Personality and Sentiment Prediction Using Graphology and Facial Expression

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Abstract—*Understanding human behavior is a complex and multifaceted endeavor that finds applications in various domains, from psychology to human-computer interaction. Graphology, the study of handwriting, has been associated with personality assessment. It posits that various aspects of a person's character, such as their emotional stability, creativity, and even hidden emotions, are reflected in the way they write. Alternative, facial expression analysis is a well-established field that examines the emotions conveyed through facial movement. By leveraging the strengths of both modalities, this approach aims to improve accuracy and robustness in predicting human behavior. Experimental validation demonstrates the effectiveness of the proposed hybrid model, showcasing its potential applications in areas like mental health assessment, human-computer interaction, and personalized user experiences. Ethical considerations and privacy safeguards are paramount in the handling of personal data, and informed consent is obtained from all participants in accordance with best practices. This study offers a promising methodology for holistic personality and emotion analysis, with implications on fields where understanding human behavior is crucial.*

Keywords—Graphology, Facial Expression, Personality assessment

1. Introduction

The project endeavors to develop an innovative approach to personality prediction and emotion analysis, fusing the disciplines of graphology (handwriting analysis) and facial expression recognition using Support Vector Machines (SVM). These methods, traditionally distinct, hold complementary insights into an individual's psyche and emotional state.Handwriting samples are analyzed to extract relevant features, including letter size, slant, pressure, and spacing, for personality trait prediction. Simultaneously, facial expression images are processed to extract key landmarks and features indicative of emotions like anger, sadness and happiness and neutral.

The SVM, a powerful machine learning algorithm known for its effectiveness in high-dimensional spaces, is employed to model the relationships between the features and the corresponding personality traits and emotions.The integration process involves feature extraction from both handwriting and facial expression data. Unified feature vector is formed by combining these features, allowing for joint analysis.This

combined feature vector is then utilized to train a new SVM model capable of predicting both personality traits and emotions simultaneously.

2.Literature Survey

Mihai Gavrilescu et al. [1] proposed a neural network-based method for predicting personality traits from handwriting features, achieving high accuracy despite the lack of a standard public database for testing. Stefanos Kollias et al. [2] presented a system for robust feature detection in facial expression recognition, although susceptible to lighting and pose variations, achieves high accuracy. Olufisao S.Ekundayo et al. [3] conducted a comprehensive review of trends and techniques in Facial Expression Recognition (FER), elucidating strengths, limitations, and benchmark databases. Chirag Dalvi et al. [4] provided a survey of AI-Based Facial Emotion Recognition (FER), encompassing ML techniques, datasets, and future directions, contributing to the ongoing advancement in this field.

Keyur Patel et al. [5] delivered an overview of facial sentiment analysis using AI techniques, acknowledging issues regarding standardization and privacy. Kinjal Chaudhari et al. [6] reviewed graphology in identifying personality traits through handwriting analysis, citing limitations in scientific evidence. Murat Topaloglu et al. [7] explored graphology for gender detection through handwriting analysis, achieving moderate success but with a limited focus. Aditya Chitlangia et al. [8] proposed a computerized approach to graphology using image processing and machine learning techniques for personality trait prediction, offering advantages over manual examination. Jayakanth Kunhoth et al. [9] suggested a machine learning-based dysgraphia diagnosis system, aiming for efficiency but lacking detailed comparative analysis and dataset diversity. Jamal Hussain Shah et al. [10] proposed facial expression classification using linear discriminant analysis and support vector machine techniques, targeting reduced false labeling but with limitations in handling large datasets. Yuan Luo et al. [11] proposed a hybrid method for facial expression recognition with high recognition rates, albeit sensitive to illumination conditions. These studies collectively represent a diverse array of approaches aimed at understanding human behavior and traits through technological means, showcasing both advancements and areas for further improvement and exploration.

3. Proposed Work

It aims to develop and implement a hybrid approach that combines graphology analysis with facial expression analysis using Support Vector Machine (SVM) models. By leveraging handwriting characteristics and textual sentiment, the goal is to provide a more comprehensive understanding of individual behavior and emotions. The project involves collecting and preprocessing diverse datasets of handwritten samples and text data, extracting relevant features for each modality. SVM models will then be trained separately for graphology and sentiment analysis tasks, optimizing hyperparameters and evaluating performance through rigorous validation techniques. The ultimate objective is to deploy these trained models into practical applications such as mental health assessment or personalized user experiences, contributing to a deeper understanding of human behavior across various domains. Through this interdisciplinary approach, the proposed work seeks to offer valuable insights into personality traits and emotional states, with potential implications for fields where understanding human behavior is crucial.

