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AI-Driven Recruitment and Hiring Automation through CV Scanning and AI Agents

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Abstract:

The presented work is dedicated to the development of an AI agent that will perform automated CV sorting and evaluation to assist current hiring processes with a supervised machine learning model. A Random Forest Regressor containing 300 trees was trained on structured features based on the unstructured CV information including years of experience, number of related skills, education level, overlap of skills with the job description, and coverage ratio. The 50 actual CVs dataset was divided to 80 percent training set and 20 percent testing set and the ground truth target used in supervised learning was HR inspired rule based scoring. The model realized an impressive predictive power, as seen with the R^2 of 0.94 and Mean Absolute Error of 4.46 which signifies a significant agreement with human based ratings. The trained model is integrated to an AI agent that automates the ranking of the candidates, short listing and scheduling of interviews. The system is particularly effective at unloading HR staff and increasing the efficiency of the recruitment process; nevertheless, some of the key issues are the bias in the training data, the tendency of the system to treat different candidates with unequal consideration, and the limited interpretability of the model. The study highlights the importance of introducing feedback loops, reducing bias, and establishing transparency to ensure that AI-based recruitment systems were ethically, reliably, and humanly deployed.

Keywords: Natural Language Processing (NLP), Artificial intelligence (AI), Autonomous Recruitment Systems, Predictive Analytics.

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Introduction

Every organization should have a recruitment section, yet the traditional hiring processes are often tedious, inaccurate and prejudiced. The HR specialists need to go through a huge number of resumes manually, screen the qualifications of the applicants, and form snap judgments, which may result in errors, delays, and discrimination. The need is to have automated, effective and urgent. fair procedures within the recruitment field as a result of the growing complexity and numbers of applications. Artificial intelligence (AI) has massive potential that can transform the recruitment sector by automating repetitive processes, standardizing evaluation processes, and enhancing the accuracy of decisions. CV sorting and assessment tools based on artificial intelligence (AI) can analyze unstructured data, quantify the qualification, experience, and suitability of a candidate to a job, and generate firstlevel scores that can be related to evaluation criteria. The aim of such systems is to reduce bias, accelerate the hiring process, and reduce the workload of the HR personnel by emulating human decision making. In spite of these advantages, AIbased hiring has some disadvantages. Biases can be passed on in training data, model decisions cannot be transparent and it is necessary to be cautious to ensure fairness across a. range of candidate profiles. These problems should be addressed by designing models carefully, continuing to improve and add feedback systems that improve accuracy, equity and interpretability. This paper introduces the development of an AI-based agent that can grade and assess the CV and states the operational, technical, and ethical challenges and emphasizes how this tool can enhance the hiring process. In addition to discussing methods for improving equity, minimizing bias, and preserving transparency, it describes the process for data preparation, model training, and evaluation. By doing this, the study advances the more general goal of developing hiring practices that are not only effective but also fair, dependable, and long-lasting. B. Problem Statement The backlog of decisions as a result of traditional hiring practices is filled with inconsistencies and bias for recruiters, which in turn slows the speed of decision-making and results in adding errors to the recruitment process. C. Research Objectives • Explore AI-driven CV scanning for automated candidate screening. • Analyze AI agents for scheduling and candidate communication in recruitment automation. • Assess the effectiveness of AI in reducing hiring time and bias. II. LITERATURE REVIEW AI has reshaped the recruitment process by improving efficiencies, precision, and significantly lessening bias. Initial research and training indicate that tools such as digital scanners that analyze resumes, and systems that

