Advanced Recruitment and Resume Building using NLP

Akhilesh Venkiteswaran
Department of Artificial Intelligence and Data Science, Chennai Institute of Technology, Chennai 600 069, India
akhileshvenkiteswaran.aids2023@citchennai.net

Dr. D. Jagadiswary
Department of Artificial Intelligence and Data Science, Chennai Institute of Technology, Chennai 600 069, India
jagadiswaryd@citchennai.net

Abstract: Human Resource Management is one of the most important aspects in shaping the growth of a particular sector or a company. Without human resource management, the company can have several consequences of facing obstacles and issues which can result in its downfall. Therefore, it is extremely crucial for the recruitment team to select the best candidates that appear through the levels even though AI plays a significant role for selection basis. This article investigates the role of AI in shaping the company's shift to hiring the most suited candidates from the selection process. This work calls out the significance of using AI in resume building which helps candidate to express their skills and stand amongst the applicants. This article has explained in detail with the proposed methodology of using Natural Language Processing and a comparison with results and discussion is done with existing methods achieving an accuracy based on the job designation. This article also talks about the current challenges faced which are resolved through various experiments and results. In addition to this, it also discusses about the upcoming challenges which needs to be resolved.

Keywords: Natural Language Processing (NLP), Artificial intelligence (AI), Human Resource Management (HRM), Resume' Matcher, Resume' Building.

I. Introduction

AI has been introduced in the role of Human Resource Management (HRM. During the period of IT companies and big co-operations and government offices were set up due to the rapid growth of economies across the globe, the HRM had a very challenging tasks during the recruitment process as they must go through hundreds and thousands of applications. Nowadays, HRM have taken up tasks very smoothly with the usage of AI. AI has helped in screening process by selecting the best candidates possible. This allows the company to inspect the candidates without looking deep into their profile and assign roles to candidates that fit into the work allotted for them. This provides the company the power to choose the type of candidates that they want at any given moment, without wasting much time. The applicants now use AI to build their resume' which is a crucial step in HRM process. Even social media brand-building of an individual has helped in increasing the likelihood of HRM selection process. This has helped many individuals to adopt AI to their advantage and showcasing their skills.

II. Literature Review

A. AI In HRM Process

AI has been gradually cohesive into numerous functioning procedures of the HR department given by Votto et. al., [1]. The super-intelligent AI machineries offer a renewed tactic to faculty management improving all-in-all company performance, efficiency and bestowing varied opportunities for performance administration [2] & [3]. The implementation of AI in HRM simplifies easier access to extremely skilled individuals for departments & organizations, making the recruitment and enrolment process very efficient. [4]. AI-affiliated training allows administrations to advance into knowledge-driven entities proficient in catering to personalized needs for training for different roles. [5]. The growing adoption of AI in HRM is determined in its ability to provide value for customers satisfaction and choices, employment and employers, and administrations equally with respect to their needs [6]. AI is also used in, task automation, chatbots, video interviews, and recreations to streamline processes and broaden candidate pools [7-9]. Elisabeth K. Kelan [10] focussed on the need for algorithms to ensure that there are equal opportunities for gender-neutral individuals, male or female in all aspects of selection process. AI in HRM helps in the automatic screening process. Priyanka et. al., [11] proposed a hybrid deep learning model called the Pyramid Dilated Convolutional Neural Network with Bidirectional Gated Recurrent Unit (PDCNN-Bi-GRU) extracts skill-related features from resumes. The model includes a fuzzy matching module, that match skill-related features with job categories, to enhance the accuracy of the candidate-job matching process.

Figure 1 shows the existing system's flow chart process of PDCNN-Bi-GRU.

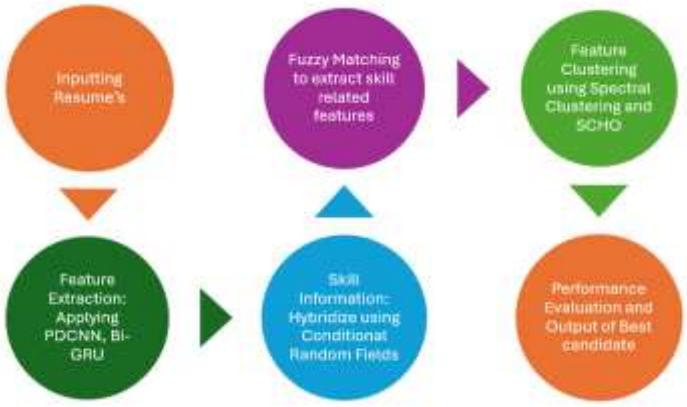

Figure 1: Flowchart of PDCNN-Bi-GRU.

