JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

CANDID-AI: AN AI-POWERED MULTIMODAL PRE-INTERVIEW SCREENING SYSTEM FOR INTELLIGENT RECURITMENT

An Explainable and Human-Centric Recruitment Framework

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Abstract: This paper presents an AI-powered pre-interview screening system designed to assist HR professionals in conducting objective, scalable, and transparent candidate evaluations. The proposed system introduces a multi-modal and human-centric assessment framework that evaluates candidates across multiple dimensions including resume relevance, language quality, communication fluency, originality of responses, test performance, confidence level, and identity authenticity. The system processes diverse input modalities such as resumes, textual answers, spoken responses, and webcam-captured images to perform comprehensive candidate analysis. Automated resume screening is performed using semantic similarity rather than keyword matching, while dynamically generated assessments evaluate domain knowledge and reasoning ability. A biometric face verification module ensures candidate authenticity before assessment access. Outputs from all evaluation components are fused into a unified scoring mechanism supported by explainable artificial intelligence techniques. An interactive HR dashboard presents transparent rankings and justifications to support informed hiring decisions.

IndexTerms **- Artificial Intelligence, Recruitment Automation, Resume Screening, Explainable AI, Face Recognition, HR Analytics**.

I. INTRODUCTION

The recruitment process is a fundamental organizational function; however, conventional hiring methodologies often suffer from inefficiency, subjectivity, and scalability limitations. Resume-based shortlisting primarily evaluates academic qualifications and experience while neglecting essential attributes such as communication skills, reasoning ability, confidence, and behavioral consistency. As applicant volumes increase, manual screening becomes time-consuming and susceptible to unconscious bias.

Recent advancements in Artificial Intelligence (AI), Natural Language Processing (NLP), and Computer Vision have enabled intelligent systems capable of evaluating candidates beyond static resumes. Modern recruitment platforms can analyze written responses, spoken communication, and visual cues, providing a more holistic understanding of candidate suitability. Despite these advancements, many AI-driven hiring systems operate as black boxes, offering limited transparency and raising concerns related to fairness and trust.

To address these challenges, this paper proposes an AI-powered pre-interview recruitment framework that integrates multi-modal candidate evaluation with explainable decision-making mechanisms. The system assesses candidates using resume analysis, automated assessments, grammar evaluation, speech fluency analysis, plagiarism detection, biometric verification, and behavioral confidence analysis. Additionally, the framework incorporates LIME (Local Interpretable Model-Agnostic Explanations) to provide human-readable explanations for AI-driven decisions. The proposed system emphasizes transparency, fairness, and scalability, enabling HR professionals to make data-driven and objective hiring decisions.

II. LITERATURE SURVEY

A) AI-Driven Resume Screening and Ranking

Resume screening has evolved significantly with the adoption of intelligent systems that improve both speed and accuracy in shortlisting candidates. Many frame-works now use machine learning algorithms like K-Nearest Neighbors (KNN), SVM, and XGBoost to assess resumes based on skill relevance and job fit. Semantic similarity techniques—such as cosine similarity and Euclidean distance—are often integrated with models like DistilBERT and XLM to match resumes with job descriptions across languages [2]. Natural Language Processing (NLP) enhances this by extracting structured data from varied resume formats. However, the real impact of such systems on final hiring decisions remains underexplored, especially when faced with inconsistent templates [15]. Some hybrid models also combine neural networks with genetic algorithms to optimize candidate job alignment, though these often assume ideal conditions and lack adaptability to diverse recruitment scenarios [14].

B) Behavioral Analysis in Recruitment

Modern recruitment is no longer limited to assessing technical aptitude alone; emotional expressiveness, speech confidence, and interpersonal behavior are being increasingly factored into hiring decisions. AI-driven tools now analyze behavioral cues such as tone, clarity, and confidence in pre-interview sessions using emotion recognition and speech-to-text technologies. Such behavioral analysis adds a human dimension to automated recruitment systems, enhancing the depth of evaluation [13]. Systems integrating these features aim to capture emotional intelligence and fluency, offering insights into how well a candidate might handle client facing or leadership roles [10]. These traits, previously assessed subjectively, are now quantifiable through machine learning, improving fairness and transparency in early screening stages [8].

