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Predictive Modeling of Candidate Personality Traits for Recruitment Using Machine Learning Techniques

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Abstract:
Personality prediction using machine learning has become an essential area of research, particularly in fields such as recruitment, career counselling, and behavioral analysis. Traditional personality assessments, often based on self-reported questionnaires, are subject to human bias and inconsistencies. Recent developments in artificial intelligence and machine learning have led to the creation of automated models for predicting personality that evaluate a range of data types, such as text, social media behaviour, vocal tones, and facial expressions. This literature review examines current studies on personality forecasting, emphasizing various machine learning methods, sources of data, and assessment criteria. Research utilizing classification techniques like support vector machines, random forests, logistic regression, and gradient boosting has shown encouraging outcomes in forecasting personality traits derived from recognized psychological frameworks, such as the Big Five Personality Traits. Moreover, techniques in natural language processing are essential for extracting linguistic characteristics from potential responses to enhance prediction accuracy. Numerous studies have also pointed out the impact of AI in recruitment, illustrating how personality prediction models contribute to diminishing biases, refining decision-making, and optimizing job-candidate alignment. This survey provides a comparative analysis of various approaches, discusses their strengths and limitations, and identifies future research directions for developing more robust, scalable, and interpretable personality prediction systems.

Keywords: personality prediction, machine learning, recruitment, natural language processing, Big Five Personality Traits

1. INTRODUCTION

Personality prediction in recruitment has gained significant attention in recent years as organizations seek data-driven methods to improve hiring decisions. Resumes, interviews, and psychometric testing are all major components of traditional hiring procedures, yet they can be laborious, subjective, and biased by people. Because personality traits influence workplace behaviour, team dynamics, and overall performance, they are important in establishing a person's fitness for a job. With advancements in artificial intelligence and machine learning, automated personality prediction systems have emerged as an efficient alternative, offering a more objective and scalable approach to candidate assessment.

Machine learning techniques enable the analysis of various data sources, including textual responses, social media activity, voice patterns, and facial expressions, to infer personality traits. The Big Five Personality Traits, which evaluate openness, conscientiousness, extraversion, agreeableness, and neuroticism, are the most popular psychological model for classifying personalities. Personality prediction systems can offer insights into candidates' behavioural tendencies by incorporating machine learning algorithms like logistic regression, random forest, support vector machines, and deep learning models. This improves the recruitment process by guaranteeing a better fit between individuals and organizational roles. This literature review aims to explore the various approaches used in personality prediction for recruitment, comparing different machine learning models, data sources, and evaluation metrics. It also examines the benefits and challenges of AI-driven personality assessment in hiring; highlighting how it reduces biases, enhances decision-making, and optimizes job-candidate matching. Finally, this review identifies gaps in existing research and suggests future directions for developing more accurate and interpretable personality prediction systems in recruitment.

2. BACKGROUND AND CONTEXT

Algorithms or mathematical models created for data analysis and prediction or decision-making are known as machine learning (ML) models. They are a core part of artificial intelligence (AI) systems, and they "learn" from patterns in data rather than relying on explicit programming.

A. Machine Learning – An overview

The goal of machine learning (ML), a branch of artificial intelligence (AI), is to develop algorithms that can recognize patterns in data and make judgments without explicit programming. Through the use of examples or prior experiences, this field allows computers to gradually improve their performance on a task. Developing systems that can generalize from the data they are exposed to, enabling them to make precise predictions or choices even with fresh, unknown data, is the core idea of machine learning. ML is used to address difficult issues including fraud detection, predictive analytics, image identification, and tailored recommendations in a variety of industries, including marketing, healthcare, finance, and transportation. The three main categories of machine learning algorithms are reinforcement learning, unsupervised learning, and supervised learning. In supervised learning, each input has a matching output, and the system is trained using labelled data.