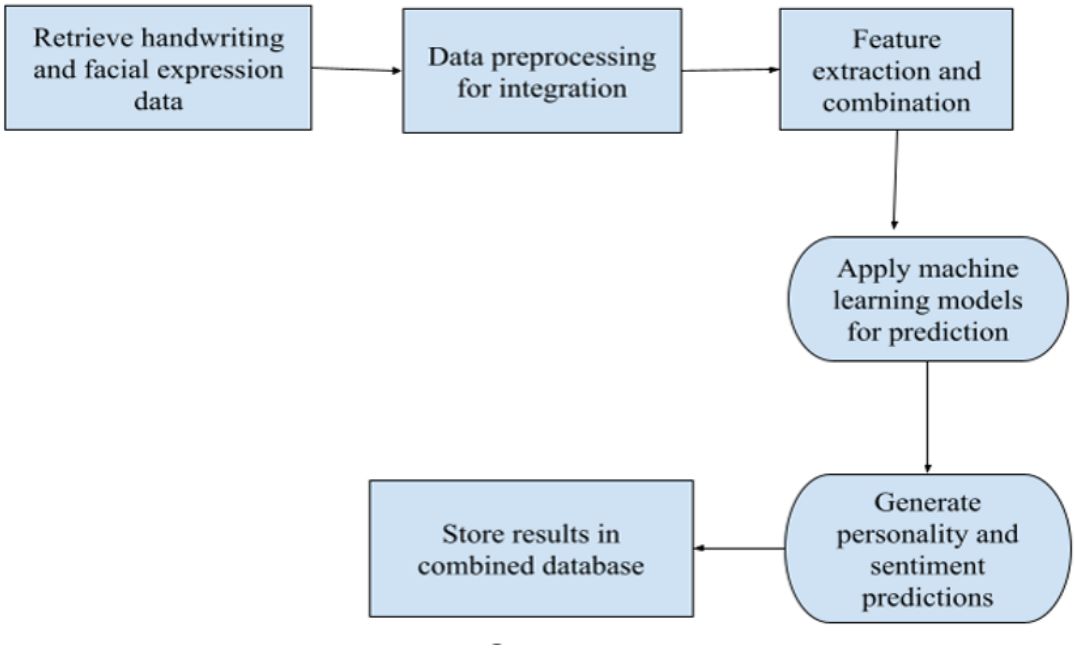

Figure.1 The system process flow chart

Figure.1 depicts the various steps from collection of the data to personality and sentiment prediction.

3.1.Design Algorithm

Support Vector Machine(SVM):

The data undergoes preprocessing to extract pertinent features for both graphology and sentiment analysis, ensuring the suitability of input for the SVM models. SVM models are trained individually for each task, utilizing suitable kernel functions and hyperparameter optimization to maximize accuracy and generalization. Following training, model performance is evaluated using metrics such as accuracy and F1-score, employing techniques like cross-validation to ensure robustness. The trained SVM models are deployed into applications for graphology and sentiment analysis, with regular monitoring and updates to maintain effectiveness over time.

3.2. System Architecture

- Data Preparation Module:

Responsible for collecting and preprocessing handwriting samples and facial expressions data. For the handwriting data, the samples are converted into digital format and relevant features are extracted In the facial expression data, the face is detected: facial landmarks are extracted and expressions are represented using appropriate features. Figure.2 depicts the system architecture.

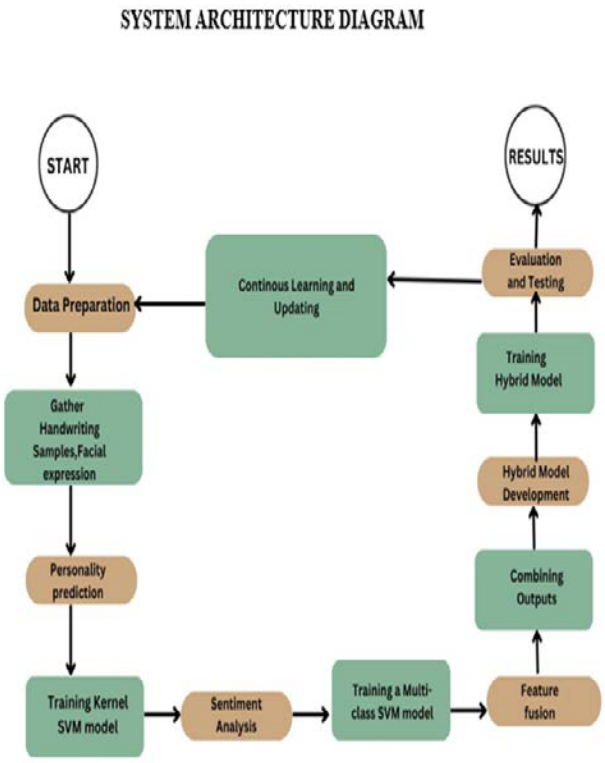

Figure.2. System Architecture

- Personality Prediction Module

Utilizes handwriting features to predict personality traits. Extracts features from handwriting samples. Support Vector Machine (SVM) Model is trained. The personality traits are predicted based on extracted features.

