

Evaluation and Categorization of Handwriting Patterns reflecting Sentiments.



Mohammad Shabaz, Urvashi Garg

Abstract: Uniqueness lies in every living being that exists on the earth. It can be viewed through its behavior, walking, personality, dressing, cramming, writing and many more. Handwriting is an important aspect that reflects the uniqueness as a whole, but when it is restricted to find sentiments it does shows certain patterns. This research is dedicated to evaluate the handwriting patterns reflecting sentiments. The major challenge faced during this research is the mood of an individual while collecting the handwriting samples. The process starts, when an observer recites a joke and the audience is given a plane piece of paper and asked them to write "I LIKE IT" those who laugh or smile and "I DON'T LIKE IT" those who do not. The collected samples are then segmented at the depth of Letter 'L' which is either viewed as a parabola or straight line till it touches the Letter 'I' with image dimensions (160, 65) pixels. It is found that the value of the standard deviation of pixels goes to 14 those who laugh at their extreme and those who just smile goes to 8. Thus, it is concluded that the level of joy of an individual from smile to laugh is in between the standard deviation of pixel value ranging from 8 to 14. It can also be concluded that the handwriting changes immediately after laughing or listening a joke. Thus handwriting goes on changing when someone becomes joyful. Testing these patterns further on another blinded sample, the technique provides a result with an accuracy percentage of 97.

Index Terms: Sentiments, Graphology, Handwriting Analysis, Pattern Evaluation.

I. INTRODUCTION

Collecting an unbiased data is the most challenging task when the goal is to find certain patterns as standard values. Keeping in mind the fundamentals of collecting the data, the observer addresses the audience as a participant. The audience was totally unaware about what the observer is going to do with this data. As a participant, the observer recites a joke and asks the audience to give feedback in a plane piece of paper whether they like it or not. Based on the feedback received, the data is categorized into positive for those who like the joke and negative for those who don't like. Taking into consideration the positive ones, the observer then proceeds to the next step where the positive data is brought to an image form. It has been noticed that the writing of letter 'L' is somewhat similar in the considered dataset. The observer then

cleans the noisy image and get the targeted segment of Letter 'L' from the whole Image with dimensions (160,65) Pixels. Using R Programming, Image is loaded and plotted to get the resultant attributes including Mean, Median and Standard Deviation of the Image Pixels. It is found that the value of Standard Deviation lies between 8 to 14 depending on the depth of Letter 'L'. As the value of Standard Deviation increases from 8 to 14, the level of joy raises from smile to laugh. From Letter 't' the personality features such as self-esteem and dreamer etc. of an individual are extracted [1]. A person is recognized as talkative if he writes letter 'O' such that it has its head open, not only for 'O' same means for 'a', 'g', 'd', 'q' with open head [2]. Moreover, a person who is in joyful or excited mood writes the letter from baseline towards right slant [3]. The study mentioned in [3] supports our approach but failed to compute the level of joy. The proposed methodology clearly computes the level of joy from its origin to extreme.

II. LITERATURE REVIEW AND RELATED WORK

Doaa Mohey El-Din M.H. [4] looked over unambiguous sentiments and perceive satisfactory polarity, for which natural language processing and text analysis approach are mostly used. This research appears to highlight the major challenges significant to sentimental approaches and surveys on 47 different articles which work on these approaches. Further, natural language processing includes parts-of-speech (POS) tagging, lexicon-based technique, n-gram, Bag-of-words etc. This research concluded with two comparisons in which first is based on the evaluation of relation between the sentiment review structure and its challenges and the second is based on the accuracy rate. Thus, as the research on sentiment challenges increases, the rate of accuracy decreases. Shaista bin-ti Nazir and Shabaz M. [5] Performed handwriting analysis after looking over the mood of individuals with different thoughts, a novel approach named SSGBSAT is formulated which focus on seven types of mood including joy, anger, disgust, fear, sad, surprise and contempt. The collected data is converted into input image, and compared it on the basis of pixel intensity with the predefined images that reflects the mood. To whichever predefined image, the input image shows the maximum similarity, it is included in the same category. Asok Bandyopadhyay and et. al. [6] Identifying handwriting features based on perception and cognition, a computational model is created for finding mendacious and veracious statements of an individual. Based on these approaches, a decision support system is prototyped which performs handwriting analysis.

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* Correspondence Author

Mohammad Shabaz*, Computer Science Engineering, Chandigarh University, Mohali, India.

