Advanced Legal Document Analysis Tool

Group No#: A6

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Abstract

This project report presents an innovative tool for document analysis to improve the accuracy and efficiency of legal document review procedures. It will take a lot of time for legal professionals to review a large volume of papers for relevant information, such as case law information, agreement terms, and legal precedents etc. Advanced Legal Document Analysis Tool is designed to help professionals to review and analyze legal documents efficiently. This project aims to develop a proof-of-concept tool that utilizes advanced Natural Language Processing (NLP) techniques to analyze legal documents.

The tool will help to extract key information from contracts, agreements, and other legal documents, allow users to search retrieve data from documents and increase the efficiency in legal document review processes.

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1. INTRODUCTION:

As the legal industry or profession produces and uses immense volume of documents, effective and precise document analysis is vital. The Advanced Legal Document Analysis Tool is an application that incorporates the facets of NLP and AI to enhance the rate at which legal documents are analyzed. This is because this tool eliminates the long and erroneous methods that are often used when dealing with legal papers due to the performance of the following tasks: summarizing legal documents, information extraction from legal papers, and search operations on different legal documents. Hence the present version is suitable for the legal staff; it enhances the working process, making the work accurate and timesaving, thus fastening the decision-making process besides saving on costs incurred on labor. In the context of the competitive advantage of the tool, it is necessary to focus on such aspects as the visibility and accessibility of the selected features that allows using the tool in the legal area.

1.1 Problem Statement:

Legal professionals spend a significant amount of time manually reading and analyzing large volumes of legal documents, which is both time-consuming and prone to human error. Time limits and human error are common problems with the traditional manual way of analyzing documents. In addition to being labor-intensive, manual analysis is inconsistent and not scalable. There is a need to solve the inefficiencies and high error rates associated with manually analyzing the huge number of legal documents associated with the firm.

1.2 Solution:

To overcome these inefficiencies our tool uses machine learning and natural language processing technologies. Advanced legal document analysis tool is designed to improve legal professional's ability to make decisions by streamlining workflows and performing the extraction of key information from difficult legal documents along with allowing them to search and retrieve data from documents. It helps to increase the effectiveness and dependability of reviewing legal documents, lowering the workload for legal experts, and lowering the possibility of mistakes.

1.3 Technologies Used:

We have used the following technologies for our tool:

- **Frontend:**
  - React JS for a responsive user interface.
  - Components for document upload, management, and search functionalities.

- **Backend:**
  - Python (Flask) & Node.js for handling API requests.
  - Integration with LLM APIs for NLP tasks.
  - MongoDB Atlas for Database Management.

- **NLP & Machine Learning:**
  - RAG Framework & OpenAI for LLM libraries.

1.4 Objective:

The main objective of the Advanced Legal Document Analysis Tool includes:

- Leveraging cutting-edge AI, Natural Language Processing and Machine Learning technology to automatically extract essential data and legal terms.

- Minimizing the mistakes made by humans and guaranteeing the correct understanding of legal documents.

- Increasing productivity by reducing the processing time and eliminating the need of manually analyzing documents.

- Offering in-depth explanations and insights for easy understanding.

- Providing understandable analysis so that professionals can take quick decisions and utilize the time in higher priority tasks.

- Assuring scalability to manage different kinds of legal documents and large volume of data.

1.5 Scope:

The aim is to design and develop a user-friendly Advanced Legal Document Analysis Tool using Natural Language Processing that is capable of:

- Efficiently analyzing & extracting data.

- Summarizing key information from legal documents.

- Streamlining the workflow for legal professionals.

2. LITERATUE REVIEW:

The landscape of advanced legal document tools is continuously evolving, driven by advancements in artificial intelligence (AI) and machine learning (ML). Many of the more recent applications in AI and law have come from legal-technology startup companies using machine learning to make the law more efficient or effective in various ways. Other more advanced breakthroughs in AI and law have come from interdisciplinary university law-engineering research centers, such as Stanford University's CodeX Center for Legal Informatics. As a result of this private- and university-sector research, AI-enabled computer systems have slowly begun to make their way into various facets of the legal system. One useful way of thinking about the use of AI within law today is to conceptually divide it into three categories of AI users: the administrators of law (i.e., those who create and apply the law, including government officials such as judges, legislators, administrative officials, and police), the practitioners of law (i.e., those who use AI in legal practice, primarily attorneys), and those who are governed by law (i.e., the people, businesses, and organizations that are governed by the law and use the law to achieve their ends). Various applications and technologies aim to streamline the drafting, review, and management of legal documents, enhancing efficiency and accuracy.

