

# Handwriting Analysis for Mental Disorder Detection

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**Abstract:-** Handwriting Analysis is an art of finding, studying and concluding the human personality. To detect an emotion won't be a difficult task for the human apart from any computer, detecting an emotion are getting to be a difficult job to perform because it's unaware of the attribute. Human Behavior are often detected by different forms like countenance, Human Eye Tracking etc. Handwriting involves cognitive planning, coordination and execution abilities. The term is typically incorrectly used to ask forensic document examination, because of the actual fact that aspects of the latter handling the examination of handwritten documents are occasionally mentioned as graphanalysis. Albeit two or more systems may share the same words, the meanings of those words could even be different. The specialized meaning of a word employed by a handwriting specialist, and thus the common meaning isn't identical. Resentment, for instance, in common usage, means annoyance. In Graphoanalysis, the term express a fear of imposition. Traditional psychological state studies believe information collected through personal contact with professional healthcare specialists. Handwriting is an action governed by brain like all other action. This process is typically unconscious and is closely tied to impulses from brain. Any quite disease affects the kinetic movement and reflects in subject's handwriting, to know the health and mental problems, it's important to specialise in how subject writes rather than what subject writes. The research work supervised to identify diseases like Alzheimer, Mild Cognitive Impairment, Dysgraphia, Schizophrenia, Autism, Parkinson's disease and mental disease supported digital handwriting analysis has been reviewed during this paper. The features associated with motion, time and pressure are used for diagnosis of disease.

**Key words:** SVM, CNN, Graphoanalysis, neurodegenerative.

## 1. INTRODUCTION

All actions including writing start in the brain. Like all activities of human, the act of writing depends on central nerve system. Our brain sends impulses to hand through nervous signals, achieving the motor act. Our brain guides our hands, everything that we put on paper is a result of two-way circuit between our brain and the muscles of our hand. It

is a fact that when a person communicates by way of speaking, only 15%-20% of brain cells are activated, whereas when a person writes, nearly 85%-90% of brain cells are activated, hence it is easier to understand a person and his mental state thoroughly through his/her handwriting. Handwriting also called as brain-writing may be a useful to calculate in recognizing the characteristic personality traits of a private. Though handwriting is driven through pen, it's movement is governed by the central system nervous, which may be a process usually unconscious, but most revealing. Handwriting is closely tied to impulses from the brain and therefore it can be reliably used to predict state of physical,

emotional and mental health of individual. Handwriting analysis is used to find out disturbance in the subject's handwriting. The useful handwriting features used for disease analysis are:

1. Congestion: it's shown by letters having ovals and curls filled with ink,
2. Fragmentation: it's shown by disconnected curves of letters,
3. Direction of lines
4. Layout of Anomalies
5. Torsion: it's an irregularity or luxuriating of a part of a letter or entire letter,
6. Viscosity: It is unclear or dirty extension of upper and lower parts of letters,
7. Shakiness: it's small disruptions in strokes of letters,
8. Slant: It is an uneven inclined right movement of pen on paper while drawing letters,
9. Movement between strokes,
10. Variation in size of letters while writing letters,
11. Changes in shape of curves for similar letters,
12. Breeze: it's the a part of stroke over sheet paper, when pen went without leaving ink,
13. Pressure applied on writing organ while writing,
14. Accent Marks and Periods which reflect memory disorders, imagination and a spotlight.

Two approaches used for handwriting analysis are below:

- Offline Handwriting Analysis
- Online Handwriting Analysis

## 2. LITERATURE REVIEW

Donato Impedovo (M'08-SM'17) "Dynamic Handwriting Analysis for the assessment of neurodegenerative disease: A Pattern Recognition Perspective" for project mental disease classification only on basis of handwriting. A paper based on artificial neural network explores the implementation of a machine learning approach in the field of handwriting analysis. This paper proposed a method to predict the personality traits of a person by analyzing the baseline, pen pressure and the letter „t“ as found in the individual's handwriting sample. These extracted features are then given as an input to the artificial neural network which in turn gives output as personality trait to the user. The future work discussed in this paper are, including more features of the handwriting like the size of the letters and the margins as inputs for personality trait determination to improve the system output.

Nikita Lemos, Krish Shah, Rajas Rade, Dharmil Shah, "Personality Prediction based on Handwriting using Machine Learning", Computational Techniques Electronics

and Mechanical Systems (CTEMS) 2018 International Conference on, pp. 110-113, 2018.

From this paper "Handwritten text recognition system based on neural network [ N. Nain and S. Panwar] "[4] we studied that offline recognition is performed on a scanned image of handwriting and thus contains no temporal data. In general, handwriting recognition is classified into two types as off-line and on-line handwriting recognition methods. In the off-line recognition, the writing is usually captured optically by a scanner and the full text is available as an image therefore it contains no temporal data. Some existing techniques are fusion based segmentation method . In this approach, over segmentation of words from text based on pixel density between upper and lower base line with multiple expert base validation for character recognition and classification has been developed. feature extraction depends on Euclidean distance between testing point and reference point. Which is used to calculate KNN neighbor. This method could classify images containing single characters. In N-gram , training is done on text corpus and character can be recognized belonging to this corpus only. We propose a system which could extract characters from running text.

