



A Deep Learning Framework for Optimizing Talent Acquisition and Placement

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Abstract: Talent acquisition and placement are critical processes in human resource management, yet they often face inefficiencies due to manual screening, bias, and mismatched hiring decisions. Finding suitable candidates for an open role could be a daunting task, especially when there are many applicants. It can impede team progress for getting the right person on the right time. In traditional models, they use ML technologies like KNN, and NLP on text based screen resuming which has limitations such as a bias, inefficiency and lack of personality assessment. To addressing this challenges we proposed a deep learning based framework for talent acquisition and placement using CNN and RNN. Comparing to the traditional models this system enhances improving accuracy, reduces recruiter workload to better workflows placement and talent acquisition. This enhances efficiency, improves decision-making, and ensures optimal talent placement in organizations.

Keywords: Academic Talents, Industry Opportunities, Higher Education, Graduate Skills, Workforce Alignment.

1. Introduction

In order to hire and hold onto talent, recruitment of the right profile is necessary. In the timeline of modern technology and workforce demand, successful recruitment strategies must now become a necessity. This paper makes an analysis of recruitment policy, assesses its impact and discusses the application of AI in Recruitment. It highlights the importance of aligning talent plans with business goals and diversity initiatives. Talent acquisition is required to recruit and retain skilled employees. With the evolution of technology and the work force, effective recruitment practices are more than a requirement. This study examines recruitment policies, their impact, and how AI is relevant to recruitment. It highlights the importance of aligning talent plans with business goals and diversity initiatives [1]. The hiring process is vital to organizations, but conventional methods have limitations such as bias, inefficiency, and time limitations. This research discusses AI-based hiring through machine learning models to rank and classify resumes in the information technology industry. Four models, namely Decision Tree, Random Forest, SVM, and KNN, were analyzed, and the best performance came from Decision Tree. AI-powered recruitment enhances precision, efficiency, and fairness and makes talent attraction more efficient. This research delves into Aspect-Based Sentiment Analysis (ABSA) to improve hiring by examining candidate reviews through AI. Using the Llama-3-70b

model, it determines the most impactful factors on candidate experience and job acceptance [2]. It reveals how sentiment analysis through AI enhances hiring strategies, employer branding, and efficiency in recruitment. This research introduces a deep learning model, VBA-Net, for the automated evaluation of surgical skills from videos. It offers summative scores for certification and formative feedback for skill enhancement. The model surpasses current approaches by employing full surgical video sequences and sophisticated AI methods. This research introduces IntelCV, an NLP and similarity-based AI-driven resume selection technique.

The evolution of deep learning has played a key role in revolutionizing video resume analysis, and it has sped up the recruitment process and made it data-based. Text-based analysis is used in traditional resume screening, which tends to overlook dominant features like non-verbal cues, communication skills, and personality. Video resumes, meanwhile, give recruiters a broader context about candidates so they can evaluate both verbal and non-verbal attributes [3]. Deep learning models draw facial recognition, voice analysis, and natural language processing (NLP) to make improved judgments of candidate presentations. Precision, recall, and F1-score are examples of evaluation metrics which have recorded incremental progress year in and year out, driven by hiring automation technologies. While tone, confidence, and

sincerity skills keep getting fine-tuned with evolving deep learning models, accuracy improves for evaluating candidates [4]. One of the issues with video resume analysis in deep learning-based approaches is interpretability of AI models. In order to provide increased trustworthiness and usability, incorporating Explainable AI (XAI) facilitates recruiters' insight into why the candidate was assessed a particular manner, promoting fair and non-biased hiring decisions. The trend tracking of video resume analysis over the years points toward a move towards automated, unbiased, and data-driven recruitment processes. With each advancement in deep learning models, they provide **increased accuracy, efficiency, and transparency.

