

**THE FUTURE OF CRIME PREVENTION:
POLICE CASE ANALYSIS USING
MACHINE LEARNING**

(Analyze and Classify Similar Case Documents
and Predict Category)

Project Id
TMP-23-224

Project Proposal Report
IT20001452 - Traveena Chandrasegar

Supervisor – Ms. Hansika Mahaadikara
Co-Supervisor - Ms. Sanjeevi Chandrasiri

BSc (Hons) - Information Technology Specializing in
Software Engineering


Department of Computer Science and Software Engineering (CSSE)

Sri Lanka Institute of Information Technology
Sri Lanka

March 2023

Declaration of The Candidate & Supervisor

We declare that this is our own work and this project proposal does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
Traveena.C	IT20001452	

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor:
(Ms. Hansika Mahaadikara)



Date: 17/04/2023

ABSTRACT

The proposed research focuses on leveraging machine learning techniques to analyze police case documents and predict potential crimes before they occur. By analyzing historical crime data, the research aims to identify patterns and trends that can be used to develop predictive models. These models can then be used by law enforcement agencies to prioritize resources and prevent crimes from occurring. The research proposal emphasizes the importance of crime prevention and highlights the potential impact of using machine learning to improve public safety. This study proposes a solution to support criminal investigations by providing a technological analysis to justify the guilt of an accused criminal. The current process of manually searching historical judgments databases for similar cases is time-consuming and prone to errors and biases. The study suggests an automated text analysis system that can help agencies quickly and consistently discover important patterns in crime occurrences. The proposed system would eliminate the need for individuals to manually search for relevant and repetitive keywords in past cases. Instead, the automated system would analyze the text data from historical judgments databases and identify patterns and similarities and classify them into a group according to its similarity in the crime occurrences. This would enable investigators to make more informed decisions during the interrogation and crime pattern detection processes. The system would also incorporate natural language processing techniques to extract relevant information from unstructured text data. The proposed system can be used by police and investigation teams and can be accomplished by using machine learning techniques. The system is particularly useful in aiding investigations of crimes against women and accidents, as it can help police investigators to easily detect connections between incidents and gain valuable insights that can be used to improve public safety. Overall, this study seeks to improve the efficiency of police investigations and aid in crime prevention efforts using advanced analytical techniques.

TABLE OF CONTENT

ABSTRACT.....	1
TABLE OF CONTENT	2
LIST OF TABLES	3
LIST OF FIGURES	3
1. Introduction	4
1.1 Background	4
1.2 Literature Review	6
1.3 Research Gap	9
1.4 Research Problem	10
2. Objectives	11
2.1 Main Objectives	11
2.2 Specific Objectives.....	11
3. Methodology	12
4. Description of Personal and Facilities.....	15
4.1 Work Breakdown Structure (WBS).....	15
4.2 Gantt Chart	15
4.3 System diagram.....	16
5. Requirements.....	18
5.1 Functional Requirements	18
5.2 Non-Functional Requirements.....	19
6. Commercial Value	20
Reference	21

LIST OF TABLES

Table 1.1 – Comparison of other applications.....	9
---	---

LIST OF FIGURES

Figure 1.1 – Case Statistic Graph– Sri Lanka.....	4
Figure 1.2 – Case Statistic – Sri Lanka.....	5
Figure 3.1 – High-level architecture diagram	12
Figure 4.1 – WBS Diagram.....	15
Figure 4.2 – Gantt Chart.....	15
Figure 4.3 – Component System Diagram.....	16
Figure 4.4 – Overall System Diagram.....	17

ACKNOWLEDGEMENT

I am grateful to our project supervisor Ms. Hansika Mahaadikara and Co-Supervisor - Ms. Sanjeevi Chandrasiri for their kind guidance, inspiration, motivation, and constructive suggestion that was helpful for me in my research project idea and preparation of this proposal. I also wish to express my gratitude to the project coordinator Mr. Jayantha Amararachchi for this support and opportunity. Also, I'd want to express my gratitude to all the educators, students, and parents who have been in touch with me for their insightful remarks and suggestions on how I may enhance the solution.

1. Introduction

1.1 Background

Crime analysis has been an important aspect of law enforcement for decades. Traditional methods of crime analysis have relied on manual data entry and analysis, which can be time-consuming and prone to errors. With the advancements in technology and the availability of large datasets, there has been an increased interest in using machine learning techniques for crime analysis. Machine learning algorithms can help in identifying patterns and trends in criminal activities and provide timely information to the police department for taking proactive measures to prevent crime. There has been significant research in machine learning for crime analysis, with a focus on developing effective algorithms that can accurately predict crime patterns and trends. The research has also explored the use of different data sources, such as social media and surveillance footage, to supplement traditional crime data for more accurate analysis. The goal of such research is to develop systems that can assist law enforcement agencies in their crime prevention and investigation efforts, ultimately leading to improved public safety.

