



A Fuzzy Logic Approach for Identifying the Human Behavior Based on Handwriting

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Abstract— *Handwritten characters recognition is one of the most challenging & burning topic in the field of image processing & pattern recognition. To recognize handwriting digit is not a difficult task for human, but for a computer. In this paper a method has been proposed to predict the personality of a person from the features extracted from his handwriting using Fuzzy logic. In this paper a method has been proposed to predict the personality of a person from the baseline, the pen pressure. There are also a lot of variations within the writing style of person to person. These variations depend on things like the context of the writing, the writing equipment, the writing situation, and the mood of the writer. The writing style may also evolve with time or practice. Thus, the performance of the automatic recognition of handwriting with their behavior heavily depends on how well the different personal writing styles and their variations are modeled with base of fuzzy rules.*

Index Terms—*baseline, pattern recognition, fuzzy logic writing style.*

I. INTRODUCTION

Handwriting analysis is a process that has been carried out for centuries. But its effectiveness when analyzing the behavior and personality of an individual is still a debate. Is it possible to detect potential deviant behavior and personality traits of an individual by carrying out an analysis of his/her handwriting? There are two methods of handwriting analysis: Graphology is the method of psychological analysis, and writing samples by a known source, or person. Handwriting is often referred to as indication of personality trait represented by neurological patterns in the brain. In other words our brain or subconscious mind actually forms the characters as a result of habit. Handwriting analysis also known as Graphology, which is a pseudoscientific study of handwriting in relation to human psychology. Graphology can be used for identifying, evaluating and understanding personality of a person through the strokes and patterns revealed by handwriting. Handwriting reveals the true personality including emotional outlay, fears, honesty, defenses and many other individual personality traits [7]. “Human character recognition by handwriting using fuzzy logic”, illustrates that the behavior or character according to the normal handwriting of the person. Proposed work gadgets particularly pointing or pinning towards human behavior and Eclipses the peculiar of human character tendency.

The project has been taken up to satisfy the following objectives:

To present a system that gives the prediction of human behavior based on his/her normal handwriting. To perform the image analysis of handwritings this helps in efficient decision making for human expertise.

To increase the eligibility of person for particular treat or work.

II. LITERATURE SURVEY

The objective of this research is to develop computer software that can recognize the Thai handwritten characters by using the genetic algorithm technique (THCRGA). The experiment was conducted on more than 10,000 Thai handwritten characters by using 8,160 for training characters and 2,040 for testing characters. The precision of the system is around 88.24%, with recognition speed of 0.42 second per character [2].

In this paper, an improved HMM based recognition model is proposed for online English and Korean handwritten characters. To deal with the problem of handwriting style variations, a modified Hierarchical Clustering approach is introduced to partition different writing styles into several classes. The recognition of handwritten characters is implemented by a modified level building algorithm, which incorporates the Korean character combination rules within the efficient network search procedure and Accuracy was 90% [3].

Character recognition is the mechanical or electronic translation of scanned images of handwritten, typewritten or printed text into machine-encoded text. This paper presents a fuzzy approach to recognize characters. Fuzzy sets and fuzzy logic are used as bases for representation of fuzzy character and for recognition. This paper describes a fuzzy-based algorithm which first segments the character and then using fuzzy system gives the possible characters that match the given input and then using de-fuzzification system finally recognizes the character. Accuracy obtained is 80% [5]

In the present study a method has been proposed for the behavioral prediction of a person through automated handwriting analysis. The handwriting is analyzed through Image Processing in MATLAB. The developed system identifies handwriting closely which may not be possible for a psychologist. It is real time and involves less image preprocessing.