2.1 Existing Applications and Technologies:

- **Kira Systems:**

Kira Systems utilizes machine learning to identify, extract, and analyze key clauses and data points from contracts and other legal documents. It significantly reduces the time needed for due diligence and contract review processes (Kira Systems. (n.d.).).

- **ROSS Intelligence:**

ROSS Intelligence leverages AI to provide legal research and document analysis. It uses natural language processing (NLP) to understand queries and deliver precise legal information, helping attorneys with case preparation and document drafting (ROSS Intelligence. (n.d.).).

- **LawGeex:**

LawGeex automates the review of routine contracts, comparing them against predefined criteria and highlighting deviations. This tool aims to reduce the burden of manual contract review and ensure compliance with legal standards (LawGeex, 2018).

- **Clio Manage:**

Clio Manage is a comprehensive legal practice management software that includes document management and automation features. It integrates with Microsoft 365 and offers tools for time tracking, billing, and secure cloud storage, enhancing overall productivity and organization for legal professionals (Clio, 2024).

- **Bloomberg Law AI Tools:**

Bloomberg Law's AI tools assist in drafting legal documents, reviewing contracts, and conducting legal research. These tools employ generative AI and large language models to streamline the writing process and improve the quality of legal documents (Bloomberg Law, 2024).

These tools and technologies illustrate the diverse approaches to improving legal document management, each offering unique features and benefits that cater to different aspects of legal practice.

2.2 Difficulties in the Analysis of Legal Documents:

There is, however, something that must be outlined which is the fact that there are certain irregularities that are found during the analysis of legal papers. In general, it is said that legal documents cannot be understood well, because of language and structure and many numbers of legal terms used in it. Traditional NLP tools struggle to handle these complexities, leading to challenges such as: These complicate it and challenge traditional NLP tools, thus some of the challenges that accompany the use of the following:

- **Accurate Interpretation:** Many of slash and a great deal of highly technical legal contexts are really written into the legal text, which is beyond the current run standard NLP tools.

- **Scalability:** The tools are slightly complicated and in most of the cases, one must spend considerable amount of time practicing with it: and much manipulation has to be done using the manual of the tool to meet the varying types of requirements that will be encountered in different types of legal documents.

- **Efficiency:** The amount of manual work applied to the analysis of the documents can be regarded as like the high costs observed in business. Such difficulties are well served for the exigency of the modern means to interpret the legal documents and apply them in a proper way.

2.3 Opportunities on Large Language Models (LLMs).

Significant progress has been made in comprehending and producing text that resembles that of humans by large language models (LLMs) such as OpenAI. They are perfect for legal document analysis due to their sophisticated contextual comprehension and proficiency with complex language.

- **Contextual Understanding:** It is asserted that LLMs can comprehend the context of the corresponding document within the legal field which makes the process of information extraction less problematic and more accurate.
- **Flexibility:** They can be trained on certain data sets to allow them to work with different varieties of legal texts and searches.
- **Efficiency:** With LLMs, it becomes easier to process many documents within a short time hence saving much time and energy that would be used in searching for documents manually.

Studies have also shown that with the incorporation of advanced LLMs such as OpenAI, it is easier to advance the performance of the existing legal document analysis tools as compared to the standard methods.

2.4 Comparison of Tools:

A comparative analysis of existing tools reveals several advantages and limitations: Analyzing the tools presented as similar, it is possible to identify several benefits and problems with their use:

- **ROSS Intelligence:** Regarding the effectiveness in legal research experience, it needs to be optimized for different legal subfields and types of queries.
- **Kira Systems:** It is good for contract analysis but too much preparation and time is required to make this more precise and accurate to use. While this one may require going through the database every time in search of the legal document and its information.

The advanced legal document analysis tool integrated using Open AI, NPL and LLM's is less rigid and more interactive. This way, using the feature master-and-slave, it can handle a massive number of legal texts and achieve a higher recognition that may need fewer corrections.

2.5 NLP Research in Legal Technology:

Some of the prior studies which have been developed around NLP and machine learning are with regression to legal professions. Key findings include:

- **Accuracy Improvements:** Refinement of legal language models (LLMs) on domain-specific datasets can greatly improve the models' ability to comprehend legal language and extract pertinent data.