In Sri Lanka, the annual average number of pending criminal cases is increasing due to several reasons. One of the reasons is the manual process of searching for past cases by the court to identify similar facets or patterns that exist in the new cases.

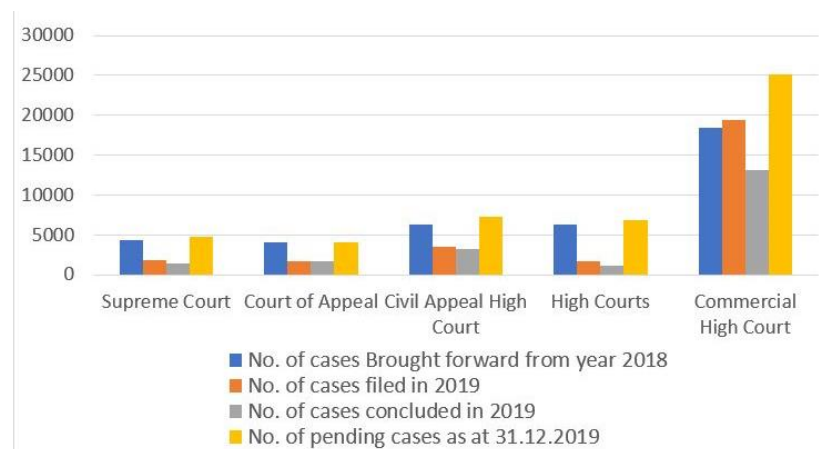


Figure 1.1: Case Statistic Graph – Sri Lanka
2019(<https://www.moj.gov.lk/images/pdf/Statistics/Case-Statistics-2019.pdf>)

This process is time-consuming, prone to errors and biases, and adds to the already overloaded workload of the court system. To address these issues, there is a need for a more efficient and effective criminal investigation process. The use of modern technologies such as automated text analysis systems can significantly improve the investigation process by identifying important patterns and similarities in crime occurrences.

Court	No. of cases Brought forward from year 2018	No. of cases filed in 2019	No. of cases concluded in 2019	No. of pending cases as at 31.12.2019
Supreme Court	4331	1873	1437	4767
Court of Appeal	4051	1632	1618	4065
Civil Appeal High Court	6324	3494	3272	7256
High Courts	6310	1650	1147	6813
Commercial High Court	18419	19449	13088	25095
Special High court trial at bar i	03	02	03	02
Special High court trial at bar ii		02		02
District Court	215123	101715	73600	234210
Magistrate's court	493097	855543	833250	488015
Children Magistrate's court	1220	189	251	1158
Total	748878	985549	927666	771383

Figure 1.2: Case Statistic – Sri Lanka
2019(<https://www.moj.gov.lk/images/pdf/Statistics/Case-Statistics-2019.pdf>)

An automated text analysis system would eliminate the need for manual searches of past cases and provide more consistent and reliable results. This would help investigators and the court system to make more informed decisions, reduce errors and biases, and ultimately speed up the investigation process. Therefore, the proposed solution would aim to develop an automated text analysis system that can assist in the criminal investigation process by identifying important patterns and similarities in crime occurrences and classify them into a labeled group.

The automated text analysis system would also be capable of extracting relevant information from unstructured text data, such as case files and police reports, which could help investigators to build stronger cases against accused criminals. The proposed solution would have significant benefits for the Sri Lankan criminal justice system. It would help to reduce the backlog of pending criminal cases, improve the efficiency and accuracy of the investigation process, and ultimately lead to quicker

resolution of cases. This, in turn, would improve the overall trust and confidence in the criminal justice system and ensure that justice is served for victims and their families.

1.2 Literature Review

The literature on crime analysis and classification using machine learning techniques is extensive and diverse, with a focus on various aspects of crime detection, prediction, and prevention. The studies mentioned in the references provide valuable insights into the use of machine learning algorithms for crime analysis, classification, and prediction, covering different domains, such as e-government, serial criminal patterns, theft crimes, cyber-crimes, social crimes, and text mining for crime analysis.

Chih-Hao Ku et al. [1] propose a decision support system for automated crime report analysis and classification in e-government. They leverage machine learning techniques to automatically classify crime reports into predefined categories, which can assist law enforcement agencies in efficiently analyzing and managing crime data.

