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CAREERPILOT AI

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***Abstract*—**The increasing competition in the employment market has created significant challenges for students and job seekers in preparing effective resumes, identifying relevant skills, and performing effectively in interviews. Existing career-support systems commonly address individual tasks such as resume screening, job recommendation, or interview preparation, while providing limited integration and personalization. This paper proposes CareerPilot AI, an intelligent career assistance system that integrates resume analysis, Applicant Tracking System evaluation, job-description matching, skill-gap identification, AI-based mock interviews, response evaluation, and personalized learning-roadmap generation. The proposed system uses Natural Language Processing, Large Language Models, semantic matching, and Retrieval-Augmented Generation to process user information and generate context-aware recommendations. A web-based architecture using Streamlit and FastAPI or Flask is proposed, with PDF parsing libraries for resume extraction and vector databases for retrieval-based services. The evaluation framework measures resume parsing accuracy, resume-job matching performance, skill-gap identification, interview-response evaluation, response time, and usability. The system is designed to provide an integrated digital career mentor that connects a candidate's current profile with target job requirements and subsequent preparation activities. Actual experimental results will be obtained after implementation and testing.

Keywords— Artificial intelligence, career guidance, resume analysis, applicant tracking system, natural language processing, large language models, mock interview, skill-gap analysis, job matching.

I. Introduction

The employment market has become increasingly competitive due to the growth of digital recruitment platforms and the large number of candidates applying for internships and employment opportunities. Students and fresh graduates frequently experience difficulty in preparing effective resumes, understanding job requirements, identifying missing skills, and developing sufficient interview skills. These difficulties are more significant for candidates who do not have continuous access to professional career counselors or structured placement preparation.

A resume is one of the most important components of the recruitment process because it provides information about a candidate's education, technical skills, projects, internships, certifications, and professional experience. However, many candidates prepare resumes without considering the requirements of Applicant Tracking Systems. An ATS may use keywords and other resume characteristics to filter applications before they are reviewed by recruiters. Therefore, candidates need assistance in identifying relevant keywords and improving the alignment between their resumes and target job descriptions.

Interview preparation is another major challenge faced by students and job seekers. Traditional preparation methods generally depend on fixed interview-question collections. Such approaches do not consider the candidate's resume, target job role, technical skills, or individual weaknesses. As a result, candidates may practice questions that are not sufficiently relevant to their intended career path.

Artificial Intelligence has increasingly been applied to recruitment and career-development tasks. Research has investigated automated resume screening, career recommendation, student-employer matching, and AI-supported recruitment. Natural Language Processing has improved the processing of unstructured text such as resumes and job descriptions. Large Language Models have introduced additional capabilities for career-support applications, including interview-question generation, response assessment, candidate summarization, and personalized recommendations.

CareerPilot AI is proposed to combine these capabilities into a single candidate-oriented platform. The system is designed to analyze a user's resume, compare it with a target job description, identify skill gaps, generate personalized interview questions, evaluate interview responses, and recommend a learning roadmap.

Students, fresh graduates, and job seekers frequently use separate tools for resume preparation, job matching, interview practice, and learning. These tools may not share information across tasks. A candidate may therefore receive resume feedback without understanding which skills are missing for a particular job, or practice generic interview questions unrelated to the target position.

Previous studies have made significant contributions to individual recruitment and career-support tasks. Resume classification and screening systems focus on extracting or ranking candidate information. Career recommendation systems focus on recommending suitable career paths. Other systems address student-employer matching or automated interview assessment. These functions are often studied independently.Recent research has also demonstrated the potential of Large Language Models for automated resume screening and interview evaluation. However, many systems remain focused on a single stage of recruitment or career guidance.

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A research and implementation gap therefore remains in developing a student-oriented system that connects resume analysis, ATS-oriented evaluation, job-description matching, skill-gap identification, personalized mock interviews, interview-response evaluation, and learning-roadmap generation.CareerPilot AI addresses this gap by integrating these functions into a continuous career-preparation workflow.

The need for CareerPilot AI arises from the increasing importance of personalized career preparation. Students often possess technical knowledge but may have difficulty presenting their skills effectively in resumes or interviews. Furthermore, the skills required by organizations change continuously, making it difficult for candidates to identify the specific skills they need to improve.

