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Shape Verification Neural Network to Detection Personal Signature

Adil Alrammahi, Hind Shaban

Abstract: ***This paper was concerned to study the standard features of the personal signature image. Independent features such as the area, height ,width, maximum vertical, maximum horizontal , and fractal dimension were taken to isomorphic of the original image . for more efficiently of this work the degree of complexity of image was studied and introduced as extra property of signature. Proposed algorithm was introduced for calculating the features of signature image. Many test image were taken for test this algorithm The executive appears that this algorithm is very sensitive and accurate when we have different and similar signature images. In this paper a method of verifying signatures using a technique of neural network is presented. static of various and dynamic of signature features are added in this model. Our proposal algorithm enhanced via neural network and Elman network. In our modified our method, many parameters of detection of digital images were added. These image parameters named as Width, Area, Maximum Vertical Projection, and Fractal Dimension. Fractal dimension is considered as the degree of complexity of the shape. Fractal dimension calculated the condensation of complexity of pure points of the shape without its boundaries. The dimension of the signature is varying between 1.0025 to 1.0584. Originally the signature is belonging to R^2-Space (with dimension 2). The signature is considered as one of to the fractal shape. The fractal dimension is calculated by the Theorem of Boxes Squares Counting. The fractal signature dimension added an accuracy to our method for detection many signature shapes by the number of similarities in certain properties.***

Keywords: ***fractal dimension, image processing, Neural Network, Elman Neural Network.***

I. INTRODUCTION

One know that the recognition of image has used in medical digital systems, computer vision, and communication. When we need to compare between two images, the formidable task must been look indistinguishable. Many researchers studied image recognition. Pande and Goel using Radial basis function in a complex values of neural network via back propagation algorithm [1]. Joshi and Tapaswi using genetic algorithm for computing the region based image similarities [2]. Ge et al introduced the method of "object-detection" in order to add the boundaries of shape. In [3] the composition between edge and corner information is introduced.

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***** Correspondence Author
Adil AL-Rammahi*, professor in faculty of computer science and mathematics, university of Kufa. Iraq
Hind Shaban, professor in faculty of computer science and mathematics, university of Kufa. Iraq

In [4] Fu et al deal with "adaptive feature preserving bidirectional flow process" for exceeding the error deduced by each of edges and jag. Lim et al Used binary vector machine to test the belonging of incoming face image[5].Oo used the detection of one dimensional object via the secant lines [6]. Ovinis et al used the concept named as "machine vision" in order to check the outcome features of surgical tasks using "robotic surgery systems" [7].
Alzaabi et al used Sift matching and the concepts of shape and object used for Recognition image [8]. When we need to check the signature among samples of database, the technique of "Signature recognition" must been used. Clearly the result is represented in zero – one values vectors. It ing is another manner for describing the ability of a computer translating to write the plain text. In [9] there is a good methods for this presentation and is called as "Optical Character Recognition (OCR)". Elmezain and El-Shinawy used generative and discriminative a model to test or check the characters of English alphabet and the integer numbers between zero and nine [10]. This paper was concerned with introduce an algorithm for determining and recognizing the scanned personal signature shape. In our modified our method, many parameters of detection of digital images were added. These image parameters named as Width, Area, Maximum Vertical Projection, and Fractal Dimension. Fractal dimension is considered the degree of complexity of the shape. Fractal dimension calculated the condensation of complexity of pure points of the shape without its boundaries. For example, the dimension of the fern is 1.682. Originally the fern is belong to R^2-Space with dimension 2. The signature is similar to the fern in many properties of the fractal shapes. Each the fern and the digital signature has a fraction dimension. They belong to R^2-Space. The fractal dimension is calculated by the Theorem of Boxes Squares Counting. The fractal signature dimension added an accuracy to our method for detection many signature shapes by the number of similarities in certain properties. The certain signature properties represented in Width, Area, Maximum Vertical Projection. From Table 1, The fractal signature dimension is varying among 1.0025, 1.0040, 1.0442, 1.0333, and 1.0584. these values asserted that the signature is one of fractal shape. The signature is close to the segment line even though it is belong to R^2-Space. The rest writing of this paper is represented as image features and neural networks. In section II we write the out of line of each of Elman method of detection the signature and basic concepts of artificial neural networks. The new main result and our modified algorithm for detection signature was put in section III. Section IV was concerned for discussion all tables a figures, values of parameters, and fractal dimension signature of our samples.

