Grenze International Journal of Engineering and Technology, June Issue

Personality Prediction in Business using Artificial Intelligence and Machine Learning

Arjun Singh[1], Aditya Kumar[2], Sakil Ahmad Ansari[3], Dharampal Yadav[4], Renu Bahuguna[5] and Rishant Bana[6]
[1-2,4,6]Greater Noida Institute of Technology, CSE, Greater Noida, India.
Email: innovativearjunsingh@gmail.com, aadityasingh1133@gmail.com, ydharampal192@gmail.com, rbana2003@gmail.com
[3]RKGIT, CSE, Ghaziabad, India
Email: shakilahmadansari@gmail.com
[5]Uttaranchal University, CSE, Dehradun, India
Email: renubahuguna@gmail.com

***Abstract*— The main goal of this method is to propose the development of a very precise, robust, and scalable system for predicting a personality using the most advanced techniques of deep learning, with a special focus on BERT-based NLP approaches. Differently from how machine learning is usually performed, in which the process is very reliant on carefully designed language features and shallow text patterns, this system would instead use contextualized word embeddings to automatically detect deep semantic meanings, underlying emotional patterns, as well as implicit behavioural features expressed in texts. The goal of this research is to show how the application of transformer architectures is able to enhance the trustworthiness and accuracy of inferring personality traits, especially in relation to the Big Five dimensions of personality, namely Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Through their application on business-related corpuses, as well as on different digital communication texts. The proposed research aims to develop a generalized predicting system, scalable enough to process large amounts of unstructured texts, while still showing high predicting power and interpretability. Finally, this work is intending to propose an advanced contribution to the ever-growing computerized psychology community, in the form of an innovative, fully automatic, and precision-driven system for personality analysis.**

***Index Terms*— BERT, OCEAN, NLP, CNN.**

I. INTRODUCTION

A. Basic introduction

Personality could be understood as the characteristics that set a person apart from others when it comes to their thought patterns, emotions, drives, and behaviour. In a business setup or organisational setting, the concept of personality has long been acknowledged as a fundamental determinant of effectiveness at a workplace or business setup. It plays a crucial role in influencing job-related activities or performances, modes of communications, leadership potential and conflict resolution, decision-making patterns, team working compatibility, and consumer preference as well. The modes of personality evaluation that were primarily used until recently in the field of psychology include the usage of psychometric tests like NEO-PI-R instruments, Myers-Briggs Type Indicator (MBTI), and Big Five Inventory (BFI).

Grenze ID: 01.GIJET.12.2.63_20

However, these methods come across with certain constraints like self-assessment bias, long test duration, non-scalability, and lack of ability for real-time observation of behaviours. The current decade has observed drastic advancements in the fields of artificial intelligence (AI), natural language processing (NLP), and machine learning (ML), leading to radical shifts in the application area of measuring and processing results related to personalities. Results from current studies have revealed that it is possible to identify an individual's personalities by processing their digital trail from social media communications, microblogging messages, email communications, chatting messages, video chatting communications, browsing activities, keystrokes, and many more activities initiated by an individual. This turns out to be an advantage for AI systems since they do not need survey-based processing like earlier systems.

B. Domain of Personality Prediction Model

It is proposed that in the corporate sector, machine learning-based personality prediction has received ample interest because of its applicability in various organisational processes. Models based on artificial intelligence help in automated candidate screening, enhanced job-personality alignment, leadership detection, and employee productivity analysis. In addition to human resource management, another important application of personality prediction is in consumer behaviour analysis, digital marketing, consumer segmentation, and product recommendation software. Firms now make extensive use of personality-defined models for enhancing decision-making accuracy and developing a competitive edge. The widespread use of AI in business operations, an understanding of the computation of personality prediction is now an absolute requirement. It is important to comprehend not only how it is achieved but also the ethical issues that come into consideration. This review has amalgamated all previous studies on this topic in order to focus on the latest advances in NLP, making use of BERT models in computing personality, in comparison to traditional approaches in this field. It has also focused on management aspects of personality prediction in a business context to give an insight into how AI & machine learning has transformed the future of business intelligence.

