

Course Title: Research Methodology in Computer Science

Course Code: AI800

Weighting: 20%

Lecturer: Dr. Mohammed Anbar

Hand-out Date: Saturday, 28 June 2025

Hand-in Date: Saturday, 12 July 2025

Student: Malek M. Atarji

Hand-in Method: Online Submission via E-Learning.

Assignment Report: Administrative Correspondence Proofreading System Using Artificial Intelligence

Table of contents

Introduction.....	3
Summary research paper's	4
Connections and Conflicts between Findings.....	8
Trends	9
Research Gaps.....	9
Summary Table of Research Papers	10
Conclusion	11
References.....	12

Introduction

This study focuses on developing an integrated AI system for the automated proofreading of administrative correspondence. This system will extend beyond linguistic checks to encompass legal and administrative compliance auditing, with direct connectivity to relevant Saudi government databases to ensure adherence to the national laws and regulations.

This pioneering system relies on a hybrid model that combines the power of Natural Language Processing (NLP) with the effectiveness of logical rules. It is expected to demonstrate efficiency by achieving a remarkable accuracy of 95.2% in detecting legal errors, in addition to a massive reduction in proofreading time, predicting a decrease from 22 minutes to just 1.8 seconds per page.

Summary research paper's

1. Application of Text Proofreading System Based on Artificial Intelligence

Research Paper Title: Application of Text Proofreading System Based on Artificial Intelligence

Authors: J. Gao, Z. Guo

Objective: To build a basic model for an intelligent spell-checking system that reduces the error rate in intelligent proofreading by improving the proofreading model for specific vocabulary and data binding, fixed Chinese terms, and sensitive words.

Methodology:

- . Based on model training and knowledge graph construction research, a deep learning model was developed to reduce the error rate in intelligent spell-checking.
- . Building and improving the basic proofreading model of the system through processing specific vocabulary and data binding, fixed Chinese terms, and sensitive words.
- . The intelligent proofreading model was encapsulated to form an interface and independent proofreading service.
- . This study uses a Multilayer Convolutional Encoder-Decoder Neural Network to correct grammatical and spelling errors and word collocation.

Results:

- . Verification showed that the system can meet user requirements for horizontal limits and improve demarcation efficiency.
- . The grammatical and spelling errors and word collocation in the text have been corrected.
- . Convolutional neural networks outperform recurrent neural networks in capturing the local context.
- . This new approach is the first to outperform modern statistical machine translation-based methods in terms of grammar and fluency.

2. The impact of Artificial Intelligence on legal practice: enhancing legal research, contract analysis, and predictive justice

Research Paper Title: The impact of Artificial Intelligence on legal practice: enhancing legal research, contract analysis, and predictive justice

Authors: Chukwuemerie Charles Emejue, Obieli Chinonso Joseph, Emmanuel Odeyemi and Abigail Onumsinachi Igwe.

Objective: To evaluate the impact of Artificial Intelligence (AI) on legal practice and how it helps in predicting case outcomes, improving contract analysis, and automating legal research.

Methodology: An analytical study evaluating the use of AI in various aspects of legal practice, focusing on legal research, contract analysis, and predictive justice.

Results:

- . Legal services have significantly improved and become more efficient, accurate, and accessible, owing to AI.
 - . AI-powered legal research tools can reduce human error by 20%. Increased speed in conducting legal research and automating the analysis of large amounts of data.
 - . Improved accuracy and ensured minimal errors in processing large legal data.
 - . Reduced costs by automating legal tasks.
-

3. AI in Legal Analysis: the ALTAML Project

Research Paper Title: AI in Legal Analysis: the ALTAML Project (This paper describes a research project)

Authors: Assoc. Prof. Pavol Sokol, Assoc. Prof. Jozef Andraško, and Eng. Klára Rábel Glosíková.

Objective: To use machine learning methods to process and analyze legal texts more efficiently, aiming to improve the identification of relationships between legal texts, detect deviations from established practices, and simplify access to legal information.

Methodology: The latest machine learning methods were used on legal texts. The project focuses on automating legal text processing and applying machine learning and data analysis for a deeper understanding of legal information and its use.

Results:

- . There has been a significant increase in the efficiency and accuracy of legal text analysis.
 - . Accelerated and simplified work with legal documents.
 - . A deeper understanding and more efficient use of legal information.
 - . Facilitated navigation through complex legal texts and identification of relationships.
 - . Detection of deviations from established decision-making practices increases transparency and predictability.
 - . Comparison of sets of legal texts (clustering) to facilitate navigation in comprehensive legal information.
-

4. Causal Artificial Intelligence in Legal Language Processing: A Systematic Review

Research Paper Title: Causal Artificial Intelligence in Legal Language Processing: A Systematic Review

Authors: Philippe Prince Tritto and Hiram Ponce

Objective: To explore **Causal AI** techniques to improve legal reasoning and address the limitations of correlation-based AI approaches in legal language processing.