II. Image Features and Neural Networks

The two concepts named as indexing and retrieval are needed of capturing of digital images. To describe a large data of accurately, the Feature extraction must have toked.
During the performing of the data, many variables are involved. When we increase the number of variables, a large memory is available. In [11] the concept of "computation power" is studied. In [12] a describing of the data has a good accuracy. In digital images the concept of "feature descriptor" is used for describing the patch point. One can use the usual paradigm to match features of digital images. A distance metric for comparing the feature descriptors is required. The geometric relationships among many good points via matching procedure utilizes the rigid. One can use the "local features" to recognize the object. Despite of significant and occlusion, the recognition is run. Indeed, the local features are studied in [13]. In [13], the "shape features" represented as "object's boundary".

A. Local Features

Clearly the local image features still used for this time in the applications of computer vision. Here we must represent the image as small overlapping using independent parts possibly. The parts must identify in different images and with the same scene. One can use the relation between the reliable statements and the content of the scene. So the extraction of the local feature containing two steps:

1. any stable local image state must be detected.
2. the patches of these images must be descripted.

B. Global Feature

When we select the small mobile, the results of features must be determined. The color or histograms are considered the vectors of our features. Here the one image is divided into a number of sub images using the grid. In this step one can get the features with more distinctive. Clearly the changes within one sub image may get an influence of the feature. One can tested the methods for different grid sizes.

C. Grid Image Feature

In [14,15,16] Elman suggested the method named as simple architecture for detecting the signature. The details
appear in Figure 1. one can note that the network consists of the following

1. The units of input, hidden, output and context.
2. A set of many connections of feedforward.
3. A relation among feedback connections and the hidden.

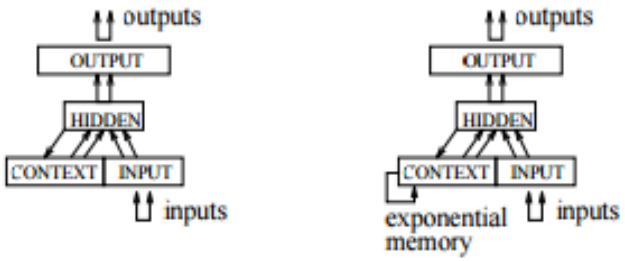

Figure 1: The basic Elman network with a modified network with exponential memory.

The structural neural network and its training is useful for many linear and non-lineal problems. For example, when we have three unknown variables and given one linear equation. The classical mathematical algebraic method are not guarantee for calculation the unknown variables independently. Here the methods or techniques of artificial neural networks are necessary. In other words, when we have a mathematical problem with linear or with non-linear independent variables, we can use the model of artificial neural network to solve our problem. Indeed the model of artificial neural network is concerned and special for finding the numerical and approximated solutions of any problems with a lot of coefficients and little equations. The proof of this model show it is stable, convergent, and with least errors.
We used Elman neural network and th e results of accurate and efficient in signature verification and distinctiveness. Based network in its work on the values of the Global features of the signature Where the network receives mono a matrix include 6 values are the results of the Global features of the signature.
Indeed the network layers are separately as the following.

1. Input layer is the first layer of Elman network. It includes mono matrix and the 6 nodes which represents the number of values of the results of the Global features of the signature.
2. Hidden layer: the number of nodes (5 nodes) and the return of my time (context layer), and that gives feedback without weight.
3. Output layer: consists of (6 nodes) according to data target (the results of the Global features of the signature).

For performance function, we use the mean square error distance (MSE) and mean absolute error distance(MAE). To find out the amount of divergence in between them using Elman neural network and which is defined as discrimination and signature and identify the person concerned.

III. NEW MAIN RESULT

In this section, new algorithm presented to recognize personal signature shape. It is depending on some features as area, maximum and minimum of each vertical and horizontal projection, height, width, and fractal dimension of scanned image. Fractal dimension is considered as the degree of complexity of the curve, figure, surface, boxes and shapes. Fractal dimension calculated the condensation of complexity of pure points of the shape without its boundaries or other non-necessary points. For example, the dimension of the fern is 1.682. Originally the fern is belonging to R^2-Space with dimension 2. The signature is similar to the fern in many properties of the fractal shapes. Each the fern and the digital signature has a fraction dimension. They belong to R^2-Space. The fractal dimension is calculated by the Theorem of Boxes Squares Counting.