B. AI in Resume Building

With the rise of AI in every sector of organizations, candidates look forward to integrating AI capabilities to use it to their own advantage. Several AI applications like ChatGPT, Gemini etc., help in building up resume's that will play as a gamechanger in the selection process. Figure 2, gives the process of AI in generating the required resume from the prompt. Figure 3 depicts the difference between informal resume and AI-Generated formal resume. The language and structure are professional compared to the informal resume. To close in the gap of hiring candidates based on individual skills, Nan Li [12] suggested the use of e-recruitment recommendation system. This system helped the job seekers to find the most optimal job options which they can apply for based on their skills and knowledge and allow the recruiters to easily get in touch with potential employees.

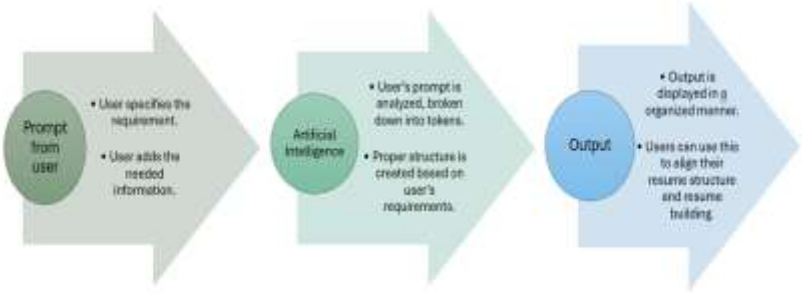

Figure 2: The process of AI in generating the required resume from the prompt.

Figure 3 is the resultant output of a formal resume to a informal resume.

Figure 3: Before and After AI generated resume.

III. Proposed Methodology

The proposed work for a resume matching for recruitment mainly focuses on NLP. Recruitment of the best candidates has become ever more difficult in recent years. This work proposes the idea of implementing natural language processing (NLP) to solve the problem of efficiency and time-consumption. Machine learning and Deep learning techniques require constant training, and, in most computers, it may not be able to process complex learning methods to run and execute the models. Therefore, a lighter, efficient and a more accurate learning is required, and the usage of NLP is introduced here. Natural Language Processing (NLP) is a field of artificial intelligence that focuses on enabling machines to understand, interpret, and generate human language. By bridging the gap between human communication and machine understanding, NLP facilitates tasks such as text analysis, sentiment analysis, machine translation, speech recognition, and chatbot development. The key components of the NLP include text processing, syntax and semantics, machine learning models, tokenization, lemmatization. Various applications of NLP include chatbots, machine translation, text summarization and spam detection. This system mainly discussed about the need to bring NLP in HRM recruitment processing. NLPs have semantic searches and in its latest addition also includes its own ability to select the required type of machine learning model is necessary for better results. Figure 4 gives the working of Natural Language Processing.

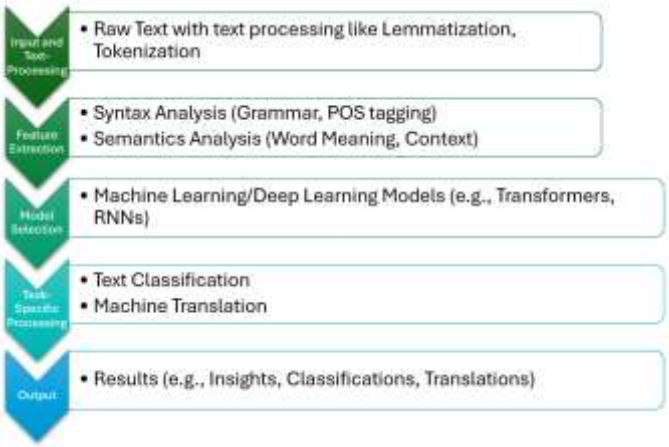

Figure 4: Flowchart of NLP.

The given Table 1 compares the existing methods with proposed methods in various points.

