ISSN No:-2456-2165

Personality Analysis through Graphology using Image Processing

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Abstract:-Graphology is a method of identifying, evaluating and understanding human personality traits in person by analysing the strokes and patterns revealed by their handwriting. Handwriting shows a person's genuine nature, including emotional outlay, fears, honesty, defences and many other traits. Graphologists, who analyse handwriting professionally, usually determine the writer from a piece of handwriting. The analyst's level of expertise affects how accurate the analysis is. Despite being effective, human assistance in handwriting analysis is expensive and error-prone. Hence, the proposed methodology focuses on developing a system that employs machine learning to predict personality traits without the need for human interaction. To make this happen, we look at handwriting features in a document to predict a writer's personality traits.After extracting all required features from the image containing the handwriting, DenseNet are trained which output personality trait of the writer. The emotions are depression, anxiety, panic, stress and no sign of psychological issues are been predicted. For the project, 4899 images of handwriting samples have been acquired.

Keywords:-*Graphology, Human Personality, Psychological Analysis, Image Processing, Machine Learning, Densely Connected Convolutional Network.*

I. INTRODUCTION

Graphology is defined as the analysis of the physical characteristics and patterns of the handwriting of an individual to understand his or her psychological state at the time of writing. Handwriting is a kind of projective test where the unconscious comes to the fore and expresses itself in the conscious. It works on the principle that while writing our hand is controlled by our subconscious mind. A writer does not consciously draw each letter by his or her hand while writing, just like how a program does not consciously remember and locate the position of each letter on a computer keyboard while typing. These graphic movements generated by the subconscious mind reflects the state of the subconscious itself. Humans have always been intrigued by variability and uniqueness of each individual. A Graphologist roughly interpret an individual's character and personality traits by analyzing the handwriting. We can use graphology to determine the personality and character profile of a person.

Handwriting analysis helps in identifying these emotions through machine learning. Approaches such as random forests, neural networks, Bayesian networks, k-NN and SVM are implemented for recognition of emotional state. Emotions can also be predicted through psychological analysis and graphology.ConvolutionalNeural Network (CNN) is a popular technique used for image recognition. Dense CNN is used to extract the features from handwritten text sample.In order to enhance the accuracy of analyzing the handwriting image.

A. Motivation

Analyzing someone's handwriting is one way among several method to understand the psychology of a person. Some applications of graphology are listed here.

- Psychological analysis: Psychologists and counsellors employ graphology in clinical testing. However, it is typically used in conjunction with other projective personality assessment tools rather than on its own.
- Employment profiling: For recruitment purposes, companies utilize handwriting analysis. A graphological report should be used in conjunction with additional resources such as inbackground checks, practical demonstration or record of work skills.

B. Problem Statement

Personality analysis through graphology using image processing. The main aim of this project is to examine and evaluate a person's personality and character by an analysis of their handwriting.

C. Existing System

Earlier, before the recent advances in deep learning and image processing,graphologists had to manually analyze handwriting in order to identify a person's traits.

- Based on the handwriting, graphologists used to examine the features as forensic documents.
- Now there are features that allow us to understand emotion of the person from their handwriting simply by scanning it or capturing it with cameras.
- Since there may be some errors and inaccuracies when evaluating the handwriting, this process requires an extensive number of human resources.

Thus, manual examinations are often performed using a limited sample of data.

D. Proposed System

A system is proposed that the basic handwriting analysis tasks of graphology to be determined in order to identify a few important psychological emotions. From a sample handwriting image, five traits or emotions are considered to beextracted from it. Each dense convolutional network will be trained for a particular personality trait using an integration of these discrete data. The classifier will then be able to predict the emotion of the writer.

II. METHODOLOGY

A. System Description

The block diagram of the proposed system is shown in figure 1. The writer gives the handwriting sample in the form of image. The emotions database is built in accordance with the DASS test results. The database's numerous classes are involved in this. The scanned image is then preprocessed using image resizing and normalization. The training dataset and validation dataset are used to train and validate the convolutional neural network algorithm.Thetesting dataset is then used to test it. The CNN model then receives a fresh input image and, using features from the image, the model predicts the emotional state of the image.Todetermine the accuracy, the predicted emotion is compared to the results of the DASS analysis. Therefore, if necessary, psychological counselling or medication is advised.

