### **Abstract: Bias-Free Resume Screening System Using AI and Fairness-Aware Models**

AI-driven recruitment platforms are transforming how organizations screen job candidates, offering speed and scalability. However, these systems often inherit biases present in historical data, leading to unintentional discrimination against certain demographic groups. This project proposes a **Bias-Free Resume Screening System** that evaluates candidates based strictly on skills and qualifications, promoting fairness, transparency, and ethical AI practices in human resource management.

The system begins with **intelligent resume parsing** using Natural Language Processing (NLP) to extract structured data such as skills, education, certifications, and work experience. Personally identifiable information (PII) and protected attributes like names, gender, and location are removed to prevent bias during model training.

A **skill-based feature extraction module** converts resumes into structured vectors using techniques like TF-IDF and BERT embeddings. These vectors represent candidates' abilities and are aligned with job descriptions to compute relevance scores. The system excludes demographic and sensitive information throughout model development.

To ensure fairness, **bias detection and mitigation tools** such as Fairlearn and IBM’s AIF360 are integrated. These tools measure bias using metrics like disparate impact and demographic parity. Where needed, bias mitigation strategies such as reweighting or adversarial debiasing are applied.

The system also includes **Explainable AI (XAI)** components using SHAP or LIME to provide transparent insights into the decision-making process. Recruiters can understand which features most influenced a candidate's evaluation, ensuring accountability and trust.

Tested on public and synthetic datasets like the Ehire Resume Dataset and AI4HR, the system demonstrates strong performance in identifying qualified candidates while maintaining fairness across demographic groups. It is compliant with global data protection and anti-discrimination standards.

In conclusion, this bias-free resume screening system addresses ethical challenges in AI-based hiring. By focusing on skills and transparency, it supports more inclusive and equitable recruitment practices—helping organizations meet both operational and diversity goals.