Behaviour Analysis Using Handwritten Data

Ankita Dolas[1], Deepali Pandit[2], Maheshwar Jadhav[3], Prof.Vishal walunj[4]

[1,2,3,4] *Department of Computer Engineering, Dr. D. Y. Patil School of Engineering and Academy, Savitribai Phule Pune University, Pune, India*

Abstract- **Graphology is a method for identifying, evaluating personality traits by handwriting. Professional Handwriting analysts are called Graphologists. Handwriting is oftenly called as Mind Writing or Brain Writing. It reflects human's thought-process through his handwriting Accuracy of Handwriting depends upon intellectual of the Graphologists. The proposed System focuses on developing software for predicting human behavior. In this paper a method has been proposed from baseline, slanting of letters, looping of letters, pen pressure and height of the letters. The system uses Convolutional Neural Network (CNN) for prediction of human nature.**

Index terms- **PyQT, NumPy, OpenCV, Image Processing, Feature extraction, CNN**

I. INTRODUCTION

Throughout history, scientists, philosophers, artists and others have been interested in the relationship between the handwriting and the writer. This attempted to relate specific handwriting elements to specific human traits.

It took a while. In 1910, Milton Newman Bunker, a shorthand teacher, in Kansas, let his curiosity get the better of him. He wanted to know why, as a penmanship student, he had put wide spaces between his letters and long finals on his words. He began to study the graphology. In 1915, Bunker made his unique discovery. He recognized that each of his students formed shorthand strokes in a unique manner. He suddenly and clearly realized that it was not the letter which had a trait meaning but the strokes – the shape of the formations within the letter. Graphology suggested that an O with an open top – that is a space opening, indicated a person who would speak very openly and often. He checked and found this to be true. He thought, however, that logically, other letters with the same circle formation (a,g,d & q) should have the same meaning and after checking carefully he found that he did after

travelling thousands of miles, and interviewing thousands of people and examining more than half a million handwriting specimens in his lifetime, the copyrighted American System of handwriting analysis Grapho analysis was born.

II. LITERATURE SURVEY

[1] Esmeralda C. Djamal projected Autography movement emulate the written element of each individual's periodicity and design. By analyzing all fundamentals of handwriting and interpreting them, using typical of graphology author could initiate a chart of the writer's character attribute, sentimental constitution and gracious design. In graph logical analysis"s, an image is separated into two accession that graphics attributes and partition digit each character. In this research, author employ graphical accession based on signature and digit of character of consumption scheme using many-frame algorithms and artificial neural networks (ANN). The image crack into two space: the signature occupied on nine appearance and consumption scheme of letters digit space. Each space had performed preprocessing to improve the recognition accuracy. ANN based classifier applies on five features of impression which outcome an exactness of 56-78%. While four appearance of the impression that disclosure using many frame algorithm result 87-100% exactness

[2] Sandeep Dhang on Handwriting Analysis of Human Behaviour Based on Neural Network, Graphology or Handwriting analysis is a scientific method of identifying, evaluating and understanding of anyone personality through the stroke and pattern revealed by handwriting. Handwriting reveals the true personality including emotional outlay, honesty, fears and defenses and etc. Handwriting stroke reflects the on paper draw of each individual's rhythm and Style. The image split into two areas: the signature based on three features and application

form of letters digit area. In this research performance evaluation is done by calculating mean square error using Back Propagation Neural Network (BPNN).Human behavior is analyzed on the basis of signature by using neural network

[3] Javier Galbally, Julian Fierrez, Marcos Martinez-Diaz, R´ejean Plamondon E´cole Polytechnique de Montre´al focus on " Quality Analysis of Dynamic Signature Based on the Sigma- Lognormal Model" . In this paper author distinct that various personal ethics can be precisely illuminate as a set of influential describe sequenced together by a Markov chain. To diagnose personal ethics from sensible data and to deduce personal ethics over a few seconds time, author then use these influential Markov layout. To ensure the virtue of this designing avenue, creator report an experiment in which, author was able to achieve 95% precision at predicting automobile drivers" subsequent actions from their starting preparatory movements.

[4] In this author distinguish a new behavioural biometric technique based on human computer communication. Author urbanized a system that captures the user communication via a lighten, and uses this observable information to verify the individuality of an individual. Using analytical pattern credit techniques, author developed a sequential classifier that processes user interaction, as reported by the user identity is considered real if a predefined accuracy level produced, and the user is classified as a pretender otherwise. Two statistical models for the features were tested, namely Parsing density opinion and a unimodal disposal. The system was checked with different numbers of users in order to assess the scalability of the proposal. Experimental results show that the normal user communication with the computer via a pointing device entails behavioral information with particular power that