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assess videos of interviews can speed up the recruitment process and access hidden talent, although such systems still require human intervention and are only as good as the training data supplied. [1] AI systems designed to analyze remote interviews on candidates's professionalism, tone, and expressions achieve a high correlation with human scoring to instantaneously hire with minimal supervision during emergencies, marking breakthrough innovations. [2] More advanced systems such as multiagent recruitment systems, which automate the hiring process from resume retrieval and analysis to candidate ranking and scoring, can complete the process up to 65 percent faster than human experts while improving the accuracy of their judgement on par with AI, marking a transition from AI as a subordinate tool to near autonomy as a recruitment tool. [3] Easier put, however, the organization-implementation captures 'ease of use', job-fit compatibility as well as perceived usefulness, while bias, data security, and cost concerns still exist. [4] AI's environmental impacts are numerous: it conserves paper and travel, though it does require large amounts of energy, pointing to the necessity of sustainable AI use. [5] The socialpsychological factors need to be included for the acceptance of AI, as the individual differences, personality types, and the level of technology user-dom affect the willingness to embrace AI, thus the need for focused campaigns and enlightened advocacy. In summary, AI is promising to enhance the efficiency of the hiring processes as long as it is designed to maintain fairness, accountability, and reasonable assurance of the processes involved in the hiring. III. METHODOLOGY This research employs a scenario-driven experimental approach to design, implement, and assess an AI-based framework for resume screening and recruitment automation. The way it is structured is as a set of interconnected processes instead of a set of procedural steps to be followed, supported by three realistic recruitment situations, hence making sure that the system evaluation is a reflection of the real-life hiring conditions. A. Data Acquisition and Scenario Design There were 50 real CVs as PDF files collected and used as the main data set. An isolated Job Description (JD) of a technical position was developed. The system was evaluated using the following three scenarios of recruitment according to the supervisor orders. : • Scenario 1 (Bulk Screening): The whole 50 CV are done simultaneously to simulate mass recruitment. • Scenario 2 (Shortlisting to Preliminary Interview): Ten most successful candidates are selected to undergo the preliminary screening process. • Scenario 3 (Final Selection): The top-three candidates are shortlisted to the final interview process. Such cases directly align with the real HR recruitment processes and allow presenting the results in a practical and decision oriented way. B. Text Extraction and Feature Engineering In order to extract

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unstructured textual content in CV PDFs a text extraction pipeline based on the PyMuPDF (fitz) library is used. The text extracted is processed to create rule-based and pattern-matching processing in order to generate structured numerical features. • Years of Experiences: Calculated with the help of the regular expression analysis. • Number of Technical Skills: Decided with the help of a given skill lexicon. • Education Level: Was represented in numerical terms based on qualification (Diploma, Bachelor, Master, PhD). • Skill Overlap with Job Description: Identified based on the comparison of CV skill with the skills needed in the Job Description. • Coverage Ratio: The coverage ratio was determined by dividing skills on the job description, which are found in each curriculum resume. These characteristics constitute predictive input variables of machine learning based scoring. C. Target Variable Construction Since labeled recruitment datasets were not available, a artificial HR-inspired target score was created which mimics human measuring: • Score = (Years of Experience × 10) + (Number of Skills × 5) + (Education Level × 5) This formulation represents pragmatic HR scoring logic and it allows guided learning within realistic conditions. D. Model Selection and Training Various regression models were under experiment such as Linear Regression, Support vector Regression (SVR), Gradient Boosting Regression (GBR) and Random Forest Regression. These selection criteria were: • Predictive accuracy (R^2) • Error in prediction (Mean Absolute Error -MAE) • Robustness to noise • Capability of representing nonlinear interactions of features. • Suitability for small datasets Since all models tested showed some degree of instability, the Random Forest Regressor showed the best and most consistent performance. The model was then trained on a 8020 train test split of 300 decision trees. The trained model achieved: • R^2 = 0.94 • MAE = 4.46 These findings confirm the high correlation between AIpredicted scores and HR-inspired ground-truth scoring. E. Scenario-Based Evaluation and Categorization All the CVs have been rated and divided by the specified recruitment scenarios using the trained Random Forest model: • Category A: All candidates (initial screening pool) • Category B: Top 10 candidates (first interview round) • Category C: Top 3 candidates (final interview stage) The ranked predictions were automatically used to compute dynamic score thresholds to make selections adaptive to various job roles. F. Interconnecting with AI Agent Interface. The trained model is incorporated in a graphical HR application (Tkinter-based GUI) that permits: • Categorizing candidates automatically. • Prediction of uploaded CVs in real-time. • Exporting of shortlisted candidates into CSV files to be used by the HR. This integration will make sure that the methodology of the experiment is not merely a theory, but a theory that is actually proved in a functional recruitment automation system. Fig. 1.

