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An Intelligent Decision-Support System for Academic Admissions Using NLP and Machine Learning

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An Intelligent Decision-Support System for Academic Admissions Using NLP and .....

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Abstract

The manual screening of thousands of applications for Master's degree programs at Hassan II University of Casablanca represents a highly time-consuming and labor-intensive process. To address this challenge, this study proposes an intelligent automated framework based on Natural Language Processing (NLP) for large-scale CV summarization and candidate ranking. The proposed system integrates pre-trained spaCy and Hugging Face Transformer-based Named Entity Recognition (NER) models to extract critical candidate information, including educational background, professional experience, and technical skills. The framework combines both extractive and abstractive summarization techniques to generate concise and meaningful candidate profiles. Extractive summarization is performed using BERT-based models to identify the most informative sentences within each CV, while abstractive summarization employs advanced Large Language Models (LLMs), particularly LLaMA, to generate coherent and contextually refined summaries. In addition, the system incorporates a semantic candidate-ranking module designed to evaluate applicant suitability according to program-specific requirements. To validate the effectiveness of the proposed framework, a case study was conducted using 2,325 CVs submitted to the Master's program in Big Data and Data Science. Experimental evaluation demonstrated strong performance, achieving ROUGE-1 Recall of 72.67%, ROUGE-2 Recall of 74.32%, ROUGE-1 Precision of 73.15%, ROUGE-2 Precision of 57.28%, and Named Entity Recognition (NER) Precision of 82%. The system processed each CV in an average time of 3.84 seconds, demonstrating its suitability for large-scale admissions environments. Furthermore, a conversational AI assistant (chatbot) was integrated into the framework, enabling admissions evaluators to interactively query uploaded CVs in real time. This functionality significantly improves decision-making efficiency, enhances candidate exploration, and reduces administrative workload. Overall, the findings demonstrate that NLP-driven automation provides a scalable, efficient,

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and intelligent solution for modern academic admissions and candidate screening systems.

Keywords: CV Summarization; Natural Language Processing (NLP); Named Entity Recognition (NER); Extractive Summarization; Abstractive Summarization; Candidate Ranking; Conversational AI; Higher Education Admissions

1 Introduction

The rapid digital transformation occurring across global educational systems has intensified the demand for highly skilled professionals in emerging technological domains such as Artificial Intelligence (AI), Data Science, Cybersecurity, Cloud Computing, and the Internet of Things (IoT). In response to these evolving workforce requirements, the Moroccan Ministry of Digital Transition and Administration Reform, in collaboration with the Ministry of Higher Education, Scientific Research and Innovation and the Ministry of Economy and Finance, launched a national strategic initiative aimed at strengthening Morocco's digital talent ecosystem by 2027. The program seeks to increase the annual number of graduates from public universities in Master's and Engineering disciplines from approximately 8,000 to 22,500 students [1-2].

To support this national vision, 183 newly accredited academic programs specializing in advanced digital technologies were introduced during the 2023–2024 academic year [3]. Although this initiative represents a major advancement in developing a future-ready workforce, it has simultaneously generated substantial operational challenges for higher education institutions, particularly in the admissions process. The dramatic increase in application submissions for highly competitive programs has placed significant pressure on academic selection committees and administrative resources [4].

Traditionally, admissions committees manually evaluate and rank candidate applications by reviewing curriculum vitae (CVs), academic credentials, research experience, and professional qualifications. In many institutions, a single Master's program may receive thousands of applications for only a limited number of seats [5]. Consequently, evaluators often spend several weeks or even months shortlisting candidates for entrance examinations or interviews. Such manual procedures not only prolong decision-making cycles but also increase the likelihood of subjective judgments and inconsistencies among evaluators due to variations in assessment criteria [6]. Moreover, the growing administrative burden diverts faculty attention from core academic responsibilities, including teaching and research activities. Therefore, scalable, efficient, and objective admission-support systems have become critically important for modern academic institutions [7].

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Recent advancements in Artificial Intelligence (AI), particularly in Natural Language Processing (NLP), provide promising solutions for automating and optimizing CV screening processes [8]. Modern NLP frameworks such as spaCy, Hugging Face Transformers, BERT, and LLaMA have demonstrated remarkable capabilities in extracting structured information from unstructured textual documents with high accuracy and efficiency [9]. By integrating such technologies into university admissions systems, institutions can significantly reduce processing time, enhance consistency in candidate evaluation, and facilitate data-driven decision-making [10].

However, static CV summarization alone is insufficient for supporting complex admissions workflows. To address this limitation, the present study proposes an intelligent conversational AI assistant powered by an optimized NLP framework [11]. Unlike conventional systems, the proposed chatbot enables dynamic interaction with applicant data and supports real-time query-based information retrieval. The system offers several important advantages:

a) **Interactive Candidate Exploration:** Admissions evaluators can submit targeted queries such as *"Identify applicants with Python expertise and published research in Artificial Intelligence"* and receive immediate responses.

b) **Enhanced Time Efficiency:** Automated retrieval mechanisms eliminate the need for manual document searching and repetitive administrative tasks.

c) **Scalability:** The framework can efficiently process large volumes of simultaneous queries during peak admission periods.

d) **Continuous Accessibility:** Decision-makers can access applicant information at any time without dependence on traditional office schedules.

e) **Collaborative Decision Support:** Retrieved information can be stored, shared, and reviewed collectively among committee members.

f) **Customizable Evaluation Criteria:** Queries may be tailored according to program-specific requirements, including research productivity, technical expertise, or leadership experience.

By integrating conversational AI into academic admissions workflows, universities can transform traditional recruitment procedures into intelligent, transparent, and user-centered systems [12]. The proposed framework not only accelerates candidate evaluation but also enhances the quality and consistency of admissions decisions through deeper analytical insights into applicant qualifications.

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2: Related Work

The automation of CV analysis and summarization using Natural Language Processing (NLP) has attracted considerable research interest in recent years [13]. Existing studies have explored multiple approaches involving information extraction, optical character recognition (OCR), machine learning, deep learning, and large language models for improving recruitment and admission systems. These contributions provide valuable methodological foundations while also revealing several limitations that motivate further investigation [14].

