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Enhancement and Cleaning of Handwritten Data by using Neural Networks and Threshold Technical

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Abstract *– This paper propose the use threshold technical and artificial neural network (ANN) for clean and enhancement scanned image for recognition task. We show noise reduction and cleaning image can used different filter that result is not gratify. Multilayer perceptron (MLP) are trained in supervised methods using a cleaning image product with threshold technical and the corresponding noise handwritten image that product from scanning with scan machine. Results showed that this method is very performance from using filter for cleaning Image. Process of cleaning image is the preprocessing for system handwritten recognition that we do this work in this paper.*

Keywords*: threshold technical, artificial neural network, handwritten recognition, clean image, multilayer perceptron*

ORIGINAL ARTICLE

INTRODUCTION

Offline handwritten text recognition is one of the most topic for the research in many years [2, 3, 4, 5]. Before handwriting recognition we need to pre-process. Automatic handwritten recognition systems normally include several preprocessing Such as noise reduction and normalization and slant correction and slope correction. Cleaning image is on step for offline handwritten text recognition that product high performance for this proposes. In this work use from artificial neural network and threshold technical is proposed. In many automatic handwritten recognition systems preprocessing does not require a binarization step. For this reason the image should be maintained in gray-level quality that cleaning image do this work us. This paper presents new techniques for cleaning image that use for multilayer perceptron (MLP) Methods that used in this paper. Database use in this work is IAM [1]. Section II introduces approach to use filter for reducing noise. In this paper used median filter, mean filter and opening/closing filter for reduce noise. Section III introduces describes cleaning image with threshold technical and section IV introduces describes method artificial neural network for cleaning image and section V is conclusion.

FILTER FOR NOISE REDUCTION

There are several classic spatial filters for reducing or eliminating high-frequency noise from images. The mean filter, the median filter and the closing / opening filter are frequently used [6]. The mean filter is a low-pass or smoothing filter that replaces the pixel values with the neighborhood mean. It reduces the image noise but blurs the image edges.

$$f(x,y)=\frac{1}{mn}\sum_{(s,t)\in s_{xy}} g(s,t) \qquad (1)$$

s_{xy} represents the set of coordinates in a rectangular subimage window(neighborhood) of size m*n, centered at point (x,y). The mean filter computes the average value of the corrupted image g(x, y) in the area defined by s_{xy}. The value of the restored image f at point (x,y) is simply the mean computed using the pixels in the region defined by s_{xy}.

The median filter calculates the median of the pixel neighborhood for each pixel, thereby reducing the blurring effect. Replaces the value of a pixel by the median of the intensity levels in the neighborhood of the pixel.

$$f(x,y)=\text{median}\{g(s,t)\} \quad \text{that } (s,t)\in s_{xy} \qquad (2)$$

Finally, the opening / closing filter is a mathematical morphological filter that combine the same number of erosion and dilation morphological operations in order to eliminate small objects from images[7,8]. The opening of set A by structuring element B, denoted $A \circ B$, is defined as $A \circ B = (A \ominus B) \oplus B$. similarly the closing of set A by structuring element B . Denoted $A \bullet B$, is defined as $A \bullet B = (A \oplus B) \ominus B$. In this part of simulation we used three filters: median, average, opening/closing. At the first step we apply median filter to remove salt and pepper noise. Then, output of this filter is passed through average filter and finally we used opening/closing filter for better separately between white and black pixels for image. Figure 1 description arrangement of this filter.

The result filter for reduce noise is not satisfactory (see figure.2).

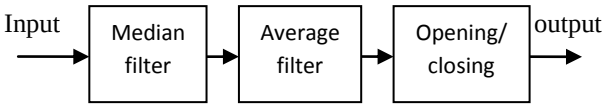
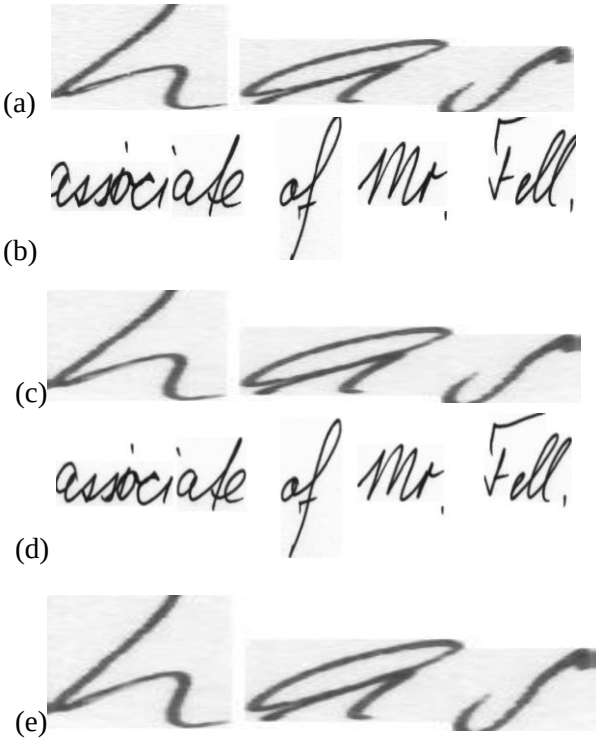