- Sentiment Analysis Module

Utilizes facial expression features to analyze sentiment. Extracts features from facial expressions Support Vector Machine (SVM) Model is trained to analyze sentiment based on extracted features.

- Feature Fusion Module

Integrates features from handwriting and facial expressions to enhance prediction and combines handwriting and facial expression features.

- Hybrid Model Development Module

Constructs a hybrid model using fused features for joint personality prediction and sentiment analysis. It defines the structure of the combined model.

- Evaluation and Testing Module

Assess the performance of individual modules and the overall system. Measures accuracy, precision, recall, and other relevant metrics for personality prediction and sentiment analysis. Conducts testing using separate datasets to evaluate the system's generalization capability.

4. Results and Discussions

The handwriting model developed using the SVM classifier has provided the required traits of the person. The eight Support Vector Machine classifiers are trained with the dataset depicting Emotional Stability, Mental Energy or Will Power, Modesty Personal Harmony and Flexibility, Lack of Discipline, Poor Concentration, non-communicativeness and Social Isolation. Despite achieving hundred percent accuracy using SVM, the extraction of the raw features like baseline, top margin from the handwriting images might introduce a little inaccuracy because of the large variation of handwriting styles of different people.

- Data Collection & Preprocessing: Gather diverse handwriting and facial expression datasets, preprocess them for feature extraction.
- Feature Extraction & Model Design: Extract handwriting and facial expression features, design a hybrid model architecture for feature fusion.
- Training & Validation: Train the hybrid model on split datasets, optimize parameters, and evaluate performance using cross-validation techniques.
- Ethical Considerations & Deployment: Ensure data privacy, obtain informed consent, and deploy the model ethically in applications such as mental health assessment and human-computer interaction, adhering to regulations and guidelines.

