Hybrid Deep Learning Framework for Personality Prediction in E-Recruitment

Prof. Rakhi Meshram, Om Sonawale, Ayaan Sayyad, Omkar Dadpe, Vivek Kumar

Prof. Rakhi Meshram, Computer Engineering, SAE
Om Sonawale, Computer Engineering, SAE
Ayaan Sayyad, Computer Engineering, SAE
Omkar Dadpe, Computer Engineering, SAE
Vivek Kumar, Computer Engineering, SAE

Abstract - The Personality prediction is a vital task in the domain of psychology, human-computer interaction, and user behavior analysis, with applications ranging from tailored advertisements to mental health assessments. Traditional methods rely heavily on self-report questionnaires or psychological assessments, which can be time-consuming and subjective. To overcome these limitations, researchers are exploring automated and objective methods using deep learning techniques, particularly Convolutional Neural Networks (CNNs) and Natural Language Processing (NLP) algorithms, which excel at capturing complex patterns in multimodal data. In this work, we propose a hybrid framework that combines CNN-based feature extraction and NLP algorithms for predicting personality traits using data such as facial expressions, speech patterns, and text analysis. The CNN model is leveraged due to its robust feature extraction capabilities, enabling it to learn intricate patterns directly from raw data inputs, which correlate with the Big Five personality traits. Additionally, we integrate a Support Vector Classifier (SVC) to classify personality traits based on the extracted features, offering improved prediction accuracy across diverse data sources.

Keywords—Personality Prediction, Big Five Personality Traits, CNN, NLP Algorithm, SVC Classifier

1. INTRODUCTION

Personality prediction using Convolutional Neural Networks (CNNs) on savory and unsavory images represents an advanced application of machine learning in the realm of psychological and behavioral analysis. This approach leverages the power of CNNs, renowned for their efficacy in image processing, to analyze visual cues in images that are categorized as savory (pleasant) or unsavory (unpleasant). By training on a dataset where images are labeled alongside the personality traits of individuals who react to them, the model can learn to infer personality characteristics from new image data. This innovative methodology combines deep learning techniques with psychological theory, aiming to uncover patterns in visual preferences that correlate with specific personality traits, offering a novel and potent tool for psychological assessment and research.

In addition to visual data, we extend this Algorithm by integrating Natural Language Processing (NLP) Algorithm for personality prediction from textual datasets. NLP Algorithm are employed to analyze written text, extracting linguistic features that can reveal insights into the psychological makeup of individuals. The textual analysis is incorporated into the CNN-based architecture, allowing the model to process and learn from multimodal data—facial images, speech patterns, and text. This multimodal approach enhances the model's predictive power by leveraging the strengths of each modality, ultimately providing a more comprehensive analysis of personality traits.

2. LITERATURE SURVEY

SR	AUTHOR	TITLE	DESCRIPTION
1.	Marco A. Moreno-Armendariz, Carlos Alberto Duchanoy Martine	Estimation of Personality Traits From Portrait	Explores predicting the Big Five traits from text using linguistic features and NLP. Correlations were found, especially for Extraversion and Openness.

			Accuracy was limited by manual features.
2.	Sonali Pakhmode, Shaikh Ayan	Implementing Personality Prediction Using Machine Learning	Uses vocal features and SVM to predict personality traits. Moderate accuracy was achieved, with Extraversion and Neuroticism being most predictable.
3.	**I** Maliki, M A Sidik	Personality Prediction System Based on Signatures Using Machine Learning	Combines facial and vocal features for prediction using Decision Trees and Random Forests. Integration improved accuracy, but manual extraction limited scalability.
4.	Jia Xu, Weijian Tian	Prediction of the Big Five Personality Traits Using Static Facial Images of College Students with Different Academic Background	Uses CNNs to predict traits from facial expressions in videos. Outperforms traditional models, especially for Extraversion and Openness, by automatically learning features.

2.2. METHODOLOGIES

Gather a diverse set of images categorized as savory or unsavory. The dataset should include a wide range of food types and presentation styles to ensure robust model training. Additionally, collect corresponding text data, such as food reviews or descriptions, to complement the image data.

Clean and preprocess images to standardize formats, sizes, and quality. Augment the dataset to enhance model performance and generalization. Similarly, preprocess text data using (NLP) algorithm, performing tokenization, stop word removal, and lemmatization.

Develop a Convolutional Neural Network (CNN) model to predict personality traits based on the analysis of savory and unsavory food images. Additionally, integrate an NLP algorithm, to analyze the text data, extracting features that can correlate with personality traits based on linguistic patterns.

• Accuracy: To evaluate overall correctness of predictions.

• Precision, Recall, and F1 Score: To evaluate the model's performance on each personality trait, incorporating both visual and text-based predictions.

