AN OFFLINE HUMAN SIGNATURE CAPTURE SYSTEM USING A MOBILE STATION

[1]Oyinloye Oghenerukevwe Elohor, [2]Akinbohun Folake O., [3]Ojedayo Benson O.
[1,3]Department of Computer Science
[2] Department of Computer Engineering
[1,3]Ekiti State University Ado-Ekiti, Ekiti State Nigeria
[2]Rufus Giwa Polytechnic, Owo, Ondo State Nigeria

Abstract: Human signatures are so vital in determining the validity of a document hence it is seen as a critical security mechanism. Several variations to produce an exact digital version of signature has resulted in capture systems ranging from light pen machine, scanned signatures. This has led to further extraction approaches (online and offline) such as iterative selection methods (threshold selection), integration of a CNP method and sliding windows which is done on computer system, classification of segmented image region using a set of representative features, document image analysis system, quasi-multi resolution technique based on distance statistics description of signature envelope.

These approaches are run on computer system and have produced a percentage of success but could not produce a system of an exactly signed ink coloured handwritten signature.

This paper discusses an implemented offline capturing system for mobile phones that produces a digital based handwritten signature with the exact color of ink used by the user eliminating scanning functions and its effects and was seen to be 76.85% accurate with signature capture under average light construct environment and a failure of 23.15% due to low construct and poor paper quality based on 108 signatures from various users.

KEYWORDS:

1.0 INTRODUCTION

Signature are used as proof of consent or agreements, major signature usage are seen in hand written signature but problems arise when the users of signature are not present to resign essential documents but is not within the environment, most people result to scanned signature which in the case of critical needs may mostly not be needed

Signature capturing for extraction mostly involves image segmentation which is one of the most crucial parts of image procuring. Its application is seen in image coding, image synthesis, pattern recognition, rendering displacement estimation [1].

The effectiveness of an extraction technique is very essential in creating capture system, offline signature to produce an exact ink-reference replica of a hand-written signature.

This paper discuss a designed model for converting paper based signature capture to computer inked signature and show the result of our design.

2.0 REVIEW OF EXTRACTION APPROACHES

Rider and caloard [2] presented a study to extract handwritten text from background using threshold selection. The effect of these study produced a white image on a black background and vice versa. An iterative

process which converges at an optimum value was used to carry out the threshold selection. A digitalization of the image is sent to a switching function. The switching function associated with it two integrators, the image integrator and background integrator. The switching function alters between 1 (background) and 0 (object). It is an array of color pixels (black and white). This system, the integrator then produces an output which is used to process the image. This process is repeated until the output is constant is the iteration. This technique is effective with low contrast but required that the image contains an object, background occupying different average gray levels. Furthermore the technique was not above to remove noise completely from the image background which led to poor finished extracted signature.

Vaau [3], developed a technique for signature extraction based on the integration of a crop method and sliding window technique. The study showed that the signature document must first be fed into a system to train the system on the approximation area and pre-processing before extraction can be done, to determine the threshold level by first binarizing the scanned document and applies this threshold level to separate the image from the background in either to remove noise. The sliding window is used on the output a pixel wide and is ran across the height of the approximation area of the object.

The density of the pixel is the sliding window is calculated as a moves one pixel at a time horizontally across the approximation area, this is repeated vertically downwards. This system can be seen to require a system the requires training, hence cannot be available to all signature and cannot be used for emergency signature extraction. Furthermore a deleted database of previously stored data can result in errors, hence its dependency ratio on previous knowledge is high.

Likhan and Hasan,[4] used segmented image region using a set of representative features to extract signature to has a pre-processing stage that allows viewing of the signature image to acquires the input image and extracts single page samples from multi-page layout. A simple dilation operator is applied to make the lines more visible and some measure of noise hence removed. The output of this pre-processing stage is worked on by segmenting based in 2 scanned component labeling approach using three processes:

(i) Assigning each pixel a provisional label by a four neighbor marks
(ii) Reading equivalent labels and
(iii) Finding a representation label for each equivalent provisional label. After which segments involving less than 350 pixels were removed and resultant was vectorized and fed into a machine learning classified. The vectorization was achieved by selecting and extracting a set of constant based feature to represent the segment as being a signature or not.

The system's reliability was enhanced by combining feature representation schemes. The system though required training before use for every signature to be applied.

Meenakshi et al.,[5] used quasi-multi resolution technique and gradient structured features (GSC) for feature extraction of signature (The study was tested on 55 writers both forged and genuine signature).

The authors used five phases names; global feature – which was used to extract every pixel that lies within a rectangle, thereby getting the transformation, series expansion and gradient analysis. The employed statistics of high grey pixels to identify pseudo-dynamic characteristics of signature. This study claims that the approach could be applied to feature gathering for local, inter mediate and large scales for object recognition making it work across all kinds of documents. The system although could not produce signature with good quality for scanned documents with coloured and required conversion to grey scale format.

Samit [6], presented a method for offline handwritten signature feature extraction by using clustering technique. The approach requires thinning of the image to one pixel, and getting the require of interest and then resizing of the image. This system requires that the scanned signature should be in grayscale and also thinned out then may cause the lots of authenticity of the signature thereby limiting the integrity of the technique.

The approaches mostly require machines to either learn or process these expected signatures. Most have low integrity and others require gray scale, hence not being about to produce a digital human exact replica of user signature. This study attempts to produce a digital human signature with no noise limitation

3.0 OUR PROPOSED SYSTEM

The proposed system is called a digital ink-coloured signature (DICS). It is a 3-tier system with a database, namely: Input module, Processor Module and colorization module. Figure 1 shows the architecture of DICS.