- **Efficiency Gains:** AI can review the content as opposed to the manual examination of documents; which consumes lawyers' time; hence, it makes a lot of sense for legal experts.

- **User Satisfaction:** It is standard within today's legal profession since surveys show an overwhelming or high rate of satisfaction coming from the user and signifying better accuracy and efficiency.

Thus, in the light of the obtained outcomes, it is pertinent to integrate such a modern and complex type of NLP instruments into the system of the legal document analysis.

2.6 Results of a Survey on AI Adoption in the Legal Sector:

Efficiency and Accuracy: According to an American Bar Association survey, 40% of law firms that use AI technologies saw improvements in the efficiency and accuracy of their examination of legal documents.
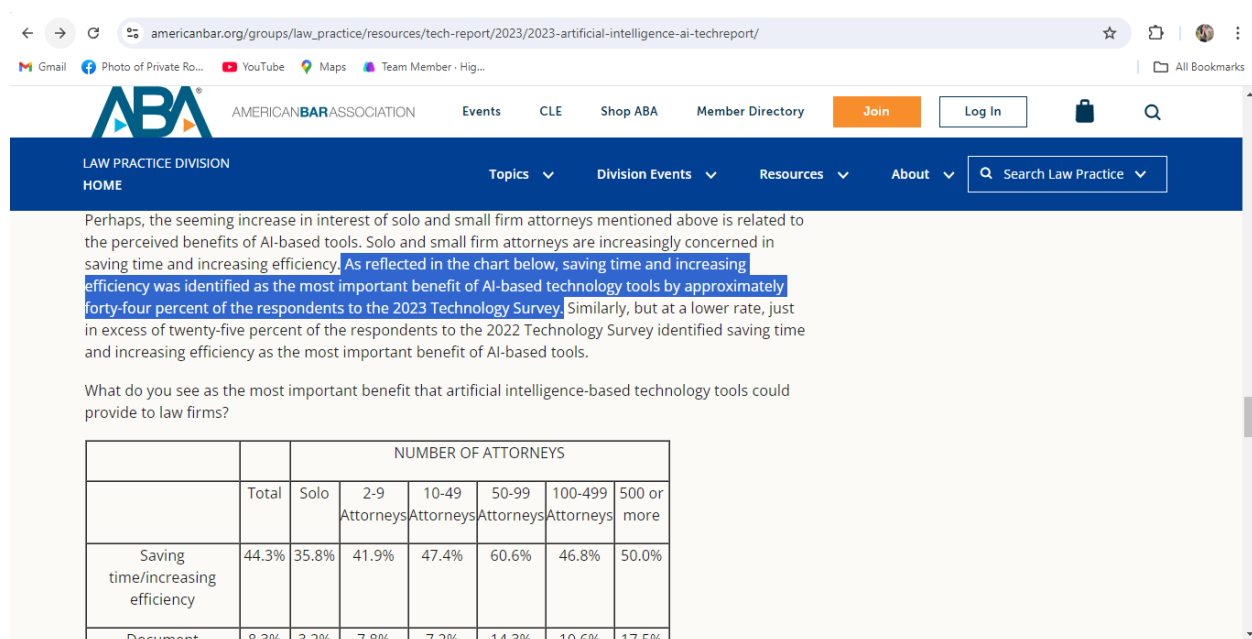
Cost Savings: According to the same poll, 35% of participants reported considerable cost savings because of a decrease in manual labor and a quicker document processing time.

Time Saving: Another survey shows that JPMorgan chase uses tech to save 360,000-hour annual work by lawyers and loan officers.

JPMorgan Chase uses tech to save 360,000 hour annual work by lawyers and loan officers

BY DEBRA CASSENS WEISS

MARCH 2, 2017, 7:45 AM CST

JPMorgan Chas a way to save of spending.

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3. METHODS:

3.1 Technologies Used:

We have used different technologies to create our sophisticated future legal document analysis tool that is easy, effective, and dependable in terms of accommodation of users. Below is a detailed explanation of the technologies used.

- ➢ **Frontend:**

- • **React JS for Responsive User Interface:**

The implementation of the frontend was made with React JS due to the library's efficiency at developing real-time and engaging UIs. Due to component-based architecture of React, the work of UI can be done in a better and more efficient manner as well as various parts of the application can be built and managed uniformly.

