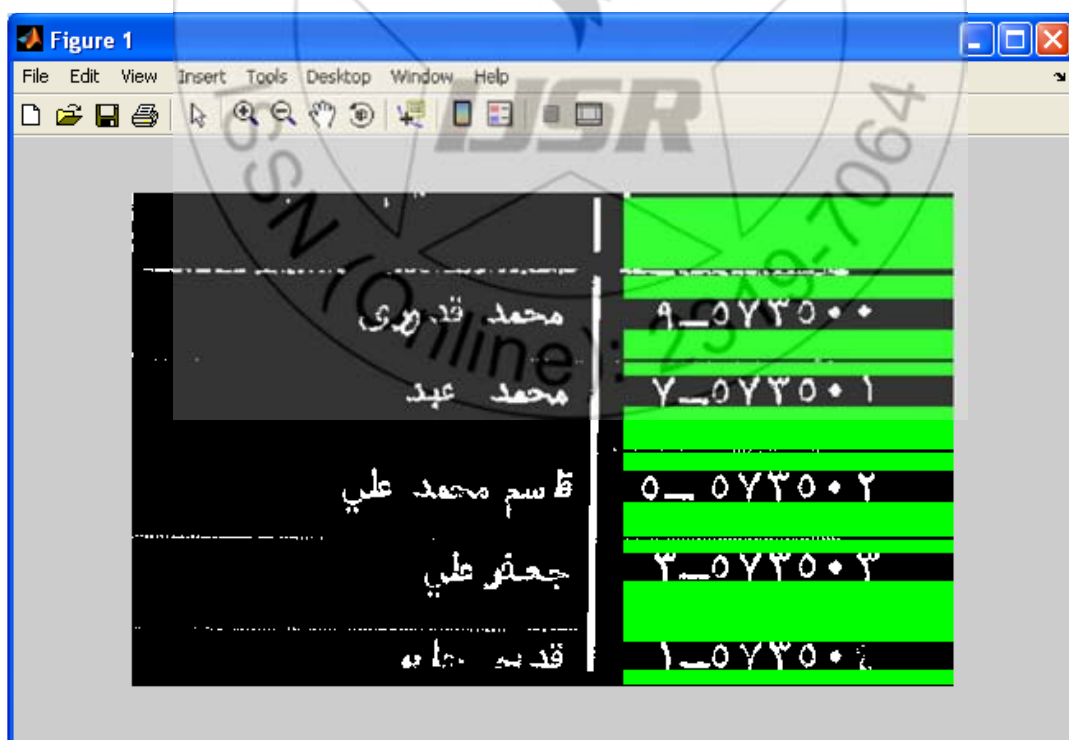

Figure 4: Shaded blank area

Dropping vertical lines and calculating the rate of the total intensity of the image pixels intensity and then determine the beginning and end of the number in its left and right sides as shown in fig(5).
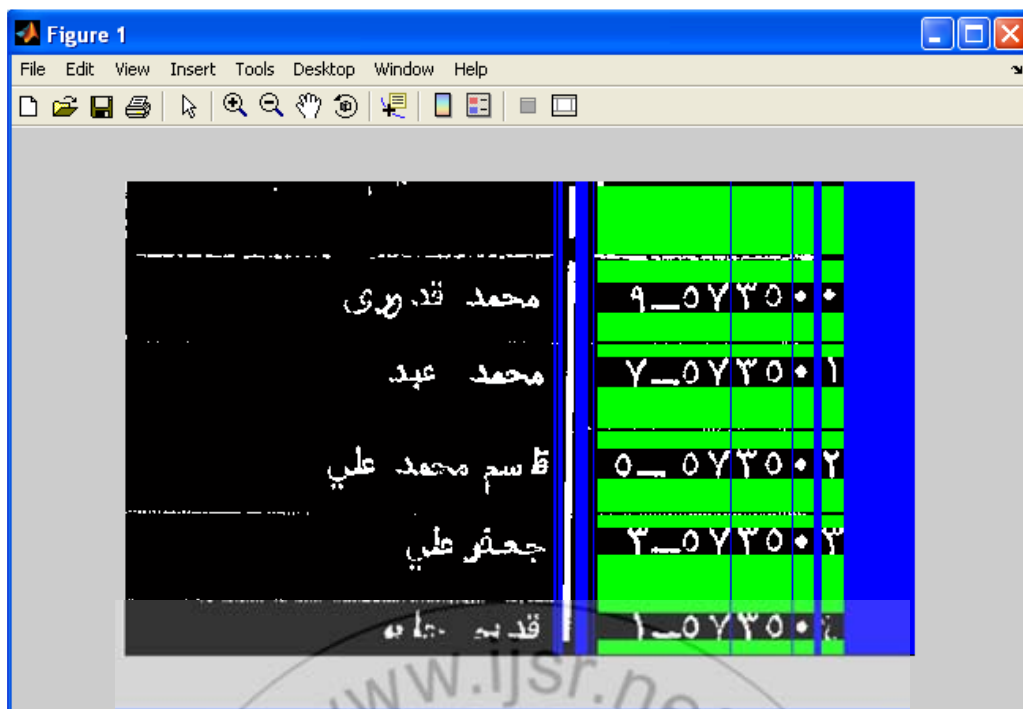
Figure 5: Vertical Line