Figure 1. Schematic of used three filters.

THRESHOD TECHNICAL

All the images that are in database are noise image. For training neural network we need clean image. And to making clean image in this research we used threshold technical. We used threshold method because in this method we can all of the value pixels in image to set with several value that useful for us and for this reason that handwritten image when see good that all of the value pixels set with 0,1. Exercising threshold technical for image by way of to grant that for value pixels is more from limit to set with 1 and for value pixels is little from limit to set with 0. With this technical we product best image for continue search. In figure.3 shows clean image that cleaning with threshold technical. In this image show that value of pixels are two state zero and one. And see that qualities of image are better from original image and consider very good from original image. Too this image for training neural network is very ideal for me.



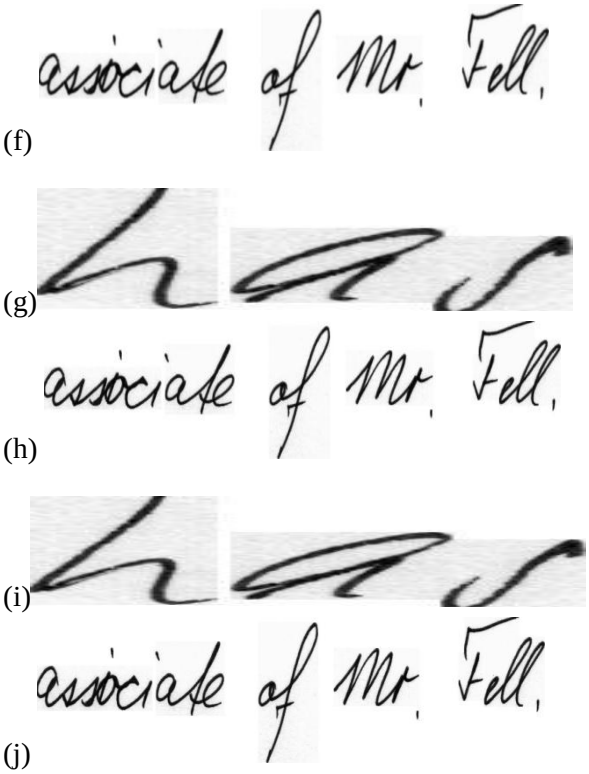


Figure 2. Original images from the IAM database (a,b) median filter for reduce noise (c,d) average filter for reduce noise (e,f) opening/closing filter for reduce noise (g, h) result using 3 filter main, median and opening/closing for reduce noise (i ,j)

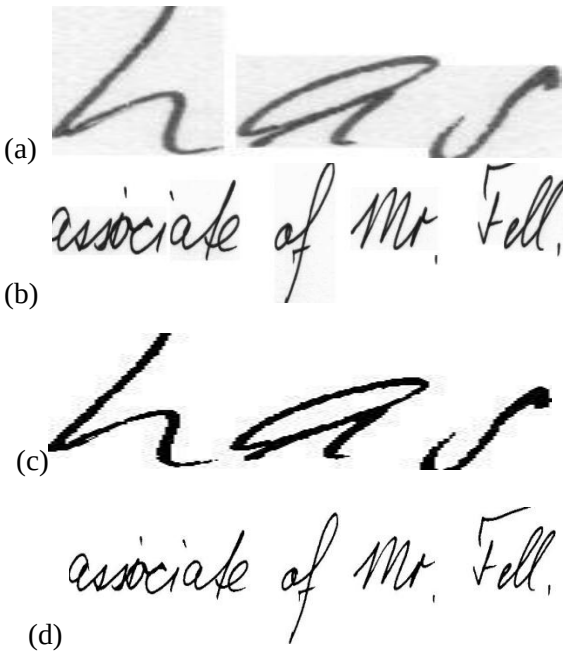


Figure 3. Original images from the IAM database (a,b) clean image with threshold technical (c ,d).