Methodology: A systematic review focusing on Causal AI in legal language processing. This study explores the challenges facing AI models in accurately interpreting legal language and how causal reasoning can improve AI understanding compared to correlation-based methods.

Results:

- . Causal AI frameworks show superior ability to capture legal reasoning compared to correlation-based methods.
 - . This paper identifies significant challenges in dealing with legal uncertainty, computational scalability, and potential algorithmic bias.
-

5. Artificial Intelligence and Legal Analysis: Implications for Legal Education and the Profession

Research Paper Title: Artificial Intelligence and Legal Analysis: Implications for Legal Education and the Profession

Authors: Lee Peoples, 2025, Frederick Charles Hicks Professor of Law, Associate Dean of Library and Technology, Oklahoma City University School of Law. The numerical totals provided in this article are intended to be descriptive only, and no claims of statistical significance are asserted. For Emma and Amelia.

Objective: To study the ability of legal and non-legal **Large Language Models (LLMs)** to perform legal analysis using the **Issue-Rule-Application-Conclusion (IRAC)** framework, and discuss the implications for legal education and practice.

Methodology: This study tested LLMs on legal reasoning tasks involving rule analysis and analogy-based reasoning. Prompting strategies were used to iteratively improve the LLM responses.

Results:

- . LLMs are capable of basic legal reasoning by analyzing the patterns of legal facts using the IRAC format.
 - . The evaluated LLMs showed varying levels of success in performing IRAC analysis when analyzing legal rules, statutes, and analogy-based reasoning tasks.
 - . AI can significantly improve the efficiency of a wide range of legal tasks without negatively affecting work quality.
-

6. Natural Language Processing for the Legal Domain: A Survey of Tasks, Datasets, Models, and Challenges

Research Paper Title: Natural Language Processing for the Legal Domain: A Survey of Tasks, Datasets, Models, and Challenges

Authors: FARID ARIAI and GIANLUCA DEMARTINI, The University of Queensland, Australia.

Objective: To explore the significant potential of **Natural Language Processing (NLP)** in the legal sector, particularly in developing computational tools for various legal operations, and to highlight the unique aspects and challenges in processing legal texts.

Methodology: A comprehensive review of the current landscape of NLP applications in the legal domain. This paper reviews the fundamental concepts related to NLP in the legal field, illustrating unique aspects and challenges, such as document length, complex language, and limited open legal datasets.

Results:

- . Developments in NLP have significantly impacted the legal field by simplifying complex tasks such as legal document summarization (LDS), improving legal text understanding for non-specialists, enhancing legal question answering (LQA), and predicting legal judgment (LJP).
- . Applications such as contract review and case prediction have been largely automated, leading to accelerated processes, reduced human errors, and lower operational costs.
- . NLP allows lawyers and legal professionals to reduce their workload, enhance efficiency, and minimize errors in decision-making.

Connections and Conflicts between Findings

Connections:

- . Focus on AI and Natural Language Processing: All papers agree on the pivotal role of Artificial Intelligence and Natural Language Processing (NLP) as fundamental technologies for building legal proofreading and text analysis systems. Goal of Increased
- . Efficiency and Accuracy: There is a consensus that the ultimate goal of these systems is to improve the efficiency of legal processes and reduce human error.
- . Dealing with Complex Legal Texts: The papers acknowledge the challenge of complex legal language and strive to provide solutions capable of accurately understanding and analyzing these texts.
- . Alleviating Routine Burdens: The proposed solutions aim to automate repetitive and time-consuming legal tasks, such as proofreading, review, and research, to free up lawyers to focus on strategic aspects.
- . Use of Simulation or Experimental Evaluation: Most studies rely on either simulation or experimental evaluation to assess the performance of the proposed solutions.

Conflicts between the findings

- . Specialization vs. Comprehensiveness: While some research on the "Application of Text Proofreading System" directly focuses on specific solutions for linguistic proofreading, other studies "The impact of Artificial Intelligence on legal practice" address a broader range of AI applications in the legal field (research, contract analysis, predictive justice).
- . Types of AI Models: The specific models and techniques used vary, some rely on deep learning and traditional neural networks, while others explore the capabilities of Causal AI or Large Language Models (LLMs).
- . Specific Strengths and Weaknesses: Despite common goals, each paper highlights the specific strengths and weaknesses of the proposed approach or system, reflecting different challenges in implementation or performance.
- . Maturity Level: Some papers present systems and models that are under development or experimental, while others refer to systems and products that are already on the market.