In order to generate predictions on fresh, unobserved data, the model must learn a mapping function from the inputs to the outputs. Support vector machines, decision trees, and linear regression are a few types of supervised learning algorithms. Unsupervised learning, on the other hand, works with unlabeled data, in which the algorithm finds latent structures or patterns without labels. Clustering (like k-means) and dimensionality reduction (like principal component analysis) are examples of common unsupervised approaches. Contrarily, Reinforcement Learning focuses on teaching models to make a series of decisions by interacting with their surroundings and rewarding or punishing them according to their behaviour.

Significance of Machine Learning in Recruitment

Machine learning has transformed the recruitment process by introducing data-driven, automated, and unbiased decision-making strategies. Traditional hiring methods, which rely heavily on resumes, cover letters, interviews, and psychometric assessments, are often subjective and time-consuming. Human biases, inconsistencies in evaluation, and limited capacity to analyze large applicant pools contribute to

inefficiencies in recruitment. Recruiters can now rapidly examine large volumes of candidate data, spot trends, and make well-informed hiring decisions thanks to machine learning, which solves these problems. In order to determine a candidate's personality traits based on well-known psychological models like the Big Five Personality Traits, machine learning models can examine their textual responses, social media activity, and other behavioural indicators using natural language processing, sentiment analysis, and predictive analytics.

This automated analysis ensures a more objective assessment, reducing the risk of hiring biases related to gender, ethnicity, or personal preferences. Moreover, machine learning enhances resume screening and job matching by extracting relevant information from resumes and matching candidates to job descriptions based on their skills, experience, and personality traits. This greatly expedites the hiring process and enables hiring managers to concentrate on the best applicants. Furthermore, companies can make proactive hiring decisions that support long-term corporate objectives by training machine learning models to forecast employee performance, retention rates, and job satisfaction. Another crucial benefit is cost and time efficiency. Traditional recruitment requires extensive human effort in short listing candidates, conducting interviews, and evaluating personality traits manually. Machine learning automates these processes, reducing hiring time and minimizing costs associated with bad hires. AI-powered chat bots and virtual assistants further streamline candidate engagement by handling initial screenings, answering FAQs, and providing real-time feedback.

B. Applications of Machine Learning in Recruitment

Machine learning has significantly enhanced recruitment by automating processes, improving efficiency, and reducing biases. Its applications in recruitment span various stages of the hiring process, from candidate sourcing to post-hire analytics. Some key applications include:

1. **Resume Screening and Short listing**

Machine learning algorithms can analyze and rank resumes by extracting relevant information such as skills, experience, education, and certifications. These models use natural language processing to match candidate profiles with job descriptions, reducing manual effort and improving accuracy.

2. **Job Matching and Recommendation Systems**

AI-powered job matching systems assess candidates' skills, experience, and personality traits to recommend the best-fit job roles. These systems benefit both recruiters and job seekers by streamlining the hiring process and improving job satisfaction rates.

3. **Personality Prediction and Behavioural Analysis**

Machine learning models analyze textual responses, voice data, and social media activity to infer personality traits using frameworks such as the Big Five Personality Traits. This helps recruiters assess cultural fit, teamwork potential, and leadership abilities.

4. **Chat bots and Virtual Assistants**

AI-driven chat bots handle initial candidate interactions by answering FAQs, collecting application details, and conducting pre-screening interviews. This enhances candidate experience and reduces the workload on human recruiters.

5. **Interview Analysis and Sentiment Detection**

Machine learning can analyze video and audio interviews using facial recognition and sentiment analysis techniques to assess candidate confidence, emotional intelligence, and engagement levels.

3. RELATED WORK

The use of Personality Prediction systems in recruitment has gained significant attention as organizations seek to optimize their hiring processes by identifying candidates who best fit their work culture and job requirements. High prediction accuracy can be attained by machine learning models, but they may also unintentionally reinforce biases present in the training data, which could result in discriminatory hiring practices.

