**AI-BASED RAPE DETECTION**

**A PROJECT REPORT**

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**[April,2025]**





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**CERTIFICATE**

This is to certify that the project report submitted along with the project entitled **AI-BASED RAPE DETECTION** has been carried out by **Arman Laliwala** under my guidance in partial fulfillment for the Bachelor of Engineering in Computer Engineering, 8th Semester of Silver Oak University, Ahmedabad during the academic year 2024-25.

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DECLARATION

We hereby declare that the project report submitted along with the project entitled **AI-BASED RAPE DETECTION**submitted in partial fulfillment for the Bachelor of Engineering in Computer Engineering to Silver Oak University, Ahmedabad, is a bonafide record of original project work carried out by me / us the supervision of **Mr. Rakesh Shah** and that no part of this report has been directly copied from any students’ reports or taken from any other source, without providing due reference.

Arman Laliwala

Name of the Student Sign of Student

**ACKNOWLEDGEMENT**

I would like to take this opportunity to express my sincere gratitude and appreciation to those who have supported me throughout the journey of completing my internship. I am acutely aware that I did not reach this point entirely on my own. First and foremost, I would like to thank my Internal guide, **Mr.** **Rakesh Shah**, for their invaluable guidance and feedback throughout the project's development. Their expertise and mentorship were instrumental in steering me in the right direction and ensuring the project's success.

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**Abstract**

The AI-based Video Classification System for Consent and Non-Consent Detection is an advanced platform designed to help in the early identification of sexual violence scenarios through video analysis. With sexual violence continuing to be a major global concern, the use of artificial intelligence in detecting consent and non-consent situations can support early intervention, safeguard individuals, and provide critical evidence for legal proceedings.

The system uses deep learning models, specifically Convolutional Neural Networks (CNNs), to classify video content into two categories: consent and non-consent. A carefully curated dataset was collected and augmented to increase diversity and robustness, reaching a total size of approximately 4.42 GB. Videos were sampled into frames, resized uniformly, and normalized before being passed through the model for training. Initially trained for 50 epochs, the model exhibited signs of overfitting. By optimizing the training to 10 epochs and applying early stopping techniques, the final model achieved a training accuracy of 97.49% and a validation accuracy of 95.00%, showcasing strong performance on the given dataset.

The platform is built using Python, TensorFlow, Keras, OpenCV, and Scikit-learn. It automates the detection of non-consensual activities by analyzing visual patterns such as gestures, body posture, and scene context, reducing the psychological burden on human reviewers and minimizing human biases in evidence evaluation. Despite the promising results, the model currently struggles with unseen or real-world data due to the limited size and diversity of the training dataset.

To address these challenges, future work will focus on expanding the dataset with more varied scenarios and integrating multi-modal data analysis, such as incorporating audio and text signals alongside video frames. Additional functionalities like violence detection, nudity recognition, and sexual harassment detection will also be explored to create a broader and more comprehensive safety application. Ethical considerations, particularly regarding privacy, fairness, and misuse prevention, remain a priority throughout the development and deployment of the system.

Thus, the AI-based Video Classification System presents an important step toward the responsible use of artificial intelligence for protecting human rights and ensuring faster, more reliable interventions against acts of sexual violence.

**List of Figures**

Fig 1.6.1 Timeline Chart ………………………………………………….. 5

Fig 4.4.1 Result …………………………………………………..

**List of Tables**

Table 6.2.1 ……………………………………………………………………… 16

Table 6.2.2 ……………………………………………………………………… 16

**Tables of Contents**

Acknowledgement…………………………………………………………………………i

Abstract…………………………………………………………………………………....ii

List of Figures…………………………………………………………………………….iii

List of Tables……………………………………………………………………………...iv

Tables of Contents…………………………………………………………………………v

**Chapter 1 Introduction to Project…………………………………………….………...1**

1.1 Project Summary…………………………………………….……..………….1

1.2 Purpose……………………………………………………………..………….2

1.3 Objective………………………………………………………………………3

1.4 Scope……………………………………………………………….………….4

* 1. Technology and Literature Review …………………………………………...4

1.6 Project Planning ……………………..……………………………. ………….5

**Chapter 2 System Analysis…………………………………………………………...…..6**

2.1 Study of Current system…………………………………………………….....6

2.2 Problem and Weakness in Current System………………………………….....6

2.3 Requirements of the new System ……………………………………………..7

2.4 System Feasibility………………………………………………………...……8

2.4.1 System Contribution to Organizational Objectives……………...……8  
2.4.2 Feasibility with Current Technology, Cost, and Schedule………...….8  
2.4.3 System Integration with Existing Systems ……………………….......9