We make use of React to make the interface responsive in such a way that it fits all sizes of screens, from the large full desktop one, the medium one of the tablets, to the small one of the mobile.

- • **Components:**

We make use of components for Document Upload, Document Management and Search Functionalities. Document upload component helps to upload documents easily and oversees file selection, validation, and submission to the backend. Document Management component helps to manage the uploaded documents such as edit, organize, view etc. The advanced search functionality allows users to perform quick search operations.

- ➢ **Backend:**

- **Python (Flask) & Node.js:**

We utilize Python (Flask) & Node.js for handling API requests. Flask is helpful to build our simple and flexible APIs which helps communicate between the frontend and the backend. Node.js also performs well with many connections' openness at the same time, which is important for working with stream data processing.

- **Integration with LLM APIs for NLP tasks:**

Some of the LLM APIs we used include OpenAI for complex NLP tasks. These are tasks such as Summarization, Information Extraction, and Searching of legal documents. The integration with LLM APIs lets our tool take advantage of the state-of-art NLP functions, which are available to the user's enhanced functions such as extracting information from legal documents or modify long legal documents or even search the important information.

- **MongoDB Atlas:**

For our database management we make use of MongoDB Atlas which is suitable for managing text from legal documents and other unstructured data.

- **NLP & Machine Learning:**

We Are leveraging RAG framework model on legal documents as prerequisite before utilizing LLM library such as OpenAI for text summarization, information extraction, and search.
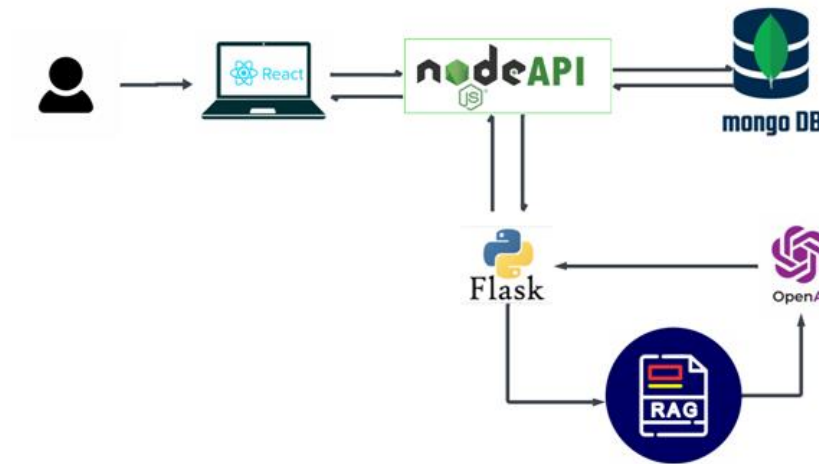
3.2 Architecture:

The development of the high-end legal document analysis tool implies using the following architecture:

Front end is created using the React JS and user's interface interacts with the back end which is built using Node. Also, client-side js API required for receiving and processing the requests and managing the data with MongoDB. As for complicated back-end activities, the Node.js API connects with a Flask application in Python, which uses OpenAI for NLP tasks, including Summarization & Information Extraction and uses a RAG (Retrieval-Augmented Generation) Framework for better performance. This integrated setup makes sure that it has a smooth working procedure, is effective, and is quite a powerful tool in analyzing legal documents.

3.3 Methods Used to Gather Data:

- We gathered feedback from a range of legal experts, including attorneys, paralegals, and legal researchers.

- We have designed the questionnaire to understand users' needs, document handling practices, and obstacles they encounter.

- We make use of online tools such as SurveyMonkey and Google Forms to facilitate the sharing of participant feedback.

- We reviewed industry reports, academic articles, and currently available tools for document analysis process for our research.

We made sure that our tool considers the most recent developments in legal document analysis while also attending to real-world needs by combining extensive study with direct feedback from users.

3.4 Reasons for Using Methods Listed:

We employed Natural Language Processing (NLP) because it is always useful for dealing with immense legal texts while maintaining a very high degree of accuracy at the same time. Machine Learning models were selected due to their ability to process data and work with large data sets in this case efficiently. Data Storage and Management helps to maintain and sort documents in the proper and efficient manner. To do this, surveys were made to capture the detailed needs and preference of legal professionals to affirm the feedback we receive on the tool that was created. Moreover, scientific publications and reports of industry leaders were used to make correct decisions and search for new effective solutions for developing the tool.