ENHANCEMENT AND CLEANING IMAGE WITH ARTIFICAL NEURAL NETWORK

Multilayer perceptions (MLPs) were used for the enhancement and cleaning of images. Only one output unit was needed to estimate the energy level (gray level) of the clean pixel. The activation function of the units of the hidden layers(s) was the sigmoid function, while the activation function of the output unit was the identity function. Due to the liner activation function, the output may be out of range, but, in practice, values were in the interval [0, 1].

We employed the identity function at the output layer instead of the more commonly used sigmoid function because the characteristics of an MLP were improved significantly with the identity function when applied to regression problems[9]. It should be noted that using a sigmoid activation function at the output layer is useful for application where the output is in the form of binary values such as binarization image processing.

The input units consisted of a squared window of pixels centered at the pixel to be cleaned. Neighborhoods from 2 to 5 were tested, where a neighborhood of n pixels means a squared (2n+1) sided input window to the MLP. The entire image was cleaned by scanning all the pixels with the MLP. The MLP, therefore, functions like a nonlinear convolution kernel. The trained neural network different in the number of neighbor pixels (from 2 to 5), the number of hidden layer (one or two hidden layer) and the number of hidden neurons in each layer (from 2 to 16 hidden units). in every case, the online version of the backpropagation learning algorithm with momentum was used. For the same topology, several training were performed varying the learning rate, the momentum term and using different initializations of the weights. The stopping criteria were the mean squared error in the validation set. The best MLP that obtained the lowest MSE in test set used 5 neighbors at the input and two hidden layers of 16 and 2 units, respectively. Too in trained neural network we use for clean image threshold technical. In figure.4 see the MLP structure and In figure.5 see the result of applying the best MLP.

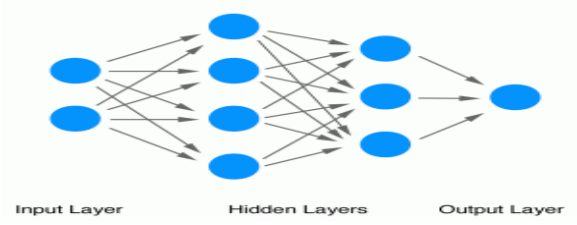


Figure 4. MLP structure

Figure 5. Result the applying MLP (a, b)

CONCLUSION

In this paper in first step we used filter for cleaning image and noise reduction but result show that filter not satisfactory for noise reduction and cleaning image. Used from three median, mean and opening/closing filter together also don't have attractive result. Then we used artificial neural network for cleaning image, that result shows it is very satisfactory and have good performance for this work for training neural network using clean image products threshold technical. Partake from threshold technical author product images that include two value pixels.

For The simulation MLP person image that include two value pixels (0 and 1) is very useful. In figure 5 comparing two results from cleaning image with MLP and cleaning image with filter. (see figure 5).

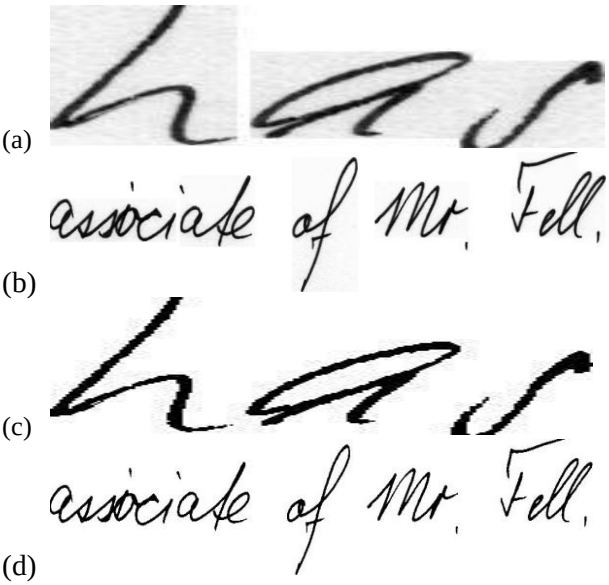


Figure 5. Cleaning image with three filter (a, b) cleaning image with MLP (c, d)

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