Dahbur and Muscarello [2] present a classification system for serial criminal patterns using artificial intelligence and law. They propose a rule-based expert system that uses decision trees and statistical techniques to identify patterns in serial crimes, which can aid in profiling and predicting serial criminal behavior.

Ghankutkar et al. [3] propose a machine learning model for analyzing crime news. They utilize natural language processing techniques and machine learning algorithms to classify crime news articles into categories such as robbery, murder, and fraud, to aid in crime analysis and prediction.

Qi [4] proposes a text classification approach for theft crimes based on the TF-IDF (Term Frequency-Inverse Document Frequency) technique and the XGBoost

machine learning model. The proposed method effectively classifies theft crimes into different categories, such as pickpocketing, burglary, and shoplifting, based on text data extracted from crime reports.

Alruily et al. [5] focus on crime type document classification from an Arabic corpus. They propose a machine learning-based approach that uses features such as keywords, text statistics, and machine learning classifiers to automatically classify Arabic crime documents into different crime types, such as theft, assault, and fraud, which can assist in crime analysis in Arabic-speaking regions.

Ch et al. [6] propose a computational system to classify cyber-crime offenses using machine learning. They utilize machine learning algorithms, such as decision trees and random forests, to automatically classify cyber-crime offenses into categories, such as hacking, identity theft, and phishing, based on features extracted from cyber-crime data.

Abbass et al. [7] present a framework to predict social crimes through Twitter tweets using machine learning techniques. They propose a text mining approach that uses natural language processing and machine learning algorithms to automatically classify tweets into categories such as hate speech, harassment, and discrimination, to aid in social crime prediction and prevention.

Kim et al. [8] focus on crime analysis through machine learning. They propose an approach that combines data mining techniques with machine learning algorithms to analyze crime data, including spatiotemporal patterns, social network analysis, and crime hotspots, to provide insights for crime prevention and law enforcement strategies.

Kaur et al. [9] propose a crime analysis approach using text mining techniques. They utilize natural language processing and machine learning algorithms to analyze crime-related text data, such as news articles and social media posts, to extract crime-related information, identify patterns, and classify crimes into different categories, such as property crimes, violent crimes, and white-collar crimes.

McClendon and Meghanathan [10] propose the use of machine learning algorithms for analyzing crime data. They present an approach that utilizes machine learning techniques, such as decision trees and support vector machines, to analyze crime data, including crime types, locations, and time periods, to identify patterns and provide insights for crime analysis and prediction.

In summary, the literature on crime analysis and classification using machine learning techniques covers various domains, such as e-government, serial criminal patterns, theft crimes, cyber-crimes, social crimes, and text mining for crime analysis. These studies demonstrate the potential of machine learning in automating the analysis and classification of crime data, which can aid law enforcement agencies in crime detection, prediction, and prevention. The use of different techniques such as natural language processing, text mining, decision trees, random forests, support vector machines, and XGBoost, among others, showcases the diversity and versatility of machine learning in crime analysis.

However, it's worth noting that there are limitations in the existing literature, such as reliance on limited data sources, language-specific approaches, lack of interpretability in some machine learning models, and potential biases in crime data. Further research is needed to address these limitations and enhance the accuracy, robustness, and interpretability of machine learning approaches for crime analysis and classification.

In conclusion, the literature on crime analysis and classification using machine learning techniques is extensive and diverse, with potential applications in various domains of crime detection, prediction, and prevention. These studies provide valuable insights and propose innovative approaches that can contribute to the advancement of crime analysis and law enforcement strategies. Further research in this area can potentially lead to the development of more effective and efficient crime analysis tools and techniques, ultimately aiding in reducing crime rates and enhancing public safety.

1.3 Research Gap

There are some studies on the use of technology in criminal investigations, there is still a significant research gap in the specific area of automated text analysis systems to support decision-making in criminal investigations, particularly in Sri Lanka. Most of the existing studies on automated text analysis systems have been conducted in other countries and may not be directly applicable to the Sri Lankan context. Furthermore, there is a lack of empirical research on the specific challenges faced by law enforcement agencies and the court system in Sri Lanka regarding the handling of criminal cases. This lack of research makes it difficult to identify the specific requirements and constraints that would need to be considered in the development of an automated text analysis system tailored to the Sri Lankan context. Therefore, there is a need for further research to investigate the specific challenges and requirements of the Sri Lankan criminal justice system regarding the handling of criminal cases. This research could help to inform the development of an automated text analysis system that is tailored to the Sri Lankan context and can effectively support decision-making in criminal investigations.