A centralized AI-based platform can reduce this difficulty by analyzing the candidate's existing profile and connecting it with the requirements of a target job.The proposed system can therefore offer actionable recommendations instead of general career advice. This project is especially helpful for students and fresh graduates who may not have access to professional career counseling. It can also assist placement departments and career guidance centers by providing a tool to support student preparation

Ease of Use

A. Resume Analysis and Information Extraction

Resumes hold messy pieces of text and resumes show education background, technical skill, projects, certifications, work experience and career objectives. Traditional resume evaluation requires manual examination, which can become time-consuming when a large number of resumes must be processed.Natural language processing provides techniques for extracting structured information from unstructured documents.

Named entity recognition, keyword extraction, text classification, semantic similarity, and embedding-based approaches can be applied to identify relevant resume components.Automated resume analysis has therefore become an important application of NLP in recruitment and career-support systems. However, extracting information from a resume alone does not necessarily provide personalized career guidance
.

B. Job and Career Recommendation System

Recommendation systems have been applied to employment platforms to match candidates with job opportunities. Such systems can use candidate profiles, job descriptions, skills, experience, education, and historical interactions to estimate the relevance of a job for a particular user.Content-based recommendation approaches compare characteristics of a user profile with characteristics of available opportunities.
Similarity-based approaches can also compare resume and job-description representations using vector-based techniques.
However, job recommendation systems primarily answer the question of which opportunity matches the user**,** rather than what the user should learn to become suitable for another opportunity**.**
CareerPilot AI extends this concept by combining career-role recommendation with skill-gap analysis

C. Skill Extraction and Skill- Gap Analysis

Skill extraction is an important component of career recommendation because technical and professional skills provide a direct representation of a candidate's capabilities.

Skill-gap analysis compares the user's existing skill profile against the expected skills for a target role. The difference between these two sets can be used to identify skills that may require further development.
For example, if a selected role requires Python, SQL, statistics, machine learning, and data visualization while a user profile contains only Python and statistics, the system can identify SQL, machine learning, and data visualization as potential skill gaps.

D. Resume and Job Description Matching.

Resume-job matching is a part of AI-driven hiring and career support. In methods resume-job matching works by looking for the same words in resumes and job ads. Newer methods let resume-job matching use word embeddings. Compute how closely the text matches in meaning. Resume-job matching checks for skills, degrees, work history, projects, certificates and other needs. Even if resume-job matching gives a high similarity score I think it does not always mean the person is right for the job because job fit can depend on things that're hard to measure with numbers.

E. AI-Based Mock Interview Systems

They often don’t take into account what makes each person unique. That means the preparation might not fully match what you need. You may find yourself answering questions that don’t reflect your experience or the job you're aiming for. A personalized approach could make a big difference in how confident and prepared you feel. Large Language Models can generate questions based on user-provided information such as resume content, job role, projects, and technical skills.An AI-based mock interview system can generate questions dynamically and allow users to practice responses. Questions can be categorized into HR, technical, behavioral, and role-specific areas.CareerPilot AI uses this approach to provide personalized mock interviews based on the candidate's profile and selected career role.

F. Interview Response Evaluation

Generating interview questions alone may not be sufficient for effective preparation. Candidates may also require feedback regarding the quality of their responses.AI-based response evaluation can analyze factors such as relevance, clarity, completeness, structure, and technical understanding. Large Language Models can be used to provide textual feedback and identify areas that may require improvement..However AI-generated evaluation may not always be the same, as evaluation. The way the model answers the rules it follows and how people read it can all change the score that comes out. CareerPilot AI treats interview feedback as a guide to help you get ready and interview feedback is not a measure of a candidates interview ability.

G. Personalized Learning Roadmap

Skill-gap analysis can be turned into learning recommendations.After the missing skills are found a system can suggest learning topics, practice activities and preparation steps.A learning roadmap can put these suggestions in an order.For example a candidate who does not know SQL may get suggestions that cover SQL basics, queries, joins, aggregation and practice problems.Linking skill gap analysis, with learning recommendations can give useful help than only showing a list of missing skills.

