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Application of RAG (Retrieval-Augmented Generation) in AI-Driven Resume Analysis and Job Matching

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Abstract: *The research introduces JobMatchr as a web-based artificial intelligence-powered system which automatizes recruitment monitoring by analyzing resumes using job descriptions. The system resolves vital recruitment issues regarding efficient candidate-job matching within the current competitive job market. JobMatchr ensures resume analysis by applying natural language processing technicalities together with vector embeddings and large language models to identify candidate-job requirements alignment through essential qualifications detection. JobMatchr achieves complete resume analysis and job recommendation functionality through its deployment of Flask as backend framework and implementation of LangChain alongside Gemini-2.0-flash model and Google's embedding technology. The experimental outcomes prove this solution improves recruitment performance by cutting man-powered screening time and resulting in superior candidate-job matches*

Keywords: Resume Analysis, Job Recommendation System, Artificial Intelligence, Natural Language Processing, LangChain, Retrival Augumented Generation(RAG)

I. INTRODUCTION

1.1 The Impact of AI on Hiring

The recruitment industry now experiences full-scale changes through the implementation of artificial intelligence technologies. Employees waste time performing manual resume assessments on vast candidate lists because modern approaches lead to unproductive discriminatory practices that offer minor advantages to both candidates and employers. The operational employee recruitment system developed by artificial intelligence solves staffing problems effectively during the selection process. The automated resume reviews conducted through AI technology both reduce human mistakes and increase operational speed. The selection tools help employers identify better candidates through evidence-based selection methods. The recruitment system delivers fair accurate employment choices by using data-analysed fundamental methods for selection. The advanced process effectiveness generates better candidates who result in excellent new hiring positions.

1.2 Challenges in Traditional Job Applications

Several factors impede candidate success in job applications due to insufficient assessment of their qualifications and indistinct review processes and unclear feedback about suitability. Job candidates encounter multiple obstacles from recruitment and hiring teams when they need to examine each application manually and identify standardized evaluation metrics within high volumes of applications.

1.3 JobMatchr: Overview and Purpose

JobMatchr launched its web-based system that employs modern AI analysis for resume-job specification comparison. The system provides:

- The system uses computer software to identify matching candidates through its programming.

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- The system analyzes resumes through a natural language processing method.
- The software displays resume-job description compatibility by showing numerical ratings.
- The system showcases professional deficiencies of job applicants during its assessment procedure.
- Users can find guidance regarding resume quality enhancement through the system interface.
- Users from screening roles and recruitment roles can easily engage with this interface because it features user-friendly functionality.

The JobMatchr system brings a significant advancement to hiring support systems through its technological implementation. The system delivers high-performance recruitment operations using AI advanced tools that enhance its intelligent functionality. The system integration brings together LangChain for task organization together with Chroma for information storage and Gemini-2.0-flash model for advanced language understanding. JobMatchr boosts recruitment procedures by integrating its various operational components into one system.

II. RELATED WORKS

2.1 Traditional HR Job-Matching Methods

During the era before AI became popular job matching strategies limited their approach to ATS that operated using keyword systems and human resume assessments. These approaches typically involved:

- Boolean algorithms allow administrators to perform resume searches using distinct language terms.
- Some currently available resume parsing tools conduct basic semantic analysis of candidate documents.
- The process uses unified application forms to provide structured assessments between job seekers and roles.
- The implementation of pre-established evaluation guidelines through manual assessment methods.

Job matching attempts through these methods introduced automation but they did not effectively interpret skills and experience relationships with job demands which produced inadequate results.

2.2 Existing AI-Driven ATS Systems

New AI-enhanced applicant tracking systems have entered the market during recent years among which are:

- Textio analyzes job descriptions through language interpretation to enhance their quality.
- Pymetrics pairs candidates through AI-powered evaluation of their cognitive and emotional profiles which candidates demonstrate during gaming exercises.
- The system uses AI to analyze videos during the recruitment process.
- The system conducts resume filtering operations and candidate pair selection by using machine learning technology.