2.5 Activity in New System / Proposed System……………………………………9

2.6 Features of New System/ Proposed System………………………...................9

2.7 List of Main Modules ………………………………………………………. .10

2.8 Section of Hardware / Software / Algorithms ……………………..................11

**Chapter 3 System Design ………………………………………………………………12**

* 1. System Design & Methodology……………………………………………..…12
  2. Database Design / Data Structure ………………………………………………13

3.2.1 Database Design…………………………………………………….……13

**Chapter 4 Implementation ……………………………….……………………………14**

4.1 Implementation Platform / Environment………………………………………14

4.2 Process / Program / Technology / Modules Specification(s)…………………..14

4.3 Finding / Results / Outcomes…………………………………………………..15

4.4 Result Analysis / Comparison / Deliberations…………………………………18

**Chapter 5 Testing ………………………………………………………………………19**

5.1 Testing plan and strategy…………………………………………………….19

5.2 Test results and Analysis ……………………………………………………19

**Chapter 6 Conclusion and Discussion ………………………………………………...23**

6.1 Overall Analysis of project ……………..…………………………………….23

6.2 Dates of continuous Evaluation ………………………………………………23

6.3 Problem encountered and solutions …………………………………………..24

6.4 Summary of project …………………………………………………………..24

6.5 Limitation and Future Enhancement ……………………………………........25

**References ………………………………………………………………………………26**

**CHAPTER 1: INTRODUCTION**

**1.0 INTRODUCTION TO PROJECT**

The use of Artificial Intelligence (AI) across different sectors has introduced transformative changes, particularly in areas requiring high-stakes monitoring and rapid decision-making. Sexual violence remains a deeply concerning global issue, and traditional methods of detecting such incidents are often reactive, slow, and emotionally burdensome. Leveraging advancements in computer vision and deep learning, AI presents new opportunities for proactive detection and intervention.

This research project focuses on developing a video classification system that uses AI to detect consent and non-consent scenarios from video footage. By analyzing visual patterns such as body movements, gestures, and scene dynamics, the AI model can assist in identifying potential rape incidents. This project highlights the impact of AI in enhancing public safety, aiding law enforcement, and addressing ethical challenges such as privacy and bias in AI decision-making.

**1.1 PROJECT SUMMARY**

AI is revolutionizing industries in ways we are only beginning to fully understand, particularly in fields where large-scale data analysis and pattern recognition are critical. In the context of security and justice, AI can offer timely, accurate, and unbiased assistance in identifying crimes like sexual assault.

Traditional methods of investigating such cases often depend heavily on human observation and manual evidence review, which can be slow, emotionally taxing, and sometimes biased. Our project aims to automate the initial screening process by developing a deep learning model capable of classifying videos into consent and non-consent categories.

We believe that AI-driven systems will save valuable time and resources for law enforcement and legal teams, reducing the need for repeated human exposure to sensitive content. Moreover, AI systems can maintain objectivity, minimizing personal biases that may influence judgment during investigations.

By training a model on a carefully curated and augmented dataset, our system aspires to flag potential incidents quickly and accurately, enabling faster interventions and stronger evidence-based actions.

**1.2 PURPOSE**

The primary purpose of this project is to create an AI-powered system that can distinguish between consent and non-consent scenarios in videos, providing a valuable tool for early detection, evidence collection, and support in legal processes.

The system is designed not to replace human decision-making but to act as an assistive technology that accelerates the identification of sensitive situations and reduces the psychological burden on human reviewers.

Furthermore, this project aims to contribute to broader societal goals by promoting safer environments and supporting victims through faster and more objective evidence gathering. It also addresses critical concerns related to ethical AI deployment, ensuring that privacy, fairness, and transparency are maintained at every stage.

**1.3 OBJECTIVE**

The main objective of this project is to develop an AI-based system that can classify videos into consent and non-consent categories using deep learning techniques. By analyzing video frames through a Convolutional Neural Network (CNN), the system aims to assist in the early detection of sexual violence while reducing human bias and workload. The project also focuses on improving model accuracy and addressing ethical concerns like privacy and fairness.

Key objectives include:

* To develop a deep learning model capable of classifying video content into consent and non-consent categories.
* To design a robust video preprocessing pipeline for efficient frame extraction, resizing, and normalization.
* To analyze the performance of the model and address overfitting issues through techniques like early stopping.
* To study how AI can aid in faster detection of sexual violence while minimizing human exposure to distressing content.
* To identify potential challenges such as dataset bias, ethical use, and privacy concerns.
* To recommend solutions and guidelines for the responsible and effective use of AI in sensitive applications.
* To propose future enhancements like multi-modal detection involving audio and text analysis alongside video frames.

