AI Based Job Application Tracking System

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ABSTRACT:

This study presents a AI powered job application tracking system focused on promoting fair and unbiased candidate assessment. Built with ReactJS and Flask, the system leverages AI Ethics tools such as TensorFlow Fairness Indicators and IBM's AIF360 to identify and reduce biases in hiring. Fairness metrics help detect potential biases in the application process, while reweighing techniques are applied to ensure that all the groups are represented equitably.

In addition, the system performs soft skills analysis, using Hugging Face NLP models to examine candidates' activity descriptions for indicators of interpersonal skills. By integrating these fairness checks with soft skills insights, the system produces a balanced score for each candidate, helping organizations make more inclusive and transparent hiring decisions. This approach addresses bias in recruitment while offering a practical solution for fairer hiring practices.

Keywords: AI Ethics Tools, TensorFlow, AIF360 tool, Hugging Face Model, ReactJS, Flask.

1. INTRODUCTION

In today's rapidly evolving job market, organizations are increasingly relying on technology to streamline their hiring processes. However, traditional recruitment methods often suffer from inherent biases, whether conscious or unconscious, which can lead to unfair hiring practices. These biases may stem from various factors, including inconsistencies in evaluation criteria, subjective decision-making, or reliance on limited data points. Such biases undermine the effectiveness of recruitment strategies and prevent companies from selecting the best candidates based on merit.

To address this critical issue, organizations are turning to Artificial Intelligence (AI) and machine learning to bring fairness and transparency to recruitment. AI-driven hiring solutions can systematically analyse large datasets, recognize potential biases in decision-making, and ensure that recruitment decisions are data-driven and objective. Ethical AI tools provide employers with a powerful means to evaluate candidates fairly by detecting inconsistencies in assessments and ensuring a standardized election process. By leveraging AI ethics, natural language processing (NLP), and fairness indicators, this study introduces an AI-powered Job Application Tracking System. The system is designed to create an unbiased hiring environment by incorporating ethical AI principles, soft skills assessment, and equitable candidate ranking mechanisms. Through this innovative approach, companies can improve hiring accuracy, enhance employee satisfaction, and maintain compliance with fair recruitment standards.

2. LITERATURE SURVEY

[1] Fairness in AI-Based Hiring: A Review of Bias Mitigation Strategies

This study explores the challenges associated with AI-driven hiring systems, particularly the biases that arise due to imbalanced training data and algorithmic limitations. The authors highlight various bias mitigation techniques, including adversarial debiasing, re-weighting strategies, and fairness-aware

learning frameworks. The research emphasizes that while AI can improve hiring processes, it is critical to continuously evaluate and refine fairness metrics to ensure ethical decision-making.

[2] AI in Recruitment: Enhancing Fairness and Efficiency

This paper discusses the role of AI in recruitment, focusing on automated resume screening, skill-based candidate ranking, and behavioral analysis. The study finds that AI can significantly reduce hiring bias when properly implemented but warns that reliance on historical data may perpetuate existing disparities. The research also highlights the importance of transparency in AI based hiring systems and the need for organizations to adopt explainable AI models to justify hiring decisions.

[3] Soft Skills Analysis Using Natural Language Processing

The study examines how NLP techniques can be used to assess candidates' soft skills based on their textual responses. Using transformer-based models, the research demonstrates that AI can effectively analyze communication styles, leadership potential, and teamwork attributes. The findings support the integration of NLP in hiring systems to ensure a more comprehensive evaluation of candidates beyond their technical qualifications.

[4] Fairness Indicators for AI-Powered Hiring Systems

This research presents an evaluation of fairness indicators, such as demographic parity, equal opportunity, and disparate impact, within AI-driven recruitment platforms. The authors propose a framework for assessing and mitigating biases in hiring algorithms, using real-world hiring datasets. The study concludes that AI fairness tools, such as TensorFlow Fairness Indicators and IBM AIF360, play a vital role in maintaining ethical recruitment practices.

