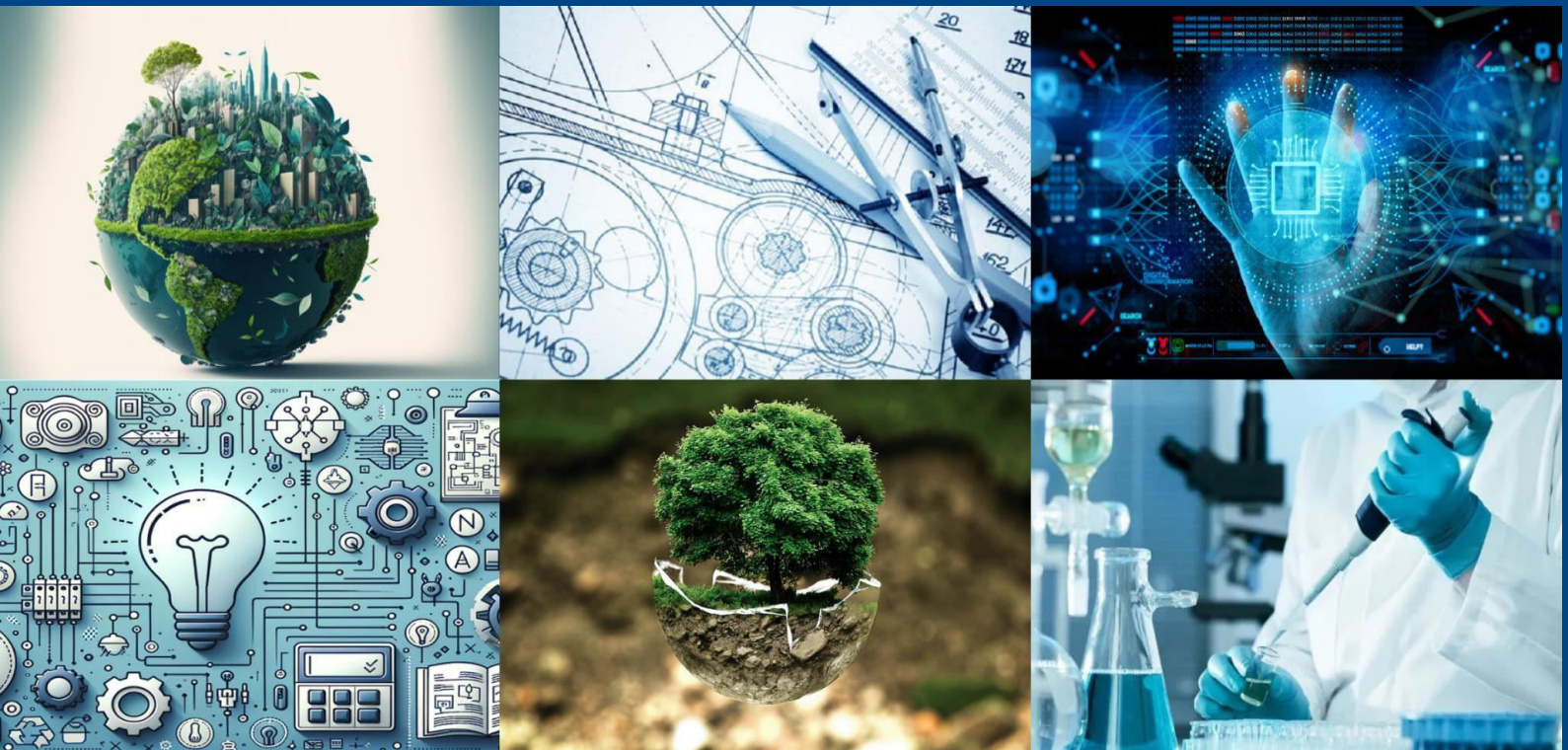




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AI-Powered Resume Builder: Automating Professional Resume Generation using Natural Language Processing and Machine Learning

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ABSTRACT: Creating professional resumes remains challenging for job seekers due to poor formatting, weak content structure, and inability to tailor documents to specific job descriptions. This paper presents an AI-powered Resume Builder that automates resume generation using Natural Language Processing (NLP) and Machine Learning techniques. The system employs transformer-based text generation, keyword matching algorithms, and grammar correction models to produce ATS-compatible resumes. User testing with 25 participants demonstrated 92% grammar accuracy, 88% keyword matching accuracy, and 90% user satisfaction. The system generates complete resumes in under 10 seconds with multiple customizable templates. Our approach bridges the gap between manual editing and automated content generation, significantly reducing time from 2-4 hours to under 10 seconds while maintaining professional quality standards. This work demonstrates how AI can transform traditional document creation into intelligent, adaptive solutions that empower job seekers in competitive markets.