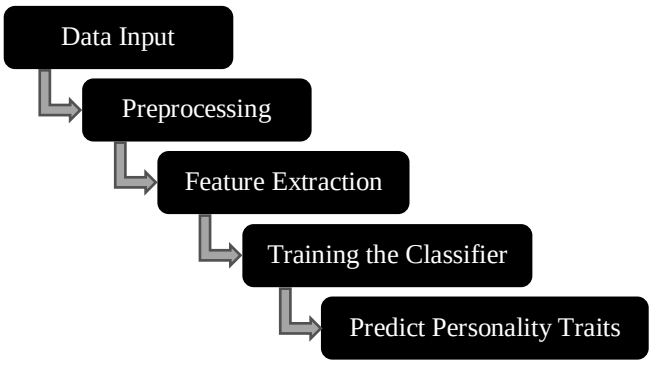

Fig. 1: An overview flow chart for the proposed system

The CNN algorithm is employed and cross verified to achieve the same result. Using complementary subsets of the dataset for evaluation and training, the cross-validation approach evaluates machine learning models. K-fold cross-validation splits the dataset into k equal parts for this CNN model, one of which is maintained for validation and the other portions of which are utilized for training.

B. Convolutional Layer

This layer is always deployed first. It receives the image (a matrix of pixel values). Assume that the top left corner of the image is where the input matrix's response begins. The software then selects the smaller matrix there, known as a filter.Convolution is then generated by the filter and is applied to the input image. Multiplying the original pixel values by the filter's value is its task. A single number is produced when all of these multiplications are combined together. Because it only reads the upper left corner of the picture, the filter moves.A unit on the right also performs a similar task. After the filter has processed each point, a matrix is produced, but it is less than the input matrix.Froma human perspective, this procedure is comparable to recognizing basic colours and visual borders. However, the full network is necessary in order to identify the fish. The network will include a number of convolutional layers with nonlinear and pooling layers.Convolutionis the initial layer to extract features from an input image. Convolution uses tiny squares of input data as its input. An image matrix and a filter or kernel are the two inputs for the mathematical process.

- Dimension of an image matrix (h×w×d)
- A filter (fh×fw×d)
- Results in a dimension (h-fh+1)× (w-fw+1) ×1

C. The Non-Linear Layer

It is adder after each convolution process. Without this trait, a network would not be sufficiently intense and unable to simulate the response variable. It has an activation function that offers a non-linear property.

D. The Pooling Layer

Similar to the non-linear layer, it also advances in that direction. It uses the width and height of the image and performs a down sampling technique to them. The size of the image is reduced as a consequence. This implies that a detailed image is reduced into smaller images if some characteristics were previously detected during the previous convolution operation and the detailed image is no longer needed for further processing.

E. Fully Connected Layer

After the succession of convolution, non-linear, and pooling layers is finished, it is crucial to link an overall linked layer. The output data from the convolution network is sent into this layer. A fully connected layer creates an N-dimensional vector when it is coupled to the network end, where N is the number of classes from which the model selects the required class.

F. CNN Model

- This CNN model was developed using the TensorFlow framework and the OpenCV library and is widely utilized in real-time applications.
- This approach may also be applied to the development of comprehensive software that monitors everyone entering at public gatherings.

G. Layers in CNN Model

Convo2D Layer: It uses the ‘ReLu’ activation algorithm and contains 100 filters. Rectified Linear Unit, or ReLu, is a function that outputs directly if the input is positive and zero otherwise.

MaxPooling2D: It is utilized with 2×2 pool or filtration sizes.

Flatten() Layer: All the layers are flattened into a single 1D layer using it.

Dropout Layer: It functions as a barrier against the model overfitting.

Dense Layer: SoftMax is the activation function used here, and it will output a vector with two values from the probability distribution.

DenseNet-201 is a 201-layer convolutional neural network. It is shown in Figure 2. The ImageNet database contains a pretrained version of the network that has been trained on more than a million images.