[5] Proposed a paper addressing problem of personal authentication through the use of autograph recognition is described in this paper. There are two method of verification: online and offline signature verification. The dynamic methods covered, are based on the analysis of the shape, speed, stroke, pen pressure and timing information. While the stationary methods involve general shape recognition techniques. The paper inclined a sharp historical outline of the extant methods and presents some of the recent research in the field. In this paper problem

of exclusive testimonial through the use of signature perception is considered. Twain on-line and offline methods have been described

III. PROPOSED SYSTEM

Graphologists identify human nature with a piece of handwritten handwriting. The accuracy of handwriting analysis depends on how skilled the graphologist is. Even though manual handwriting has been effective it is costly and prone to fatigue, hence the proposed methodology focuses on developing software for behavior analysis which can predict personality traits with the help of computer without human interference. The mostly used features of handwriting for prediction of personality traits are baseline, thickness, pen pressure, height etc. In this paper, the baseline, pen pressure, letter height and slant of letters has been considered for predicting personality

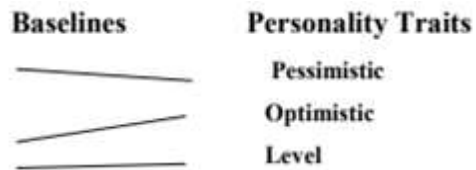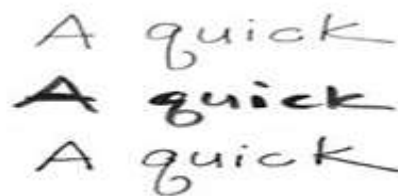Baseline: It is the line along which the writing flows.

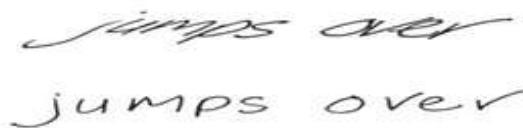Figure.1: The baselines representing different personality traits of the writer

Pen Pressure: Amount of intensity applied while writing.

Height: It is the total vertical length of letters.

Slant: It is the inclination of letters.

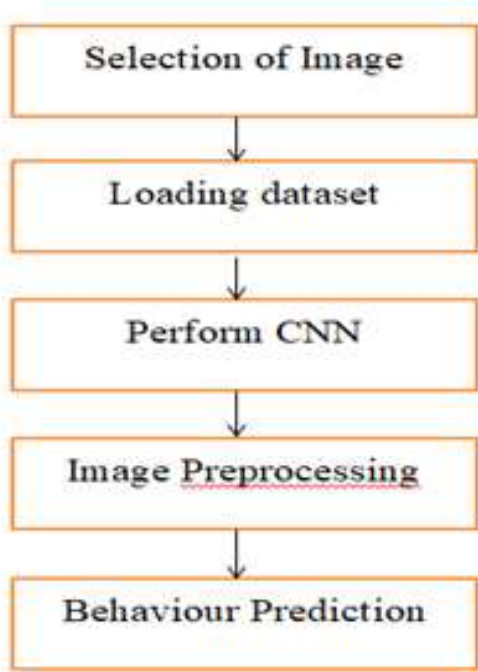Below are the implementation steps involved in Handwriting analysis.

Fig.1:- System Architecture

Image processing is done with an aim to improve the image data that suppresses unwanted distortions or enhances some image features important for further processing. The purpose of image processing is divided into 5 groups. They are:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image

METHODOLOGY (CNN):

Convolutional neural network (CNN, or ConvNet) is a form deep learning and most commonly applied to analyzing visual imagery. CNNs use a variation of multilayer perceptrons designed to require minimal pre-processing. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared-weights architecture and translation invariance characteristics. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand-engineered. This independence from prior knowledge and human effort in feature design is a major advantage. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, and natural language processing.
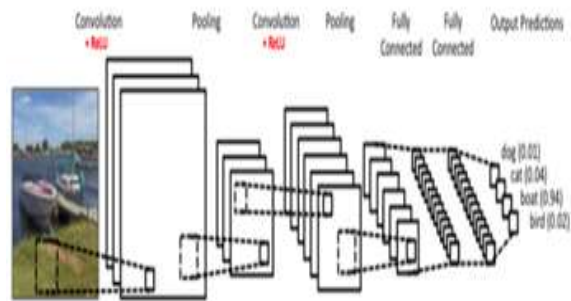

Fig2. Simple ConvNet

The Convolutional Neural Network in Fig. is similar in architecture to the original LeNet and classifies an input image into four categories: dog, cat, boat or bird. There are four main operations in the ConvNet shown in fig. above:

1. Convolution
2. Non Linearity (ReLU)
3. Pooling or Sub Sampling
4. Classification (Fully Connected Layer)

An Image is a matrix of pixel values. Essentially, every image can be represented as a matrix of pixel value Channel is a conventional term used to refer to a certain component of an image. An image from a standard digital camera will have three channels – red, green and blue – you can imagine those as three 2d-matrices stacked over each other (one for each color), each having pixel values in the range 0 to 255.