C) Cognitive Evaluation and Decision-Making Abilities

Structured interviews in modern recruitment systems now delve into candidates' cognitive capabilities, evaluating skills like logical reasoning, problem-solving, and decision-making. Among the machine learning techniques used for this purpose, Random Forest has shown notable effectiveness, achieving 72 accuracy in predicting candidate suitability [11]. These evaluations help uncover strong analytical thinkers, which is especially important for technical positions. However, such outcomes are highly dependent on the quality and structure of the input data. Complementarily, logistic regression models have also demonstrated strong predictive power while offering a level of interpretability that aligns well
with real-world HR needs [8].

D) Explainable AI and Ethical Transparency

A distinguishing feature of the proposed recruitment system is its integration of Explainable AI (XAI), which enhances transparency in automated decision-making. By incorporating interpretability frameworks, the system enables HR professionals to understand the rationale behind candidate evaluations, such as whether a low score results from inconsistent reasoning or weak emotional indicators [8]. This level of transparency is especially critical given the history of algorithmic bias in recruitment tools, such as Amazon's AI system that was found to disadvantage specific demographic groups, highlighting the risks of opaque machine learning models [5]. To mitigate such concerns, embedding explainability into deep learning predictions is essential not only for ethical alignment but also to meet evolving regulatory standards on AI accountability [9]. In addition to technical considerations, research grounded in Partial Least Squares Structural Equation Modeling (PLS-SEM) indicates that factors like organizational readiness and performance expectancy significantly influence the willingness to adopt AI-based hiring tools [4]. These findings underscore the importance of developing systems that are not only efficient but also trustworthy and aligned with human-centric values. Ultimately, fairness and inclusivity in recruitment depend on maintaining a balance between algorithmic automation and responsible oversight.

E) Integrated and Scalable HR Systems

AI systems must not only demonstrate intelligence but also scalability and adaptability across various industry domains. Modular architectures allow the customization of hiring pipelines based on role-specific competencies—such as prioritizing emotional intelligence for customer-facing positions and analytical reasoning for technical roles. This flexibility enhances the sustainability of recruitment practices, aligning with corporate goals like operational efficiency, environmental responsibility, and workforce diversity. Additionally, research highlights that AI's ability to automate resume screening and enhance analytical recruitment capabilities can lead to significant cost reductions in the hiring process [6].The application of AI in supporting Green HRM (GHRM) initiatives is especially noteworthy. By digitizing hiring processes, companies reduce the need for paper-based operations, thereby contributing to sustainability goals while simultaneously enhancing organizational performance. However, to fully leverage these benefits, challenges such as data privacy concerns, digital literacy, and long-term infrastructure sustainability need to be adequately addressed [7].

II. PROPOSED SYSTEM ARCHITECTURE

The proposed system is designed as a web-based intelligent recruitment and pre-interview assessment platform that supports interaction between candidates and HR professionals. The architecture follows a modular design, where each module performs a specific evaluation task while contributing to a centralized and explainable decision layer. The recruitment workflow begins

with candidate registration and data submission. The system collects multi-modal inputs including resume documents, textual responses, audio recordings, and webcam images. These heterogeneous inputs enable comprehensive evaluation of cognitive ability, communication effectiveness, originality, and identity authenticity.

