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Academic Year 2023 - 24

S8 PROJECT WORK II

FINAL Review

PROJECT TITLE

Machine learning based human crime activity detection system

BIP PROJECT ID

24S8INT103

CATEGORY

EXTERNAL – OWN

BATCH MEMBERS

RAGUL KANNAN S (212AD504)

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GUIDE

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LITERATURE SURVEY

Sl.No.	Journal Paper Title	Works carried out (with details of Methods/ Materials/ Software/ Algorithms)	Information gathered relevant to your project
1	Crime Prediction and Analysis	Crime prediction using machine learning methods	Highlights the importance of maintaining a proper crime database, the use of AI in crime prediction, and the effectiveness of machine learning in predicting violent crimes to aid law enforcement agencies.
2	Crime Prediction Using Machine Learning and Deep Learning	Systematic review of over 150 articles on crime prediction	Examines various machine learning and deep learning algorithms applied to predict crime, identifies trends and patterns in criminal activities, and offers insights and future directions for enhancing crime prediction accuracy.

LITERATURE SURVEY

Sl.No.	References (Journal Papers Only)	Works carried out (with details of Methods/ Materials/ Software/ Algorithms / fabrication / techniques/ components used)	Information gathered relevant to your project
3	Crime Prediction using Machine Learning	Forecasting crime-prone areas using XGBOOST algorithm	Focuses on predicting crime hotspots based on available data, facilitating easier identification of high-crime areas for law enforcement agencies, aiming to reduce the overall crime rate.
4	Criminal Combat: Crime Analysis and Prediction Using ML	Identifying crime patterns and forecasting crime probability	Utilizes mathematical and statistical models to analyze crime datasets, extract dominant features, and assess model performance, aiming to minimize crime rates and enhance societal safety.

PROJECT WORK PLAN

- Project Initiation Phase
- Research and Planning
- Data Collection and Preprocessing
- Model Development
- Training and Optimization
- Evaluation and Validation
- Deployment and Integration

AIM & OBJECTIVES OF THE PROJECT (Problem Statement)

Aim:

1. Develop an effective crime activity detection system using KNN algorithm integrated into real-time security systems.

Objectives:

1. Gather diverse crime scenario datasets, preprocess data, and extract relevant features for training the KNN algorithm.
2. Fine-tune KNN parameters, optimize algorithms, and ensure real-time processing for accurate and responsive crime detection.
3. Integrate the trained model into real-time security systems, enabling immediate detection and alerting of potential criminal activities, with a focus on evaluating performance and gathering feedback for continuous improvement.

SCOPE OF THE PROJECT

1. Problem Definition:
    1. Define the task of developing an effective crime activity detection system using the KNN algorithm integrated into real-time security systems, emphasizing the importance of timely detection and prevention of criminal activities.
2. Data Collection and Preprocessing:
    1. Gather diverse datasets of crime scenarios, ensuring representation across various types of criminal activities and locations.
    2. Preprocess the collected data to enhance consistency and quality, including tasks such as cleaning, normalization, and feature extraction.
3. Model Development and Optimization:
    1. Design and implement the KNN algorithm for crime activity detection, considering factors such as feature selection and distance metrics.
    2. Fine-tune KNN parameters and optimize algorithms to improve accuracy and responsiveness in identifying potential criminal actions.
4. Integration with Real-Time Systems:
    1. Develop a seamless integration module to embed the trained KNN model into real-time security and law enforcement systems.
    2. Enable immediate detection and alerting of potential criminal activities, ensuring the system's compatibility and efficiency in real-world scenarios.
5. Performance Evaluation and Feedback:
    1. Implement a robust evaluation framework to assess the accuracy and speed of the crime activity detection system.
    2. Gather feedback from users and stakeholders for continuous improvement and refinement of the system, focusing on enhancing both performance and usability.