Table 1: Existing vs Proposed methods comparison.

SNO.	PROPOSED METHODS (NLP)	EXISTING METHODS (ML & DL)
1.	Simple usage of NLP is needed.	Complex methodologies were being used.
2.	NLPs select the required models needed for analysis.	Machine and Deep learning models require longer time to learn and execute the operations.
3.	Rate of error is lower compared to ML & DL models.	Rate of error is higher compared to NLP.
4.	Errors are easy to solve.	Errors are quite complex to solve.
5.	Faster compared to ML & DL.	Slower compared to NLP.
6.	Highly efficient.	Efficiency is a challenge to be solved.
7.	Does not require.	Requires high processing power.

Human Resource Management requires a lot of attention as employees are the driving force for the growth of every company, every government. Analysing and understanding the importance of this department's role in shaping the way employees work is critical for major industries Several experiments based on the literature review were implemented and challenges were also solved. These experiments included the resume builder that is mentioned in Figure 3, where the candidate was easily able to write their achievements and education in a prompt and the resume was built in a structured fashion. This helps the HRM department to easily go through the candidate's profile giving a better attention to detail and understanding the skillset of that individual. This ensures bias reduction and increases the likelihood of candidate's resume be shortlisted. A resume' matcher was also built in this process using normal Python code and Flask interface framework. With the help of NLP, it was able to detect which resumes of individuals were the best choice for the role that was designated in the job description. This will allow the HRM to filter out the candidates that

do not possess the required skills and knowledge in relation with the role designation, ensuring quality candidates are picked for a smooth and efficient administration.

IV. Results And Discussion

Figure 5 shows the resume matching system. In this system, the hiring manager can compare multiple resumes and match with the job description thereby comparing with an ideal resume with candidates resume. The AI helps in predicating the likelihood of the candidate's skillset to the provided job description, which assists the HRM department to select the required candidates for shortlisting process. Additionally, resume that stands out the best is also shown, from which the recruiter can rank the resume individually or automate them. This system has improved from existing screening systems, by self-identifying the best resume, the probability of job suitability to the designated role listed with a percentage number. Multiple skills can also be listed down and still get the most appropriate predictions possible. The AI model outperformed other existing models by eliminating gender and race bias completely. The AI-NLP model only focussed on the skillset that is provided in the resume, giving a fair opportunity to all groups of individuals. The Resume matching system has used the latest technology of NLP it checks and reads every single part of the resume that has been selected initially. Next, a similarity check has been done based on the best model that its choses on its own giving it an autonomous selection of models for proper functioning. Once the job roles have been described, the best resume is then selected as shown in Figure 5.

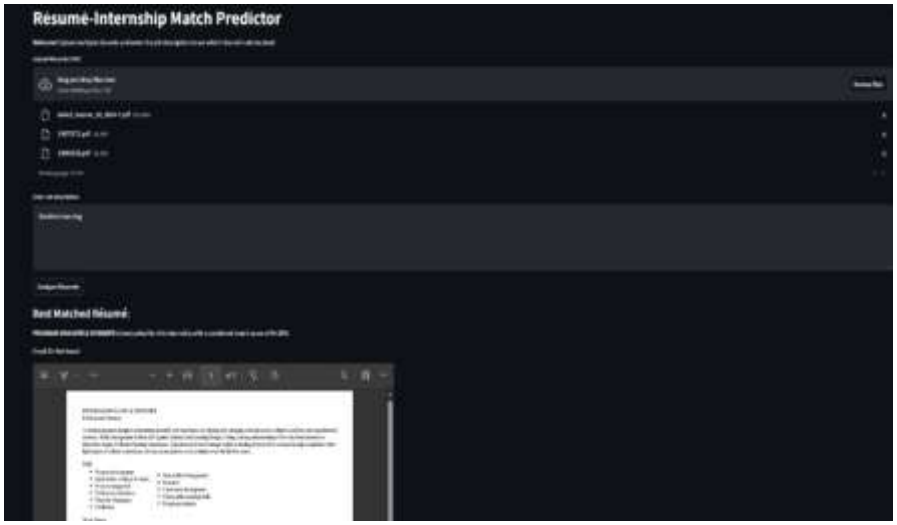

Figure 5: Resume Matcher for screening process.

