

Artificial Neural Network Implementation In Forensic Science

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Abstract

This paper deals with the handwriting examination for detection of personality traits via neural network based approach. Five related and relevant research papers are reviewed here as in which it has been found that handwriting characteristics like pen pressure, slants, size of alphabets, baseline etc. are better ways to forecast any author's personality traits. Various handwriting samples were collected for this particular trail from different sources. And also comparison between different tools has also been to understand which method/tool suits as a best mean for identification.

1. INTRODUCTION

Artificial Neural Network (ANN) is an information refinement model that is inspired via biological nervous systems such as brain and the details it processes. It is simply a mathematical model of brain used to proceed non-definite relationships in the middle of inputs/ turnouts in much the same life a human brain does every single second. It is popularly used for classification for performing various tasks. Human way of behaving can be forecasted only during controlled situation or in restricted surrounding.

Handwriting analysis/Graphology is the experimental and mathematical way of estimating/calculating, analyzing, classifying and knowing the identity of an individual via patterns or strokes which were acknowledged in handwritten samples. It exposes the factual personality including emotive disbursement like anxiety, confidence, fluency, or many more personality features of any individual. Handwriting is overtimes assigned as intellect writing. Each feature is characterized by neurological intellect arrangements. Each and every neurological intellect pattern outgrowth an individual neuro muscular shifts that is same for each individual who are having these particular attribute. While scripting down something, these minute shifts occurs insensibly. Each written act, pattern or thump acknowledges definite psyche character.

A number of researchers have worked upon AAN by taking the handwriting into consideration like:

Champa et. Al, proposed a method to anticipate the personality traits of an individual from the characters taken out from their handwriting by using ANN. The psyche features are exposed via baseline, pen compression and the by letter 't' as found in individual's handwriting. The variables taken into consideration were pen pressure, the baseline and the t-bar's height of alphabet 't'. These variables were the inputs to the unnatural neural network which gives out the personality features about author to whom it belongs.

Sl.No	Position of the t-bar	Personality trait
1.	Crossed very high (not above the stem, but in a very high region)	High self-esteem: This reveals confidence, ambition, and the ability to plan ahead, high goals, high personal expectations and an overall good self-image. This is the key to personal success and happiness.
2.	Crossed above the middle zone but not at the loop	Moderate self-esteem: This person is practical. This is a positive trait and common among successful people.
3.	Crossed very low on the stem	Low self-esteem: This person fears failure and resists change. He often remains in bad situations and relationships for too long and finds imperfections with himself. He is rarely successful enough in his own eyes despite his accomplishments.
4.	Crossed above the stem	Dreamer : This person's goals and dreams lose touch with reality. These people often talk about what they are going to do instead of doing it.

Fig: Personality traits exposed by letter ‘t’

Calculation of baseline has been done by utilizing polygonalization mode and the evaluation of pen pressure is done through grey quantity portal values. T-bars’ peak of alphabet 't' is evaluated via template/diagrammatic matching. These three parameters in one’s handwriting exposes bunch of exact details about the author. Mat-lab tool has been also used for this study. The performances have been measured by examining the multiple specimens collected.

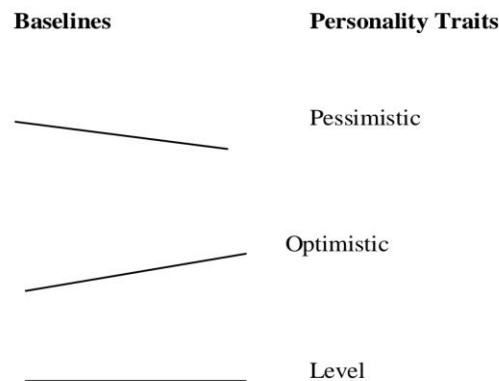


Fig: baseline characterizing different personality traits of author

The baseline and also the pen pressure in one ‘s handwriting can reveal heaps of correct info regarding the author. Baseline is the line in anyone's writing on which the script runs. The commonest baseline that occurs in anyone’s handwriting square measure are ascending, descending and straight. The another most significant trait during a writing is writing force, the number of times the force that has been exerted onto the notepaper is due to the deepness in emotions, additionally referred to as emotional power, supported the authors’ pen pressure, may be classified as lightweight author, medium author or significant author.

Writer category	Personality trait
Light writer	This writer can endure traumatic experiences without being seriously affected. Emotional experiences do not make a lasting impression on him.
Medium writer	This writer feels emotional experiences for a moderate amount of time. He has an average level of emotional intensity.
Heavy/deep writer	This person has very deep and enduring feelings. This writer may forgive, but he will never forget. He feels situations intensely.