NEED FOR THE CURRENT STUDY

1. **Enhanced Crime Prevention Measures:**
   There is a pressing need for advanced technologies that aid in crime prevention and detection to ensure public safety and security. Developing an effective crime activity detection system can significantly contribute to enhancing crime prevention measures.
2. **Real-Time Monitoring and Response:**
   Traditional methods of crime detection often lack real-time monitoring capabilities, leading to delayed responses to criminal activities. By integrating the KNN algorithm into real-time security systems, authorities can monitor and respond to potential criminal actions promptly.
3. **Diverse and Dynamic Crime Scenarios:**
   The nature of criminal activities varies widely, necessitating a comprehensive dataset that captures diverse crime scenarios. Gathering such data and training the KNN algorithm on it enables the system to detect a wide range of criminal activities effectively.
4. **Optimization for Accuracy and Responsiveness:**
   Optimizing the KNN algorithm and fine-tuning its parameters is crucial to ensure high accuracy and responsiveness in crime detection. By focusing on optimization techniques, the system can effectively differentiate between normal and suspicious activities, reducing false alarms.
5. **Integration with Existing Systems:**
   Integrating the trained model into real-time security systems streamlines the process of crime detection and response. This integration enables seamless communication between various components of the security infrastructure, enhancing overall efficiency and effectiveness.
6. **Continuous Improvement through Feedback:**
   Gathering feedback from users and stakeholders allows for continuous improvement and refinement of the crime activity detection system. This iterative process ensures that the system remains up-to-date and effective in addressing evolving security challenges.

FEASIBILITY ANALYSIS

Technical Feasibility:

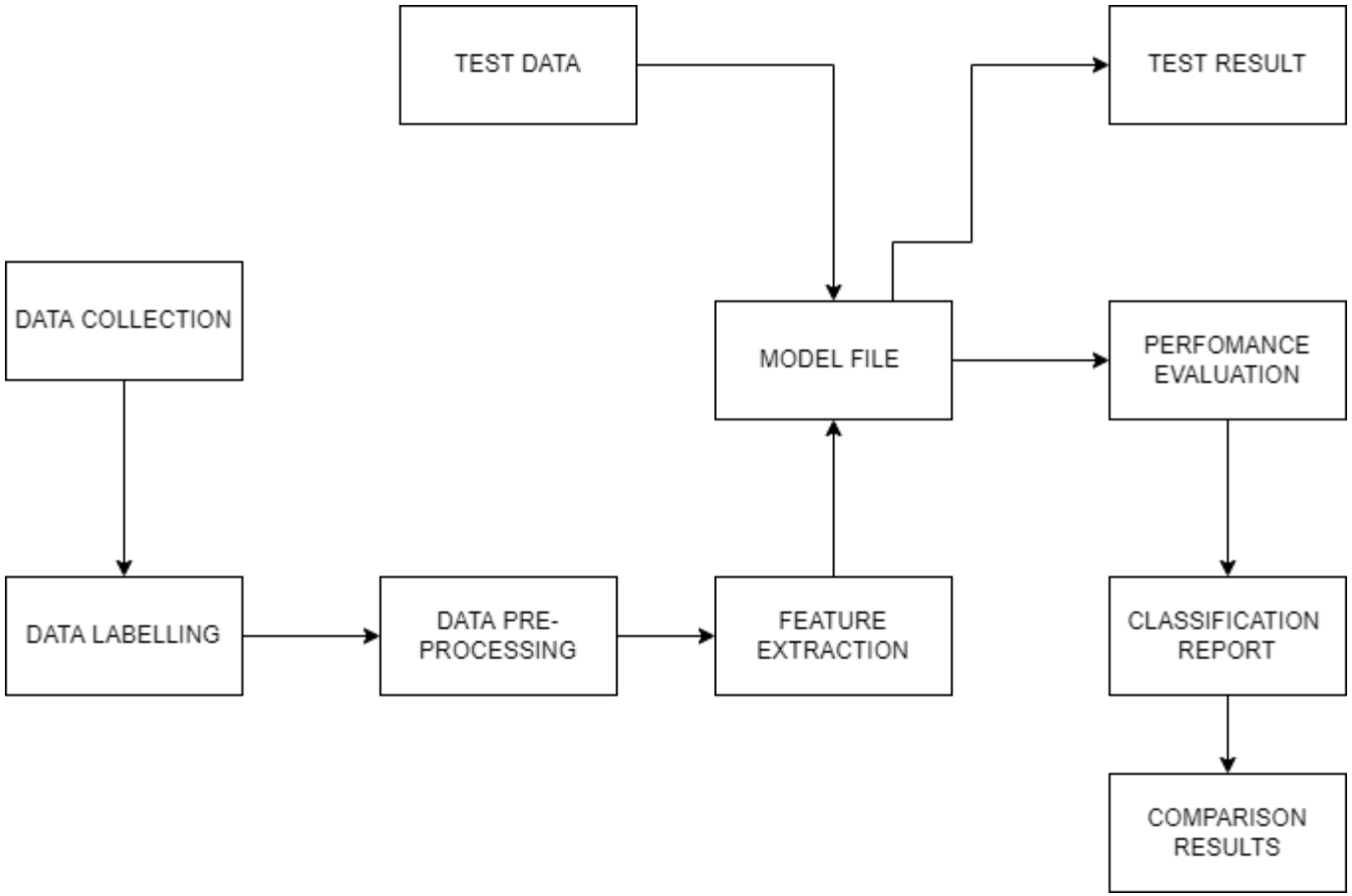
1. Availability of machine learning libraries and frameworks like TensorFlow and scikit-learn facilitates KNN algorithm implementation.
2. Modern computing infrastructure provides the necessary computational power for training and deploying machine learning models efficiently.
3. Integration frameworks enable seamless integration of the trained model into existing real-time security systems, ensuring compatibility and interoperability.