The Figure 6 shows the best job roles that can help in taking the job description that is perfectly aligned. For example, the resume of mentioned roles of "Program Manager & Designer" was preferred more compared to "Media Activities Specialist" for a machine learning job description. It also provided with an accuracy number, giving the likelihood of matching the job category.

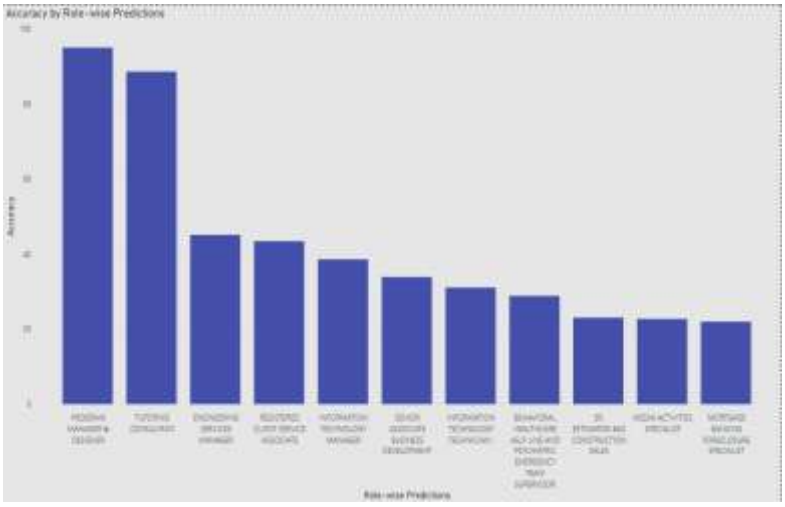

Figure 6: Predicted measurements across different skill levels and job roles.

V. Advantages Of AI In HRM

AI and other tech stacks bring far-fetched opportunities for establishments to achieve ideal premeditated business outcomes such as improved service quality, yield, cost-effective service excellence [13], return on investment [14], effective competence, client engagement and loyalty [15], workers' service excellence [16] and reducing substantial capital and operational cost. The growing

pursuit in examining AI and its power on sub-functional areas of HRM is rising. For example, emerging AI-based HRM technologies can lead provisions to talent acquisition, progress, assessment, and retaining in large technology MNEs [17 - 20] which also assists from enrolment to appointment, assessing, and cross-examining the most suitable candidate. Incorporation of AI in corporations and with employees, helps the work to get done faster, efficiently and in a better enhanced way. AI-focused HRM create beneficial employee outcomes such as job fulfilment, responsibility, employee commitment, and participation, thereby increasing their execution [21-23]. AI-driven assistants provide new employees with information and support, reducing the workload on HR teams. AI can give suggestion in providing training, mentorship, and career progression plans tailored to individual employees. It analyses performance data to provide actionable insights for appraisals and promotions. AI forecasts future workforce needs based on trends, enabling better resource allocation. Due to its flexible and scalability nature, AI can optimize the tasks for employees to complete it quickly, thereby massively improving efficiency. Figure 5 properly lists the advantages of using AI in HRM. By implementing the usage of AI in HRM, the workload and efficiency decreases and increases respectively. Figure 7 explains the advantages of AI in HRM process.

Figure 7: Advantages of AI in HRM

VI. Challenges And Future Prospects

While creating the model to extracting data to implementations, several challenges were encountered. First was the problem of overfitting. These datasets contained huge amounts of data which created a difficult situation for machines to handle the data and process it. The problem of noisy and unwanted data was encountered. Removing these data created the risk of removing needed data for NLP system. Bias was also seen when it comes to skills that are small but very crucial. An experiment was conducted on the resume matcher, where two candidates were taken as test cases, one who had more skills than the other on the same specific job role. But the candidate with lesser skills gave the better choice to be selected because of mentioning specifically only related to job criteria and other minor important skillset were not taken into consideration. Another challenge is candidates putting out fake resumes so that the AI can detect their resumes much faster thereby fool proofing AI's ability to deeply understand the individual's skillset. AI's capabilities towards live human interview are still a challenge that needs to be solved. Although this AI resume model has eliminated the bias towards gender and race by including diversity and inclusivity, there is a need for continuous improvement to fix the above challenges. Making HRM integrate with AI tools is a future perspective where the HR chooses the candidates without any bias. Developing transparent AI policies towards the recruitment process and upskilling HR managers in selection process is required. Continuous learning and development of the model especially the resume' matcher and the real-time analysis model is required.