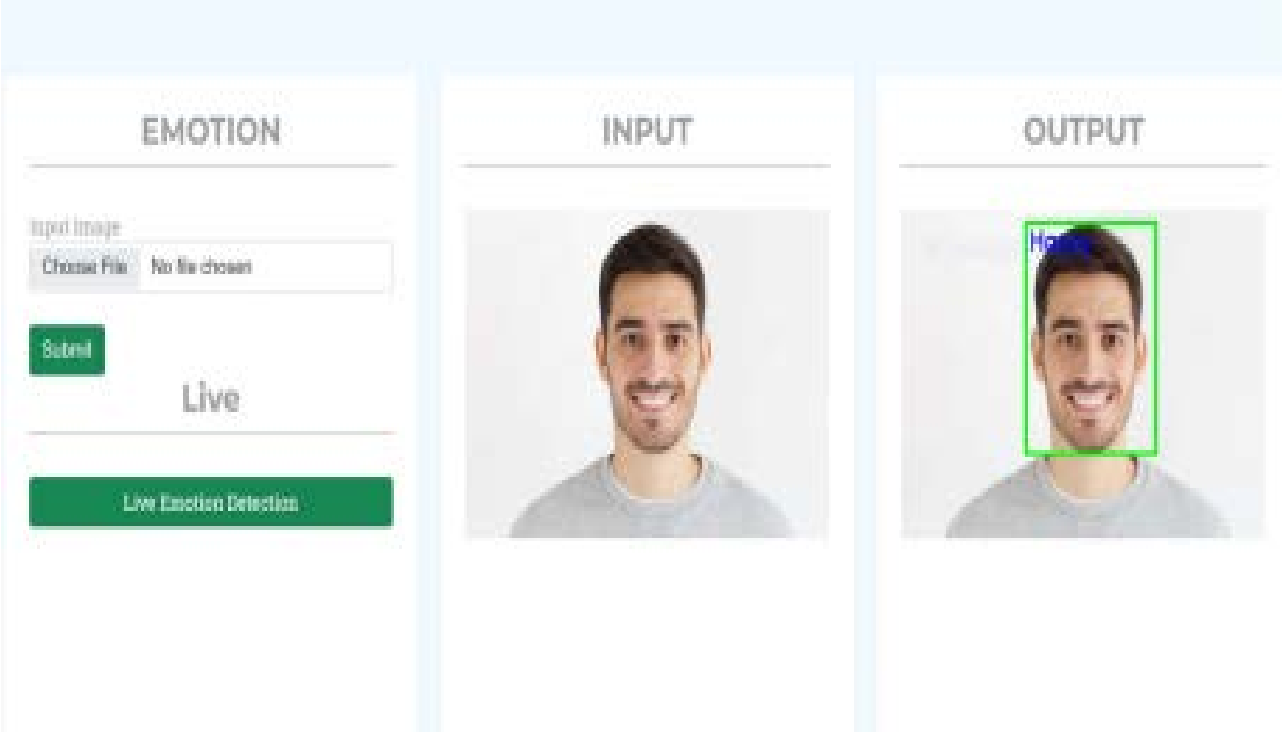

Figure 3. Output depicting the emotion of the input sample

The diagram in figure 3 depicts the example of evaluating the emotion of the person from the input sample.

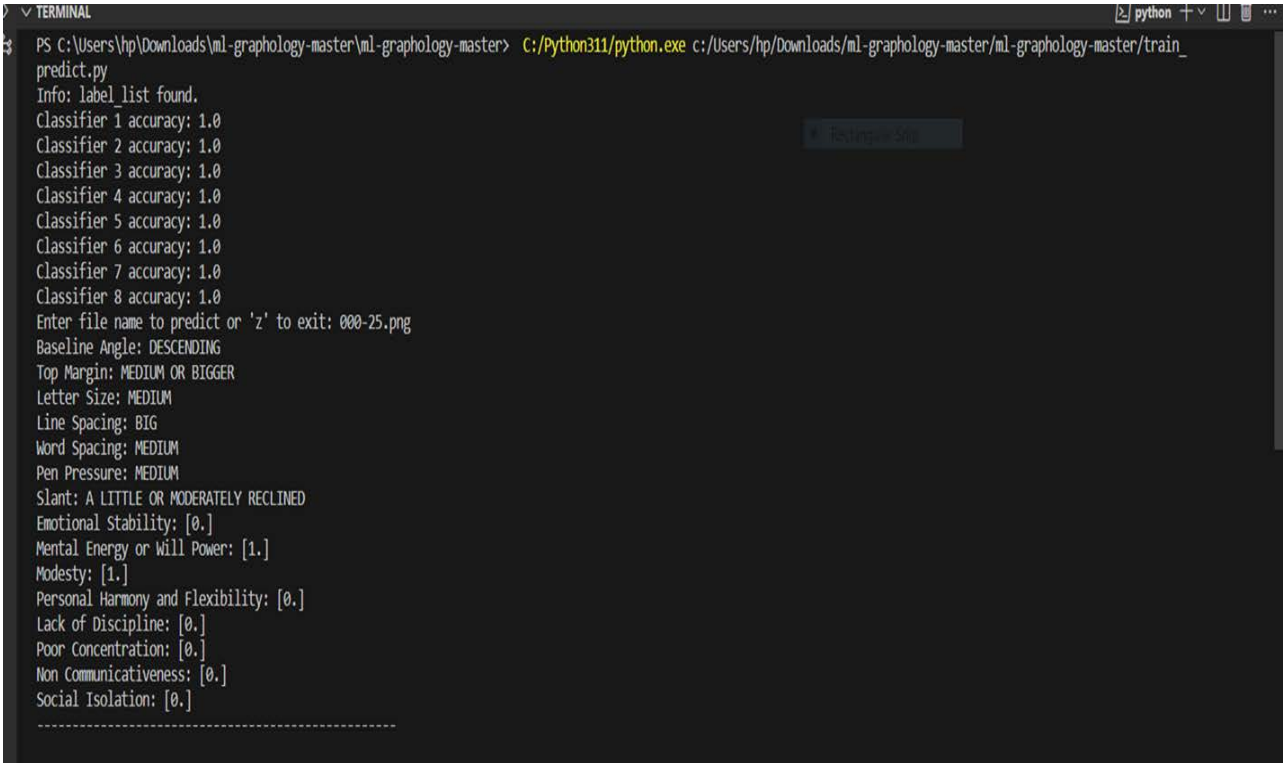

Figure 4. Snapshot of output

5.Conclusion

In this paper, a research on the unconventional data sources of graphology (handwriting analysis) and facial expression analysis to accurately predict an individual's personality traits and sentiments has been elaborated. The primary goal is to contribute to mental health diagnosis and emotional assessment. To achieve this, we will collect and preprocess diverse datasets, engineer informative features, and develop models using machine learning. This interdisciplinary approach at the intersection of graphology and facial expression analysis has the potential to offer new insights and applications in the field of personality assessment and emotional well-being.

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