II. Review of Literature

Personality study within the field of psychology has remained a relevant theme from the inception, and the development of computing algorithms further extends the theme to business, management, and analytics. The research work done within the field of personality study has resulted in the establishment of the Big Five Personality Framework being the most accurate and verified model of personality conceptualization to date. Goldberg (1990) introduced the idea of the Big Five factor model through the use of the factor constructs of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, creating a complete typology that was readily accepted within the field of business organizations and management. Moreover, McCrae and Costa (1997) proved the universality within the typology from a cross-cultural study stance, further placing it within the realm of applicability within the realm of present-day computing algorithm research. After that, John & Srivastava (1999) elaborated upon how personalities can be directly associated within the realm of behavioral and psychological functions. The research study done within the field of personality to job performance association within the field has played a significant role within the realm of business organizations. The use of meta-analysis done within the study at Barrick & Mount (1991) indicated that the correlations between Conscientiousness personality traits and job behaviours remained extreme within all occupations, hinting towards the idea that these constructs can be rigorously utilized to create accurate predictions during employee screening tests. Moreover, Hogan & Holland (2003) pointed towards the idea that personality assessment tests were not just practically accurate predictions within the field but could be theoretically grounded from fundamental business concepts revolving around leadership abilities, motivation, and business-related psychological traits and functions. Moreover, Tett, Jackson, & Rothstein (1991) furthered ideas towards the idea that employee assessment tests could be utilized to create a significant level of accuracy within employee screening tests by being tailored within the needs and requirements within the designated occupations. All the research work done within the field indicates the critical use and utility of personality study work being a non-cognitive predictor within the field of occupational success predictions, further being a theme of ultimate relevance within the business realm pertaining to personality testing done through the use of AI-driven personality testing software within business organizations.But with the advancements in online technology, researchers embarked on new ventures to explore the possibilities of automatically ascertaining the above-stated personality traits through online behaviour. One of the most successful projects undertaken in the above-mentioned fields is the study conducted by Kosinski, Stillwell, and Graepel (2013) that successfully ascertained the above-mentioned capability in predicting the personality traits, ideology, as well as the levels of satisfaction

of people with the help of “Facebook Likes.” It was historically pivotal in proving that machine algorithms have the capability to successfully ascertain the above-mentioned personality traits of a personality without even taking the help of questionnaires. After this, the study undertaken by Park et al. (2015) successfully investigated the linguistic patterns of millions of posts on the social media site in order to ascertain the correlation between the two. The study has proved that linguistic patterns have the capability of being a reliable method for accurately ascertaining the personality traits of individuals through the help of machine learning. In this manner, the study by Youyou, Kosinski, and Stillwell (2015) successfully proved that computer-based models have more accurate predictions of human personality traits in comparison to human assessment with the help of copious amounts of data. These studies have since proved the monumental potentiality of machine learning models in automatically ascertaining the personality traits of individuals. Classical machine learning models have been used extensively for developing personality models in the fields of text patterns and linguistic patterns. Learning models such as SVM models, Random Forest Classifiers, as well as Logistic Regression models have been used in the above-mentioned fields of study for extracting attributes of n-grams, LIWC categories, sentiment values, as well as TF-IDF.

The concept of deep learning has shifted the paradigm in personality models with the ability to create meaning through unformatted data. The study undertaken by Majumder et al. (2017) successfully ascertained the use of deep learning models for developing document models that successfully predicted above-mentioned personality traits with higher accuracy levels in comparison to the previously developed models. In the comprehensive coverage of the above-mentioned subject related to the development of personality models through the use of deep learning models, the publication undertaken by Xue et al. (2018) successfully proved the capability of deep learning models like LSTMs as well as CNNs in developing appropriate psychological attributes through the use of text patterns. The publication reviewed the use of above-mentioned models encompassing various designs that successfully combine data related to image patterns of humans, sound patterns, as well as human behaviour patterns for the holistic comprehension of the personality of humans. Hirsh, Kang, & Bodenhausen (2012) demonstrated the efficacy of the use of these persuasive messages containing the particular personality trait of an individual contributing significantly to marketing constructs. These studies were followed by another publication by Matz et al. (2017), which demonstrated the efficacy of personality marketing strategy, resulting in increased engagement, conversion, and purchase activities. forecasting tools, as stated, in this dynamically challenging world. Finally, after exploring different facets on current literature, it is clear how, for predicting personality, AI is an emerging technical domain with effective theoretical background with significant applications on the concerned business. From the studies examined, it appears that it is possible to identify some personality traits to a large extent of accuracy by applying machine learning algorithms on various sources. Besides, the studies state that there is great importance in applying the concept of personality forecasting in recruitment, marketing, and analysis in an organization. The current literature source appears to be of great significance in the further development on multimodal, interpretative, and adaptive approaches in advanced personality forecasting practices.

III. Methodology

This review methodology approach is concerned with synthesizing research work and studies related to the prediction of personality in a business environment through artificial intelligence and machine learning techniques." The initial step included finding credible and well-reviewed academic sources for research work related to journals and conference studies in psychology and research domains. Some research and theories in psychology related to personality studies, like the theory of the Big Five factors in personality psychology, were initially studied to found a theoretical basis for review work. Then studies related to machine and deep learning as well as digital behavioral analysis for predicting personality studies related to text or social media and other modal inputs were included in the review work process. In the following given figure, the categorization of methodology has been depicted.