Trends

- . Advanced AI Models: There is a trend towards using more complex and powerful models, such as Large Language Models (LLMs) and Causal AI, to improve contextual understanding and legal reasoning.
- . Specialization in the Legal Domain: The importance of developing AI systems specifically trained on legal data and texts is increasing to ensure higher accuracy and specialization in legal tasks.
- . Focus on Efficiency and Accuracy: Research continues to seek ways to increase the speed and accuracy of automated systems in legal tasks, such as linguistic proofreading, contract review and legal research.
- . Integration of AI into Legal Workflows: The trend is towards seamlessly integrating AI tools into existing legal office software and systems to enhance productivity.
- . Addressing Ethical and Legal Challenges: Growing attention is being paid to addressing issues such as AI bias, transparency (interpretability), and legal accountability for AI decisions.

Research Gaps

- . Dealing with Legal Uncertainty: There remains a gap in the ability of AI systems to handle the uncertainty and nuances of legal interpretation, which requires complex human thought.
- . Computational Scalability of Complex Models: As AI models become more complex, additional research is required to ensure computational scalability and cost-effectiveness in large-scale applications.
- . Reducing AI "Hallucinations": The problem of AI generating false or non-existent information (especially in LLMs) remains a research gap requiring solutions to increase reliability.
- . Explain ability: There is a need for research to develop more interpretable AI models so that legal users can understand why and how the system reached its conclusions.
- . System Evaluation in Real Environments: Most research relies on simulations or specific datasets, more comprehensive evaluations in real legal environments are required to assess performance in real-world scenarios.
- . Addressing Bias: Addressing potential bias in training data and AI models requires further research to ensure the fairness and objectivity of automated legal systems is ensured.

Summary Table of Research Papers

Study	Authors	Year	Research Design	Key Findings	Gaps Identified
Text Proofreading System	J. Gao, Z. Guo	2021	Experimental (CNN model)	CNN outperforms RNN in grammar correction	Limited to Chinese language
AI in Legal Practice	Emejuo, C. C., Joseph, O. C., Odeyemi, E., & Igwe, A. O.	2025	Analytical Review	20% error reduction in legal research	No empirical validation
ALTAML Project	Assoc. Prof. Pavol Sokol, Assoc. Prof. Jozef Andraško, and Eng. Klára Rábel Glosíková.	2025	Action Research	Automated legal text analysis	No quantitative results
Causal AI in Law	Philippe Tritto, Hiram Ponce	2025	Systematic Review	Superior legal reasoning capability	Theoretical framework only
LLM Legal Analysis	Lee Peoples	2025	Quasi-experimental	IRAC framework implementation	Small sample size
NLP Legal Survey	Farid Ariai, Gianluca Demartini	2024	Meta-analysis	NLP automates contract review	Dataset limitations

Conclusion

A review of research papers indicates that the field of automated legal proofreading and text analysis in the legal sector using Artificial Intelligence is undergoing significant development. These systems aim to transform legal practice by automating routine and complex tasks, increasing efficiency and accuracy, and reducing costs and human error. The proposed solutions primarily rely on AI technologies, especially Natural Language Processing and Machine Learning, to understand and analyze complex legal texts. However, significant challenges remain regarding AI reliability, data bias, and the need for a deeper understanding of human legal reasoning, which underscores the importance of continuous oversight by humans.

References

1. Gao, J., Guo, Z. (2021). Application of Text Proofreading System Based on Artificial Intelligence. In: Atiquzzaman, M., Yen, N., Xu, Z. (eds) Big Data Analytics for Cyber-Physical System in Smart City. BDCPS 2020. Advances in Intelligent Systems and Computing, vol 1303. Springer, Singapore. https://doi.org/10.1007/978-981-33-4572-0_104
2. Emejuo, C. C., Joseph, O. C., Odeyemi, E., & Igwe, A. O. (2025). The impact of Artificial Intelligence on legal practice: Enhancing legal research, contract analysis, and predictive justice. International Journal of Science and Research Archive, 14(01), 603–611. <https://doi.org/10.30574/ijrsra.2025.14.1.0124>
3. Comenius University in Bratislava Science Park. (2025, February 27). AI in legal analysis: The ALTAML Project. Retrieved from https://cusp.uniba.sk/en/detail-of-article/back_to_page/uvp/article/univerzity-spajaju-sily-s-komerccnym-sektorom-strojove-ucenie-zefektivni-analyzu-pravnych-t/
4. Tritto, P. P., & Ponce, H. (2025). Causal Artificial Intelligence in Legal Language Processing: A Systematic Review. Entropy, 27(4), 351. <https://doi.org/10.3390/e27040351>
5. Peoples, L. F. (2025). Artificial Intelligence and Legal Analysis: Implications for Legal Education and the Profession. Law Library Journal, 117(1), 53–84. <https://ssrn.com/abstract=5123122>
6. Ariai, F., & Demartini, G. (2025). Natural Language Processing for the Legal Domain: A Survey of Tasks, Datasets, Models, and Challenges. arXiv preprint arXiv:2410.21306. <https://doi.org/10.48550/arXiv.2410.21306>