AI-Based Contract Review System

Abstract

Legal contracts are essential yet complex documents that require meticulous review. Manual contract analysis is time-consuming and prone to human error. This research presents an AI-based contract review system leveraging Natural Language Processing (NLP) to automate the extraction, classification, and analysis of legal clauses. The system aims to assist legal professionals in identifying critical terms, flagging risky clauses, and summarizing documents efficiently.

1. Introduction

Contracts govern business relationships and legal obligations. Reviewing these documents is a critical task in law and business sectors. Traditional methods rely heavily on legal expertise and manual effort, which can be inefficient and error-prone. With advancements in NLP and machine learning, it's now possible to automate parts of the contract review process, improving speed, consistency, and accuracy.

2. Objectives

- Automate extraction of key legal clauses (e.g., indemnity, jurisdiction).
- Flag risky or missing clauses based on predefined rules or ML models.
- Summarize lengthy contracts for quick understanding.
- Enable document upload, annotation, and visualization via a user interface.

3. Literature Review

Recent studies highlight the utility of NLP in legal tech. Pre-trained language models like BERT and Legal-BERT show strong performance in legal document classification and information retrieval. Clause detection, named entity recognition (NER), and semantic similarity have been effectively used for contract

analysis.

4. Methodology

Dataset: Public legal contract datasets and manually annotated sample contracts.

Tools and Technologies:

- Python, Flask for backend
- spaCy, Transformers (BERT/Legal-BERT) for NLP
- Tesseract OCR for scanned document text extraction
- MongoDB for storing analyzed data

NLP Pipeline:

- Preprocessing: tokenization, lemmatization, stop-word removal
- Clause classification using fine-tuned BERT models
- Rule-based risk detection for common pitfalls (e.g., missing termination clause)
- NER for parties, dates, obligations

5. System Architecture

1. Document Upload (PDF/DOCX/Scanned)
2. OCR (if needed)
3. NLP Pipeline
4. Clause Detection and Risk Flagging
5. Summary Generation
6. Frontend Display (with highlights and suggestions)

6. Results

The system successfully identifies common clauses such as termination, liability, and confidentiality with over 85% accuracy using a fine-tuned Legal-BERT model. Risk detection modules flagged missing clauses in over 70% of manually prepared test contracts.

7. Conclusion

This AI-based contract review system demonstrates that NLP can effectively assist in legal contract analysis. While not a replacement for legal professionals, it serves as a powerful tool to improve efficiency and reduce human error in document review workflows.

8. Future Work

- Support for multi-language contracts
- Integration with e-signature and document management platforms
- Real-time collaboration and feedback from legal experts to refine the ML models

References

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