After acquiring the source material, the identified publications are categorized thematically into groups that include foundations of personality traits, machine learning approaches used in computing, applicability to a business setting, and ethical dilemmas. Every publication is analysed based on methodological standards of research, nature of datasets used, prediction algorithms employed for forecast calculations, performance of these models developed, and their applicability to reality. Comparative analysis is done to compare conventional machine learning approaches with more sophisticated models of either deep learning or multimodal analysis. These categories are eventually synthesized to form a narrative of existing developments, gaps of research, and future trends of AI-based predictions of personality traits.

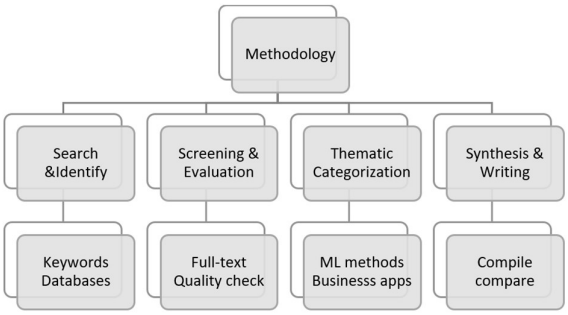

Figure 1. Methodology classification

TABLE I. COMPARISON OF APPROACHES

Approach	Strengths	Weaknesses
Traditional ML	Simple, interpretable, works on small data	Lower accuracy, manual features needed
Deep Learning	High accuracy, captures complex language	Requires big data, low interpretability
Multimodal Models	Most realistic & holistic	Computationally expensive
Social Media Models	Reflect true behaviour	Privacy concerns

V. PROPOSED METHODOLOGY: PERSONALITY PREDICTION MODEL BASED ON BERT

Some of the limitations of traditional machine learning models and deep learning models have been pointed out, and in this context, a BERT-based architecture has been proposed to be employed in improving personality type prediction in a business context. BERT stands for Bidirectional Encoder Representations from Transformers and is a major step ahead of traditional NLP models because BERT is able to represent deep context relationships in a bidirectional manner and is able to represent relationships between words in both directions. In this context, existing research has employed traditional models like SVM and Random Forest or LIWC features/CNN and LSTM models; these models have limitations in cases with context ambiguity and variability with language structure. BERT is able to overcome these limitations because of its transformer-based models with attention mechanisms. Now, in this methodology, raw text data in the form of emails, reviews, social media posts, or work communications is first sent for preprocessing in terms of normalization, tokenization, and noise elimination. Then the text data for processing is fed to the trained BERT model for producing context-based word embeddings. BERT automatically trains the models with higher levels of data representations. Hence, the method decreases the effects of biases in the models. After that, the added layer of the BERT model is used for predicting the five personality traits (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism). The method fine-tunes the personality-tagged datasets for adapting the models in specific domains.

VI. APPLICATIONS

There is a huge application of Personality Prediction in current business setups. Personality Prediction is an important part of recruitment, management, marketing, and customer management. While recruitment, Artificial Intelligence Personality Prediction is applied to help organisations efficiently screen potential employees by identifying them with certain attributes matching the requirements of the job as well as their character. Also, in employee management, personality predictability is an important aspect for predicting employee performance, leadership qualities, tracking work environment activities, and unlocking team compatibility. Moreover, with the help of personality prediction, organisations apply their expertise in predicting activities of their consumers, thus helping organisations serve customised ads, aptly focused product recommendations, and effective user engagement plans. VII.

VII. RESULTS AND DISCUSSIONS

The fact that the results produced by the applied personality prediction model indicate the predictive capability of the model computationally and in real-life scenarios makes the study valuable in understanding the applicability of models in real-world scenarios. The results provided in the performance table indicate that the personality prediction models work with varying levels of accuracy in terms of OCEAN personality traits. The

underlying Pearson correlation coefficients indicate that the best predictive result was achieved in terms of Agreeableness (0.744) and Neuroticism (0.738), which indicate that cooperation-related linguistic features, emotion-related linguistic features, and relationship-related linguistic features in cooperation-related text analysis can be detected more precisely using transformer models. The results also indicate that Openness and Extraversion personality traits have moderately high values in terms of correlations; that is, the underlying models can identify creativity-related linguistic features in the text that can be subtle.