RESEARCH	TEXT BASED ANALYTICS	LABELING CLASSIFIED CATEGORIES	POLICE RELATED	LOWER COST	AVAILABLE FOR SRI LANKAN DATA
AUTOMATED CRIME REPORT ANALYSIS & CLASSIFICATION FOR E-GOVERNMENT [1]	✓	✓	✗	✓	✗
CLASSIFICATION SYSTEM FOR SERIAL CRIMINAL PATTERNS [2]	✗	✗	✓	✓	✗
MODELLING MACHINE LEARNING FOR ANALYSING CRIME NEWS [3]	✓	✗	✗	✓	✗
THE TEXT CLASSIFICATION OF THEFT CRIME BASED ON TF-IDF AND XGBOOST MODEL [4]	✗	✓	✓	✓	✗
ANALYZE AND CLASSIFY SIMILAR CASE DOCUMENTS AND PREDICT CATEGORY	✓	✓	✓	✓	✓

Table 1.1: Comparison of other available applications

1.4 Research Problem

The research problem in Sri Lanka is that the current procedure for criminal case handling in court involves manual analysis of past criminal cases from historical judgments databases. This process is time-consuming, prone to errors, and biases, and can lead to delays in justice and wrongful convictions. There is a need for an effective crime prevention method in order to improve public safety. While police departments have access to vast amounts of data related to past crimes, it can be difficult to analyze and make use of this data in a way that is effective for preventing future crimes.

There is a need for an automated text analysis system that can quickly and consistently discover important patterns in crime occurrences and assist the judicial system in making better-informed decisions. However, the existing research in this area has largely focused on developed countries and their legal systems, and there is a lack of research on developing countries like Sri Lanka.

Therefore, there is a need to investigate the feasibility and effectiveness of applying machine learning techniques such as document topic modelling, and text classification to criminal case documents in Sri Lanka. This would involve adapting existing techniques to the Sri Lankan legal system, developing appropriate datasets and models, and evaluating the accuracy and usefulness of the system in real-world scenarios.

2. Objectives

2.1 Main Objectives

The main objective of the idea is to develop an automated text analysis system that can help law enforcement agencies in Sri Lanka to discover important patterns quickly and consistently in crime occurrences by analyzing similar case documents and classify them into related categories that can support judgments currently made manually. When literature reviewing, there were some similar projects but not a whole one platform for criminal investigation. The objective is to create a research platform that can achieve higher accuracy and quality in criminal investigations.

2.2 Specific Objectives

- Develop an automated text analysis system for identifying patterns and similarities in crime cases.
- Implement machine learning techniques such as document topic modeling, and text classification to analyze crime case documents.
- Evaluate the performance of the automated text analysis system and compare it with manual analysis methods.
- Assess the feasibility of implementing the system in the Sri Lankan environment, considering factors such as data availability, system requirements, and user needs.
- Create a user-friendly interface for the system, allowing investigators to easily search and analyze crime cases.

3. Methodology

The methodology for classifying similar case documents involves a combination of data collection, preprocessing, feature extraction, model training, evaluation, and deployment, with specific techniques and algorithms chosen based on the nature of the dataset and the research objectives. The figure [3.1] illustrates the High-level architecture diagram of our proposed system from the beginning of the data collection.

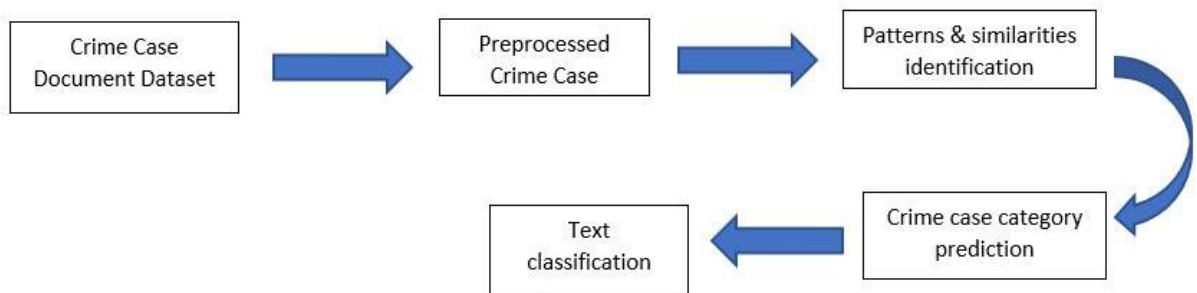


Figure 3.1: high-level architecture diagram

3.1 Procedures

Data collection

The first step is to collect a dataset of crime case documents for analysis. The dataset should be representative of the types of cases that will be analyzed and should be large enough to ensure sufficient coverage of the various categories or topics of interest.

