Personality Prediction Using Handwriting Analysis

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Abstract – *Understanding human personality traits plays a pivotal role in various fields, including human resources, psychology and social sciences. In this project, we suggest a unique method for predicting personality leveraging deep learning algorithms applied to handwriting analysis. Handwriting being an uncommon attribute provides valuable insights into an individual's personality characteristics. The dataset comprises handwritten samples categorized into five personality traits: Anxious, Cooperative, Enthusiastic, Responsible and Openness. Leveraging Convolutional Neural Networks (CNNs), Artificial Neural Networks (ANNs), and Residual Neural Networks (ResNets), Our goal is to detect complicated patterns in handwriting photographs to predict personality traits accurately. Our methodology involves preprocessing handwritten images, including normalization and feature extraction, subsequently the development and training for models based on deep learning. We employ CNNs to capture spatial dependencies in handwriting patterns, ANNs for feature extraction and dimensionality reduction, and ResNets for handling deep network architectures effectively. A significant amount of testing and analysis is done to determine how well the suggested models work. We use criteria like recall, accuracy, precision, and F1-score to assess how well the models predict each personality feature Furthermore, we investigate ensemble methods for integrating forecasts from many models for improved precision and resilience. The results demonstrate promising performance in personality prediction, with the proposed approach achieving competitive accuracy rates across all personality traits. Furthermore, the models exhibit resilience to variations in handwriting styles and dataset sizes, highlighting their generalization capabilities.*

*Key Words***: Handwriting Analysis, Personality Traits, CNN, ANN, ResNets**

1.INTRODUCTION

The importance of learning to write is to understand people and their behaviour in depth. This project looks at the distinctive characters through a review of texts in an effort to better understand human behaviour. Rather than relying on direct questions or observations, the research explored the ability of writing to reveal unconscious aspects of person's behaviour. This project explores the historical and cultural origins of handwriting and aims to bridge traditional and modern techniques.

Knowing personality features has been highlighted as a crucial instrument for matching individuals to occupations, assisting employers in the recruiting process, and assisting coaches in customizing instruction to fit various topic areas. Within the structure of psychological analysis, the knowledge acquired from the text's analysis is considered significant for designing a customized therapy strategy that engages the patient's mind.

In addition, detailed information collected in writing regarding good behaviour during a crime investigation can help solve the crime problem. In broad terms, the project aims to bring together historical practice and contemporary technology to offer a useful method for examining the complexity of human behaviour via the writing lens. Along with the growth of education, real-world applications that can improve every aspect of human life and humanity as whole are also desired results.

1.1 OVERVIEW

To forecast personality characteristics based on handwriting characteristics, the project "Personality Prediction Through Handwriting Analysis" involves collecting a dataset of handwritten samples labelled with personality traits, extracting relevant characteristics from the handwriting, and using machine learning techniques.

1.2 PROBLEM STATEMENT

While behavioural observations and subjective self-report questionnaires are the mainstays of traditional personality evaluation methods, they are labour-intensive, prone to bias, and often inaccurate. Furthermore, these techniques frequently fail to convey the complexities and complex aspects of a person's personality. In contrast, handwriting analysis has a distinctive chance to obtain insights into personality traits; nonetheless, manual analysis necessitates skill and is labour-intensive. The goal of the problem statement is to create an automated system that can more accurately identify personality traits from handwriting than current approaches can.

1.3 OBJECTIVE

By first compiling a varied and labelled dataset of handwritten samples with associated personality qualities,

the project seeks to construct an accurate handwriting analysis-based personality prediction system. Relevant handwriting attributes including slant, size, and pressure will be found through feature extraction and selection, and an appropriate machine learning model will be trained in order to determine connections between these factors and personality traits.

1.4 SCOPE

Handwriting analysis is valued for its ability to reveal personality traits because it's personal and unconscious. Writing involves both physical skills and thinking, showing a lot about someone's character. Different aspects of handwriting, like size, slant, pressure, spacing, and rhythm, can tell us about a person's emotions, behaviour, and thoughts. Unlike speech or typed text, handwriting is often more genuine and reflects someone's true self because it's harder to control consciously.

2. EXISTING SYSTEM

At the moment, self-report questionnaires, behavioural observations, and expert assessments are the main methods used in personality assessment. Even though they're used extensively, these approaches have biases, subjectivity, and poor accuracy. Furthermore, because manual handwriting analysis requires a lot of labour, even though it is insightful, it is not feasible for large-scale applications. It's possible that automated handwriting analysis systems now in use lack the intelligence and precision needed for personality prediction. Therefore, a more sophisticated and trustworthy system is required that can make use of methods for deep learning to analyse handwriting and precisely predict personality traits.

3. PROPOSED SYSTEM

The proposed strategy employs deep learning methods to handwriting analysis To be able to overcome the shortcomings of the current approaches. In order to extract characteristics from handwritten samples and categorize them into five personality traits, the system will combine CNNs, ANNs, and ResNets. The system will be able to recognize complex patterns and variations in handwriting by utilizing deep learning techniques, which will increase precision and dependability of personality prediction. Furthermore, the technique will be scalable, allowing for the quick processing of massive amounts of handwritten data.

4. DATASET

This project utilized a changed dataset, gathering a variety of handwritten example datasets labelled with the relevant personality qualities (Openness, Cooperative, Enthusiastic, Responsible, and Anxious). The dataset consists of 1000 images classified into mentioned categories from sources like Kaggle and handwriting samples of students.