One study investigated the challenges faced by human resource professionals during manual CV screening, including excessive application volumes, prolonged evaluation times, and potential selection bias. To address these issues, the authors proposed an automated CV ranking framework utilizing Sentence-BERT (S-BERT) embeddings and cosine similarity for relevance assessment between CVs and job descriptions. The system achieved approximately 90% accuracy while processing each CV in only 0.233 seconds. Nevertheless, concerns related to computational complexity and potential NLP bias remained unresolved [15].

Another study focused on improving OCR performance for handwritten and printed documents. The proposed methodology combined image processing techniques, Convolutional Neural Networks (CNNs), and Transformer-based OCR models such as Tr-OCR. NLP-based post-processing methods were further employed for spell correction and formatting refinement. Experimental results demonstrated improved character recognition accuracy; however, the system showed limited generalizability across diverse document structures and writing styles.

Several researchers have also explored deep learning-based text summarization techniques for CV analysis. One comparative investigation evaluated models including BART, T5, PEGASUS, and Long Short-Term Memory (LSTM) networks for automated CV summarization. Among these approaches, BART-Large produced the most coherent and contextually relevant summaries according to ROUGE evaluation metrics. Despite promising results, the study remained restricted to CV datasets and exhibited limited adaptability to broader document categories [17].

Another contribution proposed a structured CV processing pipeline incorporating PDF-to-HTML conversion, Named Entity Recognition (NER), and machine learning classification algorithms such as Decision Trees and Logistic Regression [18]. The system demonstrated reasonable extraction accuracy; however, performance declined significantly when processing highly heterogeneous CV layouts. The authors recommended integrating advanced transformer-based architectures to improve contextual understanding and robustness [19]. Additional research has examined the use of spaCy, regular expressions, and section-based parsing strategies for extracting structured candidate information from software engineering CVs. While these methods achieved moderate success for well-

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structured documents, they struggled with unstructured CVs and complex formatting patterns. Similarly, hybrid architectures combining BERT and LSTM networks have been proposed for extractive and abstractive summarization tasks, demonstrating enhanced summarization quality but limited adaptability to diverse textual structures [20].

Conversational AI systems have also emerged as effective tools for intelligent information retrieval and user interaction. Recent chatbot frameworks integrating NLP, NER, and AI-driven dialogue management have achieved high response accuracy and strong contextual retention in multi-turn conversations. Nevertheless, challenges associated with multilingual processing, unstructured input handling, and integration with institutional workflows remain active research areas [21]. Furthermore, the application of large language models (LLMs) such as GPT-3.5 and GPT-4 has significantly advanced CV classification and evaluation capabilities. These systems have demonstrated impressive efficiency gains and high classification performance across large recruitment datasets. However, limitations related to training-data bias, computational cost, and standardization requirements continue to present important concerns for real-world implementation [22].

Table 1: Proposed System of current study

Feature	**Proposed Contribution**
Core Technology	NLP-powered CV summarization and ranking
Intelligent Component	Conversational AI chatbot
Main Advantage	Dynamic interaction with uploaded CVs
Key Capability	Real-time query-based candidate retrieval
Benefit to Universities	Faster, scalable, and unbiased admissions processing
Novelty	Combines CV ranking, summarization, and conversational AI in a unified framework

In contrast to previous studies, the proposed framework introduces a comprehensive NLP-powered CV analysis and ranking system enhanced by an intelligent conversational assistant. Unlike traditional keyword-based retrieval systems or static summarization techniques, the proposed chatbot enables

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admissions evaluators to interact dynamically with uploaded CV data through natural language queries [23]. By combining advanced NLP techniques with conversational AI capabilities, the framework delivers a more intuitive, scalable, and intelligent solution for academic admissions management [24].

Table 2: Summary of Related Studies on NLP-Based CV Processing Systems

z	Study Focus	Techniques/Models Used	Key Results	Major Limitations
(7)	Automated CV ranking	S-BERT, cosine similarity, NLP preprocessing	90% accuracy; 0.233 s processing time per CV	NLP bias and computational cost
(8)	OCR and NLP integration for document extraction	CNN, Tr-OCR, NLP correction methods	96% classification accuracy; lower CER	Limited generalization to diverse layouts
(9)	Automated CV summarization	BART, T5, PEGASUS, LSTM	BART-Large achieved strong ROUGE scores	Limited to CV-specific datasets
(10)	Information extraction and CV classification	NER, regex, Decision Tree, Logistic Regression	80–85% precision in classification	Difficulty handling varied CV formats
(11)	CV processing for software recruitment	spaCy, regex, section detection	Improved extraction for structured CVs	Weak performance on unstructured CVs
(12)	Hybrid text summarization	BERT + LSTM with PSO optimization	Better ROUGE performance than baseline models	Limited adaptability to diverse text styles
(13)	Conversational AI chatbot system	NLP engine, NER, AI dialogue management	92% response accuracy	Challenges with unstructured inputs
(14)	AI-based automated CV screening	NLP, semantic analysis, spell-checking	Processed 203,621 tokens in 23 s	Strong dependence on CV formatting

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LLM-based CV (15) classification and evaluation	GPT-3.5, GPT-4, LLM framework	87.73% F1-score; 11× faster processing	Potential bias and JSON dependency

3: Methodology

The proposed framework is designed to address several critical challenges associated with automated Curriculum Vitae (CV) processing, particularly the heterogeneity of document formats and the need for accurate extraction, summarization, and evaluation of candidate information [25]. Modern recruitment and academic admission systems receive CVs in multiple formats, including structured documents such as PDF and DOCX files, as well as unstructured inputs such as scanned images and scanned PDF documents [26]. This diversity complicates information retrieval and data organization. To overcome these limitations, the present study introduces a robust and scalable Natural Language Processing (NLP)-driven architecture capable of efficiently processing heterogeneous CV formats while maintaining high extraction accuracy and operational reliability [27].