The paper [1] presents an automated personality prediction system using the Random Forest Algorithm, aiming to improve upon traditional, subjective methods like interviews and surveys. By processing questionnaire responses through data cleaning, encoding, and feature selection, the study trains and tests models—including Logistic Regression and SVM—demonstrating superior performance with Random Forest. Built on the Big Five Personality Traits framework, the system integrates insights from NLP and computational linguistics to offer a scalable, accurate solution with applications in marketing, HR, and mental health evaluation

The paper [2] introduces a machine learning-based system to streamline candidate selection by combining CV analysis with personality prediction. Using Logistic Regression and the Big Five OCEAN model, the system analyzes resumes parsed with Pyre sparser and evaluates personality through aptitude tests processed via NLP techniques like NLTK and TF-IDF. This integrated approach aims to reduce subjectivity in hiring and support recruiters with fair, data-driven decisions. The paper [3] proposes an automated personality evaluation system based on the Big Five (OCEAN) model, using a questionnaire with both statement-based and open-ended questions. Designed to enhance the recruitment process, the system gradually increases question complexity through an uphill algorithm to more accurately assess traits like Openness and Conscientiousness.

Paper [4] presents a machine learning-driven recruitment system that predicts and ranks candidates' personality traits using AI algorithms such as SVM and Naïve Bayes. By incorporating personality questionnaires and video resume analysis, the system automates traditional hiring steps like manual CV screening and subjective assessments. Grounded in the Big Five Personality Traits Model, the approach enhances efficiency and accuracy in candidate evaluation through an integrated E-HR platform. Paper [5] investigates the use of machine learning to predict individuals' MBTI personality types based on text data from online forums. Using models like CNNs, RNNs, and Random Forest, the study analyzes 10,000 self-reported writing samples to identify personality patterns. By linking MBTI types to suitable job roles, the research highlights the potential of personality-based recruitment to improve workplace alignment and efficiency. Paper [6] presents a machine learning approach to classify individuals' personalities using the Big Five Personality Model through questionnaire responses collected via Google Forms. The study utilizes K-Means Clustering to group similar traits and Logistic Regression for classification, based on a dataset of 972 samples. By processing features like age, gender, and trait scores, the model achieved effective prediction accuracy. The paper suggests future enhancements through NLP and deep learning techniques, highlighting the potential of machine learning in behavioural modelling and automated personality analysis.

In paper [7] presents an Automated Personality Classification System using data mining techniques to assess individuals based on the Big Five Personality Model. Targeted at recruitment agencies, the system analyzes responses from a 30-question online test using Naïve Bayes and SVM algorithms to classify personality traits and recommend job fit. Graphical outputs support visual interpretation of results, with

Naïve Bayes achieving the highest accuracy at 60%. The study suggests future improvements through larger datasets, NLP integration, and deep learning models for enhanced classification accuracy. Paper [8] introduces a deep learning-based approach to personality prediction using Twitter data, grounded in the Big Five Personality Traits Model. By analyzing 46,000 tweets from 508 users, the study uses BERT and RoBERTa for feature extraction and employs ensemble learning to enhance classification accuracy. Preprocessing included language translation and text cleaning, while data augmentation through back translation helped address class imbalances. This method demonstrates the potential of social media analysis for scalable, accurate personality assessment. In paper [9] presents a machine learning approach to predicting personality traits using social media text, based on the Myers-Briggs Type Indicator (MBTI) model. Using a Kaggle dataset with over 422,000 posts from 8,675 users, the study applies preprocessing techniques like tokenization, stemming, and TF-IDF for feature extraction. To tackle class imbalance, random oversampling is used, while XGBoost serves as the primary classifier. Model performance is evaluated using 10-fold cross-validation, demonstrating the method's effectiveness for large-scale personality prediction. Paper [10] introduces an advanced personality prediction method using deep learning models—specifically RNNs and ANNs—applied to social media data. Based on the Big Five Personality Traits, the study uses a large dataset from the myPersonality project, incorporating data from 1.33 million Facebook users. After preprocessing text through tokenization, stemming, and normalization, the ANN model is trained using backpropagation and validated with K-fold cross-validation, effectively capturing behavioral patterns for accurate personality classification.