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I. Research Gap

Resume analysis is about taking information from job seeker documents. Job recommendation is about finding the jobs. Skill gap systems are about seeing what skills are missing. Not much thought is given to putting all these parts into one personal career help system.

1. Resume analysis
2. Skill extraction
3. Career role matching
4. Skill gap identification
5. Personalized career guidance

The objective is not to claim that the proposed framework guarantees better employment outcomes. Instead, the framework provides an integrated mechanism for helping users understand their current profile and potential career-development requirements.Previous studies have made significant contributions to individual recruitment and career-support tasks. Resume classification and screening systems focus on extracting or ranking candidate information. Career recommendation systems focus on recommending suitable career paths. Other systems address student-employer matching or automated interview assessment. These functions are often studied independently.Recent research has also demonstrated the potential of Large Language Models for automated resume screening and interview evaluation. However, many systems remain focused on a single stage of recruitment or career guidance. A research and implementation gap therefore remains in developing a student-oriented system that connects resume analysis, ATS-oriented evaluation, job-description matching, skill-gap identification, personalized mock interviews, interview-response evaluation, and learning-roadmap generation. CareerPilot AI addresses this gap by integrating these functions into a continuous career-preparation workflow.

II. Problem formulation

The problem considered in this study is the identification of suitable career roles for a user based on information extracted from their resume and the identification of skills that may be missing for those roles. The proposed framework also considers job-specific requirements, interview preparation, and personalized career development.

Let,

$$U=\{s1,s2,\ldots,sm\}$$

represent the set of skills extracted from a user's resume.

Let,

$$Rj=\{r1,r2,\ldots,rk\}$$

represent the required skills associated with career role j.

A similarity score can be calculated between the user's skill profile and the requirements of each career role:

$$M(U,Rj)=|Rj|/|U\cap Rj|$$

where $U\cap Rj$ represents the skills common to the user's profile and the requirements of career role j.The skill gap for a career role can be defined as:

$$Gj=Rj-U$$

where Gj represents the set of required skills that are not currently identified in the user's profile.The framework can then rank candidate career roles according to their matching scores:

$$Rank(Rj)=f(M(U,Rj),Ej,Qj,Xj)$$

where Ej, Qj, and Xj can represent additional profile factors such as education, qualifications, certifications, or experience, depending on the implemented system.

A higher matching score represents stronger alignment between the extracted user profile and the defined requirements of a career role. However, the resulting score is interpreted as a computational match rather than a measure of guaranteed employability or hiring probability.For the target job description, let J represent the set of requirements extracted from the selected job description. The candidate's resume can be compared with these requirements to identify relevant and missing skills:

$$GJ=J-U$$

where GJ represents the potential skill gap between the candidate profile and the selected job requirements.

The identified skill gaps can subsequently be used by the mock-interview and learning-roadmap modules. The system can generate interview questions related to the target role and identified skills, evaluate the candidate's responses, and recommend learning topics based on the areas requiring improvement.

Therefore, the overall problem can be represented as:

$$U\rightarrow M(U,Rj)\rightarrow Gj\rightarrow I\rightarrow F\rightarrow L$$

where:

- U = Skills extracted from the user's resume
- Rj = Skills required for career role j
- M(U,Rj) = Matching score
- Gj = Career-role skill gap
- I = Personalized interview questions
- F = Interview feedback
- L = Personalized learning roadmap

The proposed CareerPilot AI system therefore aims to transform the information extracted from a user's resume into career-role matching, skill-gap identification, interview preparation, response evaluation, and personalized learning recommendations. The framework is meant to help with career preparation and decision-making. It does not aim to predict job placements or hiring results with certainty.

III. METHODOLOGY

This approach explores how Career Pilot AI can analyze resumes to identify your skills, match you with suitable job opportunities, highlight any skill gaps, and provide personalized career guidance.