Preprocessing

The dataset is then preprocessed to remove any noise or irrelevant information, such as stop words or punctuation, and to convert the text into a format that can be used by machine learning algorithms. This may include tokenization, stemming, and other text normalization techniques.

Feature extraction

Next, features are extracted from the preprocessed text. This may involve methods such as bag-of-words, TF-IDF, or word embeddings, depending on the nature of the dataset and the machine learning algorithms being used.

Dimensionality reduction

In some cases, the feature space may be very large and require dimensionality reduction techniques to reduce the computational burden and improve performance. Methods such as Principal Component Analysis (PCA) or t-SNE can be used for this purpose.

Model training

Once the features have been extracted and processed, machine learning models are trained on the labeled dataset to predict the category or topic of new documents. Commonly used models include Naive Bayes, Support Vector Machines (SVM), Random Forest, and Neural Networks.

Model evaluation

The trained models are then evaluated using various metrics such as accuracy, precision, recall, and F1-score to determine their performance on the dataset. Cross-validation and hyperparameter tuning may also be used to optimize the model performance.

Model deployment

Once the model has been trained and evaluated, it can be deployed to classify new crime case documents and facilitate better organization and analysis of the data.

3.2 Tools and Technology Selection

- Programming language: Python
- Integrated Development Environment (IDE): PyCharm, Jupyter Notebook
- Machine Learning Libraries: Scikit-Learn
- Data Analysis Libraries: Pandas, NumPy
- Data Visualization Libraries: Matplotlib, or Octave
- Database Management System: MySQL or MongoDB
- Data Reporting: Power BI
- Web Frameworks: Django, Flask
- Cloud Computing Platforms: Microsoft Azure, Google Cloud Platform (GCP)
- Version Control System: Git
- Collaboration Tool: Gitlab, GitHub

3.3 Testing

During the testing phase of the research, the accuracy and reliability of the outcomes generated by the proposed system will be assessed by comparing them with manual outcomes. Specifically, the outcomes obtained from past accident and crime-related data will be compared with those generated by the proposed system. The effectiveness and efficiency of the system in accurately analyzing, predicting, and classifying accident and crime-related data will be gauged through this comparison. Areas where the system may need improvement can be pinpointed, and refinements can be made to ensure that it produces the most accurate and reliable outcomes possible. The ultimate goal is to develop a system that is capable of providing valuable insights into accident and crime-related data, supporting efforts to enhance public safety and crime prevention.

