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 demographic 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.

# 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 project 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.

# 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.

# 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 based on gender, race, or background. Some tools incorporate basic fairness checks, such as gender neutral language, but these measures are often insufficient to mitigate deeper biases, especially regarding the candidate's diverse background or experiences. Additionally, these platforms typically prioritize technical qualifications, neglecting 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.

1. 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 bias throughout the recruitment process. This approach ensures that all candidates are evaluated based on their merit, irrespective of demographic factors. Furthermore, the system employs Natural Language Processing (NLP) to analyze 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 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 fairness, NLP, and transparency, the system addresses the biases present in current hiring systems, improving recruitment outcomes and ensuring a more equitable selection process.

1. SYSTEM REQUIREMENTS

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

Hardware Requirements Processor: Minimum Intel Core i3 / Recommended Intel Core i5 or AMD Ryzen RAM: Minimum 4 GB / Recommended 8 GBStorage: At least 3 GB of free space Display: Minimum 1366x768 resolution / Recommended Full HD Internet: Required for cloud-based AI tools and APIs 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

1. ALGORITHM

**Input Layer:**

1. **User Login**:
   * **Input**: User credentials (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, resume file.
   * **Process**: Applicant submits the application through the User Interface.
   * **Output**: A confirmation message indicating the submission status.

**Processing Layer:**

1. **Resume Parsing** (Using ResumeParser):
   * **Input**: Resume file (PDF/Word).
   * **Process**:
     + Extract key details such as name, contact information, education, work experience, and skills from the resume.
     + Use Natural Language Processing (NLP) techniques to structure the data.
   * **Output**: Structured data representing applicant's details and skills.
2. **Soft Skills Evaluation** (Using SoftSkillsAnalyzer):
   * **Input**: Applicant's personal details, application data, and any responses in forms or interview stages.
   * **Process**:
     + Analyze the soft skills based on pre-set criteria (such as communication skills, teamwork, leadership, etc.).
     + 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** (Using BiasDetectionModule):
   * **Input**: Application data (resume, personal details, soft skills).
   * **Process**:
     + Detect any biases related to gender, age, ethnicity, or other unfair preferences based on the analysis of historical hiring data.
     + 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** (Using MeritRankingSystem):
   * **Input**: Resume data, soft skills score, bias detection report.
   * **Process**:
     + Rank applicants based on the quality and relevance of their resumes, along with the evaluation of soft skills.
     + Ensure that bias has been addressed before final ranking.
   * **Output**: Final merit-based ranking of applicants.

**Control Layer:**

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

**Complete Algorithm Workflow:**

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

The system presents the final rankings to the recruiter, including any recommended actions (e.g., top candidates to contact)

# CONCLUSION

The proposed system underscores the transformative potential of deep learning in virtual meeting analytics, showcasing its ability to redefine how engagement is measured and understood. By seamlessly integrating video, audio, and text data, the system delivers a holistic and detailed analysis of participant behaviour, enabling enhanced decision-making and fostering better collaboration.

At the core of this system, Convolutional Neural Networks (CNN) offer the computational power to detect and analyse intricate patterns in visual data, such as facial expressions, gaze direction, and posture changes. Meanwhile, Long Short-Term Memory (LSTM) networks excel in tracking temporal dependencies, ensuring accurate monitoring of active time and engagement trends throughout a meeting.

The implementation of OpenCV plays a pivotal role in enhancing the performance of face recognition systems. By improving frame quality and optimizing processing efficiency, OpenCV ensures that FaceNet can effectively identify and process participants’ facial features, even in varying lighting conditions or resolutions. Together, these technologies form a cohesive and efficient system that provides actionable insights into meeting dynamics, paving the way for more productive and inclusive virtual interactions.

1. FUTURE ENHANCEMENT

#### **1. Real-time Processing**

Real-time processing of video frames is a crucial enhancement that would significantly elevate the system's usability. By enabling live monitoring of participant performance, the system eliminates the need for manual video uploads and post-meeting data extraction. This functionality allows facilitators to receive immediate feedback, such as alerts about disengaged participants or recommendations for interactive interventions, making meetings more dynamic and responsive. Real-time analytics also enhances the ability to adapt meeting agendas on the fly based on engagement trends.

**2. Cloud Integration**

Incorporating cloud storage and computing capabilities would address scalability and accessibility challenges, allowing the system to manage and process large-scale data efficiently. By leveraging cloud platforms like AWS, Azure, or Google Cloud, the system can store extensive amounts of extracted data without overburdening local processing units. Cloud integration also enables multi-device access, facilitating seamless data sharing and analysis across teams and locations. This enhancement ensures that the system remains robust and capable of supporting growing user demands.

**3. Incorporation of Multilayered Network:**

Expanding the model’s architecture to include more hidden layers can dramatically improve its analytical capabilities. By adopting deeper Convolutional Neural Networks (CNNs) and fine-tuning their parameters, the system can achieve higher accuracy in detecting and analyzing engagement patterns. A multilayered approach allows for the extraction of more complex features, such as subtle facial micro-expressions or nuanced body language, enabling the system to offer richer and more precise insights. This enhancement ensures that the system keeps pace with advancements in deep learning methodologies.

**4. Incorporation audio and text data:**

Integrating audio and text data further enriches the system’s engagement analysis capabilities. Speech analysis can be conducted using techniques like Voice Activity Detection (VAD) to measure verbal participation frequency, while sentiment analysis evaluates the tone and emotion behind spoken words. Monitoring chat messages during meetings adds another layer of insight, such as identifying participants who are actively contributing via text. Together, these methods complement video-based analysis, providing a multi-dimensional understanding of individual and group engagement dynamics.

**5. Personalization**

Introducing customization options for engagement metrics allows the system to cater to individual roles, preferences, and meeting objectives. For instance, a team leader might prioritize metrics related to participation frequency, while a facilitator may focus on identifying passive attendees. Personalized dashboards can display tailored insights, such as highlighting participants who require follow-up or recognizing individuals who actively drive discussions. This level of personalization not only enhances user experience but also ensures that the system delivers maximum value across diverse use cases.

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