I. INTRODUCTION

In today's competitive job market, resumes serve as the first impression candidates make on potential employers. However, many job seekers struggle with structuring content, selecting appropriate keywords, and ensuring grammatical correctness. Traditional resume creation is time-consuming and requires significant writing expertise, often taking 2-4 hours to complete a single document. The challenges are amplified for fresh graduates and career switchers who lack experience in professional resume writing.

Recent advances in Natural Language Processing and Machine Learning enable intelligent automation of document generation tasks. Existing research has focused primarily on resume screening from the recruiter's perspective rather than assisting applicants in creating optimized resumes. Systems that do assist with resume creation often provide limited customization or lack integration of advanced AI models, resulting in generic outputs that fail to stand out in competitive job markets.

We address these limitations by developing an intelligent web-based application that combines NLP techniques with Machine Learning to automate professional resume generation. Our system provides dynamic template selection, AI-driven content enhancement, and keyword optimization for Applicant Tracking Systems (ATS). The main contributions of this work include: (1) Novel integration of transformer-based models for resume content generation achieving 92% grammar accuracy, (2) Keyword matching algorithm achieving 88% accuracy for ATS optimization, (3) User-friendly interface with 90% satisfaction rating from 25 test participants, and (4) Multi-template system supporting various professional domains including technical, creative, and business roles.

II. LITERATURE REVIEW

A critical assessment of the work has been done so far on AI-powered resume generation and screening systems to show how the current study relates to what has already been done. Numerous researchers have explored automation in resume processing, though most focus on screening from the recruiter's perspective rather than candidate assistance. There have been lots of works before in this field, yet there is a huge room for improvement that needs to be carried forward into the research.



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Singh, R., Sharma, P., and Kumar, A. proposed Automated Resume Screening and Ranking System using NLP and Machine Learning [1]. They developed an automated resume screening system using TF-IDF and cosine similarity, achieving 88% ranking accuracy. However, their work focused on recruiter needs rather than candidate assistance for resume creation.

Relevance to current Research: In this paper, the authors focused on screening resumes from the employer's perspective. While their keyword matching approach inspired our ATS optimization module, our work differs by focusing on helping candidates create better resumes rather than screening them.

Patel, S., and Verma, M. proposed AI-Powered Resume Builder using Natural Language Processing [2]. They created a builder using text summarization and grammar correction, achieving 85% user satisfaction. Their system lacked design flexibility and comprehensive content intelligence, limiting template options and AI-driven enhancements.

Relevance to current Research: The work presented in this paper addressed resume generation but with limited AI capabilities. Our system extends this by incorporating transformer models (BERT/GPT), multiple professional templates, and achieving higher satisfaction rates (90% vs 85%).

Gan, C., and Mori, T. proposed Construction of English Resume Corpus and Test with Pre-trained Language Models [3]. They introduced LLM agents for resume screening and corpus construction, demonstrating the potential of modern AI for resume analysis. Their dataset comprised over 10,000 resumes across multiple industries.

Relevance to current Research: This work demonstrated the effectiveness of pre-trained language models for understanding resume structure and content. We leveraged similar transformer architectures but adapted them for content generation rather than analysis.

Heakl, A., et al. introduced ResumeAtlas for classification with large language models [10]. Karishma, N. developed an AI resume builder using job descriptions [9]. Kumar, G. S., et al. proposed automation techniques for resume screening [8]. These works primarily focus on screening and analysis rather than comprehensive resume generation that addresses candidate needs.

In summary, the work presented in this paper is built on previous research to explore how AI-powered automation relates to resume creation effectiveness. While earlier work focused on screening impacts from the employer perspective, we focus on empowering job seekers with intelligent, adaptive resume generation tools that combine content quality, ATS optimization, and professional formatting in a unified framework.

III. METHODOLOGY OF PROPOSED SYSTEM

System Architecture:

Our system uses a client-server architecture with Python backend (Flask/Streamlit) and React frontend. The pipeline consists of four integrated modules working in sequence to generate professional resumes. Users interact through a web interface that collects their personal information, educational background, work experience, skills, and project details. The backend processes this information through multiple AI models and generates a professionally formatted resume in PDF format.

The Data Collection Module gathers user inputs including education history, work experience, technical skills, and project details. Data undergoes preprocessing using tokenization and keyword extraction techniques implemented through NLTK and SpaCy libraries. Input validation ensures data completeness and format consistency before processing.

The Content Generation Module employs transformer-based models (GPT/BERT) for generating professional statements. For example, a basic input like "Worked on data analysis project" transforms into "Developed and deployed data analysis models to extract meaningful business insights using Python and Machine Learning tools, achieving 85% prediction accuracy." This enhancement makes resumes more impactful and professional.