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Scatter plot Fig 1: The scatter plot demonstrates that the highest accuracy (R^2) is obtained with the least error (MAE) with the help of Random Forest which means that the model has the best predictive stability. Fig 2: The heat-map graphically confirms Fig. 2. Heatmap that the Random Forest is always stronger in all the metric dimensions than the rest of the algorithms. Fig 3: The stacked bar plot shows that the best balanced performance based on performance in terms of accuracy, error and cost of computation is offered by the Random Forest. The classification of the candidates is carried out through thresholding model, which is forecasted through the distribution of scores of the training set. This will enable the division of the candidates into Category A (all applicants), Category B (top 10 shortlisted) and Category C (top 3 finalists). The thresholds will ensure that both existing and new submissions of resumes receive equal classification. All the functional elements are then brought together into a graphical user interface (GUI) manufactured using the Tkinter, allowing the HR personnel to visualize job descriptions, search through Fig. 3. Stacked bar numerous resumes, create classifications, and predict the type of new applicants. IV. SYSTEM DESIGN/IMPLEMENTATION A. Overview The system that will be proposed is comprised of three key stages: • CV Parsing: Get the relevant skills, experience, and qualifications. • Candidate Scoring: ML models should be used to rank the candidates based on their suitability towards the job. • AI Interaction with the Agents: Interview, respond to questions and take feedback. . B. Workflow Diagram Fig. 4. Workflow Diagram C. Technical Details • Text extractors like PyMuPDF or spaCy. • ML classifiers (Random Forest, SVM) to rank the candidates. • AI agents implemented using conversational AI frameworks for interaction. V. RESULTS AND DISCUSSION The application shows significant improvements in the efficiency of the recruitment and accuracy of candidates selection. A. Efficiency Improvements CV scanning saves a lot of time in screening the candidates by automation. The system takes an average of 50 of the CVs in minutes as opposed to hours or days required in a manual screening system. This enables HR teams to work on more strategic and senior level decision making and planning as opposed to mundane duties. B. Accuracy and Candidate Matching ML scoring and NLP based parsing makes sure the candidates are judged in a similar manner according to the predefined criteria, including skills, experience, and qualifications. Accuracy measures show that there is a high level of precision in the identification of appropriate candidates, and false negativity will be minimized whereby good candidates may be missed. C. Bias Reduction The system reduces effect of unconscious bias because the criteria used to do evaluations is standardized. Rather than the irrelevant considerations of gender, age, or ethnicity used by human

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evaluators, AI scoring encourages the hiring decision to be fairer. Fairness is also achieved through continuous monitoring and retraining of models. D. AI Agent Performance AI agents enhance the engagement of the candidates by making automated communication, arranging the interviews, and delivering prompt feedback. This lowers the administration burden and candidate experience is enhanced. Such metrics as the response rate and satisfaction questionnaires are positive, and they indicate that interactive AI is useful in recruitment. In combination, CV scanning and AI agents have an enormous recruiting efficiency that neither of the strategies can achieve independently. Such limitations are the use of non-standard CV forms, possible excessive dependence on AI scoring, and a need to upgrade the model regularly. Real-life implementation offers measurable benefits to both operational effectiveness of HR and satisfaction of applicants and can be highly applicable in a business environment. VI. CONCLUSION The comparison of the literature shows that the current studies of AI-based recruiting solutions are concentrated mostly on individual aspects of hiring rather than offering a unified system. Without providing a practical framework, Albassam (2023) provides a conceptual overview of AI-driven recruitment strategies. Similarly, Lee and Kim (2021) and Pathak and Pandey (2025) focus on AI-improved interviewing platforms and multi-agent evaluation systems and install their contributions at a later stage in the recruitment process. Other works in the literature, including the models of organizational decisionmaking and adoption (Lee & Kim, 2021), sustainability and process optimization through generative AI usage (Koteczki et al., 2025), the role of affective responses to AI usage in candidates (Koechling et al., 2023), concerns of fairness and accessibility, (Fisher et al., 2024), and technology acceptance factors (Calluso et al., 2025), have a valuable theoretical and contextual value but do not offer The given project fills this gap by providing a comprehensive, end-to-end automation pipeline to deal with resume processing and shortlisting. The system uniquely combines resume text extraction, structured feature engineering, job description-based skill alignment, multi-model evaluation, Random Forest predictive scoring, threshold-driven categorization, and a GUI-enabled deployment for HR professionals. This project provides a practical and executable solution that directly improves early-stage recruitment efficiency and decision-making, in contrast to the primarily conceptual or interview-based studies examined. This positions the developed system as a pragmatic adjunct to current research, connecting theoretical AI recruitment frameworks with practical resume automation tools. VII. ACKNOWLEDGMENT Most sincerely I would like to thank the instructor for all the help, motivation, and encouragement given in the course of this work. Their valuable

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