IV. FEATURE EXTRACTION

In pattern recognition and image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called Feature extraction. If the features extracted are carefully chosen, it is expected that the features set will perform the desired task using the reduced representation instead of the full size input. Feature extraction abstracts high level information about individual patterns to facilitate recognition. Extracted features should contain the useful information carried by the character image. The purpose of feature extraction is two-fold: to realize that not all data points are equally relevant or useful for pattern recognition and, in the case of NN, further reduction of the data input space to keep the network sizes computationally tractable

In this stage the feature extraction of character that are crucial for classifying that at recognition stage are extracted. This is important stage as its effective functioning improves the recognition rate & reduces the misclassification. Diagonal feature extraction schemes for recognizing off-line handwritten characters are proposed in this system. Several features can be considered on handwriting just to name few such as size, angle, baseline, pen-pressure and style of the script etc.

V. ANALYSIS OF HANDWRITING

Internal organization can be analyzed by trait indicators & pen stroke formations. Way the writer put in all these factors together. Criteria for judging organization is control.

In purely physical sense is analyzed. Style of writing is a pattern of behavior; a picture how you think, and therefore what you are likely to do, under given circumstances.



Fig: 3 Sample for Letter size and shape



Fig 4: Sample for slant or angle

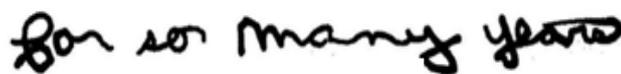


Fig 5: Sample for Pen-pressure

VI. IMPLEMENTATION

ALGORITHM 1:

Step 1: Select the image and crop the image

The character image from the image acquisition stage has the white space that is not necessary in the recognition process. Moreover, the white space needs more CPU power for the recognition process and may cause an erroneous result. Therefore, the system needs to crop only the written character boundary.

Step 2: Image resizing process

In this sub-process output of the cropped image will be resized. Initially, the captured images are resized to a fixed resolution so as to reduce the computational burden in the later processing. It is also done to improve the storage efficiency. The input image may have different size, which will affect the recognition results. Therefore, every input image will be resized to 100 x 100 pixels image. The example of the resized character image is shown below.

Step 3: Image Binarization process

The binarization sub-process will change an input character image into a binary image (0s and 1s only). A binary image helps the feature extraction module to extract character features easily.

Step 4: Image Filtering

Cropped image is then filtered using Average filter to remove the noises present in the images.

Step 5: Extract features

Texture and Color features are then extracted for the ROI result that helps in predicting the behavior of the person.

Step 5: Construction of multiset rules.

Step 6: Testing phase

Comparing with the prototype multiset rules for handwritten character recognition.

VII. RESULT

This section presents the results obtained from the experimentation on the proposed method for an effective detection of extracted features of the handwriting. The performance of our proposed method was evaluated quantitatively by comparing the resulting extractions with trained features. Sensitivity and specificity were chosen as our measurement of accuracy.

This pixel based valuation considers four values, namely true positive (TP, a number of exudates pixels correctly detected), false positive (FP, a number of non-exudate pixels which are detected wrongly as exudates pixels), false negative (FN, a number of exudate pixels that were not detected) and true negative (TN, a number of non-exudates pixels which were correctly identified as non-exudate pixels). From these quantities, the sensitivity, specificity and accuracy were computed using Equations respectively. Table 8.2 shows the quantitative result of TP, FP, FN, TN, sensitivity, specificity and accuracy from the images of diseased eyes.

RESULT	PERCENTAGE (%)
Sensitivity	84%
Specificity	67%
Accuracy	82%

VIII. CONCLUSION

A new method is proposed for the behavioral analysis using Automated Fuzzy logic. Various characteristic features of the handwriting are obtained to assess the personality of the writer. Behavioral analysis using proposed algorithms is compared with manual analysis. The proposed system giving 82% accuracy due to their dynamic changing of handwriting. The proposed system is real time and can be extended to be used for various applications of handwriting such as Psychological analysis, Forensic approach, Graphotherapy etc. The system is likely to show high recognition accuracy for most rule-based what we stored for particular handwriting. The proposed method gives a useful method for the recognition of handwritten characters with their behavior to a great extent.

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