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# InterviewBo: Multimodal Intelligence System for End-to-End Recruitment Process Automation and Skill Interpretation

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***Abstract*—**Recruitment preparation has become more demanding as modern hiring processes evaluate not only technical knowledge but also problem-solving ability, academic performance, communication clarity, and domain understanding. Traditional mock interviews, which rely on generic questions and subjective feedback, often fail to provide candidates with clear, personalized insights into their real performance. As a result, many candidates attend actual interviews without knowing their strengths, weaknesses, or the specific areas that need improvement. To address this gap, this project presents an AI-Driven Mock Interview Platform that simulates a realistic interview environment and evaluates candidates through multiple intelligent assessment stages. Sentence-BERT (SBERT) is used for profile analysis, enabling the system to understand resume content, technical skills, project descriptions, completed courses, selected job role, and academic details such as 10th and 12th marks and college CGPA. This contextual understanding helps generate role-specific and profile-relevant interview questions instead of generic ones. Aptitude and cognitive performance are assessed using a Gradient Boosting Classifier (GBC), while coding performance is evaluated through Code2Vec embeddings to analyze program structure and logic from the submitted code. A T5 based question generator enables the HR avatar to ask personalized questions, and candidate answers are evaluated using NLP for relevance, clarity, and understanding. Academic data, skills, aptitude, coding, and interview performance are combined into a final score. Using SHAP for explainability, the system shows how each factor influenced the result, highlights strengths and weaknesses, and recommends suitable courses and job roles to improve career readiness.

**Keywords--** Artificial Intelligence (AI), Mock Interview System, Natural Language Processing (NLP), Sentence-BERT (SBERT), Gradient Boosting Classifier (GBC), Code2Vec, Explainable AI (XAI), SHAP, Automated Interview Evaluation.

## I. INTRODUCTION

In today's competitive job market, interview preparation has become increasingly important for students and job seekers. Interviews play a critical role in the recruitment process, as they evaluate candidates based on multiple factors such as technical knowledge, problem-solving ability, communication skills, and cultural fit within an organization. However, traditional mock interview methods often rely on generic questions and subjective feedback, which do not provide candidates with a clear understanding of their strengths and weaknesses.

Most existing systems fail to offer personalized assessments and comprehensive performance analysis. Candidates are typically evaluated separately on aptitude, coding, or communication skills without integrating these aspects into a unified evaluation. Additionally, the lack of transparency in scoring makes it difficult for candidates to trust the results and identify areas for improvement. As a result, many candidates attend real interviews without adequate preparation or awareness of their performance gaps.

To address these challenges, this project introduces an AI-powered mock interview platform that simulates real interview scenarios and provides intelligent, data-driven evaluation. The system analyzes candidate profiles—including academic performance, technical skills, and project experience—using advanced machine learning and natural language processing techniques. Based on this analysis, it generates personalized interview questions and evaluates candidate responses across multiple dimensions such as aptitude, coding ability, and communication clarity.

Furthermore, the platform integrates Explainable AI techniques to provide transparent feedback, clearly showing how different factors contribute to the final performance score. It also offers personalized recommendations for courses and suitable job roles, helping candidates improve their skills and make informed career decisions. Overall, the proposed system enhances interview readiness by delivering a comprehensive, automated, and user-centric evaluation framework.

## II. LITERATURE REVIEW

Recent advancements in artificial intelligence have significantly transformed interview preparation and recruitment systems. AI-based interview platforms aim to improve candidate assessment by integrating machine learning, natural language processing (NLP), and explainable AI techniques. Studies such as AI-powered virtual interviewers and serious game-based systems demonstrate how intelligent agents can simulate realistic interview environments and enhance candidate engagement.

Several works focus on adaptive interview strategies, where systems analyze candidate behavior and dynamically adjust questions to improve evaluation accuracy. Research in fairness-aware and multimodal interview assessment highlights the importance of reducing bias and incorporating multiple evaluation factors such as speech, behavior, and technical skills.

AI-driven question generation and recommendation systems have also gained attention, where transformer-based models generate role-specific interview questions. Similarly, NLP-based answer evaluation techniques are used to assess semantic relevance and communication skills. These approaches improve personalization compared to traditional generic mock interviews.

Moreover, prior studies emphasize the use of machine learning models for candidate evaluation, including aptitude analysis, coding assessment, and personality prediction. However, many existing systems lack a unified evaluation framework and fail to provide transparent feedback. Recent works address this limitation by incorporating explainable AI methods to interpret model decisions and improve user trust.

Overall, the literature indicates a shift from manual and generic interview preparation methods to intelligent, data-driven systems that provide personalized assessment, multi-stage evaluation, and explainable feedback, forming the foundation for advanced AI-driven mock interview platforms.