Fig: Personality traits represented by different pen pressures

The slant has been measured by polygonalisation of one line within written text. The minuscule alphabet ‘t’ is one amongst the alphabets in anyone’s handwriting that exposes heaps of correct info regarding that particular author. Folks write alphabet ‘t’ in many alternative ways that, there square measure numerous methods to form the stem of alphabet ‘t’, and the rood onto the surface lift, or entry and exits present on the letter ‘t’, each of that depicts a particular temperament attribute of someone. One of the temperament attributes discovered by alphabet ‘t’ is that the shallowness of the author. Once the surface lift is navigated terribly huge (not higher than the stem), it expresses high self-esteem, smart certainty, desire and objectives square measure. The surface lift navigated terribly below on the stem expresses low shallowness. This type of person jitters failure and abide modification, the most important way for computerizing the feature identification is that the guide compliment. The mode of recognition of constant features of an author via examination of the alphabet ‘t’ requires guide comparing accompanied by sure preordained arrangements. The preordained arrangements square measure formed every of that mean a selected temperament. Srinivasan et.al, proposed a neural network based method which proceed towards the non-intrusive harmonical place of origin recognition. In this procedure, neural networks were devoted to take out main traits from the present day input undulation to specifically recognize various sorts of gadgets via their definite harmonical ‘designation’. This type of automatic, non-protruding tool recognition will become critical in coming times capability quality monitoring or intensification structures. Many NN based characterization replica comprises of multicoating perceptron, Radial Based Task network (RBT) or Support Route Machines (SRM) with one dimensional polynomial, or RBT cores were evolved for designation removal or tool recognition. These replicas were instructed or tried out via prong train details collected from the Fourier examination of present day input undulation in presence of multiple tools. The production of these replicas were differentiated on the basis of their accuracy, generalization capacity or noise forbearance limits. The outcome showed that MCPs and SRM both have the ability to regulate the tool presence via their harmonical designations with high level of accuracy. MCP was found to be the best way of identification because of its little computational needs or capabilities to extract out important details for high level of accuracy tool identification.

Joshi P et. al, have observed that out of all specific features of humans, handwriting transfers the wealthy details to obtain the preceptor physical, emotional or mental state of author. Graphology is the art of knowing, learning or examining written information, or an experimental and mathematical approach used for the determination of person's nature by examining various traits from handwriting. The main traits of writing like the pen compression, slants, page margins, baseline etc. can tell many things about an individual. For making this way much more well organized or well-founded introduction of tools to carry out the traits removal or mapping to many nature traits can be completed. This accompanied by the graphologists and also increases the rate of examination of hand-written samples. Many approaches have been used for this kind of computer assisted graphology along with a novel approach of machine learning technique to implement the automatic handwriting analysis tool.

Drouhard et. al, also preferred a neural network approach to make the first phase of Automatic Handwritten Designation Identification System. The directional likelihood solidity task was used as a global form element or its distinguishing capacity was improved by deducting its cardinality using filtering. Many scientific agreements were used to contrivance the Back Resistance Network (BRN) classifier. A contrast, on similar data or with the similar conclusion rule, shows that the BRN classifier is distinctly finer than the threshold classifier or contrasts commendable with the classifier.

Prasad et. al, also focused on handwriting examination that is a better way to forecast nature of any writer or for superiorly understanding the author. Allograph and its amalgamation examination is an experimental way of author recognition or assessing the way of behaving. To make it computer-operated they had considered six important and dissimilar types of traits viz. alphabet size, slant of letters/words, baseline, force of pen, spacing between alphabets and spacing between words in any record to recognize the nature of the author. Segmentation has been used to evaluate the traits from electronic handwriting and is instructed to SVM which turns out the behavior of the author. Analysis was done on different hundred authors' handwriting samples under two dissimilar conditions with similar sample and the preferred way has provided accuracy rate of 94% with RBF core. An automatic way has been presented to predict the psychological nature of author in this paper. Artificial neural network has many other applications and are described in different research documents [6-15].

2. CONCLUSION

Graphology is a branch of science which deals with the analysis of these strokes and patterns as they develop in everyone's handwriting and describes the correlation personality traits/characters.

Professional handwriting examiners referred to as specialist typically determine the author via his/her handwriting. Accuracy in examination turns on however delicate who the examiner is, though human beings' involvement in handwriting examination is efficacious, it's expensive or at risk of debility. The most common features of handwriting are those which may function them to predict temperament traits like square measure baseline, size of alphabets, pressure exerted while writing, connecting strokes of alphabets, spacing between words/letters, beginning and ending strokes, slants, and other class and individual characteristics.

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