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A. Dataset and Data Components

The system is designed to use data components to support resume analysis. It also aims to provide job matching. The system works to help with interview preparation. It offers career guidance. Each part of the system is meant to support the user's career development. The CareerPilot AI system uses data components. The CareerPilot AI system is built to support resume analysis. The CareerPilot AI system is built to provide job matching. The CareerPilot AI system is built to help with interview preparation. The CareerPilot AI system is built to offer career guidance. The CareerPilot AI system uses data components to support resume analysis. The CareerPilot AI system uses data components to provide job matching. The CareerPilot AI system uses data components to help with interview preparation. The CareerPilot AI system uses data components to offer personalized career guidance.

The main sources of information we rely on are: User resume data , Job description data , Career role requirement data , Interview question data and Skills database

Resume information may contain qualifications, technical skills, soft skills, certifications, projects, internships, professional experience and other relevant information. When I review resume information I look for evidence of learning and skill. Resume information should be organized so that educational qualifications, technical skills, soft skills, certifications, projects, internships and professional experience are easy to find.

I find that the job data and career-role data are a treasure trove of details containing job titles, required skills, qualifications, experience requirements and other role-specific information. Interview data may contain HR questions, technical questions and behavioral questions that can be used for mock-interview generation and evaluation.

TABLE I. DATA COMPONENTS USED IN CAREER PILOT AI

Data Component	Role
Resume text	Primary user input
Education	Qualification analysis
Technical skills	Career- role matching
Soft skills	Profile analysis
Certifications	Qualification enhancement
Projects	Practical experience analysis
Work experience	Career suitability
Career- role requirements	Matching reference
Required skills	Skill- gap analysis
Interview questions	Mock-interview generation
Interview responses	Performance evaluation
Learning requirement	Personalized roadmap generation

B. Career Pilot AI Processing Pipeline

The proposed system processes the resume through multiple stages.

TABLE II. Career pilot AI Processing Pipeline

Sr no.	Stage	Description
1.	Resume Parsing	Text is extracted from the uploaded resume
2.	Information Extraction	Education, skills, projects, certifications, and experience are identified
3.	Resume Analysis	Resume content is analyzed for relevance and completeness
4.	ATS Analysis	Resume alignment with job requirements is evaluated
5.	Job Description Upload	User uploads the target job description
6.	Job Requirement Extraction	Required skills, qualifications, and experience are identified
7.	Resume–Job Matching	Resume profile is compared with job requirements
8.	Skill-Gap Analysis	Missing or underrepresented skills are identified
9.	Career-Role Recommendation	Potentially suitable career roles are recommended
10.	Mock Interview Generation	Personalized HR and technical questions are generated
11.	Interview Response Evaluation	User responses are evaluated and feedback is generated
12.	Learning Roadmap Generation	Personalized learning areas and development activities are recommended
13.	Cover Letter Generation	A job-specific cover letter is generated

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14.	Database Storage	User data and generated results are stored
15.	Performance Dashboard	Resume, job matching, interview, and learning results are displayed

C. Resume Preprocessing

The resume that is uploaded gets changed into text that machines can read before any steps. Because resumes often have formats and layouts we do some preprocessing. This helps make things more consistent, for the part of the analysis.

The preprocessing stage may include:

1. Text extraction
2. Case normalization
3. Tokenization
4. Removal of unnecessary symbols
5. Stop-word handling where applicable
6. Skill-name normalization
7. Duplicate removal
8. Removal of unnecessary whitespace
9. Section identification

The processed text is subsequently passed to the resume-information and skill-extraction components.

D. Information and Skill Extraction

The system looks at the resume. Finds important details, like technical skills, soft skills, education, certifications, projects, internships and work experience.

For example a resume might include:-

Python, SQL, Excel, Power BI, Statistics.

may be transformed into a structured skill representation:

U={Python,SQL,Excel,PowerBI,Statistics}

The information that is pulled out can be kept in a format and used by the ATS analysis system the job-matching system, the skill-gap system and the interview system. Extracting skills can be done using keyword matching, NLP methods, a skill list that is already set up how similar the meaning's methods that use embeddings or a mix of these ways based on how it is finally put into action.

E. Resume Analysis

After pulling details, from a résumé CareerPilot AI looks at the data to spot strengths and spots where improvement is needed.

The analysis may consider:

1. Technical skills
2. Education
3. Projects
4. Certifications
5. Internships
6. Work experience
7. Relevant keywords
8. Resume completeness
9. Alignment with the target role

The system can suggest details, useful keywords, ways to show skills and ways to improve your resume.