FEASIBILITY ANALYSIS Cont....

Data Feasibility:

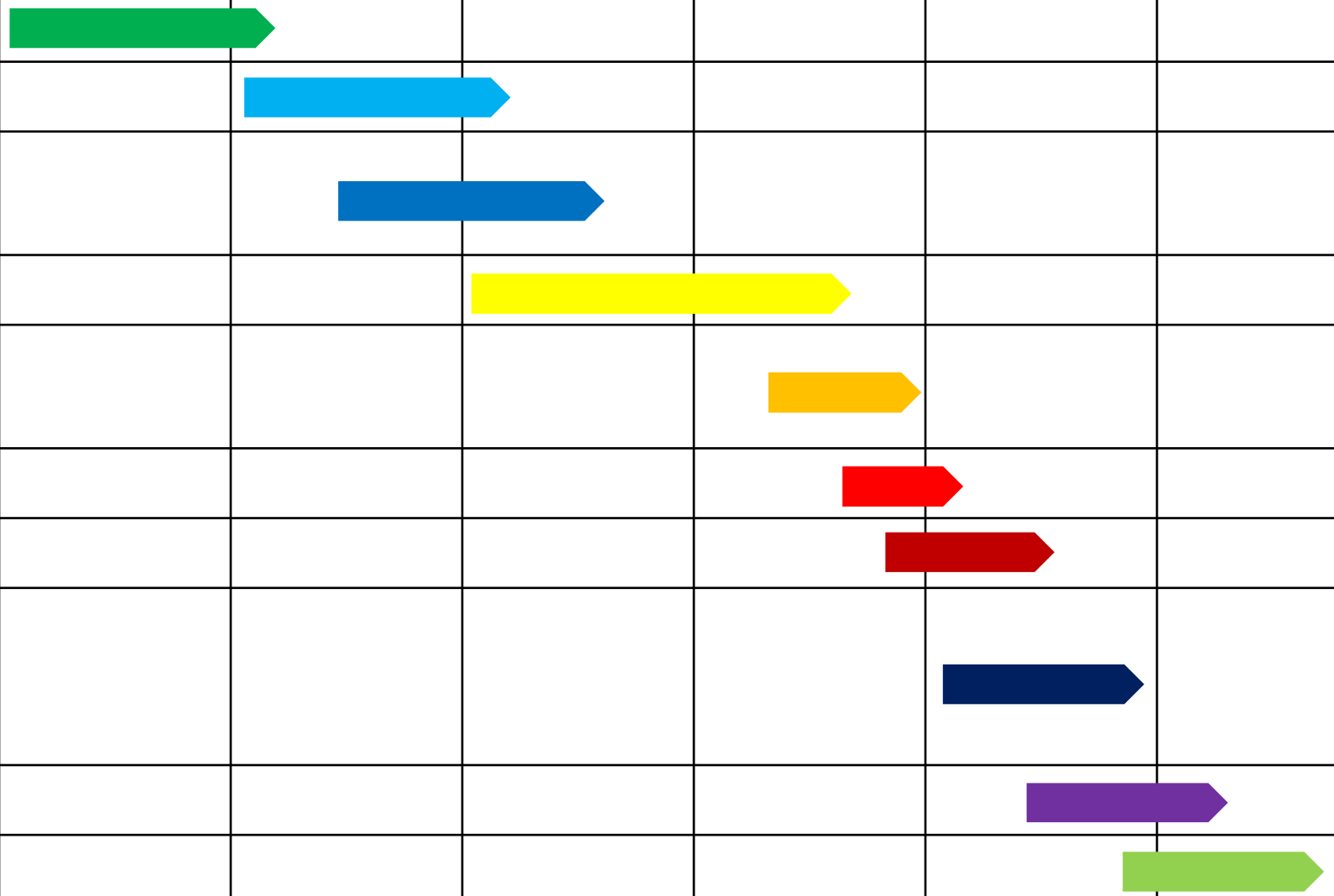
1. Diverse datasets of crime scenarios are often accessible through public repositories and law enforcement agencies.
2. Preprocessing techniques can be applied to ensure data consistency and quality, enhancing its suitability for model training.
3. Continuous data collection mechanisms can be established to maintain the relevance and timeliness of the dataset for ongoing model refinement.