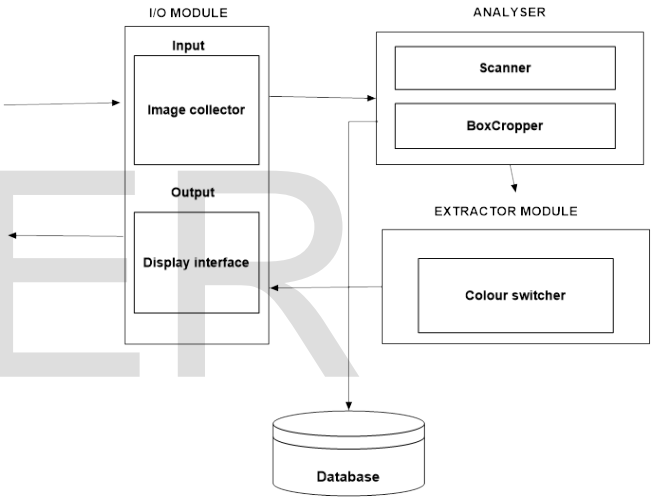

Figure 1: architecture of digital ink- colored signature

The input/output module consists of a signature capturing using an input device (mobile phone camera). The capture system employed does happen with a high quality resolution camera. This gathered image signature is bounded in a rectangular area. There by bound by the reflection of light in the area been bounded. Hence the inked handwritten covers the rectangular area been used. Next the result gathered data is presented to the processor module which applies cropping and a scanner sub-module.

The scanner sub-module determine if a typed text exist and identified it separately from a handwritten text the crop function that takes up the written area for further processing.

It creates the image of the handwritten signature and binarises it by converting it with 0 (black) and 1 (white) using the thresholding technique and the resultant is given as shown in equation (1)

C_i= (maxY, max X) (1)

Where c_i representing the corrected components of the signature an Cartesian coordinate (x, y) plane as shown in equation 2 and 3.

$y = [P_{xyo}, P_{xyi}]$ (2)

$x = [P_{xoy}, P_{xiy}]$ (3)

Where P_{xyo}, P_{xyi} and P_{xoy}, P_{xiyi} represents the final pixel point is the connected area on the x and y axis respectively.

The connected component or detected using interaction of the sliding window unit the connected component is covered assumes its final point when the distance is not greater than 1 given that any

$P_i – P_n = 1$ (4)

This determines the maximum and minimum bound x,y respectively. It then aggregates the connected area by combining close connected component (cc) on the same x axis, grouping two or more cc together if the distance between the final x bound (maximum) of connected component c_1 and initial x bound (minimum) of the next connected component ci+n is less than 10 pixels as given in equation 5

(5)

is connected group and d is connected component of i+n.

three process are then used to streamline handwritten signature as given in equation 6 to 8.

Aspect ration =
(6)

Area ratio = (7)

Density = (8)

W_c – math of cc

H_c – Height of cc

A_c – Area of cc

A_p – Area of Image

So that the signature area $A_s$is cropped based on equation 9

$A_s = A_p – A_b$

Where A_p is area of total image and A_b is area of unbounded.

The output As is given to the colorization module. This module during binarization pixels the color pixel of the signature before it is converted to black and white. It uses the color switcher to replace the colors of theof the white pixel to a transparent rub color. This would be repeated for every white pixel that falls within the category. The result of this process would be the black pixels which represent the signature image on a

transparent background the position of this black pixels is replicated on the original combinarized image. The pixel color of the original image is then chosen to find a variation of tone. So that user who signed with a blue pen the base color would be blue as it would be the major color in the signature bound.

4.0 DICS IMPLEMENTATION

The system has two major sections. Which are the extract section and the Browse file section.

The extract section is where the user will have to select the image or capture signature to be extracted which would be processed and extracted by the system. Figure 2 through Figure 9 shows the screen capture of the section.

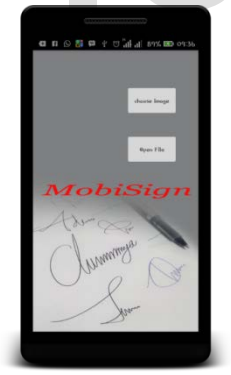

Figure 2: home screen

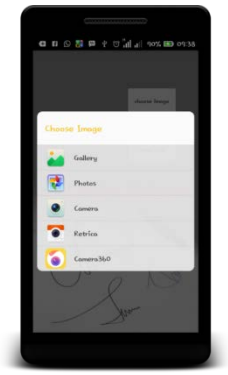

Figure 3: selection screen

Figure 4: Cropper section

Figure 5: After cropping

Figure 6: .Grey Scaled Image

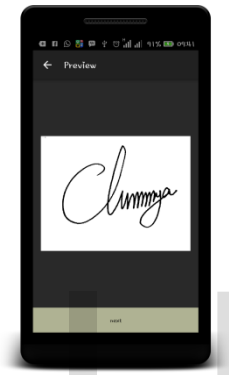

Figure 7: Binarised Image

Figure 8: After Extraction

Figure 9: signature output

The second section is the "Browse file" section which allows the user to view list of extracted images. And perform other function from there. Figure 10 to figure 12 shows the screen capture of the section.

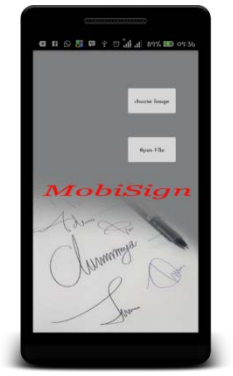

Figure 10: Home screen

Figure 11: Signature Gallery

Figure 12: Single Signature

5.0 Conclusion

This approach has provided a more an efficient method for offline signature capture system deployable on mobile devices.

6.0 Acknowledgment

We acknowledge the research assistance of Olunuga, Mayowa Anthony

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