The fractal signature dimension added an accuracy to our method for detection many signature shapes by the number of similarities in certain properties. The certain signature properties represented in Width, Area, Maximum Vertical Projection. From Table 1, The fractal signature dimension is varying among 1.0025, 1.0040, 1.0442, 1.0333, and 1.0584. these values asserted that the signature is one of fractal shape. The signature is close to the segment line even though it is belonging to R^2- Space.

First we must refer to boxes counting theorems

Theorem(Boxes Counting): Let $N_n(A)$ denote the number of boxes of length $\left(\frac{1}{2^n}\right)$ which intersect the shape(attractor). If $D = \lim_{n\to\infty}\{\frac{Ln(N_n(A))}{Ln(2^n)}\}$ exist, then A has fractal dimension D [17-20].

Through the theorem of boxes counting and its lemmas, one can calculate the dimension of regular and non-regular shapes. The regular shapes represented as the square, triangle, circle, …, etc. the non-regular shapes is represented in cloud, ice, smoking curve line, …, etc. In this theorem, the dimension of square is 2 while the dimension of fern is 1.682 and the dimension of signature is varying among 0.0020 and 0.0584.

Following an algorithm for calculating the features of signature. Our features of signature involved the properties of Width, Area, Maximum Vertical Projection, and Fractal Dimension.

Algorithm 1

1) Read image.
2) Convert Color Image to Gray:

$$g(i,j) = 0.299 * I(i,j,1) + 0.587 * I(i,j,2) + 0.114 * I$$

3) Image Enhancement:
   pk= (255-80)/(xmax - xmin)*(g(i,j)-xmin)+80
4) Converting to Binary Image.
5) Calculation the features.

For test the goodness of Algorithm 1, one can study the following scanned signatures. The calculations are programmed via MATLAB.

Table 1 Feature recognition

N	H	W	A	MVP	MHP	D
1	152	42	2234	65	20	1.0442
2	143	72	1679	105	56	1.0333
3	161	35	2949	92	25	1.0584
4	2070	1410	15527	264	206	1.0040
5	2055	1378	9376	43	71	1.0025

Table 2 sample of signatures

No	1	2	3	4	5
Signature					

Where the Elman Neural Network effects for Personal Signature Shape (2 and 3) showed in figure 2

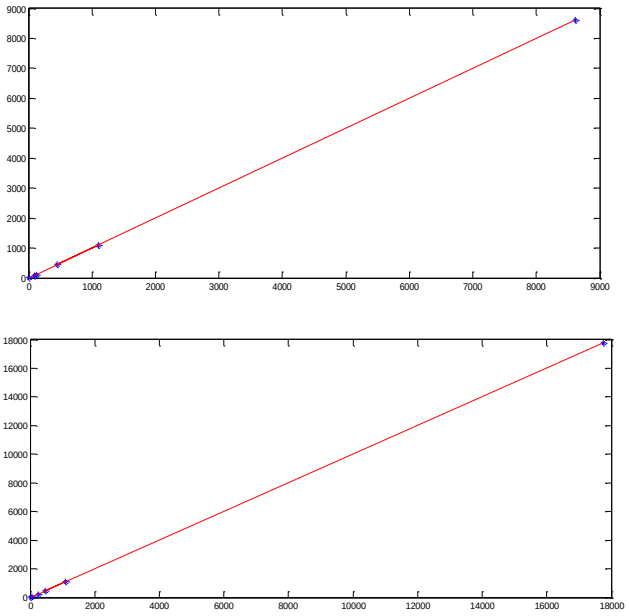

Figure 2: Elman Neural Network effects for Personal Signature Shape (2 and 3)

Where all information for Elman Neural Network for Personal Signature Shape (2 and 3) showed in figure 3.