2. Literature Survey

The 2024 paper by Prof. Sona Vikas et al. suggests that a data-driven, strategic strategy using AI and employer branding is advisable to criticize the traditional recruitment biases and high attrition. The newest technologies will raise satisfaction, decrease attrition, and improve the quality of hires, but it raises ethical concerns like AI bias, which should be monitored by humans. When all of these elements unite they create a comprehensive approach that enhances talent alignment to build a powerful workforce through HR strategic functions and equity strategies and technological integration. A 2023 report by Jayesh Singh et al. shows that present day campus recruitment systems fail because of too many human involvement points which create processing issues and communication barriers. The system introduces enhanced employer-student exchange mechanisms together with automatic program for monitoring job applications [6]. Data analytics enable strong applicant-job opening matching which produces effective hiring efficiency. Employers discover improved job placement statistics through a simplified system connecting users to profiles and job opportunities. The system provides an adaptable design to enhance recruitment performance through its advanced features including a resume builder interface and examination evaluation mechanism. The system achieves improved placement results through its ability to connect students' skills properly to existing job vacancies [20].

Robert Golej and Agata Pietron-Piszczek in their 2024 study analyze conventional recruitment processes because they are responsible for unjustified biases and ineffectiveness. The study recommends that companies should use predictive-based AI technology with computer-based CV filtering as a way of improving decision-making capacity. The discussed system reduces the recruitment process time while improving candidate-matching accuracy [7]. The time companies use AI systems, they

construct good recruitment practices based on facts and benefit from enhanced employee retention. Companies know that it is a process of change, which leads to them having organizations that embrace employees with simplicity. Using AI systems in the recruitment processes improves two areas: constructing good organizational culture and improving recruitment practices [8]. Evangelos Katsamakos worked with Oleg V. Pavlov and Ryan Saklad on a collaborative study project for 2024 to examine the impact of artificial intelligence on school hiring processes. The procedure enhances decision-making capacity through predictive analysis and resume screening capability by automatic artificial intelligence software. The procedure accelerates hiring timelines and improves accuracy in candidate-job advertisement matching. Organizations can design robust and fair recruitment procedures through the implementation of artificial intelligence. The process causes institutions to have workers who serve in a lengthier tenure while designing a good nurturing working environment. Utilization of AI in recruitment procedures consequently creates work environments that bring success as it elevates an entire corpus of employees.

Lankun Chen's research in 2024 illustrated how both critical drawbacks of conventional recruitment processes having biases and inefficiencies owing to manually sorting CVs are countered with Artificial Intelligence and Natural Language Processing by allowing this suggested technique more readily to automate resume parsing and matching out candidates. Enhanced results are created in the recruitment process and accurate candidate identification with improved speed in screening capability. The deployment strategy provides more effective candidate screening and quicker resume sorting by 70%. Integration of NLP technology and AI enhances the efficiency of recruitment processes to optimize high-demand hiring best for deployment. The system provides selection processes to allow organizations to recruit successful candidates from the best quality talent pool. The 2024 Hikmat Al-Quhfa et al. publication employs machine learning models such as Random Forest and Neural Networks to fight inefficiency with conventional recruitment [9].

Precision and recall measures indicate how the algorithms enhance recruitment accuracy. The publication suggests a data-based system that updates models to make them a reflection of changes in the labor market. This serves to enhance the business intelligence system's talent recruitment feature. Kiran Kumar Reddy Yanamala (2024) describes how AI can be used in combination with conventional hiring procedures and why it is possible and innovative. Conventional hiring procedures like manual screening and interview scheduling consume time and fail the test. Resume parsing and candidate evaluation and interview scheduling, the most critical hiring procedures, are performed by automation through

predictive analytics and virtual assistant technology. The study depicts how AI-driven onboarding reduces paperwork activity and training procedures and communicates more effectively with candidates in turn reducing admin activity [10]. AI technologies help in candidate selection based on performance outcome and cryogenic levels and optimizing non-bias selection procedures from Yanamala [11]. Studies describe how artificial intelligence outpaces recruitment management systems required for modern business processes [19].

3. Methodology

This section presents an effective methodology for analyzing video resumes using a hybrid deep learning approach that combines Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs).