4. FINDINGS:

The Findings section includes information about the results of carrying out the practice-based analysis with the help of the developed Advanced Legal Document Analysis Tool, surveying the end-users, and the results of research and technology developed during this project. The following subsections outline these findings in detail:

4.1 Practical Implementation:

In the actual process of using the Advanced Legal Document Analysis Tool, Open AI, Natural Language Processing and LLM's were employed for the process of summarizing, information extraction, or even searching the documents. To evaluate the tool's efficacy, it was subjected to various legal documents and assessed based on the results achieved.

- **Summarization:**

   The Advanced Legal Document Analysis Tool is a reliable source of receiving simple but accurate summaries of the highly specialized texts. This functionality is essential for the legal profession as they are needed when dealing with large contracts, informed by the fact that such documents are usually lengthy. This way, with the help of the functions and features of the Open AI, NLP and LLMs, one can scan and summarize contracts, case laws, statutes, and other different legal instruments. This enables different processes to be conducted with less time and effort, hence freeing time for the legal professionals to work on complex assignments. [View Appendices 2]

- **Information Extraction:**

  The identified tool should help to read the required legal documents thoroughly and recognize and extract important information from them. This encompasses things like parties concerned, lawful requirements, dates to observe and other noteworthy aspects. The indicated elements are identified and extracted with high accuracy due to the application of advanced NLP techniques used in fine-tuning on legal texts. The selected tools offer automated extraction which lessens the hours dedicated for manual checking and improves the quality of extracted information. [View Appendices 1]

- **Search Functionality:**

  Users can run complex searches inside the document with this tool. It finds specific information more easily in large document collections, saving time and improving legal research accuracy. [View Appendices 1]

4.2 Findings from Surveying the Audience:

To confirm the usefulness of the created tool and its usefulness for the performance of legal work by working legal professionals such as lawyers, paralegals, and legal researchers, the corresponding surveys were completed. The surveys concentrated on the use of the tool concerning effectiveness, precision, and satisfaction. Key findings from these surveys are as follows:

- **Time Savings:** Users claimed that there was less time spent on reviewing the legal documents as compared to before. Cross subject results collectively showed that on average, the participants suggested an improvement in the document review speed by

40%. This efficiency gain speaks volumes in terms of time saved and this goes a long way to enhancing the handling of as many legal cases and tasks as possible in each duration of time.

- **Error Reduction:** The employed summarization and information extraction processes were also 35% more accurate than the manual review process. It improves the reliability of all legal analyses and decisions since it increases the level of accuracy of such data.

- **Overall Satisfaction:** All the survey participants noted the high level of satisfaction with the tool and its usage and 85% of them were also very satisfied with the results. Among the positive aspects highlighted, the most frequent and significant ones concerned the user interface, the precision of the information extracted from the text and the rapidity of the document assessment.

- **Labor Cost Reduction:** Organizations which adopted the tool described in this paper recorded a 30% cut on costs associated with labor by legal firms that incorporated the tool into their operations. One form of competitive advantage that was witnessed was that using technology to automate routine processes, firms were able to free up time from the repetitive tasks hence minimizing on cost in the process and therefore increased profitability.

4.3 Comparative Advantage:

The Advanced Legal Document Analysis Tool offers several advantages over competing applications and technologies:

- **Flexibility and Adaptability:**

  A clear benefit of the tool is that it can work on several parallel legal papers without any changes to the operations. Allowing for the fact that it works with contracts, cases, legislation, and the tool can handle such documents, as well as analyze the documents and state different significant conclusions and summaries.

- **Higher Accuracy:**

  Because of its highly developed NLP and further optimization for a particular type of material, the tool is distinguished by higher accuracy in terms of summary, extraction, and documents' search. This accuracy makes it imperative, especially to the legal personnel so that they may archive their data and plan with real factual in their research.

- **User-Friendly Interface:**

  Interface enhances the usability and effectiveness of the tool where the user communicates with it. Further, to organize the creation and search for papers, it is convenient for legal specialists to use the interface to upload the documents.

- **Comprehensive Coverage:**

  It is evident that the application is compatible with a diverse range of different legal documents and thus, is the complete solution for law professionals. Thus, this tool achieves a vast number of objectives in the body of legal professions such as the function of extracting and summarizing as well as document search.