2.1. SYSTEM ARCHITECTURE

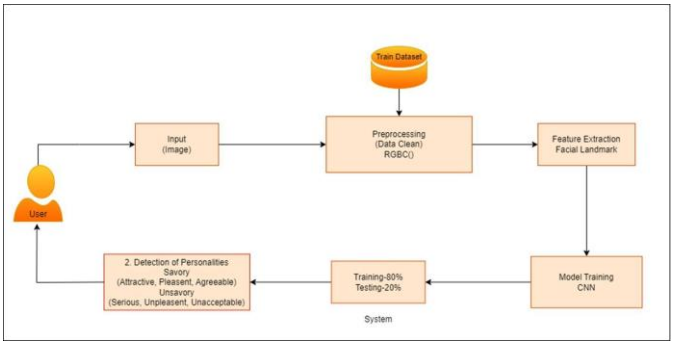

Fig-1 : figure

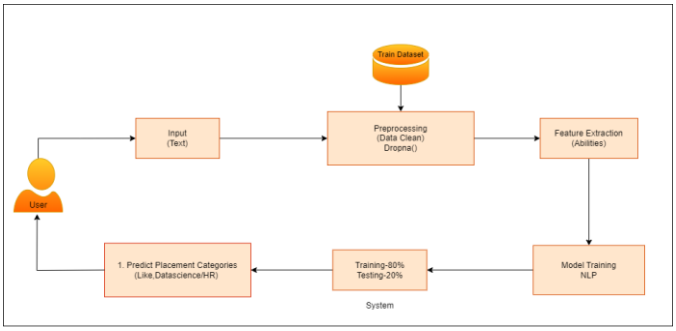

Fig-2 : figure

- CNNs are exceptionally well-suited for image and text data analysis tasks due to their ability to automatically learn hierarchical features from raw pixel data.
- CNNs can learn to extract meaningful features from images such as edges, textures, and shapes, which are crucial for recognizing patterns. Additionally, integrating NLP algorithms enables the analysis of accompanying textual data, such as incident reports or social media posts, enhancing the understanding of the context surrounding the visual content.
- CNNs are capable of achieving translation invariance, meaning they can recognize patterns regardless of their position within an image. Coupled with NLP techniques that analyze language structure and sentiment, this enables a comprehensive approach to understanding the

relationships between visual elements and associated textual information, providing deeper insights into accident-related events

2.3. LIMITATIONS

- The proposed system for personality prediction using NLP & Convolutional Neural Networks (CNNs) based on savory and unsavory images and text data has several limitations and challenges. Understanding these limitations is crucial for improving the system and managing expectations regarding its performance.

- The accuracy and generalization of the model are highly dependent on the size and diversity of the dataset. A small or non-representative dataset may lead to overfitting and poor performance on unseen data.

- The dataset might be biased towards certain cuisines or presentation styles, which can skew the predictions. Similarly, if the accompanying textual data such as reviews or comment lacks diversity or is biased, it can negatively affect the insights gained from the NLP analysis.

- Variations in image quality, such as resolution, lighting conditions, and background clutter, can impact the model's ability to accurately analyze and classify images. In the context of NLP, inconsistencies in the quality of textual data, such as spelling errors or informal language, may further complicate the extraction of meaningful features and context.

- Furthermore, the integration of image and text data may introduce additional complexity, as aligning insights from both modalities can be challenging. A lack of synergy between visual and textual features could lead to misinterpretations in the personality prediction process.

2.4. DISCUSSION

- The implications, challenges, and potential advancements in predicting personality traits using image, text datasets and Convolutional Neural Networks (CNNs) & NLP. This discussion encompasses the system's effectiveness, practical considerations, and areas for future research.
- NLP & CNNs are well-suited for image processing and text analysis tasks due to their ability to automatically learn and extract hierarchical features from raw pixel data. This capability is crucial for distinguishing between savory and unsavory images.
- NLP & CNNs can effectively identify patterns related to texture, color, and presentation style, which can be indicative of personal preferences. However, their effectiveness in predicting personality traits from these features is still an emerging area of research.
- While NLP & CNNs can identify visual preferences, the direct correlation between preferences and personality traits requires careful consideration. The model might reveal trends or correlations, but it is essential to validate these insights through empirical studies

3. CONCLUSIONS

Personality prediction plays a significant role in enhancing self-awareness, improving decision-making, and personalizing experiences across various fields such as psychology, business, marketing, and education. By leveraging data-driven approaches and advanced models, personality prediction offers valuable insights into individual behaviors, traits, and preferences. However, it also presents challenges, such as accuracy, potential biases, and ethical concerns, which need to be addressed. As technology evolves, refining these prediction methods will further unlock its potential, enabling more effective personal and professional development while fostering better interpersonal relationships.

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