3. EXISTING SYSTEM

Current AI-driven hiring platforms mainly focus on resume screening and applicant tracking. These systems rely heavily on historical data for training, which often results in biases such as inconsistencies in evaluation criteria, subjective decision-making, or reliance on limited data points. Such biases undermine the effectiveness of recruitment strategies and prevent companies from selecting the best candidates based on merit.

Additionally, these platforms typically prioritize technical qualifications, neglecting the essential soft skills like communication, leadership, and teamwork, which are crucial for overall job performance. Transparency is another challenge, as many systems operate as "black boxes," leaving recruiters unable to understand how decisions are made. This lack of clarity undermines trust in the system and makes it difficult to address potential biases.

4. PROPOSED SYSTEM

The proposed AI-powered Job Application Tracking System aims to overcome these limitations by integrating fairness indicators, NLP-based soft skills analysis, and transparent AI models. Using tools like TensorFlow Fairness Indicators and IBM AIF360, the system ensures unbiased decision-making by assessing and mitigating any bias throughout that occur thoughout the recruitment process. This approach ensures that all candidates are evaluated completely based on their merit.

Furthermore, the system employs Natural Language Processing (NLP) models to analyze candidate's soft skills such as communication, leadership, and adaptability skills often overlooked by traditional systems. By evaluating both technical and non-technical qualifications, the system offers a balanced candidate scoring mechanism that provides a comprehensive evaluation of candidates.

Unlike traditional platforms, this system offers transparency in its decision-making process. Recruiters can access detailed insights into how rankings and recommendations are made, promoting trust and accountability. By combining the use of the fairness indicators, NLP models, and the employment of complete transparency, the system addresses the biases present in current hiring systems, improving recruitment outcomes and

ensuring a more equitable selection process.

5. SYSTEM REQUIREMENTS

The requirements for the proposed system are categorized into hardware and software requirements, ensuring efficient implementation and smooth functionality

5.1 Hardware Requirements:

Processor: Minimum Intel Core i3 / Recommended Intel Core i5 or AMD Ryzen

RAM: Minimum 4 GB / Recommended 8 GB

Storage: At least 3 GB of free space

Display: Minimum 1366x768 resolution / Recommended Full HD

Internet: Required for cloud-based AI tools and APIs

5.2 Software Requirements:

Operating System: Windows 10/11, macOS, or Linux (Ubuntu 20.04+)

Programming Languages: Python 3.8+

Frontend: ReactJS, Redux

Backend: Flask, MySQL

AI/ML Libraries: TensorFlow Fairness Indicators, IBM AIF360, Hugging Face Transformers

Code Editor: VS Code

6. ALGORITHM

6.1 Input Layer:

1. **User Login**:
   - **Input**: User credentials (email or username, password).
   - **Process**: Authenticate user via the authentication module.
   - **Output**: User dashboard or error message (authentication failure).
2. **Job Application Submission**:
   - **Input**: Applicant's personal details or a resume file.
   - **Process**: Applicant submits the application through the User Interface.
   - **Output**: A confirmation message indicating the submission status.

6.2 Processing Layer:

1. **Resume Parsing:**
   - **Input**: Resume file (PDF/Word).
   - **Process**:
     1. Extract key details such as name, contact information, education, work experience, and skills from the resume.
     2. Use Natural Language Processing techniques to structure the data.
   - **Output**: Structured data representing applicant's details and skills.

2. **Soft Skills Evaluation:**
   - **Input**: Applicant's personal details, application data, and any responses in forms or interview stages.
   - **Process**:
     1. Analyze the soft skills based on pre-set criteria (such as communication skills, teamwork, leadership, etc.).
     2. Evaluate responses (if any) from behavioral questions or past job experience.
   - **Output**: Soft skills evaluation score, indicating strengths and weaknesses in key soft skill areas.