PROPOSED METHODOLOGY (Flow Chart)



PROPOSED METHODOLOGY (Gantt Chart)

TASK	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6
Data Collection						
Data Preprocessing						
Train test split						
Model Training						
Performance Evaluation						
Personalization						
Validation						
Application in Stackoverflow Assessments						
Impact Assessment						
Further Research						



CHOICE OF COMPONENTS / MODULES / METHODS/TECHNIQUES EQUIPMENT USED FOR PROJECT DEVELOPMENT

1. **Scikit-learn:** Utilized for KNN algorithm implementation, parameter tuning, and model training in the crime activity detection system.
2. **Pandas:** Employed for efficient data handling, preprocessing, and feature extraction from the comprehensive crime scenarios dataset.
3. **NumPy:** Used for numerical operations and array manipulations to enhance the efficiency of algorithm implementation and real-time processing optimization.
4. **TensorFlow or PyTorch:** Integrated for seamless embedding of the trained model into real-time systems, facilitating deployment and integration with security and law enforcement scenarios.

EFFECTIVE UTILIZATION OF THE MODERN TOOL

- **Deep Learning Frameworks**:

  Utilize TensorFlow or PyTorch for implementing the image captioning model architecture due to their flexibility and extensive support for neural network development.

- **GPU Acceleration**:

  Employ NVIDIA GPUs (e.g., GeForce RTX series) for accelerated training of deep learning models, significantly reducing training times compared to CPU-only implementations.

- **Pretrained Models:**

  Utilize pretrained CNN models such as VGG16 or ResNet for image feature extraction, leveraging transfer learning to improve model performance and reduce training time.

- **Model Deployment Platforms**:

  Deploy the trained image captioning model on cloud platforms like Google Cloud AI Platform or AWS SageMaker for scalable and efficient inference, enabling integration into production systems or applications.

- **Visualization Tools:**

  Use visualization libraries like TensorBoard or Matplotlib to visualize training metrics, model architectures, and attention maps, facilitating model debugging and performance analysis.

MODULES

1. **Data Acquisition and Preprocessing Module:** Responsible for collecting a diverse dataset of crime scenarios and preprocessing the data to extract relevant features for training the KNN algorithm.
2. **Training and Parameter Tuning Module:** Involves exposing the model to the comprehensive dataset, fine-tuning KNN parameters, and optimizing the algorithm for optimal performance in crime activity detection.
3. **Real-Time Processing Optimization Module:** Focuses on efficient implementation of the algorithm to achieve real-time processing, ensuring the system's responsiveness in identifying and alerting authorities to potential criminal actions.
4. **Integration and Deployment Module:** Handles the integration of the trained model into real-time security and law enforcement systems, emphasizing both accuracy in classification and speed for practical deployment in relevant scenarios.