## III. RESEARCH GAP

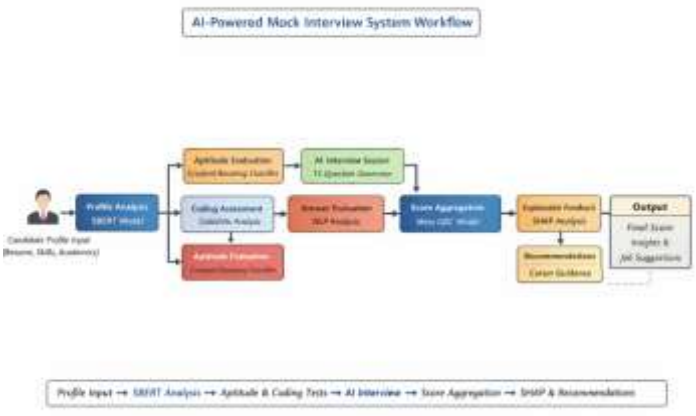
Existing mock interview systems primarily rely on generic questioning, manual evaluation, and isolated assessment methods, which fail to provide personalized and comprehensive candidate analysis. Most platforms do not integrate multiple evaluation factors such as academic performance, technical skills, aptitude, and communication ability into a unified scoring system.

Additionally, current approaches lack transparency in evaluation, offering limited insights into how performance scores are derived. There is also insufficient use of explainable AI techniques to justify decisions and guide candidate improvement.

Therefore, a need exists for an intelligent, integrated, and explainable AI-driven mock interview system that delivers personalized assessment, transparent feedback, and career-oriented recommendations.

## IV. PROPOSED SYSTEM /METHODOLOGY

The proposed system is an AI-driven Mock Interview Platform designed to provide intelligent, personalized, and explainable interview preparation. The system integrates machine learning (ML) and natural language processing (NLP) techniques to simulate real interview scenarios and evaluate candidates across multiple dimensions including academics, aptitude, coding skills, and communication ability




**Overview of the Proposed System**

The platform automates the complete interview preparation workflow, starting from candidate profile analysis to final performance evaluation and career recommendation. It eliminates the limitations of traditional mock interviews by providing personalized questions, objective evaluation, and transparent feedback.

## V. SYSTEM ARCHITECTURE AND WORKFLOW

### A. Candidate Profile Analysis (SBERT)

The system uses Sentence-BERT (SBERT) to analyze candidate profiles including resume content, academic records, skills, and projects.

- Converts textual data into semantic embeddings
- Captures contextual meaning rather than keyword matching
- Enables generation of role-specific interview questions

### A. Aptitude Evaluation (Gradient Boosting Classifier)

A Gradient Boosting Classifier (GBC) is used to evaluate cognitive and analytical abilities.

- Inputs: accuracy, difficulty level, response time
- Output: aptitude performance score
- Uses sequential learning to improve prediction accuracy

### B. Coding Assessment (Code2Vec)

The system evaluates programming skills using Code2Vec embeddings.

- Converts source code into vector representations
- Analyzes logic flow, structure, and implementation quality
- Generates a coding performance score

### C. Personalized Interview Generation (T5 Model)

A **T5 (Text-to-Text Transfer Transformer)** model generates interview questions.

- Input: candidate profile + job role
- Output: personalized interview questions
- Ensures realistic and domain-specific interview simulation

### D. Answer Evaluation (NLP-Based Analysis)

Candidate responses are evaluated using NLP techniques.

- Measures semantic similarity with expected answers
- Evaluates clarity, relevance, and understanding
- Produces an interview performance score

### E. Performance Aggregation (Meta GBC)

All evaluation scores are combined using a **Meta Gradient Boosting model**.

- Inputs: academic score, aptitude score, coding score, interview score
- Output: final comprehensive performance score
- Ensures balanced and multi-dimensional evaluation

### F. Explainable Feedback (SHAP)

To improve transparency, the system uses **SHAP (SHapley Additive Explanations)**.

- Identifies contribution of each feature to final score
- Highlights strengths and weaknesses
- Provides interpretable insights to users

### 8) Recommendation System

Based on evaluation results, the system provides:

- Skill improvement suggestions
- Course recommendations
- Suitable job role suggestions


### System Architecture

The proposed AI-powered mock interview system follows a **layered architecture**, where each layer performs a specific function in the overall workflow.

### A. Input Layer (User Data Acquisition)

This layer collects all required inputs from the candidate.

- Resume upload (text/docx)
- Academic details (10th, 12th, CGPA)
- Skills, projects, certifications
- Selected job role

### B. Preprocessing Layer

This layer prepares the input data for analysis.