3.1. Convolutional Neural Networks(CNN)

In Convolutional Neural Networks (CNNs), different layers control how features are extracted and processed for video resume analysis.

Convolutional Layer: This layer detects essential features such as **facial expressions, gestures, and visual cues** from video frames by applying **filters** to extract spatial patterns.

Fully Connected Layer: It compiles extracted features and makes a final prediction, classifying candidates based on predefined hiring criteria.

Simplified CNN Model for Video Resume Analysis

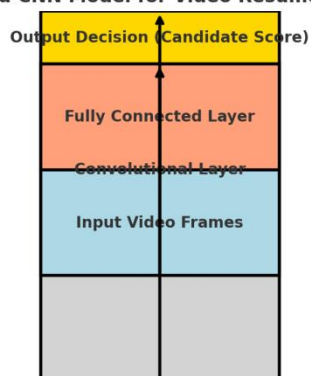


Fig.1 Trend Analysis of video resume analysis Over Time-1

3.2. Recurrent Neural Network(RNN)

Input Video Frames (Speech & Text): Extracted from video resumes.

RNN Layer (LSTM/GRU): Processes sequential speech and text data to capture context, tone, and language patterns.

Fully Connected Layer: Analyzes extracted features for classification.

Output Decision: Generates a candidate score or hiring recommendation.

Simplified RNN Model for Video Resume Analysis

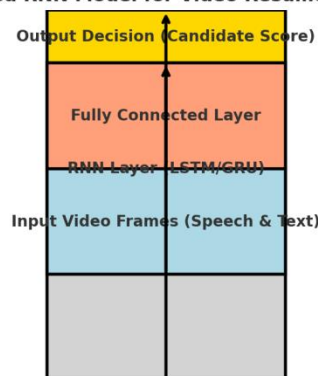


Fig.2 Trend Analysis of video resume analysis Over Time-2

3.3. Applicability Of Hybrid Approach For Video Resume Analysis

Our deep learning system revolutionizes hiring by analyzing video resumes using CNNs, giving an in-depth candidate analysis compared to traditional resumes. It takes into account verbal and non-verbal data, including speech content, tone, facial expressions, and body language, for a comprehensive evaluation of interpersonal skills and confidence [12]. This increases the efficiency of hiring by automating initial assessments, minimizing manual resume screening, and shortening recruitment timelines. Our model enhances candidate-fit predictions, resulting in improved hiring decisions and long-term employee retention. Recruiters benefit from gaining deeper, data-driven insights, enhancing hiring quality and interactions. Job seekers enjoy an improved more dynamic and engaging application process, highlighting their talents with personality [13]. The framework allows for accurate, efficient, and effective talent acquisition for organizations.

3.3. Algorithm

Input: Advanced analysis of video resumes

Step-1: Start

Step-2: Video Resume Dataset Collection (Data Gathering)

Step-3: Perform Data Preprocessing (Frame extraction, audio segmentation, and text transcription)

Step-4: Data Cleaning for missing values and noise reduction

Step-5: Feature Engineering, extracting key visual, audio, and text-based features

Step-6: Design an Efficient Hybrid Model using CNN for spatial feature extraction and RNN (LSTM & GRU) for sequential data analysis

Step-7: First, applies CNN to extract spatial features

from video frames (facial expressions, gestures).

- Step-8: Second, uses LSTM to sequentially learn speech and text patterns over time.
- Step-9: Third, applies GRU to effectively handle long-term dependencies in candidate speech.
- Step-10: Model Performance Estimation using Accuracy, Precision, Recall, and F1-Score 8.Graphs of the Projections
- Step-11: Plot actual vs. predicted candidate evaluation scores for all models Compare the performance of CNN-LSTM and CNN-GRU models
- Step-12: Stop

3.4. Analysis of Video Resume with CNN, LSTM, and GRU

The video resume analysis pipeline encompasses gathering video resumes, speech, and interview data. Preprocessing of data entails frame extraction and speech-to-text transcription to purify and organize the data. Feature selection determines principal features such as facial expressions [14], speech tone, and gestures. CNN extracts spatial features from video frames. LSTMs or GRUs measure sequential trends in speech and body language. The performance of the model is measured in terms of accuracy, precision, and recall. The final maybe presented graphically showing trends, which makes it much more accurate and efficient than making assessments verbally.