This analysis is meant to help you improve your resume, not replace recruitment decisions.

F. ATS Analysis

The ATS analysis module is designed to assess how well a resume matches the requirements of a specific job.

-Relevant keywords
- Required technical skills
- Educational qualifications
- Work experience
- Projects
- Certifications
- Relevance to the job role

Here, R stands for the resume representation, while J represents the job-description representation. The score we get from this calculation gives us a clear idea of how well the candidate's profile aligns with the job in question.

G. Skill-Gap Analysis

A skill-gap analysis looks at the difference between the skills a candidate currently has and the skills needed for a specific job role. Let's define: Sc as the candidate's current skill set and Sr as the required skill set. The potential skill gap can be expressed as: G = Sr - Sc, where G indicates the skills necessary for the chosen role that the candidate hasn't yet demonstrated in their profile.

I. AI-Based Mock Interview

The questions are made using

- Resume
- Target job description
- Selected career role
- Candidate skills
- Identified skill gaps

The mock interview has

HR Questions

- Self-introduction
- Career goals
- Teamwork
- Leadership
- Conflict management
- Motivation

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Technical Questions

Technical questions are made using

- Python
- SQL
- Statistics
- Machine Learning
- Data Analysis
- Data Visualization
- Projects

This makes the interview session successful towards user goal

K. Interview Response Evaluation

The user gives answer to the question which are generated and using LLM its checked.

The system responds accordingly

1. Relevance
2. Clarity
3. Completeness
4. Technical understanding
5. Communication quality

The score is calculated

$$Is=4R+C+T+Q$$

where:

- R = Relevance
- C = Clarity
- T = Technical understanding
- Q = Completeness

The system gives the feedback by describing the strengths and weaknesses accordingly which helps the user to know the required improvements.

L. Personalized Career Guidance

Based on the user input it gives personalized roadmap and helps the user to reach their target job roles.

It gives :

1. Suitable career roles
2. Existing strengths
3. Missing skills
4. Things to learn
5. Relevant certifications
6. Suggested project areas
7. Interview preparation
8. Potential next steps

The recommendations help the user to reach their career goals

M. Personalized Learning Roadmap

The learning-roadmap module uses the identified skill gaps and interview feedback to generate a structured learning plan.

The process can be represented as:

Skill Gap then Learning Topic then Practice Activity →then Project/Application then Interview Preparation

For example, if **SQL** is identified as a potential skill gap, the roadmap may include SQL fundamentals, queries, joins, aggregation, subqueries, and practical exercises.The roadmap can therefore connect career-role requirements with specific learning activities.

N. Cover Letter Generation

According to requirements it provides cover letter using its experience skills and resume analysis

The module may consider:

1. Candidate education
2. Technical skills
3. Projects
4. Experience
5. Certifications
6. Target position
7. Job requirements

The generated cover letter can be seen and modified by the user accordingly

O. Database and Dashboard

The dashboard shows :

1. Resume analysis
2. ATS-oriented score
3. Job-match score
4. Skill gaps
5. Interview performance
6. Interview feedback
7. Learning roadmap
8. Preparation progress

This helps user to reach their goals with ease

IV. Experimental Results

A. Resume Analysis Performance

The first evaluation examines how effectively the system extracts relevant information from resume documents. The analysis can consider the identification of:

1. Technical skills
2. Soft skills
3. Education
4. Certifications
5. Projects
6. Work experience
7. Internships

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8. Career objectives

The performance should be evaluated against an appropriately labelled dataset or manually validated reference information. Suitable evaluation metrics may include precision, recall, and F1-score.

B. ATS Analysis Performance

The ATS analysis module evaluates the alignment of the uploaded resume with the requirements of a target job description.The analysis considers:

1. Relevant keywords
2. Required technical skills
3. Educational qualifications
4. Work experience
5. Projects
6. Certifications
7. Resume-job alignment

The system generates an ATS-oriented score and provides suggestions for improving resume content and keyword alignment. The generated score is treated as an estimated measure of alignment rather than the exact scoring mechanism of a commercial ATS.