In paper [11] uses machine learning to predict personality traits from social media content, combining the Big Five and MBTI models. Using classifiers like SGD, Logistic Regression, and KNN on 8,600+ entries, the study achieves up to 99% accuracy, with KNN performing best. It highlights social media's potential for accurate, real-time personality prediction. In paper [12] uses LSTM networks to predict personality traits from social media text, leveraging the MBTI dataset from Kaggle. With random oversampling and RMSprop optimization, the model achieves 86.31% accuracy, outperforming traditional methods. The study highlights LSTM's effectiveness for personality prediction in applications like recruitment and personalized marketing. Paper [13] presents a recruitment-focused personality prediction system using aptitude and psychometric tests, with SVM achieving 63% accuracy. By applying the Softmax function and real-time data collection, the system improves over time, enabling automated, fair CV ranking. It streamlines hiring by prioritizing personality-job fit alongside qualifications. Paper [14] examines personality prediction from Twitter data using the Big Five traits and linguistic features from LIWC and the MRC dictionary. Four machine learning models—SVM, Naïve Bayes, Random Forest, and Logistic Regression—are evaluated, with SVM achieving the highest accuracy at 88%. The study highlights the effectiveness of machine learning for social media–based personality assessment and its potential in marketing and personalized services. Paper [15] analyzes Twitter data for sentiment classification and MBTI personality prediction using BERT and six machine learning classifiers. The SVM model achieved the highest accuracy of 88.19% on a large Kaggle dataset, demonstrating the value of social media analysis for recruitment, marketing, and psychological assessment.

In paper [16] explores machine learning and deep learning methods for predicting Big Five personality traits from social media text. Evaluating various models—including SVM, XGBoost, CNN, and LSTM—across multiple datasets, the study finds that deep learning approaches, especially CNN with GloVe embeddings and LSTM models, outperform traditional classifiers. The research underscores the

potential of social media data for accurate personality analysis in fields like psychology, marketing, and recruitment.Paper [17] predicts Big Five personality traits by analyzing Facebook posts using machine learning algorithms like Linear SVC, Logistic Regression, and Random Forest. Tested on 27,182 posts from 100 users, the Linear SVC model achieved the highest accuracy of 89.37%. The study highlights the effectiveness of machine learning in deriving personality insights from social media for applications such as advertising, recruitment, and psychology.Paper [18] proposes a hybrid model combining fuzzy neural networks and deep neural networks to predict Big Five personality traits from social network data. By integrating structural and linguistic features through a two-stage fusion, the model achieves 83.2% accuracy, outperforming prior methods. The study emphasizes applications in customer relationship management, targeted advertising, and e-commerce personalization. Paper [19] uses machine learning and NLP to predict Big Five personality traits from CVs and free-text responses of 8,313 applicants. The models showed moderate accuracy, outperforming human recruiters in personality judgment, and matched self-reported traits in predicting vocational interests. This approach offers a scalable, privacy-conscious tool for improving candidate evaluation in recruitment. Paper [20] presents a framework for predicting Big Five personality traits by analyzing social media interactions like likes, comments, and shares. Using data mining, sentiment analysis, and NLP, the study automates personality identification, offering a scalable alternative to traditional questionnaires. This approach has applications in marketing, HR, and behavior analysis.Paper [21] proposes a deep learning method using BERT, RoBERTa, and XLNet to predict personality from Facebook and Twitter texts. By combining multiple social media sources and model averaging, it achieves high accuracy—86.2% on Facebook and 88.5% on Twitter—surpassing previous approaches and showing promise for applications like recruitment and advertising.