Apart from other systems JobMatchr offers unique strengths which include:

- An emphasis on bidirectional matching that serves both employers and job seekers
- The system incorporates contemporary large language model gemini-2.0-flash to achieve enhanced semantic understanding capabilities.
- The system operates through a minimal web platform to deliver convenient deployment capabilities to users.
- The system offers a multiple analysis technique to deliver complete information about resume-job compatibility results

III. SYSTEM DESIGN AND ARCHITECTURE

3.1 System Architecture Overview

The JobMatchr system employs a modular structure that separates its user interface functions from processing operations and analytical AI functions. The system features its high-level architectural design presented in Figure 1.

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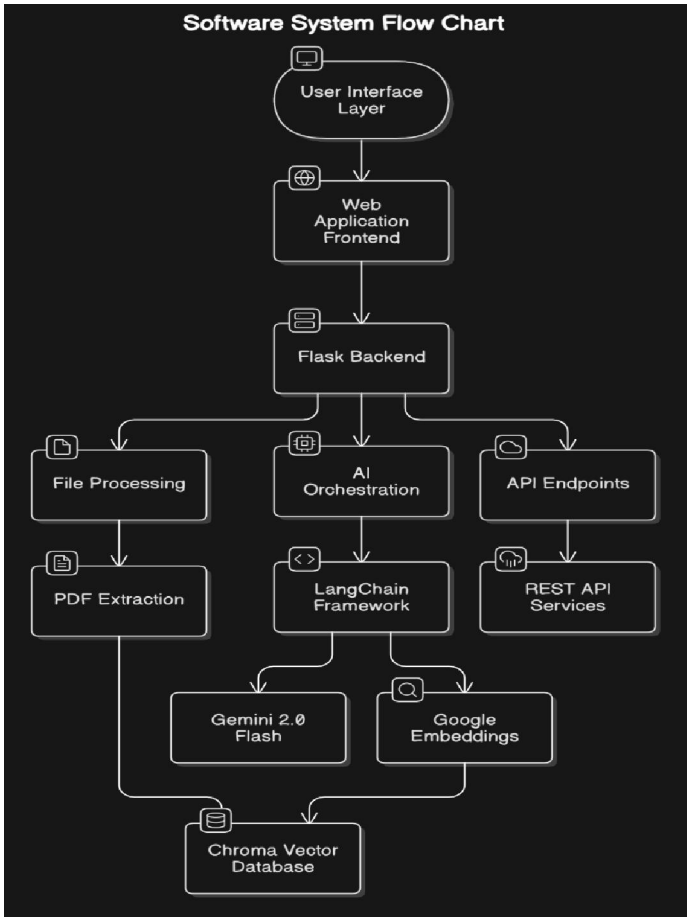
Figure 1: JobMatchr System Architecture



JobMatchr utilizes a layered design structure as represented in the diagram where data moves sequentially from user input points to system components until analysis results become available for viewing. JobMatchr implements open-source alongside proprietary AI technologies to create its extensive resume evaluation system that matches job openings for users.

3.2 Frontend Components

A standard interface runs through web technologies HTML, CSS, JavaScript to present an easy-to-use interface for end users. Key components include:

- File upload interface for resume submission
- A text area enables users to write the job description.
- The user interface shows real-time results which present both match percentage data and analysis information.
- Interactive keyword visualization

Standard web technologies allow the interface to maintain clear simplicity in order to welcome users with different levels of technical experience.

3.3 Backend Framework

The backend implements Flask as its foundation framework to manage these functions:

- RESTful API endpoints for client-server communication
- File processing and storage

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- Integration with AI components
- Response formatting and delivery

The main application file provides needed API endpoints that support critical operations.
/upload endpoint manages both file transfer for resumes as well as the subsequent data extraction process.
/about_resume: Generates a comprehensive analysis of the resume against the job description
/keywords endpoint detects lost keywords before it proposes better alternatives.
/percentage_match determines match scores while supplying recommendation results.

