

AI Based Neural Network Model For Stroke Prediction

Ramya K¹, Ragupathi R², Sivasakthi S³, Thanigasalam V⁴, Vasanthakumar S⁵

¹Assistant professor, Dept of CSE

^{2, 3, 4, 5}Dept of CSE

^{1, 2, 3, 4, 5} Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambalur, Tamil Nadu, India.

Abstract- Many individuals encounter situations where they need basic legal information and guidance. However, obtaining professional legal advice can be prohibitively expensive, especially for minor issues or general inquiries. As technology continues to advance, the legal field has not been left behind. Artificial intelligence (AI) offers new possibilities for assisting individuals in understanding their rights and navigating complex legal frameworks. This project introduces LawyerBot, an AI-powered virtual assistant designed to provide accurate information about Indian laws and legal sections. LawyerBot offers guidance on handling various legal issues and understanding how laws can address them. Utilizing natural language processing (NLP) and Bidirectional Encoder Representations from Transformers (BERT), LawyerBot engages users in a conversational manner through a chat interface. Users can input their queries or describe their legal concerns, and the AI leverages its training on Indian legal frameworks to deliver relevant information and recommend next steps. LawyerBot offers several benefits, including prompt and accessible legal guidance, which helps users avoid consultation fees for minor matters. It also enhances legal literacy by increasing awareness of Indian laws among the general population. Through its intuitive chat interface, LawyerBot empowers individuals to independently understand their rights and navigate the legal system. By democratizing access to legal knowledge, LawyerBot represents a cost-effective, user-friendly solution for those seeking legal information and support in India.

Keywords- Legal chatbot, Artificial intelligence, Natural language processing, BERT, Indian Penal Code, Legal literacy, Offense classification, Legal assistance system, Machine learning, Real-time legal guidance

I. INTRODUCTION

In a democratic society, access to legal information is a foundational right that enables citizens to understand their entitlements, obligations, and the judicial mechanisms available to protect them. However, in countries like India, where the legal system is vast, complex, and predominantly written in legalese, the average citizen often struggles to

comprehend statutory provisions or navigate judicial procedures. Legal services remain expensive, geographically inaccessible, and heavily reliant on human expertise, which creates barriers for marginalized and low-income populations. Furthermore, the Indian Penal Code (IPC), despite being central to criminal jurisprudence, is rarely understood in depth by laypersons. This underscores a pressing need for accessible, scalable, and intelligent tools that can democratize legal knowledge. With the rapid advancement of Artificial Intelligence (AI) and Natural Language Processing (NLP), new opportunities have emerged to bridge the legal literacy gap using conversational AI systems. This paper presents LawyerBot, an AI-powered chatbot developed to provide real-time legal guidance, offense classification, and professional legal recommendations based on user inputs. Leveraging BERT (Bidirectional Encoder Representations from Transformers) for contextual understanding and classification, LawyerBot is designed to analyze user queries, map them to relevant IPC sections, and offer actionable legal insights in a user-friendly chat interface. In addition, the system supports multilingual interactions and geographical matching of users with legal professionals, thereby expanding the reach and impact of digital legal assistance. The integration of this legal chatbot into digital platforms promises to reduce the burden on legal institutions, promote awareness of individual rights, and transform how ordinary citizens engage with the law.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

Early and equitable access to legal information is a cornerstone of justice and societal well-being. Yet, millions of individuals, especially in India, face significant obstacles when attempting to understand legal procedures or seek advice on everyday legal matters. High costs, geographic inaccessibility, and complex legal language have created a gap between the public and the justice system. To bridge this divide, there is an urgent need for intelligent systems that can automate legal assistance through advanced natural language processing (NLP) and machine learning. This section explores the current limitations of legal access and builds the case for adopting AI-powered chatbots like LawyerBot to democratize legal guidance and enhance legal literacy.

2.1 Challenges in Traditional Legal Assistance

Legal advice in India is largely dependent on professional consultation with advocates, which can be financially prohibitive and time-consuming. For minor offenses or informational needs, individuals may be deterred by consultation fees or long wait times. Moreover, rural areas often suffer from a lack of legal professionals, widening the access gap. Legal aid clinics, though helpful, are limited in capacity and availability. The overall system remains difficult to navigate, especially for those with little formal education in law.

2.2 Limitations of Manual Legal Research

Manual legal research, whether conducted through law books or online databases, demands familiarity with legal terminology and concepts. For non-lawyers, interpreting statutory sections such as those within the Indian Penal Code (IPC) is both intimidating and inefficient. Search results often yield lengthy and outdated documents, lacking contextual relevance. Furthermore, the subjectivity in interpreting legal language can lead to misunderstandings and incorrect conclusions, potentially escalating simple issues into complex legal conflicts.

2.3 Need for Automation and Real-Time Accessibility

With increasing public reliance on digital platforms for essential services, it is logical to integrate automated legal assistance into online systems. Automating legal query analysis through AI chatbots ensures consistent, real-time guidance without the need for a human intermediary. An automated platform can instantly parse user input, classify the offense, and return relevant IPC sections and potential legal outcomes. This standardizes legal communication and ensures uniform access across geographies and demographics.

2.4 Emergence of NLP and BERT in Legal Intelligence

Recent advancements in NLP—particularly models like BERT (Bidirectional Encoder Representations from Transformers)—have enabled machines to understand the nuances of natural language with unprecedented accuracy. BERT's bidirectional architecture allows it to grasp the context of a legal query more effectively than traditional rule-based systems. When trained on legal datasets, such models can extract intent, detect named entities, and match queries to relevant laws, offering a robust backbone for intelligent legal assistance systems.

2.5 Justification for Adaptive and Scalable Legal Chatbots

The legal landscape is not static; laws evolve, amendments are passed, and judicial interpretations shift. Therefore, an effective AI legal assistant must be able to adapt over time. Using continuous learning or fine-tuned retraining cycles, platforms like LawyerBot can stay updated with new legislation and user patterns. This ensures sustained accuracy in predictions and recommendations, even as the system scales to accommodate millions of users. A modular design also allows integration with regional languages, legal professionals, and third-party platforms, further expanding its utility.

III. PROPOSED SYSTEM

This research introduces **LawyerBot**, an AI-powered legal assistance system designed to address the accessibility and complexity challenges faced by Indian citizens seeking legal information. The system automates the interpretation of user queries, classifies offenses under the Indian Penal Code (IPC), and provides structured legal guidance, eliminating the need for traditional manual research or costly consultations. The core of the system integrates a BERT-based natural language processing (NLP) model for contextual understanding and classification. This section elaborates on the data preparation, preprocessing, feature extraction, model training, prediction flow, and deployment strategies used in developing this intelligent legal chatbot.

3.1 Dataset Collection and Preparation

The performance of LawyerBot hinges on the quality and comprehensiveness of the legal dataset used for training. A custom dataset was constructed by compiling IPC sections, associated offense descriptions, punishments, and legal interpretations. Each entry includes a section number, offense label, and a natural language description of legal scenarios. To ensure robust model training, the dataset was enriched with examples of both minor and major offenses, covering domains like theft, assault, cybercrime, and fraud. The dataset was manually annotated to align user-described offenses with correct IPC references and was partitioned into training, validation, and testing subsets to maintain class balance and avoid bias.

3.2 Text Preprocessing

Given the variability and complexity in how users describe legal issues, preprocessing is critical for model performance. The text preprocessing pipeline included tokenization to break input into words, stopword removal to eliminate irrelevant words (e.g., "is", "the"), and lemmatization to reduce words to their root forms. Named

entity recognition (NER) was applied to identify crucial information such as dates, locations, and involved persons. The cleaned and structured data was then vectorized using TF-IDF to highlight term importance and prepare the data for input into the machine learning model. This step ensures the model receives consistent and meaningful input regardless of user vocabulary or phrasing.

3.3 Feature Extraction and Model Architecture

At the core of LawyerBot is a fine-tuned **BERT (Bidirectional Encoder Representations from Transformers)** model, selected for its contextual understanding and bidirectional encoding capabilities. Unlike traditional models, BERT understands the intent and semantics of legal queries in context. The model uses embedded token representations and attention mechanisms to classify queries into relevant IPC sections. Each query is passed through BERT's transformer layers, and the output embeddings are used in a classification head to generate predictions. The model is capable of handling overlapping legal meanings and multiple offenses in a single sentence due to BERT's powerful language representation.

3.4 Model Training and Validation

The BERT model was trained using a supervised learning approach. Pre-trained weights from a general-purpose BERT base model were fine-tuned using the custom IPC dataset. During training, user queries and their corresponding IPC section labels were used as input-output pairs. To prevent overfitting and improve generalization, data augmentation techniques such as paraphrasing and synonym replacement were applied. The model was evaluated using standard metrics including accuracy, precision, recall, and F1-score. Additionally, manual inspection of predictions ensured that the model's outputs were legally valid and logically aligned with real-world legal interpretations.

3.5 Prediction Workflow and Output Generation

Once deployed, the model powers the real-time LawyerBot system. When a user submits a legal query via the chatbot interface, the input is preprocessed and passed to the BERT model, which outputs the most probable IPC section(s) and offense category. The system then retrieves a humanreadable summary of the legal implication, including the IPC text, punishment range, and advice on potential next steps. A recommendation engine complements this output by suggesting local legal professionals or government legal aid services based on the offense type and user location. For

transparency, the system highlights key tokens influencing the prediction, improving user trust and explainability.

3.6 System Deployment and User Interface

LawyerBot is deployed as a web-based application developed with Flask for the backend and MySQL for secure data storage. The frontend uses HTML, CSS, JavaScript, and Bootstrap to create a clean and responsive chat interface. FlaskSocketIO enables real-time communication between users and the AI model. The system includes an admin panel for uploading new datasets, retraining the model, and managing legal expert listings. Users can interact with the chatbot in multiple languages, thanks to integrated translation APIs. The lightweight design ensures compatibility with modest hardware, making it suitable for public kiosks, mobile devices, and rural deployments. Additionally, the modular architecture supports future integration with government portals, court databases, and voice-based input systems.

IV. SYSTEM DESIGN

The architecture of the LawyerBot system is designed as a modular, scalable framework that transforms raw natural language queries into actionable legal insights and recommendations. It operates through six critical stages: query acquisition, preprocessing, feature extraction, model training, inference, and deployment. The system begins with user input collected through a web-based interface or chatbot, allowing individuals to describe legal concerns using everyday language. These queries are then preprocessed using NLP techniques, including tokenization, stopword removal, and lemmatization, facilitated by tools like NLTK. Multilingual support is integrated via translation APIs to make the system accessible to users from diverse linguistic backgrounds. Once cleaned, the input is processed through a BERT-based model that extracts deep contextual features by interpreting the bidirectional relationships between words, enabling precise classification of legal issues. The model is fine-tuned using a labeled dataset of IPC sections, legal descriptions, and punishments, optimizing accuracy with strategies like dropout, transfer learning, and realtime data augmentation. After training, the system performs inference on new queries, identifying applicable IPC sections, summarizing offenses, and estimating penalties while highlighting relevant parts of the query for transparency. A severity assessment module evaluates the seriousness of the case, and a recommendation engine suggests appropriate legal professionals based on user needs and location. Finally, the fully developed platform is deployed via a Flask-based web application with MySQL integration, offering real-time interaction, secure access control, and admin-level dataset

management. It supports both cloud-based scaling and edge deployment for low-connectivity environments, making it suitable for widespread use in India's legal ecosystem. This comprehensive design ensures speed, accessibility, and reliability in delivering legal literacy and guidance to a broad user base.

4.1 Input Query Acquisition

The process begins when users submit their legal queries through a web-based interface or chatbot system. Queries may include descriptions of legal problems, criminal incidents, or rights-based concerns. These inputs are captured in natural language through a user-friendly interface built using Flask and Bootstrap, compatible with both desktop and mobile platforms. The system supports real-time entry and also allows batch testing for administrative and development purposes. The data collected from users forms the foundation for legal analysis, classification, and downstream recommendations.

4.2 Preprocessing Pipeline

To prepare user queries for machine learning analysis, the system performs a structured sequence of preprocessing operations. The Natural Language Toolkit (NLTK) is used to tokenize sentences, remove stopwords, and apply lemmatization to normalize word forms. This ensures that the input data is clean, consistent, and optimized for semantic interpretation. For multilingual support, queries may be translated to English using Google Translate API before preprocessing. These steps help reduce noise and maintain grammatical integrity, thereby enhancing model performance.

4.3 Feature Extraction via BERT

The cleaned and normalized queries are then passed through a BERT-based language model trained specifically on Indian Penal Code (IPC) legal datasets. BERT enables deep contextual embedding by learning bidirectional dependencies across words and phrases, effectively capturing the semantics of legal language. Unlike traditional vectorization methods such as TF-IDF, BERT generates dynamic, position-aware representations of each token in a sentence, allowing the model to distinguish nuanced variations in query phrasing. This forms the basis for accurate legal classification and recommendation.

4.4 Model Training and Fine-Tuning

The classification engine, referred to as the LawNet Model, is trained using supervised learning with labeled

datasets containing IPC sections, offense descriptions, and punishments. The training process employs cross-entropy loss and backpropagation, with performance tracked via validation accuracy and mean Average Precision (mAP). Dropout regularization and learning rate scheduling are used to prevent overfitting. Transfer learning is applied to initialize the BERT layers with pretrained weights, accelerating convergence and improving generalization across legal queries.

4.5 Inference and Response Generation

During inference, the system classifies new user queries by predicting relevant IPC sections and generating detailed legal responses. These responses may include section descriptions, associated penalties, and legal interpretations. In cases where confidence scores are low, the system flags the output for manual verification or requests additional user input. To enhance transparency, attention visualization tools are integrated, helping users understand the rationale behind specific predictions. The system also generates a severity score based on legal context and recommends appropriate legal professionals when needed.

4.6 System Deployment and User Interaction

Finally, the platform is deployed through a Flask-based web application supported by a MySQL database. General users can interact with the system via a chatbot interface that supports multilingual replies and real-time feedback. Administrative users have access to a backend dashboard for model retraining, dataset management, and parameter adjustment. The platform supports both on-premise deployment for legal institutions and cloud-based hosting for public access. Security features such as login authentication, session tracking, and data encryption are included to ensure compliance and user accountability.