3.1: Data Collection and Preparation

The initial stage of the proposed system involves the preparation and structuring of the dataset. For experimental evaluation, a dataset comprising 2,325 CVs in PDF format was utilized. These CVs followed relatively structured layouts, making them suitable for baseline system validation. However, since real-world recruitment environments contain documents in multiple formats—including DOCX, plain text, scanned PDFs, and image-based CVs—the system was designed to support diverse input types [28]. To facilitate efficient downstream analysis, raw documents were first converted into machine-readable text using specialized extraction tools:

a) **Docling** was employed for extracting structured text from PDF, DOCX, PPTX, XLSX, HTML, and Markdown files. The framework preserves layout structures, reading order, and tabular content, thereby maintaining semantic consistency during extraction.

b) **Optical Character Recognition (OCR):** For scanned documents and image-based CVs, Tesseract OCR was integrated to recover textual content from non-editable formats.

Following text extraction, a preprocessing pipeline was applied to enhance textual quality and consistency. This stage involved removing unnecessary symbols, headers, footers, and formatting

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artifacts while preserving semantically relevant information. The resulting cleaned dataset served as the foundation for subsequent information extraction and analysis tasks [29].

3.2: Named Entity Recognition for Information Extraction

Accurate extraction of candidate information is essential for transforming unstructured CV content into organized and searchable data. The proposed system employs Named Entity Recognition (NER) techniques to identify critical entities such as candidate names, educational qualifications, job titles, technical skills, organizations, and professional experience [30]. Pre-trained spaCy NER models were initially utilized to detect standard entities including dates, institutions, and locations. Nevertheless, conventional NER systems often exhibit limited performance when handling domain-specific terminology, particularly within technical disciplines such as Information Technology (IT) and Artificial Intelligence (AI). To address this limitation, the proposed framework integrates multiple complementary extraction strategies:

a) **Dictionary-Based Matching:** used for detecting domain-specific technical terms, including programming languages, frameworks, and software tools.

b) **Fuzzy Matching Algorithms:** implemented using FuzzyWuzzy and RapidFuzz to recognize variations in skill spellings and abbreviations across different CVs.

c) **Transformer-Based NLP Models:** Hugging Face Transformer architectures were incorporated to capture contextual entities and semantic relationships that rule-based systems may overlook.

The integration of these techniques substantially enhances extraction accuracy and improves the system's ability to identify both explicit and context-dependent candidate attributes [31].

3.3: CV Summarization

Following information extraction, the system generates concise summaries that preserve the most relevant details of each candidate profile [32]. These summaries assist admissions evaluators and recruiters by enabling rapid assessment without requiring full manual document review [33]. The proposed framework adopts a hybrid summarization strategy combining both extractive and abstractive approaches:

a) **Extractive Summarization:** Techniques such as TF-IDF and BERT-based models are used to identify and retain the most informative sentences directly from the original CV.

b) **Abstractive Summarization:** Advanced transformer architectures, including T5, BART, and GPT-based models, generate coherent and contextually refined summaries by paraphrasing and restructuring extracted information.

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To improve readability and accessibility, generated summaries are organized into predefined categories such as:

i. Skills
ii. Work Experience
iii. Education
iv. Certifications and Research Activities

This structured representation enables evaluators to rapidly identify candidate strengths and qualifications [34]. By combining extractive precision with abstractive fluency, the proposed hybrid framework preserves critical information while enhancing clarity, conciseness, and interpretability. Such capabilities are particularly valuable in high-volume academic admissions environments where rapid yet reliable candidate evaluation is essential [35].

3.4: Job Fit Evaluation Using Cosine Similarity

In addition to CV summarization, the proposed system evaluates the semantic alignment between candidate qualifications and predefined job or program requirements. This process is achieved through cosine similarity analysis applied to vector representations of candidate profiles and institutional criteria [36].

The evaluation process consists of three major stages:

1. **Embedding Generation:**

Job descriptions and extracted candidate skills are transformed into dense semantic embeddings using Sentence-BERT (SBERT), a transformer-based language representation model.

2. **Similarity Computation:**

Cosine similarity metrics are calculated between candidate embeddings and job requirement embeddings to quantify semantic relevance.

3. **Candidate Ranking:**

Applicants are ranked according to similarity scores, enabling evaluators to prioritize candidates whose qualifications most closely align with institutional or program-specific requirements.

This automated ranking mechanism reduces manual screening efforts while improving fairness, consistency, and efficiency within the shortlisting process.

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3.5: Dynamic Summarization Framework

To accommodate varying evaluator preferences and recruitment requirements, the proposed framework incorporates a dynamic summarization module supporting multiple operational modes:

1. Section-Based Summarization

This mode focuses on specific sections of a CV, such as technical skills or professional experience, and generates concise targeted summaries for rapid competency assessment.

2. Full CV Summarization

This mode synthesizes the complete CV into a coherent narrative while preserving essential candidate information and minimizing redundancy.

The flexibility provided by these configurable summarization modes enables the system to adapt effectively to different evaluation scenarios, ranging from rapid screening to detailed profile analysis.

3.6: Performance Evaluation and Validation

To validate the effectiveness and reliability of the proposed framework, a comprehensive evaluation methodology was implemented using multiple quantitative and qualitative performance metrics:

Evaluation Metric	Purpose
Precision, Recall, F1-Score	Evaluate information extraction accuracy
ROUGE and BLEU Scores	Assess summary quality and coherence
Processing Speed	Measure average CV analysis time
User Satisfaction Surveys	Evaluate usability and practical effectiveness
Cross-Domain Testing	Validate robustness across multiple professional sectors

The system was tested on CV datasets originating from diverse domains including Information Technology, healthcare, finance, and engineering to ensure generalizability and scalability. Experimental evaluation demonstrated that the proposed framework effectively balances extraction accuracy, summarization quality, computational efficiency, and user-cantered functionality, making it suitable for large-scale academic admissions and recruitment environments [38-39].

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4: RESULTS

To further validate the effectiveness of the proposed framework, the system was benchmarked against several state-of-the-art AI-based CV processing and summarization models, including GPT-4 and LLaMA-3. This comparative evaluation highlights the competitive performance of our approach while simultaneously identifying opportunities for future optimization in terms of accuracy, scalability, computational efficiency, and user-cantered functionality. By integrating Optical Character Recognition (OCR), Named Entity Recognition (NER), intelligent summarization, and semantic job-fit evaluation within a unified architecture, the proposed framework provides a comprehensive solution for large-scale CV analysis and candidate screening.