Dropping horizontal lines for the image, as shown in fig(6) for the purpose of diagnosis the number edge according to the direction of upper and lower, also this process depends on the sum of intensity and it could be computed according to the threshold in order to overcome the problem of the noisy image. [9]
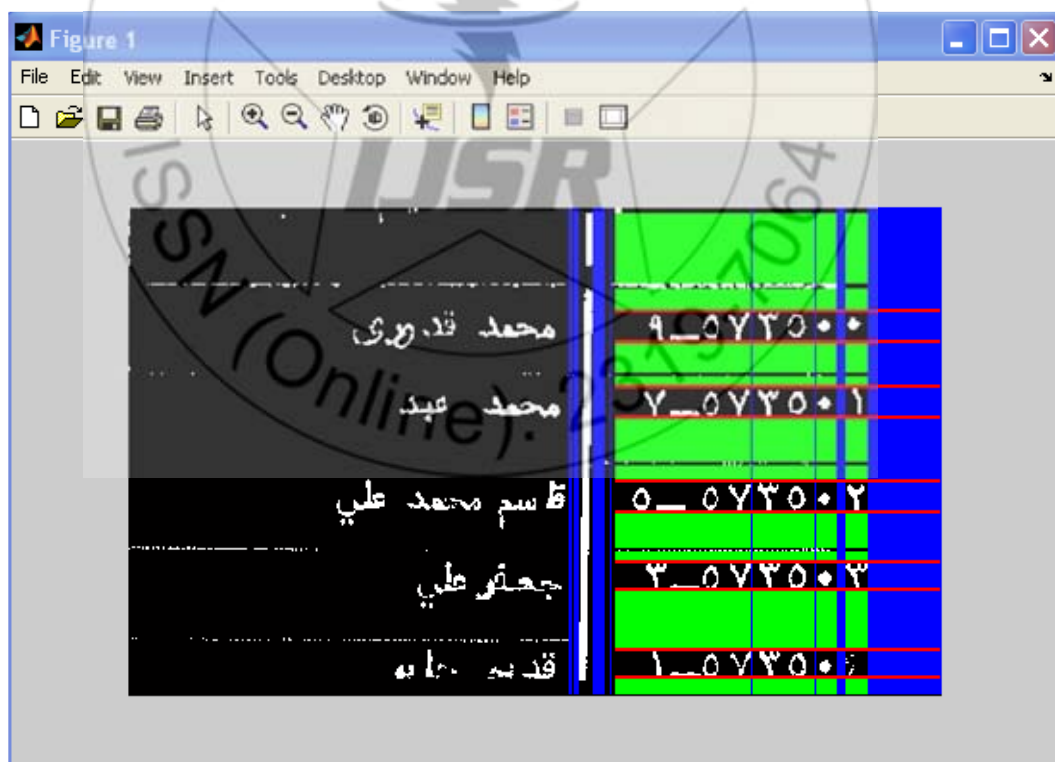

Figure 6: Horizontal Lines

Forming image numbers matrix

An easy mechanism through which to construct the matrix is to choose sample from the image to be search and try to construct and save each individual number image. When the process of searching for given number the first step is to build the number image from the saved individual image number, then starting the search process as shown in fig(7).
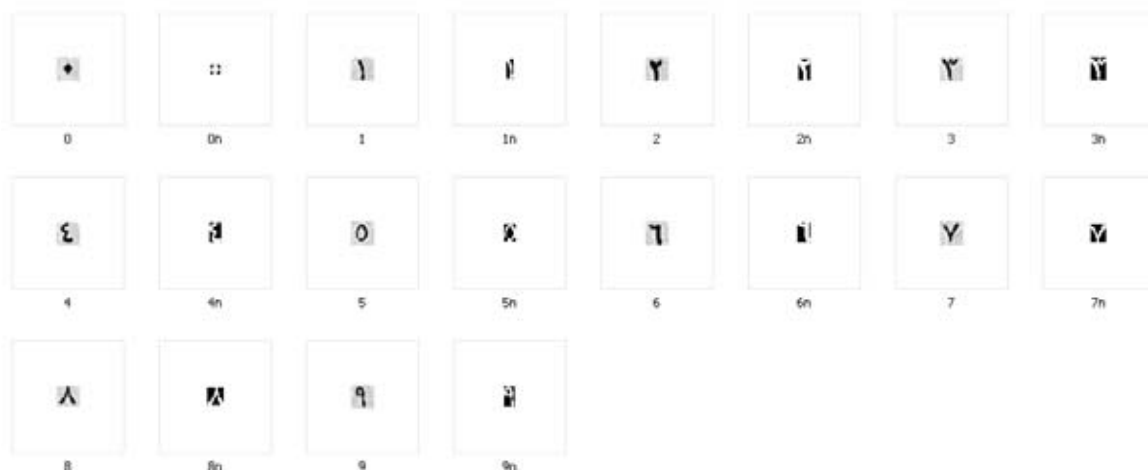
Figure 7: Number photo elements