VII. Conclusion

The proposed system highpoints the transformative role of Artificial Intelligence (AI) in reforming Human Resource Management (HRM) processes. AI significantly improves employment by automating resume screening and skill matching, reducing bias, and refining decision-making effectiveness. Using Natural Language Processing as a different approach, the model was able to accurately decide which is the best suited resumes. This also helped the computers to use lesser processing power with fewer errors and letting NLP technology decide which is the best suited model that is required for it to do the analysis. The integration of AI in HRM holds enormous potential for further modernisations. Addressing challenges like data privacy, overfitting, and the inclusion of minor skills in assessments is crucial. Transparent AI guidelines and upskilling HR professionals will be vital to maintain ethical standards and enhance AI applications in HRM. AI has demonstrated to be a game-changer in HRM, transforming recruitment and employee management processes while promoting a healthier work environment. By addressing current challenges and embracing future innovations, AI can ensure fairness, efficiency, and inclusivity in workforce management, driving both employee satisfaction and organizational success. This proposed method underscores the vital role of AI in shaping the future of HRM across industries.

VIII. Abbreviations

HRM – Human Resource Management.
AI – Artificial Intelligence.

NLP – Natural Language Processing.

Acknowledgment

This work was partially funded by the Center for Research at Chennai Institute of Technology, India, under funding number CIT/CFR/2024/RP/001.

References

[1] Votto, A. M., Valecha, R., Najafirad, P., & Rao, H. R. (2021). Artificial intelligence in tactical human resource management: A systematic literature review. International Journal of Information Management Data Insights, 1(2), 1–15. https://doi.org/ 10.1016/j.jjimei.2021.100047

[2] Khaled, A. S. D., Sharma, D. K., Yashwanth, T., Reddy, V. M. K., doewes, R. I., & Naved, M. (2023). Evaluating the role of robotics. In S. Yadav, A. Haleem, P. K. Arora, & H. Kumar (Eds.), Machine Learning and Artificial Intelligence in the Field of Performance Management BT - Proceedings of Second International Conference in Mechanical and Energy Technology (pp. 285–293). Singapore: Springer Nature.

[3] Hemalatha, A., Kumari, P. B., Nawaz, N., & Gajenderan, V. (2021). Impact of Artificial Intelligence on Recruitment and Selection of Information Technology Companies. In Proceedings - International Conference on Artificial Intelligence and Smart Systems, ICAIS 2021 (pp. 60–66). https://doi.org/10.1109/ICAIS50930.2021.9396036

[4] Meshram, R. (2023). The role of artificial intelligence (ai) in recruitment and selection of employees in the organisation. Russian Law Journal, 11(9s), 322–333. https://doi.

[5] Chen, Z. (2022). Artificial intelligence-virtual trainer: Innovative didactics aimed at personalized training needs. Journal of the Knowledge Economy, 29, 2007–2025. https://doi.org/10.1007/s13132-022-00985-0

[6] Chowdhury, S., Dey, P., Joel-Edgar, S., Bhattacharya, S., Rodriguez-Espindola, O., Abadie, A., & Truong, L. (2023). Unlocking the value of artificial intelligence in human resource management through AI capability framework. Human Resource Management Review, 33(1), Article 100899. https://doi.org/10.1016/J.

[7] Tambe, P., Cappelli, P., & Yakubovich, V. (2019). Artificial intelligence in human resources management: Challenges and a path forward. California Management Review, 61(4), 15–42. https://doi.org/10.1177/0008125619867910

[8] Suen, H.-Y., Chen, M. Y.-C., & Lu, S.-H. (2019). Does the use of synchrony and artificial intelligence in video interviews affect interview ratings and applicant attitudes? Computers in Human Behavior, 98, 93–101. https://doi.org/10.1016/j. chb.2019.04.012

[9] Duggan, J., Sherman, U., Carbery, R., & McDonnell, A. (2020). Algorithmic management and app-work in the gig econ omy: A research agenda for employment relations and HRM. Human Resource Management Journal, 30(1), 114–132. https://doi.org/10.1111/1748-8583.12258

[10] Kelan, E. K. (2024). Algorithmic inclusion: Shaping the predictive algorithms of artificial intelligence in hiring. Human Resource Management Journal, 34(3), 694–707. https://doi.org/10.1111/1748-8583.12511KELAN

[11] Priyanka, J. H., & Parveen, N. (2024). DeepSkillNER: an automatic screening and ranking of resumes using hybrid deep learning and enhanced spectral clustering approach. *Multimedia Tools and Applications*, *83*(16), 47503-47530.