3.4 AI Components

JobMatchr leverages several cutting-edge AI technologies:

- The framework LangChain manages the process between different AI components while offering a system for language model utilization.
- Gemini-2.0-flash represents the latest state-of-the-art large language model that operates as the semantic analysis engine.
- Google Generative AI Embeddings: Creates vector representations of text for efficient comparison
- Semantic matching capabilities rely on the Chroma Vector Database that serves to store and obtain vector embeddings.

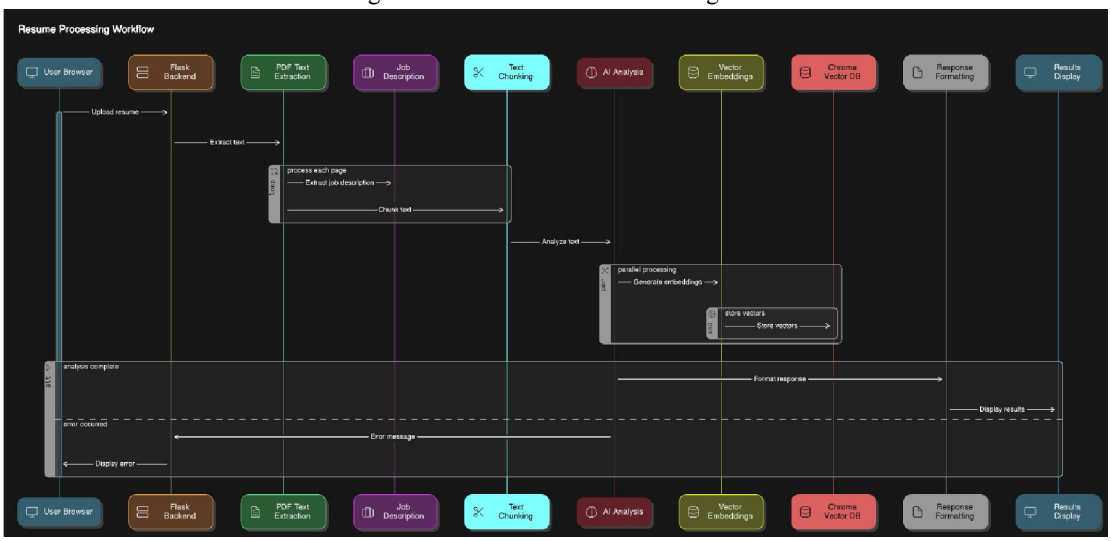
The components unite to perform complex analyzes that surpass basic keyword matching through their capability to grasp contextual meanings of resumes as well as job descriptions.

3.5 Data Flow Architecture

The system's data flow follows these steps:

- User uploads resume (PDF format) and enters job description
- Backend extracts text from the PDF using pdfplumber
- Text is chunked and processed for embedding
- Google's embedding model creates vector representations
- Chroma stores these embeddings for efficient retrieval
- LangChain orchestrates the analysis workflow using specialized prompts
- Results are calculated and returned to the frontend
- Frontend displays the analysis in a user-friendly format

Figure 2: JobMatchr Data Flow Diagram



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The graphical representation displays the full data processing path that JobMatchr system performs beginning with user interaction and ending with displayed results.

IV. METHODOLOGY

4.1 Data Processing

4.1.1 Resume Text Extraction

JobMatchr operates a solid text extraction system which processes uploaded resumes through its PDF parsing component. JobMatchr deploys pdfplumber as its text extraction engine to capture all text from PDFs with different configurations and structures. Through this method stability is achieved for text extraction processes across different types of PDF documents that appear in resumes.

4.1.2 Text Preprocessing

After extraction the text needs to complete various preprocessing operations that include:

- The text gets divided into smaller portions through RecursiveCharacterTextSplitter with 1000 character chunks while maintaining 200 character overlap.
- The data goes through an object conversion process for subsequent embedding and retrieval steps.
- Storage in a vector database for efficient semantic search

4.2 Embedding Techniques

JobMatchr relies on Google's Generative AI Embeddings together with the Chroma vector database for maintaining vector storage and management functions. The system benefits from this approach because it provides the following capabilities:

- The system transforms several pieces of text into vector representations which contain multiple dimensions
- A suitable index structure should store these vectors.
- Job descriptions can be evaluated against resumes through semantic similarity searches as a part of analysis.