Urvashi Garg, Computer Science Engineering, Chandigarh University, Mohali, India.

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Three main features are evaluated from the handwriting sample like local features consisting of change in time, pressure, acceleration etc., global features consisting of maximum writing speed, pen down time etc. and the spatial features including mean pressure, standard derivation of pressure, mean stroke etc.

Shitala, P. and et. al. [7] Centre of interest on various handwritten forms of a letter called allographs used by different individuals while writing. To compute this, six main features are taken into consideration including slant height, size, baseline, pen pressure, spacing between letters and words. A machine learning algorithm called RBF Kernel is used in the proposed methodology that provides an accuracy percentage of 94 with the sample size of 100. Starting from word segmentation preceded with letter segmentation resulting with the mentioned features extraction. Joshi, P. and et. al. [8] Features such as baseline and slant height of letter that reflects the personality traits of an individual are evaluated using polygonization and template matching techniques. This research mentioned the impact of letter 'L' to predict more accurate results but leaves the research for future evaluation. The size of sample is 100 taken from the individuals between the age of 20-35 years.

III. PROPOSED METHODOLOGY

The methodology to evaluate the level of joy from its origin till extreme is presented in the following points preceded by algorithm.

1. Collecting handwriting samples consisting of words like 'LIKE', 'LIFT' etc. after reciting a joke or anything hilarious.
2. Convert these samples into an image with dimension (160,65) pixels.
3. Segment the depth of Letter 'L' till it touches 'I' which seems as either Parabola or Straight line.
4. Load and Plot the segmented image for finding the central tendency properties of pixels like mean, median and standard deviation using R Programming.
5. Gathering the similarity among different samples collected on the basis of central tendency properties.
6. Set the gathered similarity to test for another blinded sample for validation.
7. Finally, display the computed level of joy.

Algorithm 1 logically shows the methodology which is used for the implementation over R-Programming. Basic functions are used to evaluate the central tendency properties. The Algorithm can be implemented in any other language as per the convenience of a programmer.

Algorithm 1

```
Load(image) {
image=readjpeg ("image source");
plot (0:1, type='n') //This function plots the image on
particular location in (x, y) plane.
rasterImage(im,1,0,2,1) //This function displays the plotted
image.
dim(image) //This functions displays the dimensions
of the input image.
mean(image/10^5) //Calculating the mean of pixels.
median(image/10^5) //Calculating the median of pixels.
sd(image/10^5) //Calculating the standard deviation of
pixels.
```

}
After going through Algorithm 1, where to find central tendency properties like mean, median and standard deviation, the image pixels are divided by 10^5 , this value is nowhere standard. It is only used because the value of image pixels is in millions.

IV. RESULTS

After implementing the proposed methodology to find the level of joy, the following parabolic segmented figures were found, as shown in Table 1 which shows the origin of joy (smile) till its extreme level (laugh). Mainly standard deviation is taken into consideration. The methodology is further tested on a sample size of 100 individuals and resulted to obtained an accuracy percentage of 97.

Table 1 shows the level of joy as mentioned inside the heading of table.

Level of Joy from its origin till extreme pictorially shown			
Segmented Image	Mean	Median	S.D
	-77.2	-75.7	8.6
	-59.4	-55.9	9.0
	-76.7	-70.4	11.6
	-24.8	-21.7	12.4
	-74.1	-67.1	13.8

Looking into Table 1, the value of standard deviation of pixels goes on increasing and shape of the image becomes completely parabolic at the end.

V. CONCLUSION

This research is restricted to find the level of joy from smile to laugh but sentiments are not only confined to joy. The approach remains the same to evaluate and categorize patterns for finding other sentiments as well. In the proposed approach, the depth of letter 'L' is considered and as the value of standard deviation of pixels goes on increasing from 8 to 14, the level of joy starts raising. Thus through handwriting analysis, this research achieves to compute the level of joy. The algorithm is implemented in R-Programming but based on the convenience of programmer, it can be implemented over some other language.

The collected sample for pattern formation and evaluation are unbiased. Moreover, in future we are going to work on pattern formation using other letters.

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AUTHORS PROFILE



Mohammad Shabaz is pursuing Ph.D. in Computer Science Engineering from Chandigarh University, Mohali, India.



Dr. Urvashi Garg is Ph.D. in Computer Science Engineering and working as Associate Professor at Chandigarh University, Mohali, India.