In paper [22] proposes a personality prediction system combining text and facial image analysis using SVM. It preprocesses text and detects faces with Haar Cascade to assess Big Five traits, aiming to support workplaces and schools. Future work includes handwritten text analysis and an Android app. Paper [23] introduces TraitBertGCN, a hybrid model combining BERT and Graph Convolutional Networks with data fusion for personality trait prediction. It integrates a pre-trained BERT for language understanding and a three-layer GCN to capture structural relationships, using essays and myPersonality datasets to enhance generalizability. The model achieves average accuracies of 77.42% and 87.59% on the respective datasets, outperforming previous methods. This work demonstrates the power of combining deep learning and graph-based techniques, with applications in psychology, marketing, and HR management. Paper [24] uses Twitter data and machine learning, including fine-tuned BERT, to predict Big Five personality traits. It applies various feature extraction methods and finds that analyzing individual tweets improves accuracy. The approach outperforms other models, showing promise for marketing, recruitment, and user profiling. The paper [25] proposes an ontology-based system to predict Enneagram personality types from Twitter text. Using preprocessing, bag-of-words feature representation, and ontology-driven feature selection, the model identifies personality based on probability distributions.

4. SYSTEMATIC ANALYSIS

SL No	REF .NO	METHOD	MERITS	DATASET	ACCURACY	DEMERITS
1	Sakshi Shenavi et al. [1]	Random Forest	High Accuracy Versatility Scalability	responses from individuals who completed the questionnaire	82%	Data Collection Complexity, Computational Cost, Overfitting Risk
2	Vijayanirmala B et al. [2]	Logistic Regression, Big Five Model, NLP, TF-IDF Algorithm	Efficient Recruitment Process, Fair Selection, Scalability	CVs/resumes and personalitytest scores from various job applicants.	72%	Data Privacy Concerns, Algorithmic Limitations, Self-report Bias
3	Siddharth Bhatt et al. [3]	Big Five (OCEAN) Model,uphill algorithm	Efficient &Automated ,Improves Hiring Quality,Reduces Bias	OCEAN model-based assessments.	90%	Limited Scope,QuestionnaireDependence,Potential for Manipulation

4	L. Ancy Geoferla et al. [4]	Support Vector Machine (SVM), Naïve Bayes Algorithm	Reduces HR workload and recruitment time. Automated ranking ensures faster and unbiased selection. Video resume analysis enhances personality assessment beyond textual resumes.	Kaggle's Personality Prediction Datasets	SVM Accuracy-81.5%,Naïve Bayes Accusssssssracy-72%	Potential bias, applicants to have stable internet access,Limited understanding of complex human behavior
5	P.Jeevana Jyothi et al. [5]	• CNN,RNN,Random Forest	High Accuracy, Text-Based Analysis, Automated Personality Prediction	10,000 text samples from online forums	CNN-84% RNN-70% Random forest-50%	Dataset Dependency,Limited to Text Data, Bias in Self-Reported Data
6	Devesh Agarwal et al. [6]	K-Means Clustering Algorithm, Logistic Regression	Automated Personality Classification, Application in Multiple Fields, Big Five Personality Mode	real-time participants via Google Forms surveys	71%	Limited Dataset,Self-Reported Data Bias, Clustering Limitations

7	Sandhya Katiyar et al. [7]	SVM, Naïve Bayes Algorithm	Automated Personality Classification, Graph-Based Job Suitability Analysis,Provides Self-Insight	responses from applicantswho took theonline personality survey.	60%	low Accuracy (60%),Limited Dataset, SVM Performance Issues
8	Eggi Farkhan Tsani et al. [8]	BERT, RoBERTa	Effective for Social Media, Transformer-Based Approach,Data Augmentation Enhanced Performance	Twitter Dataset	73%	Computationly Expensive,Limited to Text Data, Class Imbalance Issue
9	Alam Sher Khan et al. [9]	XGBoost	High Accuracy, Handles Data Imbalance, Efficient Model	Kaggle (Personality Cafe platform)	85%	Dataset Bias, Overfitting Risk, Limited to Textual Data
10	Harshita Samota et al. [10]	RNN,ANN	High Accuracy,Automation, Scalability	myPersonality project database	86.07%	Privacy Concerns, Computationally Expensive, Overfitting Risk
11	Dharshni P et al. [11]	SGD Classifier Logistic Regression K-Nearest Neighbors (KNN) Classifier	predicting personality using positive and negative traits.	Myers-Briggs Type Indicator (MBTI) dataset	95%	Privacy concerns