4 Description of Personal and Facilities

4.3 Work Breakdown Structure (WBS)

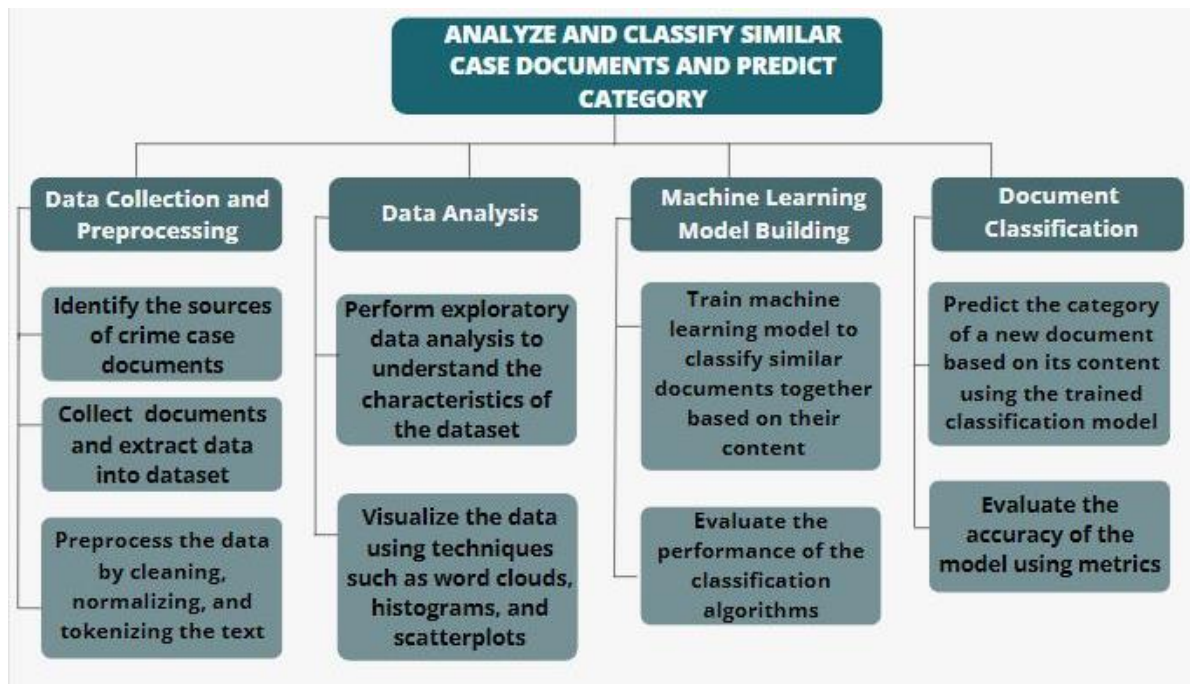


Figure 4.1: WBS diagram

4.4 Gantt Chart

Tasks	2022	2023											
	December	January	February	March	April	May	June	July	August	September	October	November	December
Topic Clarification													
Topic Assessment													
Project Charter													
Requirements Gathering													
Making of Project Proposal													
Project Presentation													
Proposal Report													
Progress Presentation-1													
Research Paper													
Final Report													
Progress Presentation-2													
Testing and Fixing issues													
Website Assessment and Research Book													
Final Report (Soft bound)													
Status Document Submission													
Final Presentation and Viva													
Final Report Submission													