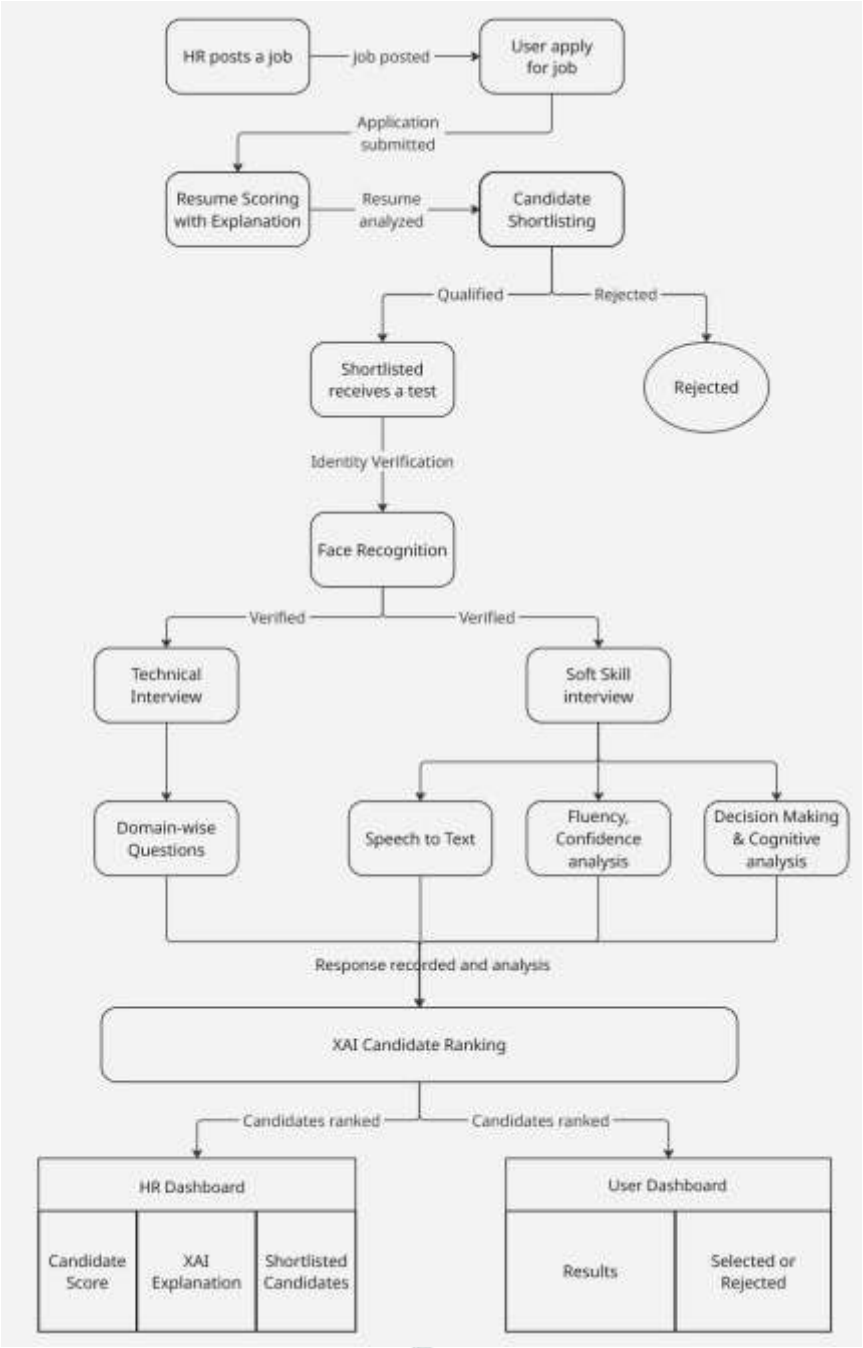

Fig. Proposed System Architecture

A. Resume Processing and Semantic Scoring

Candidate resumes uploaded in PDF or DOCX format are converted into structured plain text using pdfplumber and python-docx libraries. The extracted resume content and job description are passed to a large language model via the Gemini API to perform semantic similarity analysis. Unlike traditional keyword matching, this approach evaluates contextual alignment between candidate skills and job requirements. The model generates a relevance score ranging from 0 to 100 along with a detailed justification explaining the degree of alignment. This enables intelligent and context-aware resume shortlisting.

B. Dynamic Assessment Generation

The assessment module generates domain-specific evaluation content using the Groq API integrated with large language models. Based on the selected job role and difficulty level, the system dynamically generates multiple-choice questions, logical aptitude problems, and scenario-based reasoning tasks. Questions are produced in structured JSON format to support automated rendering and evaluation. This approach eliminates manual question creation and ensures adaptive testing aligned with job requirements.

C. Grammar Evaluation Module

Candidate textual responses are analyzed using the LanguageTool API, which evaluates grammar errors, spelling mistakes, and sentence structure inconsistencies. The identified linguistic issues are quantified and contribute to the candidate's written communication score, enabling objective evaluation of language proficiency.