DESIGN(S) (HARDWARE / SOFTWARE ARCHITECTURE)

Hardware Architecture:

- Utilize high-performance GPUs or TPUs to accelerate the training and inference of deep learning models for image caption generation
- Consider distributed computing frameworks to scale the training process across multiple devices for improved efficiency and reduced training time

ADVANTAGES AND DISADVANTAGES

- **Advantages:**

1. **High Accuracy:** The KNN algorithm, when properly trained and tuned, can provide high accuracy in crime activity detection, making it a reliable tool for law enforcement.
2. **Real-time Responsiveness:** Efficient algorithm implementation enables real-time processing, allowing the system to promptly identify and alert authorities to potential criminal actions.
3. **Practical Deployment:** The methodology's emphasis on both accuracy and speed makes it suitable for practical deployment in security and law enforcement scenarios, addressing the critical need for timely and accurate crime detection.

- **Disadvantages:**

1. **Computational Intensity:** KNN can be computationally intensive, especially with large datasets, impacting real-time responsiveness and system efficiency.
2. **Sensitivity to Noise and Outliers:** KNN is sensitive to noise and outliers in the data, which can lead to less robust performance, particularly when dealing with diverse and complex crime scenarios.
3. **Dependency on Proper Parameter Tuning:** The performance of KNN is highly dependent on proper parameter tuning, which requires careful consideration and experimentation to achieve optimal results.

CONCLUSION

In conclusion, leveraging machine learning techniques, specifically the KNN algorithm, for the development of a crime activity detection system offers a promising avenue for enhancing security and law enforcement capabilities. The methodology's focus on high accuracy, real-time responsiveness, and practical deployment aligns with the urgent need for efficient crime detection. However, considerations such as computational intensity, sensitivity to noise, and careful parameter tuning underscore the importance of a well-balanced approach to fully harness the potential of this methodology in addressing the complexities of real-world crime scenarios.

INDIVIDUAL CONTRIBUTIONS TO THE WORK

Batch Member 1 : (212AD504 & RAGUL KANNAN S)

1. real-time integration and deployment phase of the project. They work on developing a seamless integration module using TensorFlow or PyTorch to embed the trained model into security and law enforcement systems. Their contribution ensures that the system functions cohesively, maintaining responsiveness in identifying potential criminal actions and facilitating practical deployment in real-world scenarios.

INDIVIDUAL CONTRIBUTIONS TO THE WORK

Batch Member 2 : (212IT511 & SRI RAM PRASATH D)

1. acquiring and preprocessing the comprehensive dataset of crime scenarios. They are responsible for selecting relevant features, handling data cleaning, and ensuring the dataset's suitability for training the KNN algorithm. Additionally, they contribute to the fine-tuning of parameters during the training process to optimize the model's performance.

INDIVIDUAL CONTRIBUTIONS TO THE WORK

Batch Member 3 : (202IT123 & CALVIN FELIX R)

1. The Machine Learning Engineer focuses on the algorithmic aspects of the project. They implement and fine-tune the KNN algorithm using Scikit-learn, ensuring that the model is well-suited for crime activity detection. Their expertise is crucial in addressing the computational intensity challenge, optimizing the algorithm for efficient real-time processing, and achieving a balance between accuracy and speed.

COST BENEFIT ANALYSIS

- Framework:

Jupyter notebook (open source)
Keras (open source)

- Deployment

Flask (open source)

- Cloud services for hosting

AWS : ₹ 100 p.m
Azure: ₹ 500 p.m

- System requirement :

CPU	i7 8750h	₹ 28,991
GPU	GeForce gtx 1050 TI	₹ 26,850
RAM	16GB RAM	₹ 8,000

CONCLUSION

In conclusion, leveraging machine learning techniques, specifically the KNN algorithm, for the development of a crime activity detection system offers a promising avenue for enhancing security and law enforcement capabilities. The methodology's focus on high accuracy, real-time responsiveness, and practical deployment aligns with the urgent need for efficient crime detection. However, considerations such as computational intensity, sensitivity to noise, and careful parameter tuning underscore the importance of a well-balanced approach to fully harness the potential of this methodology in addressing the complexities of real-world crime scenarios.