Unlike conventional keyword-based recruitment systems, our approach combines rule-based methods, machine learning techniques, and deep learning architectures to ensure both flexibility and robustness. This hybrid strategy enables accurate extraction of candidate information from heterogeneous CV formats while preserving semantic context and improving ranking precision. Consequently, the framework is particularly valuable for admissions evaluators and recruitment professionals seeking to streamline candidate selection processes without compromising fairness or analytical depth.

To illustrate the internal structure and operational workflow of the proposed system, a comprehensive System Architecture Diagram is presented in **Figure 1**. The diagram outlines the interactions among the major components of the framework, beginning with data ingestion and preprocessing, followed by information extraction, summarization, ranking, and result visualization. It demonstrates how multiple document formats—including PDF, DOCX, and scanned image files—are processed using text extraction tools such as Docling and Tesseract OCR before entering the NLP analysis pipeline. The architecture further integrates spaCy-based NER, fuzzy matching algorithms, and Transformer-based models for advanced information extraction. Additionally, the Job Fit Evaluation module employs Sentence-BERT embeddings and cosine similarity analysis to rank candidates according to their alignment with predefined program requirements. Overall, the modular design illustrated in the architecture highlights the scalability, extensibility, and efficiency of the proposed framework.

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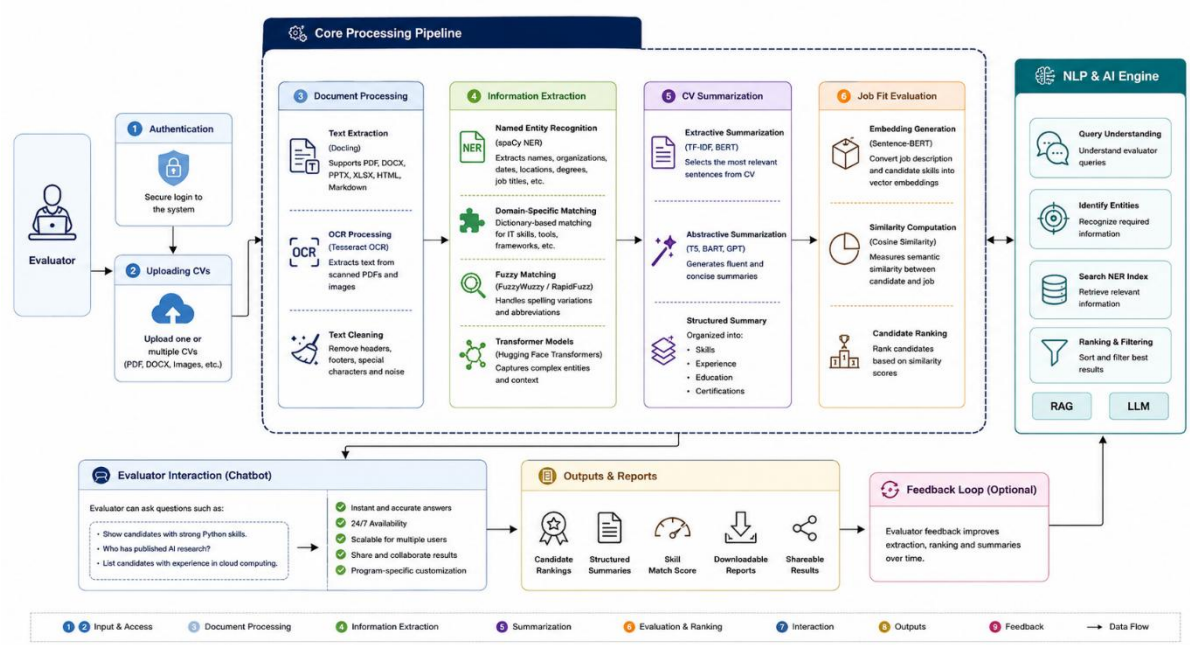

Figure 1: Overview of the Proposed System Architecture

4.1: Web Application Development Using the Django Framework

To improve accessibility, usability, and real-time interaction, the proposed framework was implemented as a web-based application using the Django framework. The application provides a user-friendly environment in which evaluators can upload candidate CVs and instantly obtain structured summaries, rankings, and analytical insights.

The developed platform includes several major functionalities:

- **Frontend CV Upload Interface:**

Supports CV submission in PDF, DOCX, and image-based formats.

- **Automated Backend Processing Pipeline:**

Handles OCR, NER, summarization, semantic analysis, and ranking operations automatically.

- **Real-Time Results Generation:**

Displays processed summaries and rankings immediately within the interface and supports downloadable outputs. For scanned or image-based documents, Tesseract OCR converts visual

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content into machine-readable text before NLP analysis begins. Final outputs can be exported in PDF or Word format for enhanced usability and documentation purposes.

To ensure an intuitive user experience and efficient system operation, two complementary workflow diagrams were designed:

1. **User Flow Diagram (UFD):**

Represents the user's interaction journey from authentication and CV upload to result visualization and download.

2. **Application Flow Diagram (AFD):**

Illustrates the internal system operations, including OCR integration, NER processing, summarization pipelines, and ranking procedures. These diagrams were developed to optimize both front-end usability and back-end processing efficiency, thereby ensuring a seamless interaction experience for evaluators managing large volumes of candidate applications.