Figure 4.2: Gantt Chart

4.5 System diagram

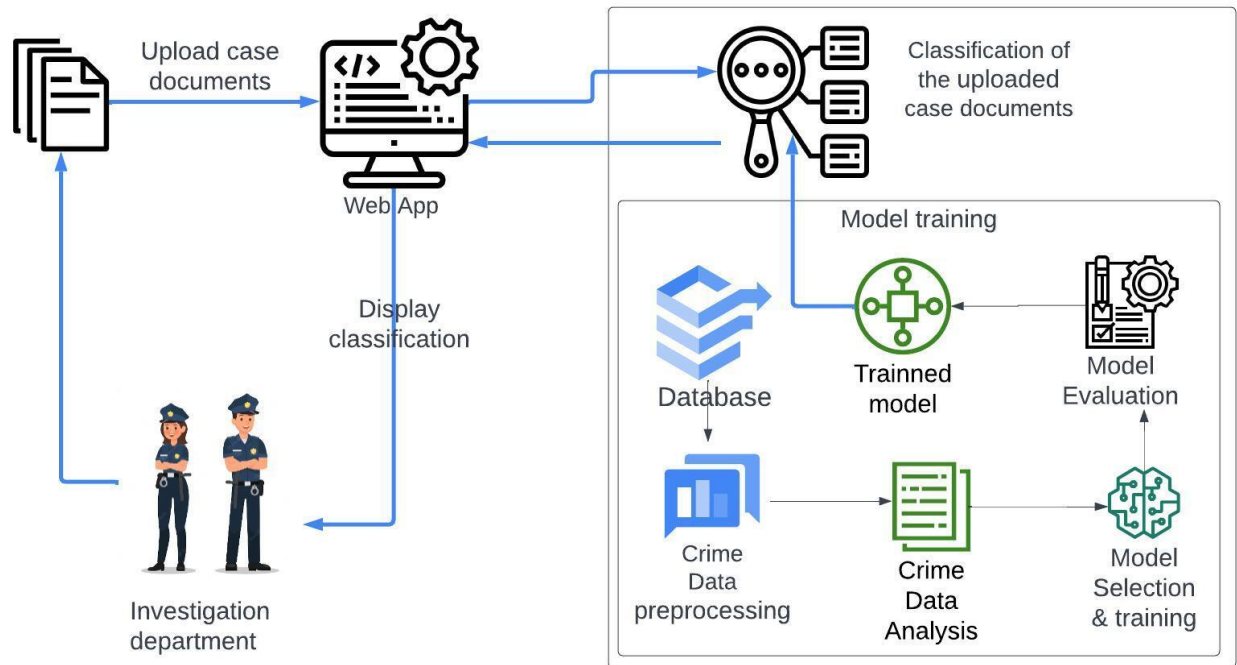


Figure 4.3: Component System diagram

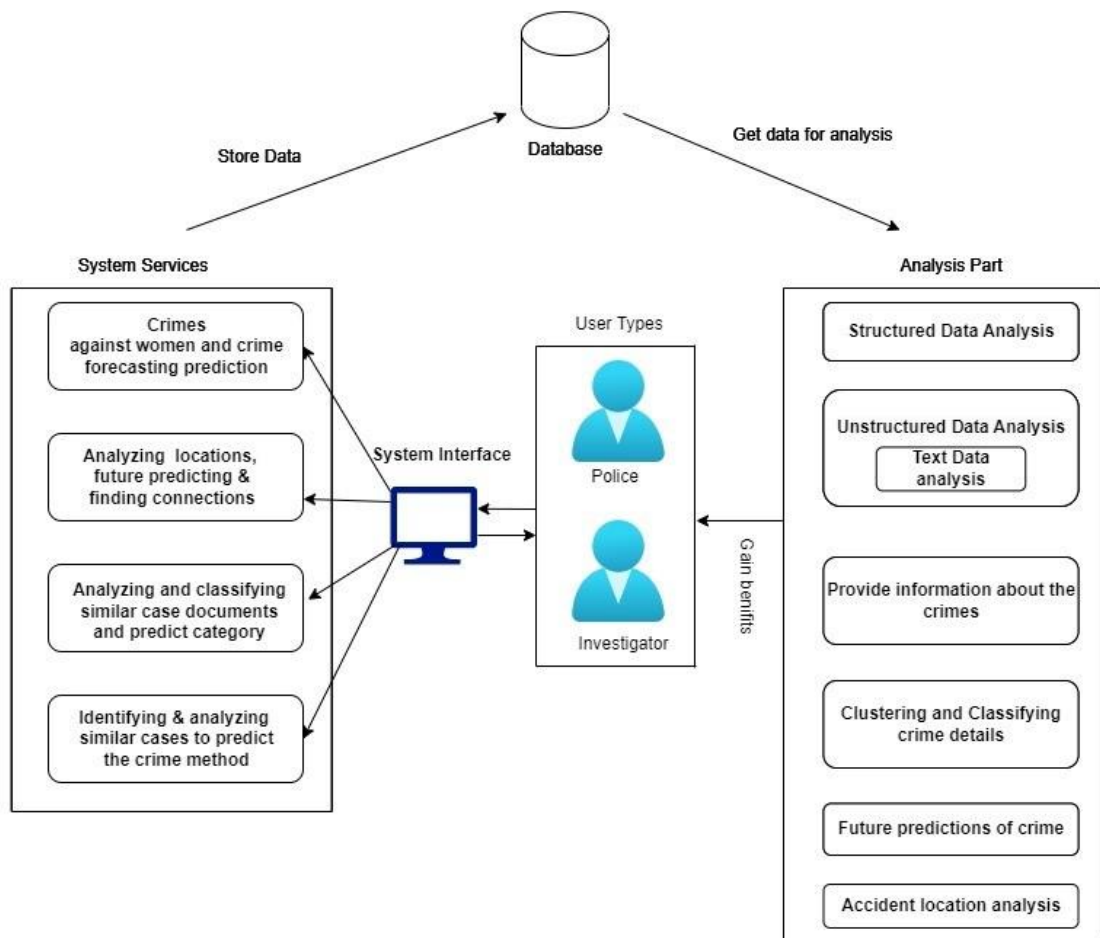


Figure 4.4: Overall System diagram

5 Requirements

5.3 Functional Requirements

- 1) The system should be able to collect crime case documents from various sources, such as police reports, court documents, and other relevant documents. The collected data should be pre-processed to clean and normalize the text data.
- 2) The system should be capable of identifying patterns and similarities in the crime case documents. This could involve techniques such as natural language processing (NLP), text mining, and machine learning algorithms to extract relevant features.
- 3) The system should be able to identify common patterns, trends, and relationships among the crime cases to uncover meaningful insights. Topic modeling algorithms to identify the topics present in the crime case documents and assign each document to a particular topic.
- 4) The system should have the capability to classify crime cases into relevant categories or classes based on their content. This could involve the use of supervised machine learning algorithms, such as Naive Bayes, support vector machines (SVM), or deep learning models, to train a classification model using labeled data. The system should be able to automatically categorize crime cases into predefined categories.
- 5) The system should incorporate text classification algorithms that are capable of predicting the category of a new crime case document. This could involve the use of algorithms such as decision trees, random forests, or deep learning models, to classify the new documents into relevant categories based on their content. The system should be able to adapt and update the classification model as new data becomes available to improve the accuracy and reliability of the predictions.

5.4 Non-Functional Requirements

Performance: The system should be able to handle large volumes of data and provide quick response times to users.

Accuracy: The system should be able to accurately classify crime case documents to avoid errors and biases.

Scalability: The system should be designed to scale up as more crime case documents are added to the database.

Security: The system should have robust security measures in place to protect sensitive data and prevent unauthorized access.

User-friendly Interface: The system should have a user-friendly interface that is easy to use for police investigators and other authorized personnel.

Compatibility: The system should be compatible with different file formats and databases commonly used in the criminal justice system.

Reliability: The system should be always reliable and available for use, with minimal downtime for maintenance or upgrades.

Accessibility: The system should be accessible to authorized users from different locations and devices, with appropriate access controls in place to maintain data privacy and security.

6 Commercial Value

1. Sri Lanka has a high volume of criminal cases that need to be processed by the courts. An automated text analysis system that can quickly identify patterns and similarities in past cases would significantly improve the efficiency of the criminal justice system.
2. The manual analysis of past criminal cases is prone to errors and biases. An automated system that uses machine learning techniques to analyze the data would increase the accuracy of the analysis and reduce the risk of errors and biases.
3. Automating the process of analyzing past criminal cases would save time and resources for the courts and law enforcement agencies, making it a cost-effective solution.
4. An automated text analysis system would make the analysis of past criminal cases more accessible to all stakeholders in the criminal justice system, including lawyers, judges, and law enforcement officers.
5. The proposed solution could be customized to meet the specific needs of the Sri Lankan criminal justice system, considering the unique characteristics of the system.

By addressing these factors, the proposed solution can increase its commercial value and stand out among other products in the market.

References

- [1] Chih-Hao Ku, Gondy Leroy, A decision support system: Automated crime report analysis and classification for e-government, *Government Information Quarterly*, Volume 31, Issue 4, 2014, Pages 534-544, ISSN 0740 624X. <https://www.sciencedirect.com/science/article/pii/S0740624X14001282>
- [2] Dahbur, K., Muscarello, T. Classification System for Serial Criminal Patterns. *Artificial Intelligence and Law* 11, 251–269 (2003). <https://doi.org/10.1023/B:ARTI.0000045994.96685.21>
- [3] S. Ghankutkar, N. Sarkar, P. Gajbhiye, S. Yadav, D. Kalbande and N. Bakereywala, "Modelling Machine Learning For Analysing Crime News," 2019 International Conference on Advances in Computing, Communication and Control (ICAC3), Mumbai, India, 2019 <https://ieeexplore.ieee.org/abstract/document/9036769>
- [4] Z. Qi, "The Text Classification of Theft Crime Based on TF-IDF and XGBoost Model," 2020 IEEE International Conference on Artificial Intelligence and Computer Applications (ICAICA), Dalian, China, 2020, pp. 1241-1246. <https://ieeexplore.ieee.org/abstract/document/9182555>
- [5] M. Alruily, A. Ayesh and H. Zedan, "Crime Type Document Classification from Arabic Corpus," 2009 Second International Conference on Developments in eSystems Engineering, Abu Dhabi, United Arab Emirates, 2009 <https://ieeexplore.ieee.org/abstract/document/5395104>
- [6] Ch, Rupa, Thippa Reddy Gadekallu, Mustufa Haider Abidi, and Abdulrahman Al-Ahmari. 2020. "Computational System to Classify Cyber Crime Offenses using Machine Learning" *Sustainability* 12, no. 10: 4087 <https://doi.org/10.3390/su12104087>
- [7] Z. Abbass, Z. Ali, M. Ali, B. Akbar and A. Saleem, "A Framework to Predict Social Crime through Twitter Tweets By Using Machine Learning," 2020 IEEE 14th International Conference on Semantic Computing (ICSC), San Diego, CA, USA, 2020. <https://ieeexplore.ieee.org/abstract/document/9031496>
- [8] S. Kim, P. Joshi, P. S. Kalsi and P. Taheri, "Crime Analysis Through Machine Learning," 2018 IEEE 9th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), Vancouver, BC, Canada, 2018, pp. 415-420, <https://ieeexplore.ieee.org/document/8614828>
- [9] H. Kaur, T. Choudhury, T. P. Singh and M. Shamoan, "Crime Analysis using Text Mining," 2019 International Conference on contemporary Computing and Informatics (IC3I), Singapore, 2019, pp. 283-288 <https://ieeexplore.ieee.org/abstract/document/9055606>

- [10] McClendon, L., & Meghanathan, N. (2015). Using machine learning algorithms to analyze crime data. *Machine Learning and Applications: An International Journal (MLAIJ)*, 2(1), <https://airccse.org/journal/mlaij/papers/2115mlaij01.pdf>
- [11] S. Ananyan, "Crime pattern analysis through text mining," in *Proceedings of the 2004 Americas Conference on Information Systems (AMCIS)*, 2004, pp. 236. Available: <https://aisel.aisnet.org/amcis2004/236>