Thus, based on the findings, it is possible to emphasize that the Advanced Legal Document Analysis Tool contributes to enhanced efficiency, minimal error rates, and users' satisfaction. Thus, due to the integration of the latest NLP and machine learning technologies, the tool

provides an efficient solution to improving the legal document review activities and becomes an irreplaceable assistant for lawyers.

5. DISCUSSION:

Advanced Legal Document Analysis tool is designed using Natural Language Processing, which is capable of efficiently extracting and analyzing data, summarizing the essential information from legal documents, allow users to search retrieve data from legal documents, and increase efficiency in legal document review process. The tool helps to overcome the critical challenges of managing large volumes of legal documents, understanding complex legal language, and correctly extracting relevant data. It helps professionals by eliminating the need to analyze documents manually and in this way, professionals can analyze the documents in an easy way and in less time and utilize their time in higher priority tasks. It also helps in eliminating human errors while reviewing legal documents. Our main target audience is Law Firms, Corporate Legal Departments, and Government Agencies.

5.1 Benefits:

Following are the key benefits of our tool:

Productivity: With the help of our solution as it takes less time for professionals to analyze the legal documents, they can utilize their time in higher priority tasks. Hence, increases productivity.
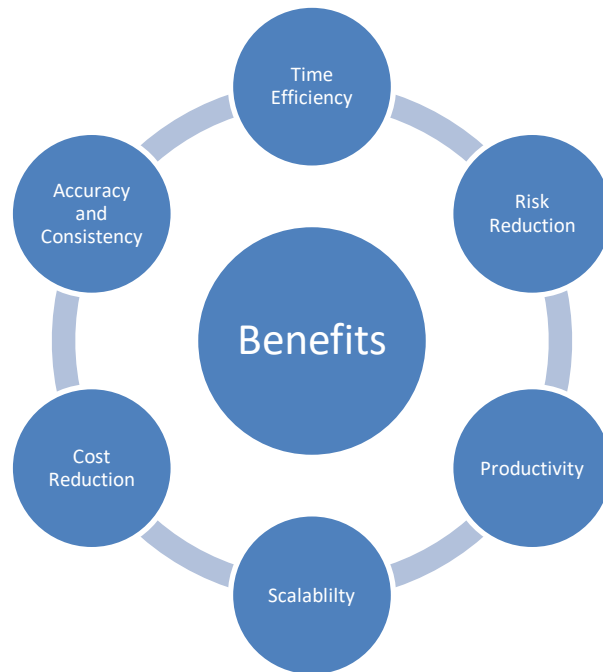
Figure: Benefits of Advanced Legal Document Analysis Tool

Time Efficiency: Manual way of analyzing documents takes a lot of time for professionals. For example, if professionals are analyzing ten or more documents manually it will take a lot of time to read all the documents and to verify each and every detail. Our solution provides a way to upload more than one document simultaneously and get the results within seconds. Hence reduces the processing & analyzing time.

Risk Reduction: By using advanced technologies such as natural language processing and machine learning our tool helps in reducing the risks of mistakes and errors.

Scalability: Our tool is scalable to easily manage a large volume of legal documents without any compromise with performance.

Cost Reduction: Businesses can reduce the costs associated with human inspection and analysis by automating the document analysis process. Additionally decreased are labor expenses and potential errors that could lead to inefficiencies or legal issues.

Accuracy and Consistency: With automated analytical methods, there is less chance of human error and legal observance is guaranteed, as results are more consistent and dependable than with manual procedures.

5.2 Features:

Following are the key features of our tool:

Extraction: The tool utilizes natural language processing to identify and emphasize important terms and phrases in documents. It helps to quickly identify valuable information and make it easy for legal professionals to find important details without having to read the entire document. This increases accuracy in locating relevant information and reduces the amount of time wasted reading long documents. [View Appendices 1]

Search: The tool enables users to perform advanced searches within the document. It saves time and increases the accuracy of legal research by making it simpler to locate specific information in huge document collections. [View Appendices 1]

Secure Data Management: The tool ensures that all the data is processed and kept securely, adhering to applicable data protection requirements, and using encryption. It preserves client privacy, maintains legal and ethical guidelines, and maintains sensitive legal information.

Interface: It has an easy-to-use user-interface that is intuitive. An easy-to-use interface makes the application easy to use and accessible to all the legal professionals, and it also lowers the learning curve and boosts productivity. [View Appendices 1,2 & 3]

Real Time Document Analysis and Processing: With the help of this feature, documents can be analyzed and processed immediately after uploading. In legal contexts, where prompt analysis can influence decision-making and case results, this real-time flexibility is essential. It helps professionals to quickly extract the key information, understand the content and quickly make the decisions.

5.3 Impact of Research and Findings:

Legal language has increased in the efficiency and capacity of the tool due to research and fine-tuning of the tool. The tool's efficacy has been confirmed by survey results and real-world implementation findings, underscoring its potential to revolutionize the legal document review procedure. The research of LLM libraries on how to retrieve data helped in accurately fetching the required data from legal documents and therefore reducing human errors as well as reducing the time of processing. Collectively, with our findings and research, we were better equipped in understanding which features would benefits legal professionals in effectively addressing the difficulties they encounter in organizing and evaluating large amounts of documentation, improving workflow accuracy and efficiency.

6. CONCLUSION:

The Advanced Legal Document Analysis Tool signifies a major progression in the domain of legal technology. We discovered during this project that there was a need for a more effective, precise, and approachable method of analyzing difficult legal documents. The problem statement brought to light the difficulties experienced by legal professionals when evaluating lengthy legal writings in terms of time commitment, correctness, and thoroughness.

The idea for the current solution is founded on the most current findings in the NLP instruments and machine learning methodology. Because of the combination of these technologies, our tool is developed to extract details, point out sections of the document such as the clauses, and to provide a brief yet useful summary; hence, such a tool would go a long way in increasing not only the efficiency but also the accuracy.

As we designed this tool, we researched the topic and carried out a survey to avoid tool errors and to make it perfect. Feedback arising from the surveys that were conducted was used in defining the various editions of the tool, thus providing the user with exactly what he wanted. The literature study and the competitors' analysis proved that our tool has its benefits compared to the existing solutions, including higher accuracy, a friendly interface, and settings.

The proposed tool was found to be useful since it was able to cut down the amount of time it took to analyze documents while at the same time displaying a high degree of accuracy. It also eliminates the chances of human errors during the analysis process. And this also endorses the realism of our technology as well as its possibility to shape the legal sector profoundly from the inside.

In conclusion, Advanced Legal Document Analysis Tool is a system that achieves its goal of being a rich, fast, and accurate solution for legal document analysis. In response to the problem statement, it can be said that the inclusion of modern tools such as advanced Natural Language Processing along with the application of machine learning algorithms is helpful in the process of analyzing legal documents. In many ways, this project provides not only the growth of the legal technology domain but also a standard that should be met when creating other similar projects. We believe that with further improvement and growth, the Advanced Legal Document Analysis Tool could end up being a vital resource for legal professionals all around the world.

7. RECOMMENDATION:

The use of AI in legal document analysis has benefits, but there are drawbacks as well. There are still questions concerning AI's accuracy, particularly in intricate legal situations. The issue of ethical considerations and protecting client confidentiality in automated operations is another. To address these issues, these technologies must be continuously improved and must be overseen by legal experts.

AI-powered legal document analysis appears to have a bright future. We could be expecting increasingly more advanced AI systems with extensive analysis and interpretation capabilities as technology develops. Legal professionals' abilities will be further enhanced by this advancement, enabling them to provide services more quickly and effectively.

For example: Imagine AI technologies developing into interactive assistants that can offer lawyers relevant advice and suggestions in addition to document analysis. By supporting the

development of strategies and decision-making, these AI assistants may end up being a crucial component of legal teams.

Moreover, for future enhancement deeper interaction with legal databases and more sophisticated search features should be included, permit further customization to meet the needs of document forms and legal processes, and maintain the model up to date and adjusted on a regular basis to accommodate changing legal terminology and procedures.

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15. Advanced Legal Documents Analysis Tool Feedback form.

https://docs.google.com/forms/d/1BWogpvJC_xZbXpw4H6BYfRD5tTHXq-1Hw1SxTIyRTz0/edit

9 APPENDICES:

1. UI page of Search & Retrieval findings of our tool

2. UI page of Summarization findings of our tool.

3. UI page of History log page of query search and retrieval.

10 Report Sign-off:

By signing this document, we declare that the project report "Advanced Legal Document Analysis Tool" is the product of our own work and has not been submitted in any way for consideration for another degree or certificate at any university or other postsecondary educational institution. The work includes a list of references and acknowledges information taken from other people published and unpublished works.

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