Status on Partial Completion and Submission of Project Report

List of Documents to be Submitted

SL.No	List of Documents	Status (Provide the drive link of prepared document)
1	Cover Page & Title Page (Both are in same format)	https://drive.google.com/file/d/11u7_doynPMnJUFeBAaBY2KJLjGaJLTcH/view?usp=sharing
2	Bonafide Certificate	https://drive.google.com/file/d/14z75C85_WaW5JdggmEslHF1CSqy2c1L-/view?usp=sharing
3	Declaration	https://drive.google.com/file/d/1WDqBngUJHSWkjxHPfAqXBWGI23ItLHdE/view?usp=sharing
4	Acknowledgement	https://drive.google.com/file/d/1HZ10w8SCDp20MCQ1jOGLqfLkmFbBbEj5/view?usp=sharing
5	Chapter I – Introduction	https://drive.google.com/file/d/1Wn1YG9CPPu8f4MabXo5bMoVeHOyPcWvd/view?usp=sharing
6	Chapter 2 – Literature Survey	https://drive.google.com/file/d/1LJK5fNp4UXMK1EsA5pEPrW6SINWLFYwp/view?usp=sharing

Submission of Project Report

List of Documents to be Submitted

SL.No	List of Documents	Status (Provide the drive link of prepared document)
7	Chapters 3 - Objectives and Methodology	https://drive.google.com/file/d/1fw0XFGc3p3QeXuzpIpXyImrMzIZD5Fdw/view?usp=sharing
8	Chapters 4 - Proposed work modules (Chapter name can be based on the work)	https://drive.google.com/file/d/18GTnyRzt-sjsIXYwPpZJi03x_Y7ZdLof/view?usp=sharing
9	Chapter 5 - Results and Discussion	https://drive.google.com/file/d/101izNwE8-A78cC2KHhMGwnr38ivqdJ-5/view?usp=sharing
10	Chapters 6 - Conclusions & Suggestions for Future work	https://drive.google.com/file/d/1-Nlj6RUELH5Xzt3kmXCG-dzaEpFqzRGu/view?usp=sharing
11	References	https://drive.google.com/file/d/1431GHNHBebyOOaZirrcZKNhq8JlH8Y3C/view?usp=sharing
12	Appendices	https://drive.google.com/file/d/10oEF6nn6P9hQyXcpTVv9FI1SfV9mAGMu/view?usp=sharing

PUBLICATIONS (CONFERENCE / JOURNAL / PATENT)

SL.No	Paper/Manuscript Title	Status (Provide the drive link of prepared document)
1	SIMATS	https://drive.google.com/file/d/1Ce6DQH8QLPtlPQUSWG80UMYD2JcwMH2M/view?usp=sharing

ORIGINALITY SCORE

SL.No	Tool name for checking originality score	Status (Provide the drive link of prepared document)
1	TURNITIN SOFTWARE	https://drive.google.com/file/d/1ZsyRQMl7GT1nl5H05hATMXzH1S6KoA0E/view?usp=sharing

REFERENCES
(Journal Papers/ Books/ Website References)

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2.Rohan Mathur,Tejas Chintala,D Rajeswari,"Detecting Criminal Activities and Promoting Safety Using Deep Learning",2022 International Conference on Advances in Computing Communication and Applied Informatics (ACCAI)
3.Verlyn V. Nojor,Jarod Augustus C. Austria,Adrian A. Galit,Joaquin Tyrone B. Guevarra,Kathleen Q. Jogno,Maria Cecilia A. Venal,Mary Jane F. Somao-i,"Design of a Deep Learning-based Detection System for Criminal Activities",2022 3rd International Informatics and Software Engineering Conference (IISEC)
4."Crime Prediction Using Machine Learning and Deep Learning: A Systematic Review and Future Directions",IEEE Access
5.P.Varaprasada Rao,Sukesh Sunkari,Tejeshwararao Raghumandala,Ganesh Koka,Deepak Chowdary Rayankula,"Prediction of Crime Data using Machine Learning Techniques",2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS)