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AI-Driven Resolution of Property Disputes: An NLP and BERT-Based Chatbot Approach

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ABSTRACT: In recent years, there has been growing interest in leveraging artificial intelligence (AI) for legal decision-making. This trend underscores the increasing engagement of academics and professionals in exploring AI's role in legal systems. AI technologies, including machine learning and natural language processing (NLP), have the capability to analyse vast amounts of legal data, extract meaningful insights, and enhance decision-making processes. This study aims to develop a robust AI-driven framework to resolve property disputes by integrating advanced AI methodologies and utilizing real estate legal datasets. By automating legal document analysis, this approach can enhance decision-making accuracy and reduce the manual workload of legal professionals. Our research introduces a hybrid ensemble model specifically designed for property dispute resolution. This model capitalizes on pre-trained embeddings and large language models to improve legal decision predictions. By harnessing the strengths of pre-existing embeddings and incorporating sophisticated language models, our proposed system achieves high predictive accuracy and efficiency in property dispute settlements. Furthermore, we emphasize the model's interpretability, highlighting its capacity to identify key factors in legal decision-making. Achieving an accuracy rate of approximately 83%, our research demonstrates how large language models (LLMs) and deep learning techniques can effectively forecast legal outcomes.

KEYWORDS: AI-powered Dispute Resolution, BERT(Bidirectional Encoder Representations from Transformers), Natural Language Processing (NLP)

I. INTRODUCTION

The application of AI in property dispute resolution has gained substantial momentum. Courts, real estate professionals, and legal practitioners are increasingly adopting AI-powered solutions to enhance efficiency and accuracy in legal decision-making. Traditional property dispute resolution requires extensive analysis of legal texts, precedents, and statutory interpretations—a time-consuming and error-prone process. AI-driven tools, particularly NLP and machine learning, offer promising solutions to streamline and automate these tasks. This paper presents an innovative AI-based framework that employs large language models and hybrid ensemble techniques to improve the accuracy of legal outcome predictions.

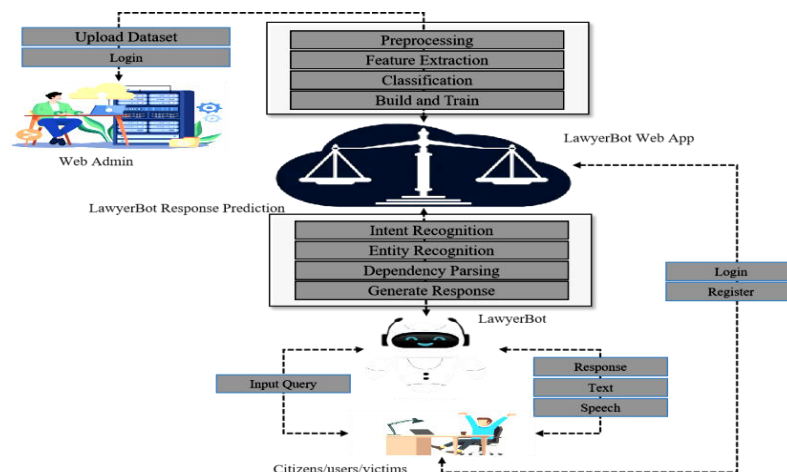
II. RELATED WORK

Prior studies have explored various AI methodologies for legal decision-making, including text classification, NLP-based legal analysis, and predictive modelling for property-related court rulings. Research on AI-assisted dispute resolution has primarily focused on machine learning models like support vector machines (SVM), deep learning models such as convolutional neural networks (CNNs), and pre-trained language models like BERT and RoBERTa. While these approaches have significantly improved legal text analysis, they often lack interpret ability and fail to integrate multi-modal data sources effectively. Our study addresses these limitations by introducing a hybrid ensemble model that combines pre-trained embeddings with large language models, enhancing predictive accuracy and model explain ability.