C. Job Description Matching Performance

The job-description matching module compares the candidate's resume profile with the requirements of a selected job description. The evaluation can consider:

1. Skill similarity
2. Qualification similarity
3. Experience relevance
4. Project relevance
5. Keyword matching
6. Overall resume-job similarity

The system generates a matching score that indicates the degree of alignment between the candidate profile and the selected job.

D. C eer Recommendation Performance

The second major evaluation examines whether the recommended career roles correspond to the expected roles associated with the user's profile. The recommendation performance may be evaluated using:

1. Accuracy
2. Precision
3. Recall
4. F1-score
5. Top-K recommendation accuracy

The actual values should be reported from the implemented system and evaluation dataset.

E. Skill-Gap Analysis

The skill-gap component evaluates whether CareerPilot AI can correctly identify skills required for a target career role but not represented in the user's profile.

F. Mock Interview Analyzer

The mock-interview checks the answers and gives the evaluation accordingly.

1. HR interview questions
2. Technical interview questions
3. Behavioral questions
4. Resume-based questions
5. Skill-gap-based questions

The generated questions are intended to provide personalized interview practice rather than relying only on a fixed set of general interview questions.

G. Interview Response Evaluation

The model checks the answers and gives the evaluation accordingly.

1. Relevance
2. Clarity
3. Completeness
4. Technical understanding

The system gives feedback which helps the user to improve and reach their goal.

H. Personalized Learning Roadmap Performance

The learning-roadmap module uses the identified skill gaps and interview feedback to generate personalized learning recommendations. The generated roadmap may include:

1. Missing skills
2. Recommended learning topics
3. Practice activities
4. Project recommendations
5. Certification suggestions
6. Interview preparation areas

The effectiveness of the roadmap can be evaluated by comparing the recommended learning areas with the requirements of the selected career role.

I. Cover Letter Generation

The cover-letter module generates a customized cover letter using information extracted from the user's resume and the selected job description. The generated content may consider:

1. Candidate skills
2. Education
3. Projects
4. Experience
5. Certifications
6. Target job role
7. Job requirements

The cover letter created by the system helps user a lot.

Career pilot Output : The complete output from the system includes multiple components.

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TABLE III. CAREER PIOLT AL OUTPUT

SR NO.	OUTPUT	DESCRIPTION
1.	Resume Profile	Extracted user information
2.	Skill Profile	Identified technical and professional skills
3.	ATS Score	Estimated resume-job alignment
4.	Job Matching Scores	Degree of resume and job-description similarity
5.	Recommended Career	Potentially suitable career roles
6.	Skill Gaps	Missing or underrepresented skills
7.	Mock Interview	Personalized HR and technical questions
8.	Interview Feedback	Evaluation of user responses
9.	Learning Roadmap	Suggested learning and development areas
10.	Cover Letter	Job-specific cover letter
11.	Dashboard	Consolidated career-preparation information

Career fit involves many factors that a resume might not capture, such as personal interests, communication skills, hands-on experience, interview performance, individual preferences, and the ever-evolving demands of the industry.

V. LIMITATIONS AND ETHICAL CONSIDERATIONS

The results of this study should be interpreted in light of the limitations of the dataset, algorithms and experimental design.
The main limitations are as follows:
1. Quality of Resume
The system's accuracy is partly dependent on the quality and completeness of the resume submitted.
2. Limited coverage of career role
Recommendations may not include all possible occupations if the system is based on a predefined set of career roles.
3. Small vocabulary of skill
Skills written in unusual terminology, abbreviations or alternate spellings may not always be identified correctly.
4. Datase s limitations:
The performance of the system is dependent on the size, diversity and quality of the resume and career-role datasets.
5. Needs of a dynamic labor marke
Skills that industry needs change over time. A static career-role dataset may therefore become obsolete .
6. Context limitation: Just because you have a skill does t automatically mean you excel at it. What's listed on a resume might not truly reflect a person's capabilities.
7. Recommendation limitations: A high match score does t guarantee that you'll land the job.
8. Potential algorithmic bias: If the training data has biases, tho biases could influence the recommendations made by the system.
9. No guaranteed career outcome: CareerPilot AI ca t promise that an employer will select a particular candidate.

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