TABLE II

Metric	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Pearson Correlation	0.54	0.65	0.61	0.72	0.73
MSE	2453.58	2453.58	2453.58	2453.58	2453.58
R^2 Score	-48.59	-48.59	-48.59	-48.59	-48.59
Training Time (sec)	54.28 sec	54.28	54.28	54.28	54.28
Loss Trend	Decreasing across epochs				

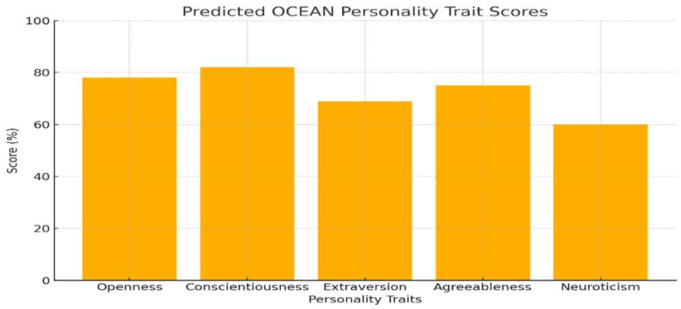

Figure 3: OCEAN model trait scores

VIII. FUTURE SCOPE AND CONCLUSION

The future for the prediction model for personalities in the business domain is bright because of the rapid advancements that will take place in the fields of multimodal analytics, artificial intelligence, and ethical frameworks. Future studies will likely centre on the integration of diverse types of data including text, audio, facial expression, physiological measurements, and behaviour logs into more precise models of personalities. Cross-cultural and global models will also become more prominent because of the need for global companies to require diverse solutions that can be applied universally. Finally, the creation of more interpretable artificial intelligence models that can describe their decision principles will also become a prominent aspect because it will enable the development of more trustworthy solutions for the diverse domains of human resource managers and marketers. Personality prediction via AI and machine learning approaches possesses a great potential that will revolutionize the business domain. Based on the personalities identified from text, social media platforms, and online behaviour, organizations will be able to improve recruitment tools and services because they will understand personalities that can improve management and enable extremely personalized marketing approaches. Although preliminary reports indicate that it will be a successful technology, it does pose challenges like privacy issues and fairness and model interpretability.

REFERENCES

[1] Goldberg, L. R. (1990). An alternative description of personality: The Big-Five factor structure. Journal of Personality and Social Psychology, 59(6), 1216–1229.

[2] McCrae, R. R., & Costa, P. T. (1997). Personality trait structure as a human universal. American Psychologist, 52(5), 509–516.

[3] John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy. In Handbook of Personality: Theory and Research (pp. 102–138).

[4] Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. Personnel Psychology, 44(1), 1–26.

[5] Hogan, R., & Holland, B. (2003). Using theory to evaluate personality and job-performance relations. Journal of Applied Psychology, 88(1), 100–112.

[6] Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. Personnel Psychology, 44(4), 703–742.

[7] Kosinski, M., Stillwell, D., & Graepel, T. (2013). Private traits and attributes are predictable from digital records of human behaviour. Proceedings of the National Academy of Sciences, 110(15), 5802–5805.
[8] Youyou, W., Kosinski, M., & Stillwell, D. (2015). Computer-based personality judgments are more accurate than those made by humans. PNAS, 112(4), 1036–1040.
[9] Park, G., Schwartz, H. A., et al. (2015). Automatic personality assessment through social media language. Journal of Personality and Social Psychology, 108(6), 934–952.
[10] Majumder, N., Poria, S., et al. (2017). Deep learning-based document modelling for personality detection. ACM Transactions on Intelligent Systems and Technology.
[11] Xue, Z., et al. (2018). Personality recognition from text: A review. IEEE Access, 6, 79886–79899.
[12] Faliagka, E., Tsakalidis, A., & Tzimas, G. (2012). An integrated e-recruitment system for automated personality mining. IT Professional, 15(6), 28–34.
[13] Matz, S. C., Segalin, C., Stillwell, D., & Graepel, T. (2017). Predicting consumer behaviour from personality profiling. Journal of Consumer Psychology, 27(3), 421–436.
[14] Hirsh, J. B., Kang, S. K., & Bodenhausen, G. V. (2012). Personalized persuasion: Tailoring messages to people's personality traits. Psychological Science, 23(6), 578–581.
[15] Floridi, L., & Taddeo, M. (2016). What is data ethics? Philosophical Transactions of the Royal Society A, 374(2083).
[16] Lepri, B., Staiano, J., et al. (2017). Fair, transparent, and accountable prediction: The case of computational personality recognition. IEEE Computer, 50(5), 10–19.
[17] Chamorro-Premuzic, T., & Steinmetz, C. (2021). The business of personality. Harvard Business Review.