III. METHODOLOGY

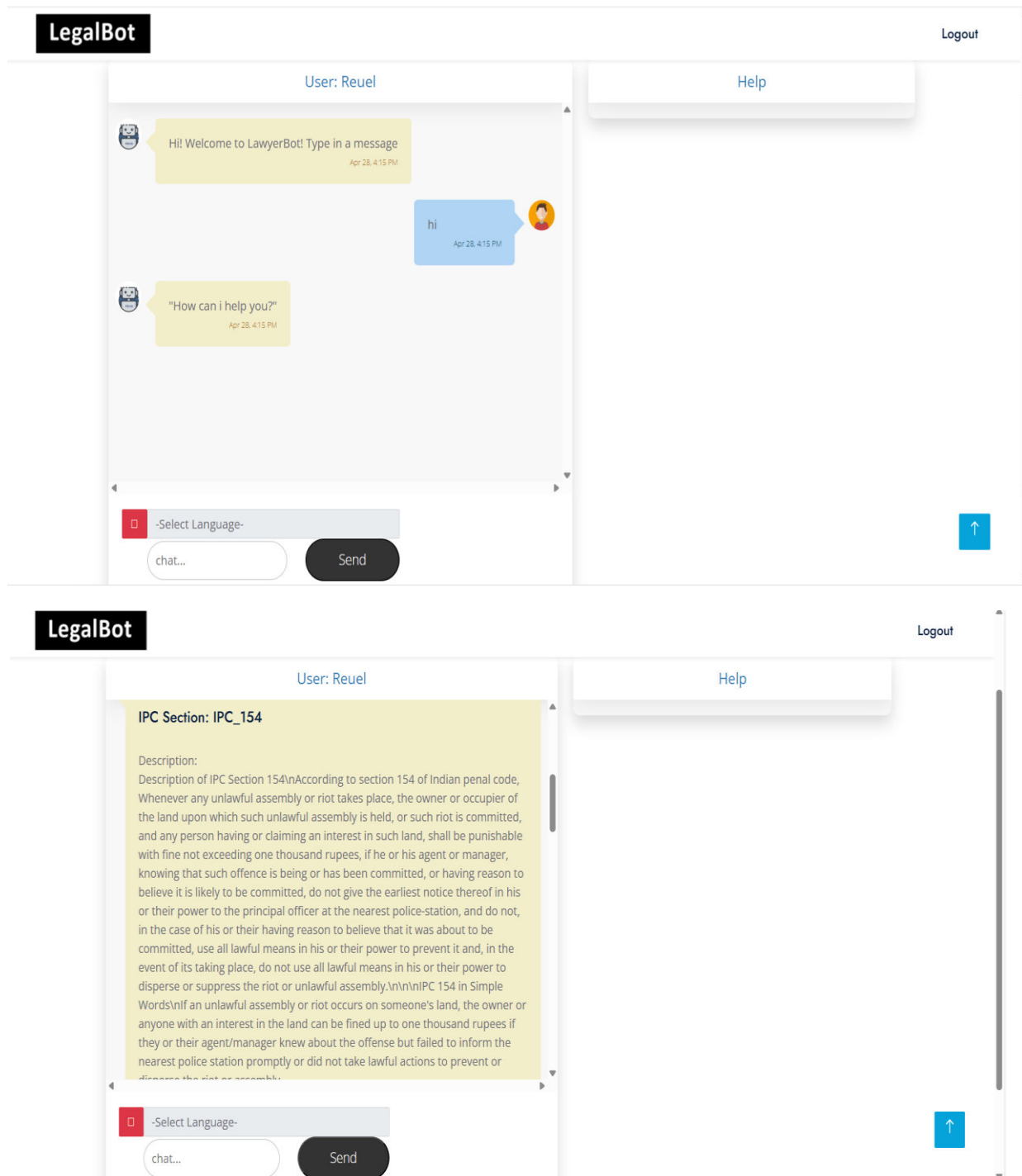
Our AI-driven framework consists of multiple components designed to analyse legal texts and predict property dispute outcomes. The key steps in our methodology are:

- **Data Collection:** We compile a dataset from real estate legal cases, covering disputes related to property ownership, tenancy, and land rights.
- **Preprocessing:** Legal documents undergo preprocessing steps such as tokenization, stop-word removal, and embedding transformation using GloVe and transformer-based embeddings.
- **Model Architecture:** Our hybrid ensemble model integrates multiple language models, including BERT, ALBERT, RoBERTa, and Distilled BERT, combined with pre-trained embeddings.
- **Training and Optimization:** The model is trained using supervised learning with a cross-entropy loss function and optimized via the Adam optimizer.
- **Prediction and Interpret ability:** The model generates dispute resolution predictions while ensuring interpret ability by highlighting key legal arguments



IV. EXPERIMENTAL RESULTS

We assess our model's performance using standard evaluation metrics, including accuracy, precision, recall, and F1-score. Our results indicate that the proposed approach achieves an accuracy rate of approximately 83%, surpassing traditional machine learning classifiers and single-model transformer architectures. Furthermore, we analyse the interpret ability of predictions by examining feature importance scores derived from attention mechanisms in transformer models.



V. DISCUSSION

Our findings underscore the effectiveness of AI-based approaches in property dispute resolution. The hybrid ensemble model not only enhances prediction accuracy but also provides valuable insights into the factors influencing legal decisions. By leveraging pre-trained embeddings and transformer models, our framework can efficiently process complex legal texts while ensuring model interpretability. However, challenges persist in adapting AI models to

various legal jurisdictions and mitigating biases in training data. Future research should explore domain-specific adaptations and address ethical concerns related to AI's role in legal systems.

VI. CONCLUSION

This study introduces an AI-powered framework for resolving property disputes, utilizing large language models and hybrid ensemble techniques. Our model significantly improves legal outcome predictions, achieving high accuracy while maintaining interpretability. The integration of AI in property law has the potential to revolutionize real estate dispute resolution, enhancing decision-making efficiency and reducing the workload on legal professionals. Future research will focus on expanding the dataset, refining model architectures, and addressing ethical considerations in AI-driven legal decision-making.

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