D. Fluency and Communication Analysis

Spoken responses are processed using AssemblyAI, which extracts speech-related features such as fluency score, pause frequency, filler word usage, and speech clarity. These metrics serve as indicators of communication effectiveness and confidence, particularly relevant for roles requiring strong interpersonal skills.

E. Plagiarism and Authenticity Detection

To ensure originality, candidate textual responses are evaluated using the Sapling AI API, which detects plagiarism probability and AI-generated content likelihood. This module preserves assessment integrity by preventing copied or machine-generated answers.

F. Face Recognition and Biometric Verification

A biometric authentication module ensures candidate identity verification during assessments. The module employs Flask for backend services, OpenCV DNN (SSD-ResNet) for face detection, and FaceNet (keras-facenet) for facial feature extraction. Facial embeddings are generated and compared using Euclidean distance:

$$d = \| E_{ref} - E_{live} \|$$

If the distance is below a threshold of 0.55, the candidate is authenticated. Multiple successful matches are required to improve robustness and reduce spoofing risks.

G. Confidence Assessment Module

The system includes a confidence analysis module that evaluates non-verbal behavioral cues such as facial posture and head orientation. A ResNet-18 Convolutional Neural Network classifies candidates into confident or unconfident categories. The model is trained using the Confident–Unconfident Dataset (Kaggle) and produces a confidence probability score that contributes to the overall behavioral evaluation.

H. Explainable Decision Fusion using LIME

All evaluation outputs—including resume relevance, assessment performance, grammar quality, fluency metrics, plagiarism results, confidence score, and identity verification status—are aggregated into a unified scoring layer. To ensure transparency, LIME is employed to generate localized explanations identifying influential features affecting candidate evaluations. This enables HR professionals to understand and trust AI-generated recommendations.

I. Decision Support and HR Dashboard

The final candidate evaluation is presented through an interactive HR dashboard displaying resume scores, test results, communication metrics, authenticity indicators, and final composite scores with explanations. This transforms the system into a decision-support tool rather than a black-box automation solution.

IV. RESULTS AND ANALYSIS

TABLE I
MODULE PERFORMANCE METRICS

Module	Metric	Score
Resume Semantic Matching (LLM)	Accuracy (%)	89
Confidence Classification	Accuracy (%)	90.1
Face Recognition	Accuracy (%)	93.3

This section presents the evaluation outcomes of the proposed AI-powered pre-interview recruitment framework, which was tested using real candidate data, including resumes, textual responses, audio recordings, and facial images. The analysis demonstrates that the integrated AI-based modules perform effectively in providing a holistic candidate assessment, with biometric verification and confidence analysis achieving the highest accuracy among all components. Behavioral and communication analysis revealed notable differences in candidates' communication effectiveness, where individuals exhibiting fewer grammatical errors, reduced filler word usage, and stable speech patterns obtained higher communication scores, highlighting the suitability of these metrics for roles requiring strong verbal and written skills. Additionally, the plagiarism detection module successfully identified copied or AI-generated responses, thereby ensuring assessment integrity, while biometric verification reliably authenticated candidate identities using facial embeddings and Euclidean distance thresholding. The confidence assessment module further contributed to behavioral evaluation by classifying candidates based on non-verbal cues such as facial posture and head orientation. Finally, all module outputs were aggregated into a unified scoring mechanism,

and LIME-based explanations identified resume relevance and confidence score as the most influential features, thereby enhancing transparency and supporting informed and explainable HR decision-making.

V. CONCLUSION

The proposed system introduces a comprehensive and intelligent recruitment framework by leveraging Explainable Artificial Intelligence (XAI) and Machine Learning (ML) to enhance candidate evaluation processes. It captures and analyzes multi-dimensional inputs such as emotional tone, cognitive reasoning, and communication clarity using advanced deep learning models. The integration of explainability tools such as SHAP, LIME, and attention mechanisms ensures that every decision made by the system is transparent and understandable. This architecture empowers HR professionals with unbiased, consistent, and interpretable assessments, reducing manual effort and human error. By aligning AI insights with human-centered evaluation, the system promotes fairness, accountability, and trust in modern hiring practices, ultimately contributing to more ethical and data-driven talent acquisition.

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