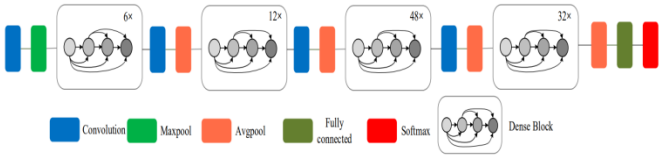

Fig. 2: Schematic diagram of DenseNet-201 model

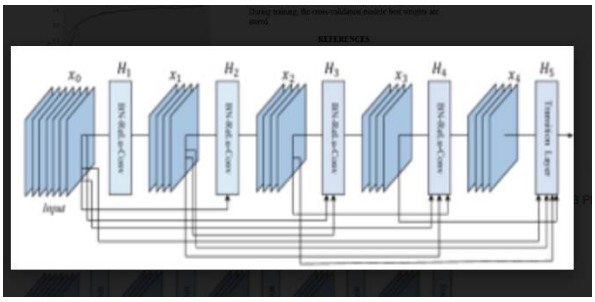

Fig. 3: Architecture of Densely Connected Convolutional Network

III. RESULT

A crucial component of every neural network model is the loss function. It demonstrates how projected value and actual value diverge. There will be loss and validation accuracy for each fold for the cross-validation models on the validation dataset. The average degree of accuracy was 95.27%. The accuracy for the training dataset and validation dataset as determined by the cross-validation approach is shown in Figure 4.Thenumber of epochs and loss/accuracy are displayed on the X and Y axes, respectively. With increasing epoch values, the colored lines, or validation accuracy, increase higher.

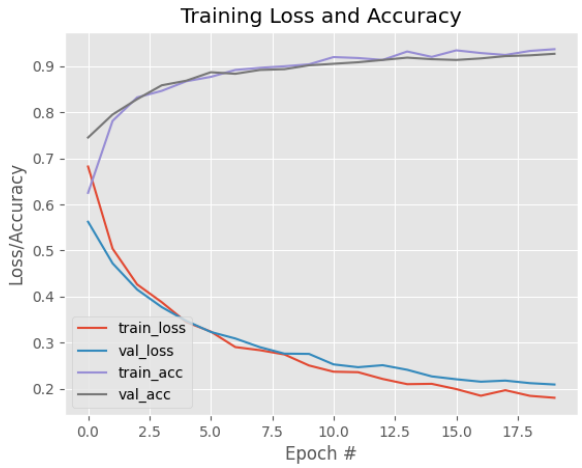

Fig. 4: Loss and Accuracy for the training dataset

By using machine learning to analyse a person's handwriting patterns, a method has been proposed to predict some psychological emotions and personality characteristics. Five handwriting characteristics could be extracted, and any one among those five personality traits could be predicted using various combinations of those characteristics. Each neural network classifier is trained for each of the personality traits. After sufficient of training, we can predict personality characteristics on fresh samples of handwriting quite accurately and effectively.Thisdemonstrates that using an ensemble of the best cross-validation model weights increases classifier accuracy. Finally, we draw the conclusion that we can predict negative emotions like depression, panic, anxiety, stress and excludes no sign of psychological issues using handwritten words.

IV. FUTURE WORKS

The project has potential for further enhancement. Here is a list of some enhancements that may be made:

- More data can help machine learning algorithms be trained, therefore gather more handwriting samples from more writers.
- Improve the algorithms to handle difficult handwriting scenarios for greater accuracy.
- Develop more algorithms to extract additional characteristics so that more personality traits may be identified.
- Other machine learning algorithms such as KNN, Decision Tree, ANN, etc. are trained and compared.
- Develop a graphical user interface to make the task simple for anybody to utilize.

V. CONCLUSION

Our project proposes an automated method to predict a person's personality from a sample of their handwriting using CNN algorithm.Theproposed system may be utilized by the graphologist as an additional tool to improve the accuracy of handwriting analysis and also make the process fast. A person's handwriting may be taken into consideration as a significant indicator of their mental health. The same goal is accomplished using machine learning. In order to extract characteristics from handwriting samples and classify them into the relevant groups, convolutional neural network technique is utilized. The number of training samples rises when cross-validation is utilized, improving accuracy. During training, the cross-validation models' best weights are stored.

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