12	Mawadatul Maulidah et al. [12]	Long Short-Term Memory (LSTM)	Use of LSTM for MBTI prediction, Optimized hyperparameters	Personality Cafe.com.	86.31%	Reliance on a single dataset, Risk of overfitting
13	Hemalatha et al. [13]	Support Vector Machine (SVM)	Automates applicant ranking, reducing bias.	aptitude and psychometric tests	63%	Risk of biased data affecting predictions.
14	SumanMaloji et al. [14]	Support Vector Machine (SVM) Random Forest Algorithm Naïve Bayes Algorithm Logistic Regression	Focuses on the Big Five Personality Traits, which are widely accepted in psychology.	10,000 tweets from Twitter users	Support Vector Machine (SVM): 88% accuracy Naïve Bayes Algorithm: 87.5% accuracy Logistic Regression: 62.5% accuracy Random Forest Algorithm: 37.5% accuracy	The dataset lacks diversity, potentially limiting generalizability.
15	Prajwal Kaushal et al. [15]	BERT	Uses BERT for sentiment analysis, which improves contextual understanding of tweets.	Kaggle MBTI dataset	82.58%	The dataset is imbalanced, affecting the reliability of some personality classifications.

16	Hetal Vora et al. [16]	Support Vector Machine (SVM)	Covers multiple personality theories, including the Big Five, MBTI, and Cattell's 16PF	MyPersonality Dataset	80%	Lacks a concrete experimental implementation, focusing more on summarizing existing works.
17	Mervat Ragab Bakry1 et al. [17]	Linear Support Vector Classification (LSVC),Logistic Regression (LR),Multinomial Naïve Bayes (MNB), Random Forest Classifier (RFC)	Incorporates natural language processing techniques to analyze text-based user activities.	100 Facebook profiles with 27,182 posts	Linear SVC achieved the highest accuracy: 89.37%,Logistic Regression: 87.11%,Multinomial Naïve Bayes: 78.81%, Random Forest Classifier: 54.44%	No deep learning techniques like transformers or neural networks were explored for potential accuracy improvements.

5. CONCLUSION

The hiring process has changed dramatically as a result of machine learning, which has made it more objective, data-driven, and efficient. Resume screening, job matching, personality prediction, and interview analysis have all been automated using a variety of techniques, including support vector machines, random forests, logistic regression, deep learning, and natural language processing. These techniques enable organizations to assess candidates based on their skills, experience, and behavioural traits, reducing reliance on traditional, often biased, human evaluations. Machine learning models provide several advantages, including faster hiring decisions, reduced recruitment costs, improved candidate-job fit, and enhanced diversity in hiring by minimizing human biases. Additionally, predictive analytics help organizations forecast employee performance and retention, allowing for better long-term workforce planning. However, despite these benefits, machine learning in recruitment also comes with challenges. If models are trained on historical data that reflects preexisting biases in hiring procedures, algorithmic biases may still exist. As AI-driven systems handle vast amounts of personal and professional data, privacy and security issues surface. Large datasets and significant processing power are also necessary for deep learning models to function well, which may be a barrier for smaller businesses. Another challenge is the lack of explainability in some AI-driven decisions, making it

difficult for recruiters to understand why a candidate was shortlisted or rejected. While machine learning improves hiring efficiency, it cannot fully replace human judgment, especially in assessing soft skills, emotional intelligence, and cultural fit. To address these challenges, future research should focus on improving model transparency, ensuring ethical AI implementation, and integrating hybrid approaches that combine human expertise with machine learning insights. As advancements continue, machine learning will play an increasingly vital role in recruitment, making the process more scalable, accurate, and aligned with organizational goals.

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