The Convolution Step:

ConvNets derive their name from the " convolution" operator. The primary purpose of Convolution in case of a ConvNet is to extract features from the input image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of input data. We will not go into the

mathematical details of Convolution here, but will try to understand how it works over images As we discussed above, every image can be considered as a matrix of pixel values. Consider a 5 x 5 image whose pixel values are only 0 and 1 (note that for a grayscale image, pixel values range from 0 to 255, the green matrix below is a special case where pixel values are only 0 and 1.

Also, consider another 3 x 3 matrix as shown. Then, the Convolution of the 5 x 5 image and the 3 x 3 matrix can be computed as shown in the animation in Fig below:
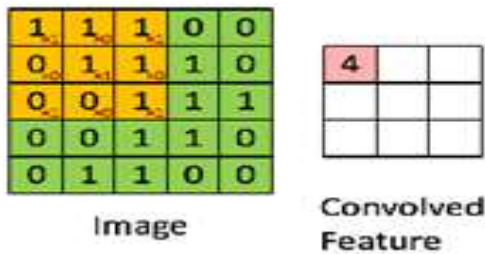

Fig3. The Convolution operation

In the table below, we can see the effects of convolution of the above image with different filters. As shown, we can perform operations such as Edge Detection, Sharpen and Blur just by changing the numeric values of our filter matrix before the convolution operation– this means that different filters can detect different features from an image, for example edges, curves etc.

Operation	Filter	Convolved Image
Identity	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	
Edge detection	$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$	
	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$	
	$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$	
Sharpen	$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$	
Box blur (normalized)	$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	
Gaussian blur (approximation)	$\frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$	

Introducing Non Linearity (ReLU):
An additional operation called ReLU has been used after every Convolution operation in Figure above. ReLU stands for Rectified Linear Unit and is a non-linear operation.

The Pooling Step:
Spatial Pooling (also called subsampling or down sampling) reduces the dimensionality of each feature map but retains the most important information. Spatial Pooling can be of different types: Max, Average, Sum etc.
In case of Max Pooling, we define a spatial neighborhood (for example, a 2×2 window) and take the largest element from the rectified feature map within that window. Instead of taking the largest element we could also take the average (Average Pooling) or sum of all elements in that window. In practice, Max Pooling has been shown to work better.

IV. ACKNOWLEDGEMENT

V. CONCLUSION

A simpler method has been proposed to predict the personality of a person by exploring his handwriting. The system extracts features from breaks, size, space between words, baseline, loop of ' e' and few other features like pressure, margin, slant and dot distance in ' i' . The proposed system can be used as a twin tool by graphologist to improve the accuracy and anticipate the behavior s of a person faster. The estimated weighted accuracy of 93.77 % is achieved.

REFERENCE

[1] Champa H N, Dr. K R Ananda Kumar, Artificial neural network for human behaviour prediction through handwriting analysis, International Journal of Computer Applications (0975 – 8887) Volume 2-No.2, May 2010.

[2] Automated Human behavior prediction through handwriting analysis" By Champa H N and K R Anandakumar

[3] S. M. E. Hossain and G. Chetty," Human Identity Verification by Using Physiological and Behavioral Biometric Traits" , International Journal Bioscience, Biochemistry and Bioinformatics, Vol. 1, No.3 ,September 2011

[4] Esmeralda C Djamal, Sheldy Nur Ramdlan, Jeri Saputra, " Recognition of Handwriting Based on Signature and Digit of Character Using Multiple of Artificial Neural Networks in Personality Identification, Information Systems International Conference (ISICO), 24 December 2013

[5] Sandeep Dang ,Prof. Mahesh Kumar, Mahesh, Handwriting Analysis of Human Behaviour Based on Neural Network, ISSN: 2277 128X, Volume 4, Issue 9, September 2014

[6] Javier Galbally, Julian Fierrez, Marcos Martinez-Diaz, R´ejean Plamondon E´cole Polytechnique de Montre´al," Quality Analysis of Dynamic Signature Based on the Sigma- Lognormal Model, 2011 International Conference on Document Analysis and Recognition

[7] Albert Ali Salah1, Theo Gevers1, Nicu Sebe2, and Alessandro Vinciarelli3," Challenges of Human Behavior Understanding"

[8] Handwriting Personality Profile. http://hand writingpro.com (1998)

[9] S. M. E. Hossain and G. Chetty," Human Identity Verification by Using Physiological and Behavioral Biometric Traits, International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 1, No. 3, September 2011

[10] Hugo Gamboaa and Ana Fredb," A Behavioral Biometric System Based on Human Computer Interaction"

[11] Ajzen I, Fishbein M. (1999) Theory of reasoned action/Theory of planned behavior. University of South Florida.