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REHEARSALAI: AN INTELLIGENT PLATFORM FOR DYNAMIC INTERVIEW PREPARATION USING SEMANTIC ANALYSIS AND AI-DRIVEN FEEDBACK

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Abstract

RehearsalAI introduces an intelligent frame for interview medication, combining motor- grounded language models and semantic alignment algorithms to resolve inefficiencies in conventional styles. The platform employs a two-tier evaluation system: (1) BERT's contextual embeddings (768-dimensional vectors) to interpret nuanced semantic relationships in user responses, and (2) cosine similarity metrics to quantify alignment with predefined ideal answers. Dynamic question generation is achieved via Gemini AI, a generative language model fine-tuned on domain-specific corpora, which synthesizes role-relevant queries using temperature-controlled sampling (τ=0.7). Real-time feedback is generated through a multi-stage pipeline integrating syntactic analysis (via SpaCy's dependency trees) and semantic gap detection, enabling granular insights into response coherence and keyword relevance. This architecture ensures adaptive, low-latency (<2s) feedback tailored to individual user performance. The system leverages modern technologies such as Next.js, React, and NeonDB to ensure scalability and user-centric design. Testing demonstrates significant improvements in user confidence and interview readiness, with similarity scores validating response alignment to ideal answers. RehearsalAI bridges the gap between generic practice tools and personalized, context-aware interview simulations, offering a scalable solution for job seekers globally.

Keywords: AI-driven interview simulation, Transformer-based language models, Semantic similarity analysis, Contextual embeddings, Real-time NLP feedback, Scalable architecture

1. Introduction

Navigating job interviews remains a pivotal challenge in professional growth, yet conventional preparation frameworks often fail to deliver tailored, data-driven experiences due to rigid methodologies. Current solutions depend on fixed query databases or crowdsourced evaluations, which introduce algorithmic subjectivity and operational inefficiencies. To bridge these gaps, this study presents *RehearsalAI*, a novel platform that synergizes context-aware question generation (via GeminiAI's transformer architecture), semantic coherence assessment (BERT embeddings + cosine similarity scoring), and AI-optimized feedback to emulate authentic, role-specific interview dynamics. The core objectives include:

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1. Engineering a role-specific question synthesis engine using GeminiAI's few-shot learning capabilities.

2. Implementing a hybrid evaluation framework combining BERT's bidirectional context modelling (768-D embeddings) and cosine similarity thresholds (sim≥0.68sim≥0.68) for granular feedback.

3.Empirically validating efficacy through A/B testing (n=150 users) against baseline tools like InterviewBit.

This work advances AI-augmented educational technologies by demonstrating how context-aware NLP techniques and scalable full-stack architectures (Next.js/NeonDB) can revolutionise interview readiness, setting a benchmark for adaptive, industry-aligned skill development.

2. Related Work

Recent advancements in NLP, particularly transformer-based models like BERT [1] and GPT [15], have revolutionized conversational AI. Prior research highlights the efficacy of semantic similarity metrics (e.g., Cosine Similarity [2]) in evaluating text alignment. However, existing interview platforms often lack contextual adaptability and rely on superficial scoring. Zhu et al. [9] emphasized NLP's role in interactive systems, while Clerk.dev [10] showcased secure authentication frameworks. RehearsalAI builds on these foundations by integrating role-specific dialogue generation and explainable feedback mechanisms, addressing scalability and personalization gaps.

3. Methodology

3.1 System Architecture

RehearsalAI employs a three-tier architecture:

- Frontend Next.js and Reply for responsive UI, enabling part- grounded simulations.

- Backend: Node.js handles API calls, integrating GeminiAI for question generation and BERT for embeddings.

- Database: NeonDB with Drizzle ORM manages users sessions history and data .

3.2 AI Model Integration

- Dynamic Question Generation: GeminiAI processes job descriptions and experience levels to generate context-aware questions.

- Semantic Evaluation: User responses and model answers are converted into embeddings via BERT. Cosine Similarity computes alignment scores (0–1), with higher values indicating stronger semantic overlap.

- Feedback Mechanism: Scores are paired with actionable insights (e.g., missing keywords, structural flaws) using a rule-based NLP layer.

3.3 User Workflow

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1. Authentication via Clerk.

2. Role and difficulty selection.

3. Real-time interview simulation with audio/video recording.

4. Speech-to-text conversion and semantic analysis.

5. Feedback delivery with performance metrics.

4. Results

4.1 Technical Validation

- Question Relevance: GeminiAI-generated questions showed 92% alignment with industry-specific job descriptions (tested on 50 roles).

- Feedback Accuracy: BERT embeddings achieved an F1-score of 0.89 in identifying key response components, compared to human evaluators.

- User Testing: 85% of participants (n=120) reported improved confidence, with a 40% increase in similarity scores after three sessions.

4.2 Case Studies

- Software Engineers: Technical questions achieved a 0.78 average similarity score.

- Entry-Level Candidates: Feedback highlighted structural improvements (e.g., using STAR method) in 70% of cases.

4.3 Limitations

- BERT's 512-token limit constrained long-form responses.

- Computational latency averaged 1.8s per feedback cycle, necessitating optimization.

5. Conclusion

The RehearsalAI platform exemplifies the efficacy of machine learning-powered tailored interview coaching, resolving long-standing limitations of static preparation paradigms. By integrating adaptive query synthesis (via transformer architectures), contextual semantic scoring (BERT embeddings + cosine similarity), and precision-tuned feedback (rule-based NLP pipelines), the system mitigates scalability bottlenecks and contextual relevance gaps inherent in conventional approaches. Future iterations will prioritize low-resource language compatibility (e.g., multilingual BERT fine-tuning) and latency-aware optimizations (quantized inference engines) for edge deployment. To democratize career development, RehearsalAI's modular open-source architecture (Apache 2.0 licensed) fosters community-driven innovation, enabling extensibility for niche domains and accessibility-focused use cases.

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