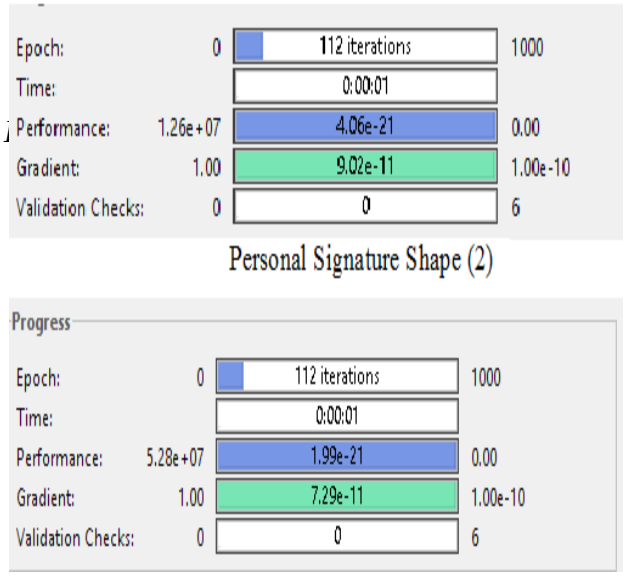

Figure 3: All information for Elman Neural Network for Personal Signature Shape (2 and 3)

Table 4: comparison between Performance1 and our Performance 2

Personal Signature Shape No.	Performance1 (Mean square error performance function(MSE)	Performance2 (MAE)
Personal Signature Shape 1	1.4979e-021	1.7347e-011
Personal Signature Shape 2	4.0649e-021	3.1155e-011
Personal Signature Shape 3	2.8715e-021	2.4039e-011

IV. CONCLUSION

Many different scanned signature images were tested under our proposed algorithm for finding its features. For check the efficiently or goodness of our program, we took approximated or similar images. The number of features of this image are different between them. That is clear from image (4) and image (5) of Table 1 although images (4) and (5) are very similar.

Clearly by table4 and for performance function calculating using mean squares error distances and mean absolute error distances. It is appearing the goodness of our method.

In our modified our method, many parameters of detection of digital images were added. These image parameters named as Width, Area, Maximum Vertical Projection, and Fractal Dimension. Fractal dimension is considered the degree of complexity of the shape. Fractal dimension calculated the condensation of complexity of pure points of the shape without its boundaries. For example, the dimension of the fern is 1.682 [17-18]. Originally the fern is belong to R^2-Space with dimension 2. The signature is similar to the fern in many properties of the fractal shapes. Each the fern and the digital signature has a fraction dimension. They belong to R^2-Space. The fractal dimension is calculated by the Theorem of Boxes Squares Counting [19-20]. The fractal signature dimension added an accuracy to our method for detection many signature shapes by the number of similarities in certain properties. The certain signature properties represented in Width, Area, Maximum Vertical Projection. From Table 1, The fractal signature dimension is varying among 1.0025, 1.0040, 1.0442, 1.0333, and 1.0584. these values asserted that the signature is one of fractal shape. The signature is close to the segment line even though it is belong to R^2-Space.

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AUTHORS PROFILES

Adil AL-Rammahi has been working as professor in faculty of computer science and mathematics, university of Kufa. He studied Applied Mathematics at University of Technology, Baghdad, Iraq. From the same university, he obtained his M.Sc in Lyapunov stability of large systems. He was awarded the degree of PhD in Fractals Geometry in 2005. He has supervised several M.Sc. dissertations. He has headed the Mathematics Department for three years from 2008-2011. He has adopted as Assistant of Dean from 2014-2017. His research interests include Fractals, Numerical Analysis, Cryptography and Image Processing. He published more than 25 papers and one book. He was selected as an editor, reviewer and a scientific committee member in many journals and conferences. He is continued as a professor and a supervisor for high studies in mathematics.

Hind Shaban has been working as professor in faculty of computer science and mathematics, university of Kufa. She has M.Sc from University of Babylon 2000. She has been worked as Computer Lab manager in College of Education for woman, University of Kufa during 1993-1997, and She has adopted as a Head of Computer Center. During 1997-1999, and Asst. in Dept. of Mathematics during 2000-2001, and Central Computer unit director in 2002, and a Head of Computer Science Department during 2003-2005. She has been worked as Asst. in Department of Computer Science in 2009 in Faculty of Mathematics & Computer Science, University of Kufa, and She has adopted as Asst. Dean for Scientific Affairs, during 2010-2013, and a Head OF Computer Department Head during 2013-2016. She published many papers and books. He was selected as an editor, reviewer and a scientific committee member in many journals and conferences. She is continued as a professor and a supervisor for high studies in computer sciences.