In order to overcome the limitations
1) The distances between the variable numbers.
2) The classic way is not flexible it is based on a comparison of blocks.
3) All deadhead in the picture affect negatively on the comparison.
4) In some cases this method produce wrong result because of the possibility that all the individual number except one give us perfect comparison result, the only one is not the same as the search number but give us moderate comparison result and for that the whole result will be give us the comparative two numbers is the same, this is wrong. In another case where the two comparative numbers are the same but the total comparative result tell us the two number is not the identical, due to each individual matched number give us specific error and in this case the total error is greater than the threshold.

The number image will be divided into tokens, each concerning the individual number. The comparing is implemented for each individual number which will result comparative number (the correlation function) for that token. Another improvement is to introduce a threshold for each individual comparative result which will be determine the comparative is correct or not and for all number the general criteria is build from these token comparative result, this process will overcome the error that could be result as whole comparative number. This method is successful and distinguished career at finding the desired number and the fast processing in order to return the information for the comparative record.

When a search process needed for the number "7_573501". The process start to capture each number as in fig(8) in the image and try to search with each token in it with the standard stored number as shown in fig(9).
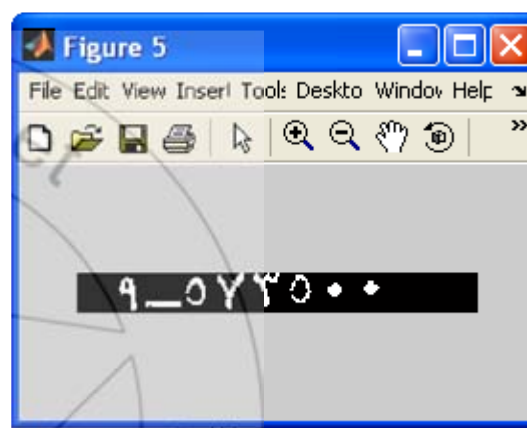

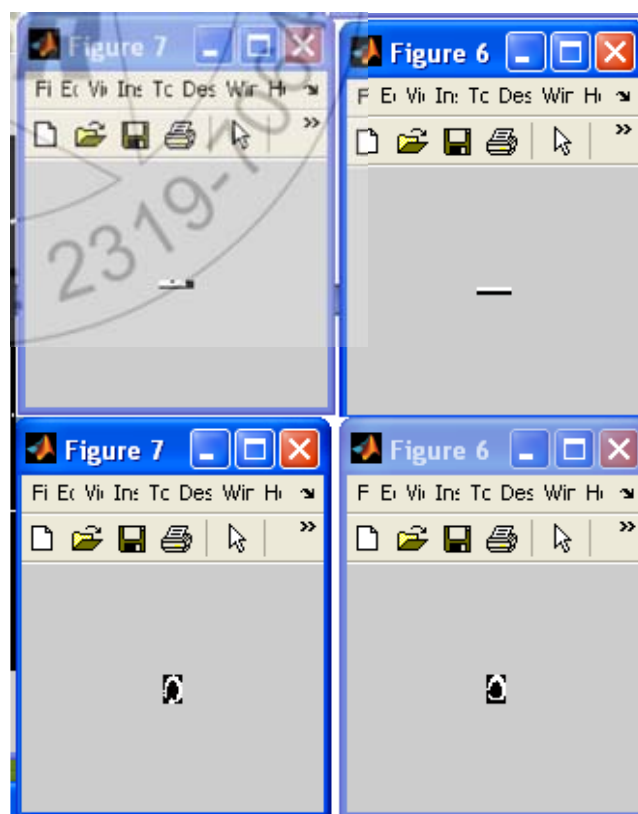**Figure 8:** The first capture image number