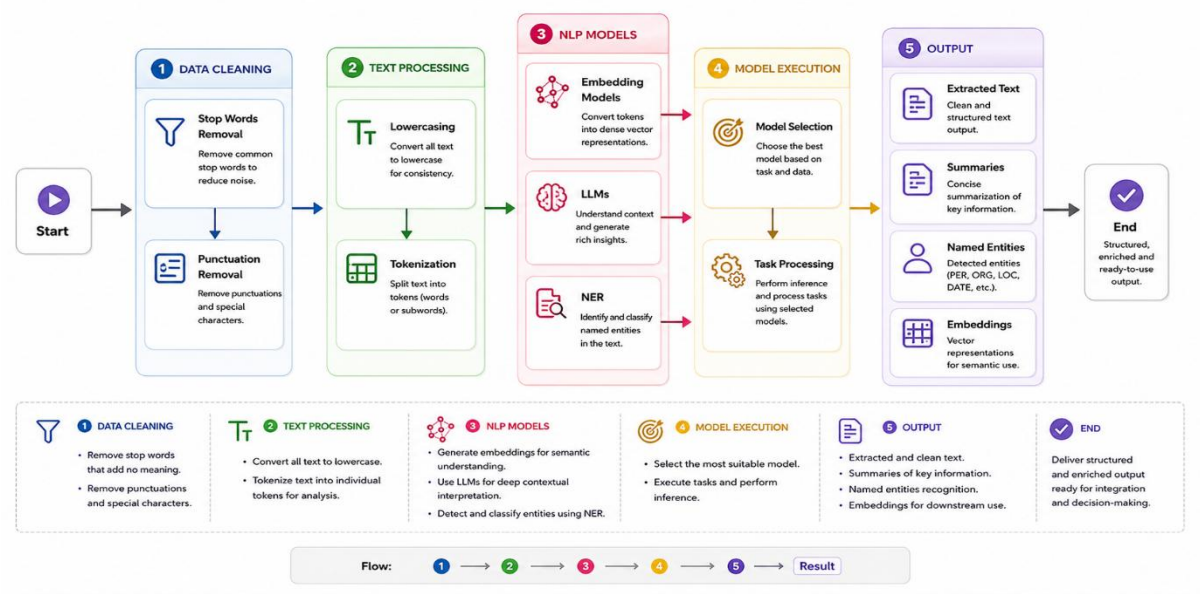

Figure 2 here: User Flow Diagram

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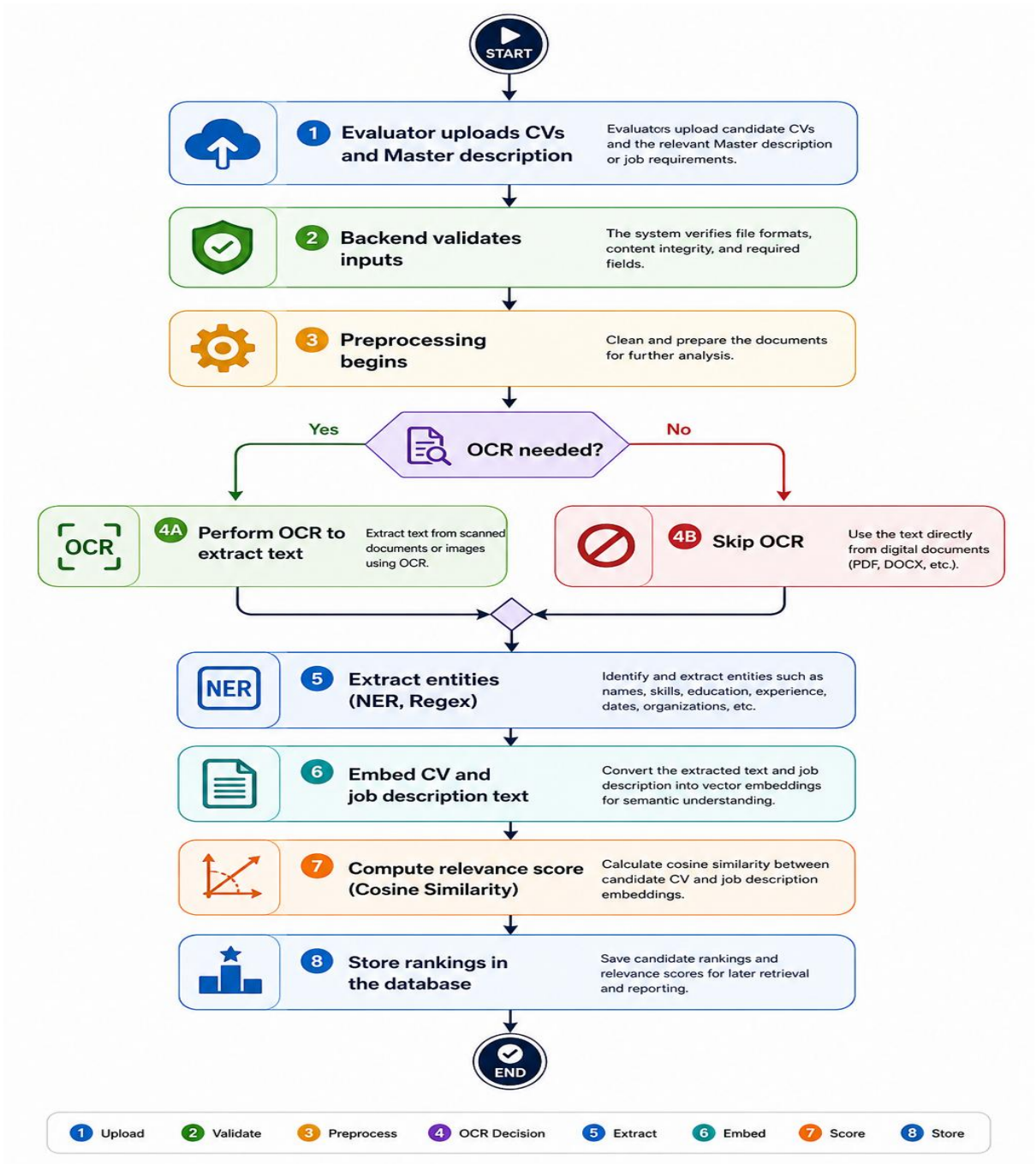

Figure 3 here: Application Flow Diagram

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After successful authentication, users are presented with a streamlined dashboard interface that supports batch uploading of multiple CVs in different formats. Once the upload process is completed, a comprehensive suite of analytical tools becomes available for candidate evaluation and management. As illustrated in **Figure 4**, the homepage serves as the primary navigation interface, enabling users to access CV summarization, candidate ranking, and conversational AI functionalities through an organized and intuitive layout.

Figure 4 here: Web Application Home Page

4.2: CV Summarization Module

The CV summarization module enables users to generate concise and structured representations of uploaded candidate profiles. As shown in **Figure 5**, the system supports two summarization modes:

- **Full CV Summarization:**

Produces a comprehensive overview of the entire CV.

- **Section-Based Summarization:**

Generates focused summaries for specific sections such as skills, education, work experience, or certifications.