3.5. Dataset Description

Emotion-based video resume assessment enhances candidate screening through the measurement of communication skills, confidence, and emotional intelligence using deep learning algorithms like CNN, LSTM, and GRU [15]. The system evaluates video resumes by extracting frames, converting speech to text, and analyzing facial expressions and vocal tones [18].

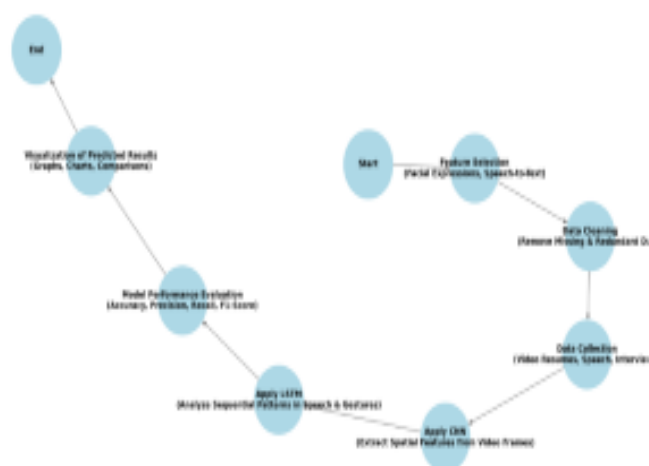


Fig.3 Processing of the datasets along with selecting the proper models CNN detects spatial features, while LSTM and GRU detect sequential patterns in speech and emotions to provide a comprehensive evaluation. Performance metrics like accuracy, precision, and recall validate model efficiency [15], with results presented in the form of graphs and emotion heatmaps. The process provides data-driven, unbiased hiring, improving candidate selection and hiring efficiency [16]. The data consists of hand images taken through an ordinary camera and tagged for gesture recognition. Text input is supported by a trained neural network via hand-gesture recognition [17]. The steps involve hand segmentation, classification of gestures, and tracking motion through a convex hull algorithm for precise and efficient interpretation of the gestures for use in text input.

Trend Analysis of Deep Learning-Based Video Resume Analysis Over Time

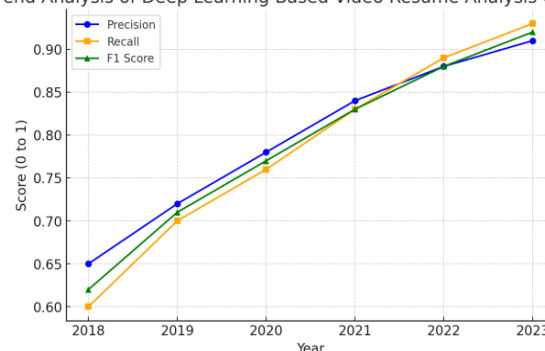


Fig.4 Trend Analysis of video resume analysis Over Time

4. Conclusion

Our deep learning system revolutionizes hiring by analyzing video resumes using CNNs, giving an in-depth candidate analysis compared to traditional resumes. It takes into account verbal and non-verbal data, including speech content, tone, facial expressions, and body language, for a comprehensive evaluation of interpersonal skills and confidence. This increases the efficiency of hiring by automating initial assessments, minimizing manual resume screening, and shortening recruitment timelines. Our model enhances candidate-fit predictions, resulting in improved hiring decisions and long-term employee retention. Recruiters benefit from gaining deeper, data-driven insights, enhancing hiring quality and interactions. Job seekers enjoy an improved more dynamic and engaging application process, highlighting their talents with personality. The framework allows for accurate, efficient, and effective talent acquisition for organizations.

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