Figure 9: The comparative tokens

The search process continue for all token of the first number and there is pointer of the success of every search, finally the it will obvious that the whole number is identical or not and the search continue for the next number image until the needed number (identical) found as in fig(10).
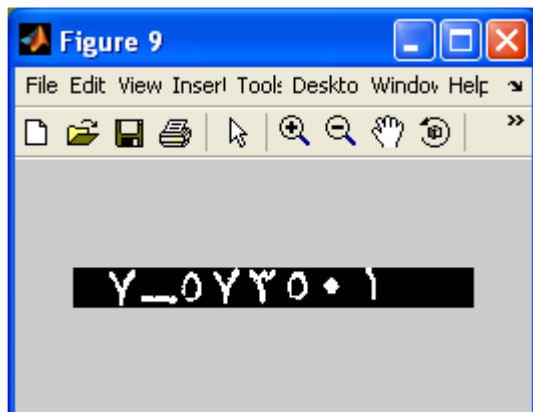

Figure 10: The Needed number

Another improvement has been adopted through the operation which is implemented with each token.

Image shifting: is procedure used to apply shifting for the number token. The shifting was implement in circular direction with the first neighboring pixels, and then with the second neighboring pixel. This procedure will avoid the shifting that could be occur with search image number due to many affected environment parameters such as variable scanning device. As shown in fig(11)
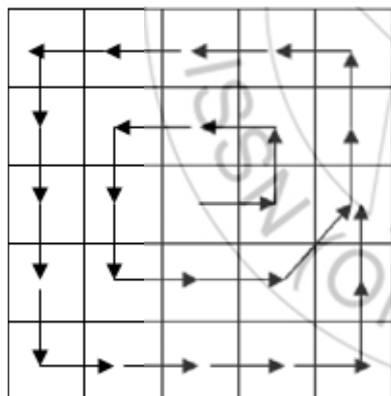

Figure 11: The Image movement center

- Images rotation: is procedure used to rotate the token in small degree at both directions clockwise and anticlockwise.
- Scaling the image: is procedure used to scale the image token into small variation (increase size or decrease size).

4. Method Of Artificial Intelligence

Artificial intelligence play important role for varied modern applications. It includes several techniques. The most important one is the back propagation. A trial was implemented in order to start using the technique in diagnosis for the needed number. The back propagation has two main phases [10]

First Phase (Training): In this phase the designed network will be trained to give output for give input. The training phase is time consuming. In training the threshold that stop the process is the learning rate, also using the momentum in order to increase the accuracy of training. Different learning rate has been choose and the best was .25 which will help us to avoid falling into local minimum trap. [11]

Second Phase (Diagnosis): In this phase the work for determining the number is implemented. This part consists of only forward processing.

The results were unsatisfactory and slow processing search.

Software Model

The main and the most important portion of this system is the software model. The software model use series of image processing techniques which are implemented in MATLAB 7.0.0.19920 (R14). The system algorithm is broadly divided into four parts:[12]
- Loading image.
- Extract the number from the image.
- Process each token in number.
- Recognize the numbers depending on each token search.

5. Result

The algorithm was implemented on real student degree photo and a great result has been obtained according to the accuracy in detecting the desire number with high speed processing. Table (1) below give brief description for the varied used technique.

Table 1: Varied Searched Methods size

Search Methods	Use in true color image	Use in gray scale image	Accuracy in detecting	Difficulty	Processing speed
Method without operation	Yes	Yes	High	Simple	Fast
Method with operation	Yes	Yes	High	Medium	Fast
Back Propagation	Yes	Yes	Low	Difficult	Slow

Also some of the sample token that have been applied with the three operation shifting, scaling, and rotation is shown in fig(12) bellow

Figure 12: Three operation applied to token

6. Discussion and Suggestions

The paper introduces simple and flexible methods for solving the problem retrieving conformation from huge amount of old archives that were stored as picture in previously time. The suggested method start from the classical correlation criteria and comparing the desire number images with the number achieve images. The classical method suffer from low ability to recognize the desire number location, many improvement have been made including the process of scaling comparative number token before the comparing process, the improved process of extract the token from number, the process of extracting the number from other, the parameter that determine the success of token search. Operation of scaling image, rotating image for the token were implemented as improvement step before

comparing process. The adopted model implement shifting in circular shape of each token in order to overcome the environment affected noise. A trial was implemented using the back propagation technique of trying to detect the desire number, but it was very slow and gives unsatisfactory result. Finally It must be mention that high accuracy and fast processing search have been obtained with simple method that is ready to work with real data.

The adopted system could be used with small modification in:
1) Car number plates recognition.
2) Bar code scanner.
3) Text recognition.

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