The summarization process is powered by an advanced Large Language Model (LLaMA-3), which generates coherent and contextually accurate summaries in near real-time. The generated outputs are

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displayed directly within the user interface, enabling evaluators to rapidly interpret candidate qualifications without manually reviewing lengthy documents.

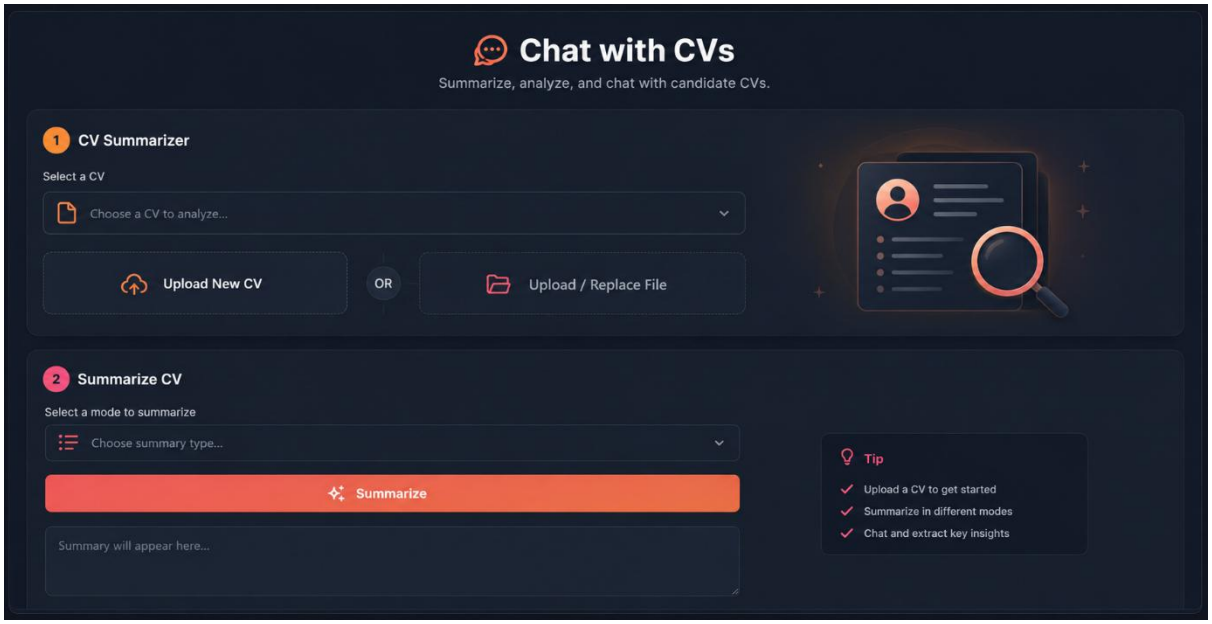

Figure 5: User Interface for Generating CV Summaries

4.3: CV Ranking Module

The candidate ranking functionality is designed to evaluate the alignment between applicant profiles and specific academic or professional requirements. As illustrated in **Figure 6**, evaluators first provide a description of the Master's program or recruitment criteria either manually or by uploading a predefined description document. The system subsequently applies semantic matching techniques using NLP-based embeddings and cosine similarity analysis to rank uploaded CVs according to relevance scores. The resulting rankings are displayed through an interactive interface that includes advanced filtering and sorting capabilities, allowing evaluators to efficiently identify the most suitable candidates. This automated ranking mechanism significantly reduces manual screening efforts while improving consistency and objectivity during candidate selection.

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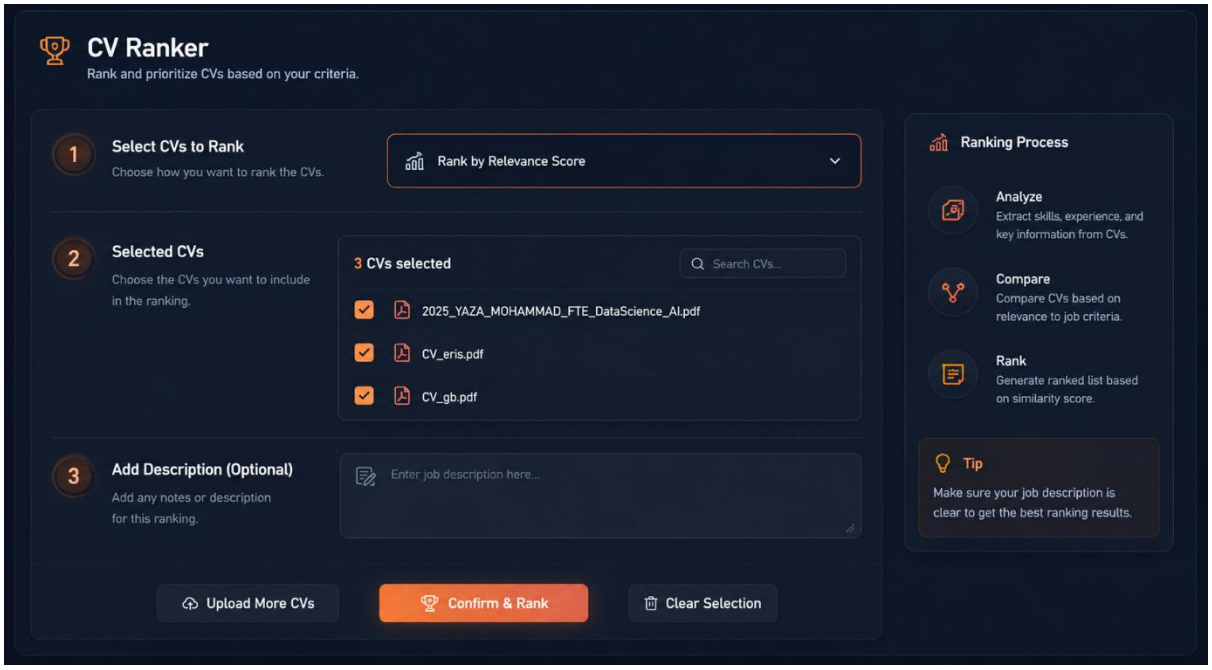

Figure 6 here: CV Ranking Module User Interface

4.4: Conversational AI Chatbot Module

To further enhance evaluator interaction and decision-making capabilities, the framework incorporates an intelligent conversational assistant for querying uploaded CV data. As shown in **Figure 7**, evaluators can interact with the system using natural language questions related to candidate qualifications, technical skills, research expertise, or professional experience. For example, evaluators may ask:

"Which candidates demonstrate strong expertise in machine learning and statistical analysis supported by academic projects or research experience?"