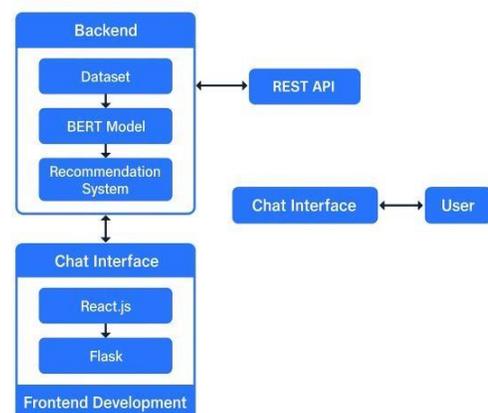


Fig 4.1 System Architecture

V. CONCLUSION

In conclusion, the LawyerBot project aims to revolutionize the legal assistance landscape by providing users with user-friendly platform for concerted effort to bridge the gap between individuals seeking legal guidance and the complexities of the legal systems. By leveraging cutting-edge technologies such as natural language processing (NLP) and machine learning, LawyerBot aims to provide users with a seamless and intuitive platform for accessing legal assistance. Through the development of a user-friendly web interface and the implementation of NLP techniques, users can easily submit queries related to legal matters, offenses, or IPC sections. The system's robust machine learning model, built on the BERT architecture and trained on a comprehensive dataset, ensures accurate classification of offenses and provides detailed information on predicted IPC sections, including descriptions and prescribed punishments. Furthermore, LawyerBot goes beyond classification by integrating a recommendation system that suggests legal professionals based on user queries and geographical location. This personalized approach enhances the user experience and facilitates access to relevant legal expertise. With the development of an admin panel, the project also empowers administrators to manage datasets, train machine learning models, and oversee user accounts efficiently. Additionally, the emphasis on deployment, system maintenance, and continuous improvement ensures that LawyerBot remains reliable, scalable, and responsive to user needs over time. In essence, LawyerBot represents a pioneering effort to democratize access to legal assistance, empowering individuals with actionable insights and facilitating informed decision-making in legal matters. Through its comprehensive feature set and commitment to ongoing refinement, LawyerBot stands poised to revolutionize the legal landscape and make legal assistance more accessible to all.

REFERENCES

- [1] G. Attigeri and A. Agrawal, "Advanced NLP Models for Technical University Information Chatbots: Development and Comparative Analysis," *IEEE Access*, vol. 2024, doi: 10.1109/ACCESS.2024.3368382.
- [2] N. Sandu and E. Gide, "Adoption of AI-Chatbots to Enhance Student Learning Experience in Higher Education in India," in *Proc. IEEE Int. Conf. Information Technology Based Higher Education and Training (ITHET)*, 2019, doi: 10.1109/ITHET46829.2019.8937382.
- [3] G. A. Santos and G. G. de Andrade, "A ConversationDriven Approach for Chatbot Management," *IEEE Access*, vol. 2021, doi: 10.1109/ACCESS.2022.3145323.
- [4] G. Daniel and J. Cabot, "Xatkit: A Multimodal Low-Code Chatbot Development Framework," *IEEE Access*, vol. 2020, doi: 10.1109/ACCESS.2020.2966919.
- [5] V. Socratyanurak and N. Klangpornkun, "LAW-U: Legal Guidance Through Artificial Intelligence Chatbot for Sexual Violence Victims and Survivors," *IEEE Access*, vol. 2022, doi: 10.1109/ACCESS.2021.3113172.
- [6] T. Akiyoshi and J. Nakanishi, "A Robot That Encourages Self-Disclosure to Reduce Anger Mood," *IEEE Robotics and Automation Letters*, vol. 2021, doi: 10.1109/LRA.2021.3102326.
- [7] R. Surve and T. Purohit, "HealthCare Chatbot Using Machine Learning and NLP," in *Proc. Int. Conf. Automation, Signal Processing, Instrumentation and Control (ICAST)*, 2023, doi: 10.1109/ICAST59062.2023.10455027.
- [8] K. R. A. and K. S., "Legal Solutions - Intelligent Chatbot using Machine Learning," in *Proc. Int. Conf. Computational Electronics for Biological Systems (ICCEBS)*, 2023, doi:10.1109/ICCEBS58601.2023.10448748.
- [9] P. S. and N. Balakrishnan, "Design and Development of AI-Powered Healthcare WhatsApp Chatbot," *IEEE Xplore*, 2023, doi: 10.1109/10157423.
- [10] T. Sruti and R. Sneha, "Crime Awareness and Registration System Using Chatbot," in *Proc. Int. Conf. Communication and Power Control (ICCP)*, 2022, doi: 10.1109/ICCP55978.2022.10072070