- Text cleaning and normalization
- Resume parsing
- Feature extraction from academic and skill data

### C. Profile Analysis Layer (SBERT)

The AI layer is the core component responsible for intelligent candidate evaluation. It consists of multiple specialized models:

**D. Assessment Layer**

This layer evaluates different aspects of candidate performance through multiple modules:

**a) Aptitude Evaluation (GBC)**

- Uses Gradient Boosting Classifier
- Evaluates reasoning and cognitive ability

**b) Coding Evaluation (Code2Vec)**

- Analyzes program structure and logic
- Generates coding score

**c) Interview Module (T5 + NLP)**

- T5 generates personalized questions
- NLP evaluates candidate responses

## VI. ALGORITHMS AND MODELS USED

The proposed system integrates multiple machine learning and deep learning models to enable accurate, automated, and multimodal candidate evaluation.

**A.Sentence-BERT(SBERT):**

Sentence-BERT is used for candidate profile analysis. It converts resume content, skills, academic details, and project descriptions into semantic embeddings. These embeddings capture contextual meaning and enable:

- Semantic similarity matching
- Profile understanding
- Context-aware interview question generation

SBERT improves efficiency compared to traditional BERT by using a Siamese network architecture for faster similarity computation.

**B.Gradient Boosting Classifier(GBC):**

The Gradient Boosting Classifier is used for:

- Aptitude and cognitive skill evaluation
- Final performance score aggregation (Meta GBC)

It is an ensemble learning algorithm that builds models sequentially, where each new model corrects the errors of the previous one. It analyzes features such as:

- Accuracy
- Response time
- Problem-solving patterns

This ensures robust and accurate prediction of candidate performance.

**C. Code2Vec:**

Code2Vec is used for programming competency analysis. It converts source code into vector representations by analyzing:

- Abstract Syntax Trees (AST)
- Code structure and logic paths

Using attention mechanisms, it generates embeddings that capture semantic meaning of code, enabling evaluation of:

- Code quality
- Logic correctness
- Implementation efficiency

**D. T5 Transformer Model:**

The T5 model is used for personalized interview question generation. It follows a text-to-text framework where:

- Input: Candidate profile context
- Output: Role-specific interview questions

Fine-tuning allows the model to generate relevant and domain-specific questions based on candidate background.

**E. SHAP (SHapley Additive Explanations):**

SHAP is used for Explainable AI (XAI) in the system. It interprets model predictions by calculating the contribution of each feature to the final score. It helps in:

- Identifying strengths and weaknesses
- Providing transparent feedback
- Supporting decision-making

**F.Meta Learning Model (Final Scoring Model):**

A Meta Gradient Boosting model combines outputs from:

- Profile analysis
- Aptitude evaluation
- Coding performance
- Interview response analysis

It generates a comprehensive final performance score, ensuring balanced evaluation across all factors.

## VII. RESULTS AND DISCUSSION

The proposed AI-driven recruitment system was implemented and evaluated using a multimodal dataset consisting of resumes, aptitude test records, coding submissions, and interview audio-video data. The system successfully automated all stages of recruitment, from resume screening to final decision-making.

**A. System Performance:**

The proposed system successfully generated personalized interview questions using SBERT and T5 models. The Gradient Boosting Classifier (GBC) and Code2Vec effectively evaluated aptitude and coding performance. The system achieved reliable accuracy in multi-stage candidate assessment.

**B. Functional Validation:**

All modules, including resume analysis, question generation, aptitude testing, coding evaluation, and score aggregation,

were validated through testing. Results confirm correct functionality and seamless integration across modules.

### C. Performance Analysis:

The system handled multiple users efficiently and maintained stable performance. Most operations, including question generation and evaluation, were completed within acceptable time limits, with minor delays observed in complex coding analysis.

### D. Explainability and Feedback:

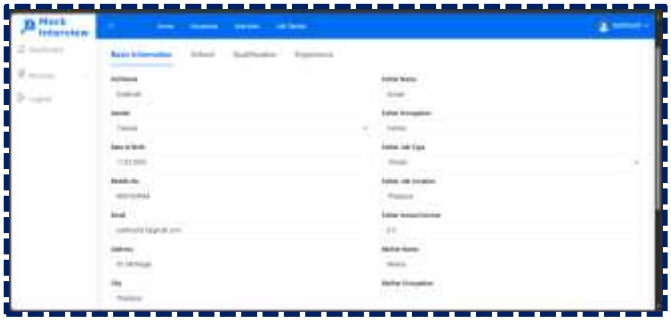
The integration of SHAP provided transparent evaluation by explaining the contribution of each factor to the final score.