The chatbot processes these queries using an optimized NLP pipeline that combines structured information extraction with semantic reasoning techniques. The system then generates concise, evidence-based responses derived directly from the uploaded CV content. This conversational interface transforms traditional static document review into an interactive and intelligent evaluation process, thereby improving analytical efficiency and enabling deeper exploration of candidate profiles.

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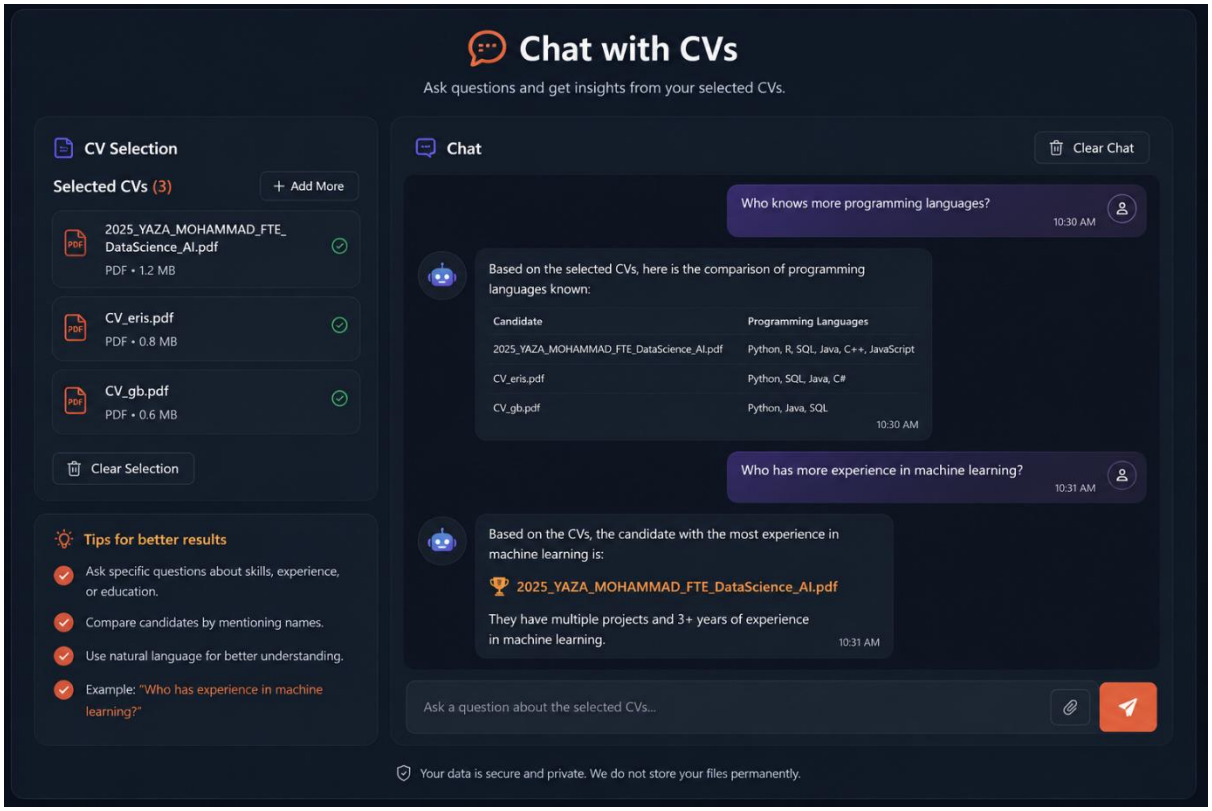

Figure 7: Chatbot Module for Questioning and Analyzing CV Data

Experimental evaluation demonstrated that the proposed framework successfully integrates OCR, NER, semantic summarization, ranking, and conversational AI within a unified scalable architecture. The system effectively processed heterogeneous CV formats while maintaining high information extraction accuracy and rapid response times.

Compared with conventional CV screening approaches, the proposed system offers several significant advantages:

Feature	Proposed Framework Advantage
Multi-format CV Processing	Supports PDF, DOCX, scanned images, and OCR-based extraction
Intelligent Information Extraction	Combines NER, fuzzy matching, and Transformers
Real-Time Summarization	Generates concise summaries instantly

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Semantic Candidate Ranking	Uses Sentence-BERT and cosine similarity
Conversational Analysis	Enables interactive querying of CV content
Scalability	Handles large-scale admissions workflows efficiently
User Experience	Interactive Django-based web application

The obtained results demonstrate the practical applicability of the proposed framework for academic admissions and recruitment systems requiring scalable, transparent, and AI-driven candidate evaluation methodologies.

5: Discussion

The proposed framework presents a comprehensive and scalable solution for automated CV processing, specifically designed to address the increasing complexity of candidate evaluation in academic admissions and recruitment environments. By integrating Optical Character Recognition (OCR), Natural Language Processing (NLP), semantic similarity analysis, and conversational AI within a unified architecture, the system demonstrates strong capabilities in extracting structured information, generating meaningful summaries, and supporting intelligent candidate assessment. One of the primary strengths of the framework lies in its ability to process heterogeneous document formats efficiently. In real-world admissions scenarios, CVs are submitted in multiple forms, including PDF files, DOCX documents, scanned images, and scanned PDFs. Such variability often poses major challenges for conventional parsing systems. To overcome this issue, the proposed framework combines Docling with Tesseract OCR, enabling reliable text extraction across both structured and unstructured document types. This integration significantly enhances system adaptability and real-world applicability. Nevertheless, OCR performance remains dependent on document quality, particularly in cases involving low-resolution scans, handwritten text, or highly complex layouts. Although the current framework achieves satisfactory performance, additional optimization and error-correction mechanisms may further improve extraction reliability for degraded or noisy inputs.