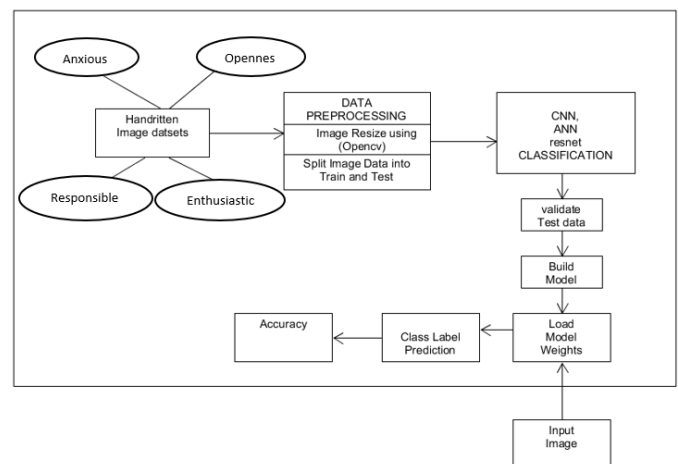**Fig -1:** Handwriting Samples

5. METHODOLOGY

Fig -2: Flowchart of Personality Prediction

5.1 DATA COLLECTION

Collect handwritten samples of different types of personality traits (Anxious, Cooperative, Enthusiastic, Responsible, and Openness) and label them with the respective traits. To enhance model generalization, make sure the collection includes a range of handwriting variations and styles. Contemplate obtaining data from multiple sources., such as crowdsourcing websites, digital archives, and handwriting samples from psychological research.

5.2 DATA PRE-PROCESSING

Convert the handwritten images into a standardized format appropriate for models of deep learning, such as grayscale or RGB images. Resize the photos to a consistent scale and apply contrast enhancement techniques to normalize the photographs and guarantee feature consistency. Change the dataset by rotating, scaling, and flipping it to improve model generalization and diversify the training samples.

5.3 FEATURE EXTRACTION

Create a list of all the relevant details from the handwriting photos that have already been processed in order to identify the unique traits connected to each personality trait. In order to identify important traits from the samples of handwriting, take into consideration methods like contour detection, texture analysis, and edge detection.

5.4 MODEL SELECTION

Choose appropriate deep learning architectures for personality prediction, including Convolutional Neural Networks (CNNs), Artificial Neural Networks (ANNs), and Residual Neural Networks (ResNets). Experiment with different architectures and configurations to find the optimal model for the task. Consider using pre-trained models and fine-tuning them on the handwriting dataset to leverage transfer learning and improve model performance.

5.5 MODEL TRAINING

To make sure that every personality trait was fairly represented in each group, the dataset was divided into testing, validation, training, and test sets using stratified sampling. Utilizing suitable loss functions and optimization techniques (such as the Adam optimizer and categorical cross-entropy loss), train the chosen models on the training set. To avoid overfitting and enhance model convergence, keep an eye on the training procedure and modify the hyperparameters as necessary. Validate the training models on a testing set in order to assess their performance and make the necessary hyperparameter changes accordingly.

5.6 MODEL EVALUATION

Evaluate Utilizing performance indicators such as F1-score, recall, accuracy, and precision, assess the trained models on the test set to determine how well they predict personality traits. Perform a thorough error analysis to find recurring misclassifications and model improvement opportunities. Determine which model or architecture performs best for personality prediction from handwriting by comparing its performance.

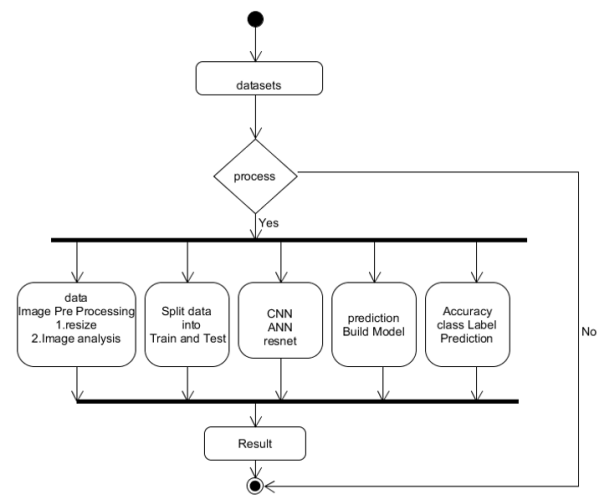## 5.7 ACTIVITY DIAGRAM

Fig -3: Activity Diagram

Gathering a large number of handwriting samples is the initial action in the process of predicting personality traits from handwriting. Following preparation for analysis, these samples are resized to a standard size and key information is extracted from the handwriting.

Subsequently, the collection of handwriting is divided into two groups: training and testing. Three distinct models are taught to the training group: a Residual Neural Network (ResNet), an Artificial Neural Network (ANN), and a Convolutional Neural Network (CNN). These models do well in image analysis.

These models are prepared to generate predictions after they have assimilated knowledge from the training set. Each model incorporates the testing group's handwriting and uses the information it has acquired to forecast personality traits.

After getting predictions obtained from each one of the three models, we check how accurate they are. This entails contrasting the actual personality qualities of the individuals who wrote the handwriting in the testing group with the expected traits.

6. RESULT

Fig-4 A sample handwriting image to predict personality from.

7. CONCLUSION

A method using machine learning can predict personality traits by analysing handwriting patterns. We used seven handwriting features to predict five traits. Each trait was predicted by a different CNN classifier. After training, the system accurately predicts traits from new handwriting samples. The system uses image processing methods and feature extraction algorithms, relying on the OpenCV and Sci-kit Learn libraries. These libraries are essential for achieving our results. While the system works well, extreme handwriting styles might lead to inaccurate predictions. It's best to prepare handwriting images specifically for this system.

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