From this paper " An overview of character recognition focused on off-line handwriting. IEEE Trans. Syst. Man Cybern. C Appl. 31(2), 216–232 (2001) [ Arica N., Yarman-Vural F.T]"[8] we studied that character recognition (CR) is used as an umbrella term, which covers all types of machine recognition of characters in various application domains. The overview serves as an update for the state-of-the-art in the CR field, emphasizing the methodologies required for the increasing needs in newly emerging areas, such as development of electronic libraries, multimedia databases, and systems which require handwriting data entry. The study investigates the direction of the CR research, analyzing the limitations of methodologies for the systems, which can be classified based upon two major criteria: 1) the data acquisition process (on-line or off-line) and 2) the text type (machine-printed or handwritten).

Varshney and S. Puri, "A survey on human personality identification on the basis of handwriting using ANN," 2017 International Conference on Inventive Systems and Control (ICISC), Coimbatore, 2017, pp. 1-6, doi: 10.1109/ICISC.2017.8068634.

### 3.ALGORITHM

#### I. CNN ALGORITHM

The steps that enter this process are weakened as follows:

##### Step 1: Convolution Operation

The first building block in our plan of attack is convolution operation. In this step, we'll touch on feature detectors, which basically function the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and the way the findings are planned out .

##### Step 1(b): ReLU Layer

The second a part of this step will involve the Rectified linear measure or ReLU. We will cover ReLU layers and explore how linearity functions within the context of Convolutional Neural Networks. Not necessary for understanding CNN's, but there is no harm during a quick lesson to enhance your skills.

##### Step 2: Pooling

In this part, we'll cover pooling and can get to know exactly how it generally works. Our nexus here, however, are going to be a selected sort of pooling; max pooling. We'll cover various approaches, though, including mean (or sum) pooling. This part will end with an indication made employing a visual interactive tool which will definitely sort the entire concept out for you.

##### Step 3: Flattening

This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

##### Step 4: Full Connection

In this part, everything that we covered throughout the section are going to be merged together. By learning this, you will get to see a fuller picture of how Convolutional Neural Networks operate and the way the "neurons" that are finally produced learn the classification of images.

## II. SVM ALGORITHM

A simple linear SVM classifier works by making a line between two classes. That means all of the data points on one side of the line will represent a category and the data points on the other side of the line will be put into a different category. This means there are often an infinite number of lines to settle on from. What makes the linear SVM algorithm better than a number of the opposite algorithms, like k-nearest neighbors, is that it chooses the simplest line to classify your data points. It chooses the line that separates the data and is the furthest away from the closet data points as possible.

A 2-D example helps to make sense of all the machine learning jargon. Basically you've got some data points on a grid .You're trying to separate these data points by the category they ought to slot in , but you do not want to possess any data within the wrong category. That means you're trying to find the line between the two closest points that keeps the other data points separated.

So the two closest data points give you the support vectors you'll use to find that line. That line is named the choice boundary. The decision boundary doesn't need to be a line. It's also mentioned as a hyperplane because you'll find the choice boundary with any number of features, not just two. There are two different types of SVMs, each used for different things:

- Simple SVM: Typically used for linear regression and classification problems.
- Kernel SVM: Has more flexibility for non-linear data because you can add more features to fit a hyperplane instead of a two-dimensional space

#### 4.CONCLUSION

Handwriting is additionally called as brain writing. it's won't to predict physical, emotional and psychological state of a private . during this paper, a generalized system of handwriting analysis for diagnosis of health and mental issues has been presented. A model of machine learning has been used for training and testing. The research work administered to diagnose diseases like Alzheimer, Mild Cognitive Impairment, Dysgraphia, Schizophrenia, Autism, Parkinson's disease and mental disease supported digital handwriting analysis has been reviewed during this paper. it's found that features associated with motion, time and pressure are very helpful for diagnosis of health and mental diseases using handwriting analysis approach. It is conclude that a strategy to predict the accurate personality traits of a private from the features extracted from handwriting employing a machine learning approach. These features are going to be extracted from the handwriting samples into feature vectors which might be compared with an initially trained data set; then mapped to the category with corresponding personality trait.. Thus we've studied the various methods used for human behavior prediction. Handwriting study has both its believers and unbelievers. It can give hints or clues to parts of an individual , but it's not proven that it can accurately concede depth pictures of an individual's abilities or personality. More conclusive research must prove the validity of this practice before it's continues to be used with such blind faith. If experts enforce using traditional handwriting analysis it's imperative to use it with other things, and not let a choice reside solely on how hard an individual presses down on paper with their pen. But if we will analyze anyone's personality and his mental condition by this method, then it'll be very beneficial for us. for instance , we will determine any quite physical or mental disabilities of a toddler , we will determine whether a frustrated person is suicide prone or not etc. Depending upon this, people are often advised to measure a far better life and solution of any upcoming problem also can be concluded.

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