Another important contribution of this study is the implementation of a hybrid information extraction strategy. Generic Named Entity Recognition (NER) models frequently exhibit reduced effectiveness when applied to domain-specific terminology, particularly in technical disciplines such as computer science, engineering, and artificial intelligence. To address this limitation, the proposed system combines multiple complementary approaches, including dictionary-based matching, fuzzy string matching, and Transformer-based contextual models. This multilayer extraction framework

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substantially improves the identification of technical skills, software tools, programming languages, and specialized professional experiences. The integration of these techniques increases recall while preserving high precision in entity recognition. However, the rapidly evolving nature of technical terminology necessitates continuous refinement of domain-specific dictionaries and periodic retraining of contextual models to maintain extraction accuracy over time. The summarization component also represents a significant advancement of the proposed framework. By combining extractive and abstractive summarization techniques, the system effectively balances factual consistency with linguistic fluency. The ability to generate either full-document summaries or section-specific summaries provides flexibility for different evaluator requirements, ranging from rapid screening to detailed candidate analysis. This adaptability enhances usability and reduces the cognitive burden associated with reviewing large numbers of applications. Despite these advantages, abstractive summarization models occasionally produce generalized or contextually imprecise outputs, particularly when handling ambiguous or poorly structured content. Consequently, incorporating feedback-driven refinement strategies or human-in-the-loop validation mechanisms may further improve summary reliability and factual accuracy. The Job Fit Evaluation module, based on Sentence-BERT embeddings and cosine similarity analysis, demonstrated strong effectiveness in ranking candidates according to their alignment with Master's program requirements or recruitment criteria. This automated ranking mechanism contributes to more objective and transparent decision-making by reducing dependency on purely manual evaluation procedures. Furthermore, semantic similarity analysis enables the system to capture contextual relationships between candidate qualifications and institutional expectations more effectively than traditional keyword-based approaches. Future enhancements may include the integration of contextual knowledge graphs, ontology-based reasoning, or advanced embedding architectures to model deeper semantic relationships between candidate profiles and program objectives. From a usability perspective, the Django-based web application successfully bridges advanced AI functionality with practical user interaction. The developed platform provides real-time CV analysis, ranking, summarization, and conversational querying capabilities through an intuitive interface accessible to evaluators with varying levels of technical expertise. Preliminary user feedback indicated strong satisfaction regarding system responsiveness, usability, and analytical functionality. However, broader usability evaluations involving multiple institutions, evaluators, and recruitment contexts are necessary to fully assess the platform's generalizability and identify potential adoption barriers. Performance evaluation further confirmed the scalability and robustness of the proposed framework. Metrics including Precision, Recall, F1-score, ROUGE, BLEU, and processing speed demonstrated the system's ability to efficiently process large-scale CV datasets while maintaining high analytical accuracy. Cross-domain experiments involving finance, healthcare, and technical-sector CVs also validated the framework's adaptability beyond academic admissions. Nonetheless, slight reductions in NER

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accuracy within non-technical domains suggest that domain-sensitive customization and fine-tuning remain important for achieving consistently optimal performance across diverse application areas. Overall, the present work establishes a strong foundation for intelligent AI-driven CV processing within academic admissions and recruitment systems. By combining technical rigor, semantic analysis, and user-centered design principles, the proposed framework offers a practical and scalable alternative to traditional manual candidate evaluation methods. Although certain limitations remain—including OCR sensitivity to document quality, occasional abstractive summarization drift, and evolving domain terminology—the modular and extensible nature of the architecture enables straightforward integration of future improvements. Future research will focus on refining domain-adaptive models, incorporating deployment-driven feedback mechanisms, and exploring explainable AI techniques to improve transparency, trustworthiness, and evaluator confidence in automated decision-support systems.

6: Conclusions

The proposed automated CV summarization and ranking framework provides a comprehensive and intelligent solution for addressing the growing challenges associated with large-scale candidate evaluation in academic admissions and recruitment systems. By integrating advanced Natural Language Processing (NLP) techniques with Artificial Intelligence (AI)-driven analytical models, the system delivers an efficient, scalable, and adaptable platform for processing heterogeneous CV data. A key contribution of this work is the development of a hybrid architecture that combines extractive and abstractive summarization strategies with semantic ranking and conversational AI capabilities. This integrated methodology enables accurate information extraction, context-aware candidate evaluation, and interactive exploration of applicant data through a user-friendly interface. Unlike conventional manual screening approaches, the proposed framework supports real-time CV analysis, automated ranking, and intelligent querying, thereby significantly improving evaluation efficiency and consistency. The implementation of dynamic summarization and chatbot-assisted interaction further enhances the practical utility of the system. Evaluators can rapidly obtain concise candidate insights, compare applicants based on specific criteria, and interact with uploaded CV data using natural language queries. Such functionality reduces administrative burden, minimizes subjectivity in decision-making, and supports a more transparent and data-driven admissions workflow. Experimental findings demonstrate that the proposed framework effectively processes diverse CV formats while maintaining strong performance in information extraction, semantic matching, and summarization tasks. The integration of OCR, NER, Transformer-based NLP models, and Sentence-BERT similarity analysis contributes to improved candidate assessment accuracy and scalable system

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performance. Furthermore, the modular design of the architecture allows seamless integration of future enhancements and domain-specific customizations. Despite these achievements, certain limitations remain. OCR performance may still be affected by poor-quality scanned documents, while abstractive summarization models occasionally generate generalized or contextually imprecise outputs. Additionally, rapidly evolving technical terminology necessitates periodic updates to domain-specific dictionaries and contextual models. Nevertheless, the extensible nature of the proposed framework provides a strong foundation for continuous refinement and long-term adaptability.

Future work will focus on improving domain-adaptive summarization models, integrating explainable AI mechanisms, and incorporating feedback-driven learning strategies to enhance transparency and evaluator trust. Moreover, the system may be extended to support multimedia-based candidate assessment as video CVs become increasingly common in modern recruitment environments. This includes the integration of speech-to-text transcription, sentiment analysis, and visual analytics techniques for richer evaluation of communication skills, presentation quality, and professional attributes. In conclusion, the proposed AI-powered CV processing framework establishes a modern and intelligent approach to automated candidate evaluation by combining technical sophistication with practical usability. The system demonstrates significant potential for transforming academic admissions and recruitment workflows through scalable automation, semantic intelligence, and user-centered design.

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