3. **Bias Detection:**
   - **Input**: Application data (resume, personal details, soft skills).
   - **Process**:
     1. Detect any biases related to gender, age, ethnicity, or other unfair preferences based on the analysis of historical hiring data.
     2. Use AI/ML algorithms to ensure fairness in evaluating applicants.
   - **Output**: Bias detection report (flagging any potential bias in the evaluation process).

4. **Merit-Based Ranking and Recommendation:**
   - **Input**: Resume data, soft skills score, bias detection report.
   - **Process**:
     1. Rank applicants based on the quality and relevance of their resumes, along with the evaluation of soft skills.
     2. Ensure that bias has been addressed before final ranking.
   - **Output**: Final merit-based ranking of applicants.

6.3 Control Layer:

1. **Threading**:
   o **Input**: Multiple concurrent tasks such as resume parsing, soft skills evaluation, and bias detection.
   o **Process**:
      1. Utilize threading to handle the tasks concurrently, ensuring that the system remains responsive and does not block while one task is being processed.
      2. Different tasks (resume parsing, soft skills analysis, and bias detection) are handled by separate threads.
   o **Output**: Smooth operation of the application system with no delays during multiple task processing.

6.4 Complete Algorithm Workflow:

1. **User Login**:
   o The user logs in using their credentials. If successful, the system proceeds to the applicant dashboard.
2. **Job Application Submission**:
   o The applicant submits their application with personal details or a resume. The system confirms receipt.
3. **Resume Parsing**:
   o The system processes the resume and extracts structured data such as skills, experience, and education.
4. **Soft Skills Evaluation**:
   o The system evaluates the applicant's soft skills (if applicable), such as communication, leadership, etc., using predefined criteria.
5. **Bias Detection**:
   o The system analyzes the applicant's data for any potential biases. If bias is detected, the system flags the data for review.
6. **Merit-Based Ranking**:
   o Based on the parsed data, soft skills evaluation, and bias-free score, the system generates a merit-based ranking of applicants.
7. **Recruiter Dashboard**:
   o The recruiter logs into the system, views the ranking, and proceeds to review applications for hiring.

8. **Final Recommendation**:
   o The system presents the final rankings to the recruiter, including any recommended actions (e.g., top candidates to contact based on various criteria).

7. CONCLUSION

This study presents a practical and ethical approach to tackling biases in AI-powered hiring systems. By integrating fairness evaluation tools like AIF360 and TensorFlow Fairness Indicators, and enhancing candidate evaluation through soft skills analysis using NLP models from Hugging Face, the system offers a more inclusive and holistic hiring solution. The local-first design ensures data privacy and transparency, enabling recruiters to make better-informed decisions without relying solely on traditional, potentially biased AI screening methods.

In conclusion, through this work, we demonstrate that AI can be both powerful and fair when developed with intentional safeguards against bias. The proposed system not only promotes equity in recruitment but also introduces a novel layer of candidate profiling based on behavioral and soft skill traits, which are often overlooked in early screening stages. With further enhancements, the system holds the potential to become an industry-ready tool that bridges the gap between fairness and efficiency in modern hiring practices.

8. FUTURE ENHANCEMENT

As the system currently provides a foundational bias-free hiring and soft skills evaluation platform, several enhancements can be made to extend its capabilities and ensure robust industrial deployment:

1. **Enhanced Soft Skills Classifier:**
   o Integrate transformer-based models like BERT fine-tuned on soft skills-related datasets to improve contextual understanding of applicant activities.
2. **Live Feedback System:**
   o Build a live dashboard for recruiters to view bias reports and fairness visualizations before making decisions,

promoting transparency.

3. **Real-World Dataset Testing:**
   o Test the system with anonymized resumes from actual hiring datasets to evaluate its performance and fairness in practical scenarios.

4. **Scalability Improvements:**
   o Containerize the application using Docker and deploy using Kubernetes to ensure scalability and reliability for enterprise-level usage.

5. **Integration with HR Platforms:**
   o Provide API endpoints or plugins to integrate with popular HR systems like Workday, Greenhouse, or Lever.

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