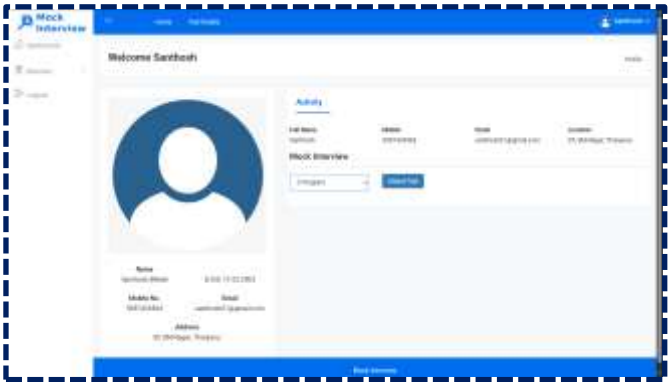
The system effectively identified strengths, weaknesses, and provided course and job recommendations.

### E. Discussion:

The results show that the system overcomes limitations of traditional methods by offering personalized, comprehensive, and explainable evaluation. However, improvements are needed in NLP response interpretation and coding evaluation efficiency.

## Screenshots:






### A. Limitations and Observations:

- NLP-based answer evaluation may misclassify vague or partially correct responses.
- Coding evaluation shows slight delay for complex or large programs.
- System performance may degrade under high concurrent user load.
- Limited dataset size may affect model generalization and accuracy.
- Current system supports limited resume formats and structured inputs.
- Real-time emotional or speech-based analysis is not included.

**Observations:**

- Personalized question generation significantly improves interview relevance.
- Multi-stage evaluation provides a more comprehensive candidate assessment.
- Explainable AI (SHAP) enhances transparency and user trust.
- Integration of aptitude, coding, and interview modules improves scoring accuracy.
- System performs reliably under moderate workload conditions.
- Candidates benefit from clear feedback and targeted career recommendations.

### B. Discussion Summary

The proposed system effectively integrates profile analysis, aptitude testing, coding evaluation, and NLP-based interview assessment into a unified platform. Personalized question generation improves interview relevance, while multi-stage evaluation ensures comprehensive candidate assessment. The use of explainable AI enhances transparency and user trust. Despite minor limitations in coding evaluation speed and NLP accuracy, the system demonstrates reliable performance and provides an efficient solution for improving interview readiness and career guidance.

## VIII. PERFORMANCE EVALUATION

The performance of the proposed AI-powered mock interview system was evaluated using functional, performance, and security testing methodologies.

The system demonstrated reliable operation across all major modules, including profile analysis, question generation, aptitude assessment, coding evaluation, and final score aggregation.

Experimental results show that the system can handle multiple users simultaneously (up to 50 users) while maintaining stability and acceptable response time. Interview question generation, resume processing, and performance report generation were completed within efficient time limits. The integration of machine learning models such as SBERT, Gradient Boosting Classifier, Code2Vec, and NLP-based evaluation ensured accurate and consistent scoring across different evaluation stages.

However, minor performance limitations were observed in coding evaluation for large programs and occasional delays in NLP-based response analysis. Overall, the system achieved efficient processing, scalability under moderate load, and reliable performance, making it suitable for real-time interview preparation applications.

## IX. CONCLUSION

This paper presents an AI-powered mock interview system that enhances interview preparation through personalized question generation, multi-stage candidate evaluation, and explainable feedback. By integrating models such as SBERT, T5, Gradient Boosting, and Code2Vec, the system effectively analyzes candidate profiles, assesses aptitude and coding skills, and evaluates interview responses. The use of SHAP ensures transparency in scoring and provides meaningful insights into candidate strengths and weaknesses. Experimental results demonstrate that the system delivers accurate, reliable, and comprehensive performance evaluation. Overall, the proposed approach improves interview readiness and supports data-driven career guidance, making it a scalable solution for modern recruitment and training applications.

## X. FUTURE WORK

The proposed system can be further enhanced to improve scalability, accessibility, and evaluation depth. Future work includes integrating the platform with job portals to enable automatic matching of candidate performance with relevant job opportunities and direct application support. A mobile application can be developed to provide greater accessibility, allowing users to practice interviews and assessments anytime and anywhere. Additionally, a learning progress tracking module can be incorporated to monitor candidate improvement over multiple sessions and provide adaptive feedback.

Further enhancements may include improving NLP-based answer evaluation for better contextual understanding, optimizing coding assessment performance for large-scale inputs, and incorporating advanced features such as real-time emotion and speech analysis to simulate more realistic interview environments. Expanding dataset size and diversity can also improve model accuracy and generalization, making the system more robust for real-world deployment.

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