[12] Mashayekhi, Y., Li, N., Kang, B., Lijffijt, J., & De Bie, T. (2024). A challenge-based survey of e-recruitment recommendation systems. ACM Computing Surveys, 56(10), 1-33.

[13] Upadhyay, A., & Khandelwal, K. (2018). Artificial Intelligence in Human Resource Management. *International Journal of Research in Human Resource Management, 45*(3), 45–60.

[14] Wirtz, J. (2020). Organizational ambidexterity: cost-effective service excellence, service robots, and artificial intelligence. Organizational Dynamics, 49(3), 1-9.

[15] Torres, E. N., & Mejia, C. (2017). Asynchronous video interviews in the hospitality industry: Considerations for virtual employee selection. International Journal of Hospitality Management, 61, 4-13.

[16] Prentice, C., & Nguyen, M. (2020). Engaging and retaining customers with AI and employee service. Journal of Retailing and Consumer Services, 56, 102186.

[17] Nguyen, T. M., & Malik, A. (2022). Impact of knowledge sharing on employees' service quality: the moderating role of artificial intelligence. International Marketing Review, 39(3), 482-508.

[18] Bersin, J., & Chamorro-Premuzic, T. (2020). New ways to gauge talent and potential.

[19] de Kervenoael, R., Hasan, R., Schwob, A., & Goh, E. (2020). Leveraging human-robot interaction in hospitality services: Incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots. Tourism Management, 78, 104042.

[20] Malik, A., De Silva, M. T., Budhwar, P., & Srikanth, N. R. (2021). Elevating talents' experience through innovative artificial intelligence-mediated knowledge sharing: Evidence from an IT-multinational enterprise. Journal of International Management, 27(4), 100871.

[21] Aouadni, I., & Rebai, A. (2017). Decision support system based on genetic algorithm and multi-criteria satisfaction analysis (MUSA) method for measuring jo

[22] Azadeh, A., Yazdanparast, R., Zadeh, S. A., & Keramati, A. (2018). An intelligent algorithm for optimizing emergency department job and patient satisfaction. International journal of health care quality assurance, 31(5), 374-390.

[23] Castellacci, F., & Viñas-Bardolet, C. (2019). Internet use and job satisfaction. Computers in Human Behavior, 90, 141-152.

Akhilesh Venkiteswaran is an undergraduate student at Chennai Institute of Technology, specializing in Artificial Intelligence and Data Science. With a strong academic foundation and practical experience in AI and machine learning, he has developed expertise in areas such as data analytics, natural language processing, and software development. As an enthusiastic researcher, he is currently exploring advanced topics like facial expression recognition in real time video streams and the application of AI in Human Resource Management. Akhilesh is also a top 10 finalist in the Green FinTech Hackathon conducted by RBI-H IIT Jodhpur TISC. Through various projects, internships, and research initiatives, he is building a solid foundation in AI while contributing to cutting-edge technologies and methodologies.

E-Mail Id akhileshvenkiteswaran.aids2023@citchennai.net, akhileshvenki05@gmail.com

Dr. D. Jagadiswary M.Tech., Ph.D., Professor in the Department of Artificial Intelligence and Data Science, Chenai Institute of Technology, Chenai. She received her Ph.D through QIP, AICTE from Pondicherry university. She received the bachelor's degree in Electronics and Communication and master's degree in information security from Pondicherry University. She is a life member of ISTE. She published 12 International Journals, 2 National Journals, 24 International Conferences and 4 Patents. Her research interests include Machine Learning, Security Analytics, Logic Circuit Design, Electromagnetics, Cryptography and Network Security, Formal Languages and Automata Theory.

E-Mail- Id- jagadiswaryd@citchennai.net, jagadiswary@ptuniv.edu.in