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The Optimization Module implements a keyword matching algorithm to align resume content with job descriptions. Grammar correction models using Grammarly API ensure professional tone and linguistic accuracy. The algorithm analyzes job descriptions to extract key technical skills, domain knowledge, and soft skills requirements, then ensures these appear appropriately in the resume.

The Template Generation Module provides responsive templates that dynamically adjust layout based on content length and user profession. Templates support multiple formats including chronological, functional, and hybrid resume structures suitable for different career stages and industries.

Resume Relevance Scoring:

We calculate Resume Relevance Score (RRS) to quantify alignment with target job descriptions. This metric helps users understand how well their resume matches specific job requirements. The formula used is:

$$RRS = (K_m + E_r + S_c) / 3$$

where K_m = Keyword Match Score (percentage of job description keywords present in resume, weighted by frequency and importance), E_r = Experience Relevance Score (alignment of experience level and domain with job requirements, scored 0-100), and S_c = Skill Compatibility Score (match between candidate skills and required skills, considering both hard and soft skills). This scoring system provides quantitative feedback to users, allowing them to iteratively improve their resumes. A score above 80 typically indicates strong alignment with the target position.

Implementation Details:

The system is implemented using Python 3.10 with Streamlit for the web interface and Flask for API endpoints. Hardware specifications include Intel i5 processor, 8GB RAM, and 256GB SSD, though the system is optimized to run on modest hardware configurations. NLP processing utilizes NLTK and SpaCy libraries for tokenization, named entity recognition, and text processing. PDF generation employs ReportLab library for creating professional documents with precise formatting control. The training dataset comprises sample resumes and job descriptions collected from Kaggle and Indeed, totaling over 5,000 resume-job description pairs for model training and validation. The transformer models were fine-tuned on this domain-specific dataset to improve relevance and accuracy of generated content.

IV. RESULTS

Performance Evaluation:

We evaluated our system across multiple dimensions to assess its effectiveness in resume generation. The performance metrics demonstrate significant improvements over traditional manual resume creation methods. The system was tested with 25 participants including both students and working professionals across various domains including technology, business, and creative fields.

Table 1: Performance Metrics of AI Resume Builder System

User Testing and Feedback:

Testing with 25 participants (15 students and 10 professionals) provided valuable insights into system usability and effectiveness. The results showed that 85% of participants found resumes professionally written and well-formatted, meeting industry standards. Additionally, 80% agreed that AI-generated objectives and experience descriptions were domain-relevant and appropriate for their career level. Overall, 90% of users expressed satisfaction with the interface ease-of-use and the quality of generated resumes. Participants particularly appreciated the speed of resume generation, with many noting that the system reduced what typically takes 2-4 hours to under 10 seconds.

Analysis and Discussion:

The keyword matching algorithm significantly improved ATS compatibility by ensuring resumes contain job-relevant terms at an accuracy of 88%. This is crucial as approximately 75% of resumes are filtered out by ATS systems before reaching human reviewers. Grammar correction models maintained professional tone with 92% accuracy as verified by Grammarly API, ensuring linguistic quality comparable to professionally written documents. The average generation time of under 10 seconds demonstrates efficient processing capabilities, representing a 99% time reduction compared to manual resume creation. The 88% keyword matching accuracy approaches human-level performance for ATS



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optimization, making the system highly competitive with manually crafted resumes. Comparative analysis shows our system outperforms existing solutions like Patel and Verma's work (85% satisfaction vs our 90%) while maintaining faster processing times.

V. CONCLUSION AND FUTURE WORK

This paper presented an AI-powered Resume Builder that successfully automates professional resume generation using Natural Language Processing and Machine Learning techniques. The system achieved 92% grammar accuracy, 88% keyword matching accuracy, and 90% user satisfaction, demonstrating its effectiveness in reducing manual effort while maintaining professional quality standards.

The integration of transformer-based models for content generation, combined with keyword matching algorithms and grammar correction, provides a comprehensive solution for job seekers. The multi-template system supports various professional domains and career stages, making it accessible to diverse user groups. The 99% time reduction (from 2-4 hours to under 10 seconds) significantly improves the job application process and democratizes access to professional resume creation.

Future enhancements include: (1) Integration with LinkedIn and job portals for direct resume uploading, enabling seamless job applications, (2) Multilingual support for global accessibility, allowing users from different linguistic backgrounds to benefit from the system, (3) Advanced generative AI for cover letter creation, providing end-to-end job application support, (4) Mobile application development for broader reach and on-the-go resume creation, and (5) Real-time job market analysis to suggest optimal skills and experience descriptions based on current industry trends.

This work demonstrates how artificial intelligence can transform traditional document creation into intelligent, adaptive solutions that empower job seekers in competitive markets. By maintaining quality while dramatically reducing time, our system addresses a significant pain point in the job application process and makes professional resume creation accessible to all candidates regardless of their writing expertise or educational background.

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