4.3 Matching Algorithm

A sophisticated retrieval augmented generation system runs through the core matching algorithm within LangChain. The analysis makes use of three specialized prompts which address distinct aspects of the process.

- An overall match assessment utilizes prompt1 to determine the candidateetooth-job fit through professional evaluation while identifying both positive and negative aspects in the profile.
- This process (Missing Keywords Analysis) detects significant role-based keywords which the candidate lacks then describes their role value while suggesting methods to enhance ATS performance.
- The Match Percentage Calculation system (prompt3) uses skills and experience and keywords to generate dynamic match percentages while showing which keywords are missing and delivering final assessment recommendations.

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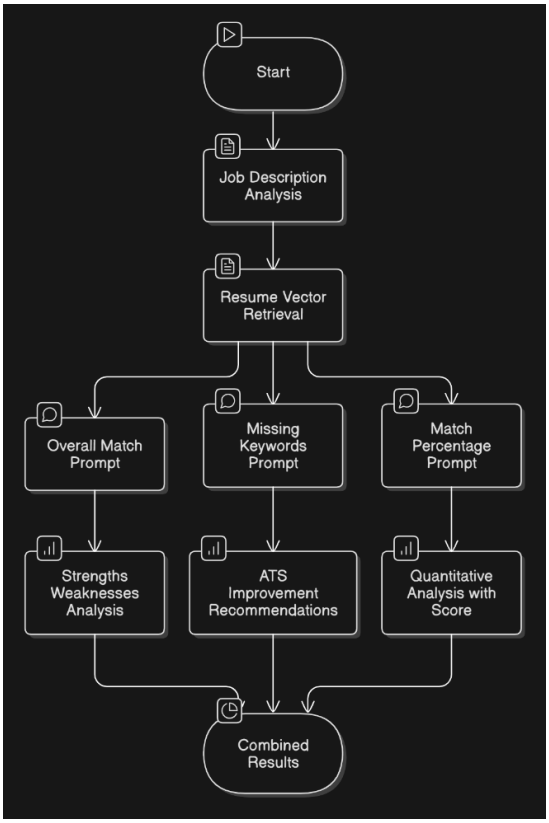
Figure 3: JobMatchr Matching Algorithm



This diagram shows how the different prompt-based analyses are combined to provide a comprehensive assessment of the resume-job match.

V. IMPLEMENTATION

5.1 Frontend Implementation

The interface keeps its design simple by including basic system elements.

Resume upload functionality

Job description input area. The program generates technical results by displaying information through three different graphical visualizations named overview view, keyword view and percent view.

There are actionable insights with clean presentation of results

5.2 Backend API Endpoints

Through its Flask application implementation the system provides various essential API endpoints.

5.2.1 /upload Endpoint

The system activates file uploads while checking formats and starts executing text extractions. The endpoint functions to process only valid PDF files and produces suitable error messages whenever users upload invalid content.

5.2.2 /about_resume Endpoint

The API creates a detailed evaluation of the resume content in regard to the Technical Human Resource Manager role requirements. After finding relevant resume sections through the vector retrieval system the API endpoint transmits them to the LLM for processing.

5.2.3 /keywords Endpoint

The system finds absent keywords and provides optimization solutions specific to ATS requirements. The specialized prompt enables the endpoint to focus on ATS aspects of resume optimization.

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5.2.4 /percentage_match Endpoint

The endpoint functions with a dynamic scoring algorithm to determine the match score alongside recommendations which it returns to users. Users can get an accurate numerical resume-job match rating through this endpoint with featured recommendation guidelines.

5.3 Integration Of AI Model

The AI model integration proceeds through the platforms called LangChain and Gemini. The LangChain framework creates a link between Gemini-2.0-flash model and vector-based search systems. The connected system deepens resume analysis through description-to-resume comparison. Context analysis through the framework enables resume-job description comparisons which enhances the evaluation process for candidate-job suitability.

The system provides purpose-built prompts which direct the LLM to execute particular analyses.

- A professional evaluation of candidate-job alignment is generated through the Technical Human Resource Manager evaluation process.
- ATS Scanner Prompt enables the system to assess ATS optimization and detect absence of important keywords.
- The Match Percentage Prompt operates by providing both verbal scores and guidance about potential employer matching possibilities.

The prompts are built to extract particular analytical responses from the LLM for achieving both thorough and appropriate results.

VI. RESULTS AND EVALUATION

6.1 Match Percentage Calculation Accuracy

The system generates dynamic match percentage results through an analysis which considers multiple evaluation parameters.

- Keyword presence and relevance
- Experience alignment
- Skills matching
- Education requirements

The LLM executes match percentage calculations through complete document evaluation between resumes and job descriptions rather than performing a basic keyword counting method. This method leads to better accuracy in the evaluation process.

6.2 Missing Keyword Detection

The system detects essential missing competencies as its main operational advantage. The particular prompt for analysis of specific job keywords includes analyzing the following steps:

- The system determines essential terms that are crucial for the occupational position.
- These keywords carry special importance for ATS evaluation
- The system delivers practical advice about how to integrate appropriate keywords.
- This approach reveals which essential words job seekers lack in addition to explaining their meaning and effective implementation strategies.

6.3 User Feedback

User testing during the first phase has yielded positive results.

Job seekers indicate that the practical recommendations enable them to enhance their application documents.

RTC systems earn appreciation from recruiters because their search process moves further than limited keyword surveys.

The system receives high value for its comprehensive evaluation method that avoids numerical scoring preferences.

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VII. CONCLUSION AND FUTURE WORK

7.1 Summary of Contributions

JobMatchr stands as a leading advancement among resume analysis AI systems that generate job recommendations. This AI system delivers actionable data to recruiters and job seekers because it integrates high-end language models and embedding technology into its optimized design structure.

Key contributions include:

- Use advanced gemini technology (gemini-2.0-flash) to understand meanings in a detailed way.
- Implementation of a vector-based retrieval system for efficient matching
- The system features unique prompts tailored for various aspects during resume evaluation tests.
- Build a user-friendly webpage that allows users to locate and grasp results without any difficulty. The designed web page must feature simple directions together with user-friendly navigation which allows all users to access it easily. Users without computer expertise must have straightforward access to vital information and understand its significance without difficulty.

7.2 Limitations

JobMatchr displays several disadvantages that researchers must consider although it shows strong functionalities.

- Dependence on the quality of text extraction from PDFs
- The language models in the system have the risk of displaying biased output decisions.
- The system shows restricted capacity to analyze visual aspects included in resumes such as graphical or chart representations.
- The comprehension of computer requirements for working with large language models should be a priority. A substantial amount of computing resources is necessary for big models to operate optimally. Large language models operate best when installed on computers containing robust processors together with ample memory. The proper equipment enables such models to operate effectively with optimal efficiency. Insufficient computational power creates barriers for effective implementation since this leads to slower performance or difficulties in processing information.

7.3 Future Work

Several opportunities for enhancement exist:

- Job boards integration: The system should obtain appropriate job descriptions
- The system generates customized development guidance which adjusts to individual user sectors alongside their current professional level
- The platform allows users to transform recommended edits into an improved resume format.
- Visual tools that display the concentration of skills gaps alongside matched capabilities should be included.
- The system will adapt its recommendation process using data collected from users' actions and results.

7.4 Conclusion

The recruitment process receives a transformation from JobMatchr through advancements in artificial intelligence technology. The system carries out thorough assessments of resumes combined with job descriptions. The system implements vector embeddings and language models as advanced methods to achieve effective results. The system possesses a user-friendly interface which guarantees accessible information throughout the procedure. JobMatchr operates as a vital tool which brings together job seekers with companies searching for new employees. The essentiality of JobMatchr will increase as AI technology improves. The system accelerates the hiring procedures while maintaining equal opportunities for all participants.

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