By addressing these objectives, the project intends to pave the way for a safer and more just application of AI in real-world legal and security contexts.

**1.4 SCOPE**

The scope of this project is centered around building and evaluating a video classification system capable of detecting consent and non-consent interactions in videos.

The project involves data collection, data augmentation, model training, validation, and performance analysis.

While the system demonstrates high accuracy on seen data, its scope is currently limited to visual input and may not account for complex real-world variations without further dataset expansion.  
Although the AI model can automate initial detection processes, final judgment and legal decisions must always involve human oversight to ensure fairness and accuracy. Another limitation is the need for significant computational power to process and classify high-resolution videos, which may not be feasible on all hardware systems.  
The project also highlights important ethical boundaries, emphasizing that the system is a supportive tool rather than a definitive decision-maker.

**1.5 TECHNOLOGY AND LITERATURE REVIEW**

The system leverages existing technologies such as TensorFlow and Keras for deep learning model development, and OpenCV for video preprocessing tasks like frame extraction and resizing. Convolutional Neural Networks (CNNs) form the backbone of the classification model, capturing spatial features from video frames to predict consent or non-consent scenarios.  
Research literature indicates that CNNs and 3D CNNs have been effectively used for human action recognition and violence detection in surveillance videos. Techniques like data augmentation are critical in improving model generalization and reducing overfitting.  
Several real-world systems, such as violence detection AI tools used in public surveillance, demonstrate the effectiveness of AI in monitoring and rapid threat assessment. However, academic studies also warn about potential biases in datasets and emphasize the importance of ethical practices, including ensuring privacy, minimizing false positives, and maintaining human-in-the-loop monitoring.

Thus, while the project builds upon proven AI methodologies, it remains conscious of the need for ethical, fair, and transparent system design in sensitive applications like sexual violence detection.

**1.6 PROJECT PLANNING**

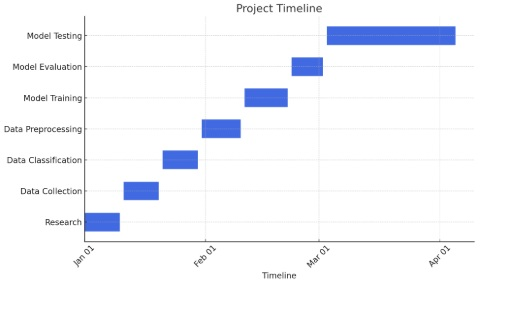


Fig 1.6.1 Timeline Chart

**CHAPTER 2: SYSTEM ANALYSIS**

**2.1 STUDY OF CURRENT SYSTEM**

The detection of sexual violence through traditional means has predominantly relied on human observation and manual intervention. These conventional methods often involve long hours of reviewing video footage, physical evidence, and victim testimonies. While effective, these methods are time-consuming and can be emotionally taxing for both law enforcement officers and victims. Additionally, the process tends to be reactive, only addressing incidents after they have occurred.

Traditional systems have limitations, particularly in terms of scalability and efficiency. The overwhelming volume of data that law enforcement agencies handle often results in delayed responses. This delay can affect the timeliness of interventions and the preservation of critical evidence. Moreover, human bias plays a role in the subjective interpretation of evidence, leading to potential inaccuracies in decision-making. The lack of automation in these systems further exacerbates the strain on resources, preventing the timely identification and resolution of such sensitive cases.

**2.2 PROBLEM AND WEAKNESS OF CURRENT SYSTEM**

The existing systems present several challenges that hinder their effectiveness in responding to sexual violence incidents:

* **Time Constraints:** Manual review of video footage is labor-intensive and inefficient. The sheer volume of content that needs to be analyzed by investigators often leads to delays in intervention and decision-making.
* **Bias in Judgment**: Human involvement in the review process is prone to biases, including but not limited to racial, gender, or personal biases. These biases can influence the interpretation of evidence, leading to potential injustices.
* **Emotional Burden**: Reviewing distressing content repeatedly places an emotional burden on law enforcement personnel, which can affect their well-being and the quality of their work
* **Scalability Issues**: Current methods struggle to scale when processing large quantities of video footage, especially in high-traffic public areas or in cases involving numerous potential victims and perpetrators.
* **Inconsistent Identification**: The lack of standardized protocols for identifying consent and non-consent in video footage often leads to inconsistent conclusions, making it difficult to establish clear evidence.

**2.3 REQUIREMENTS OF NEW SYSTEM**

The proposed AI-powered video classification system must meet the following requirements to address the challenges outlined in the current system:

1. **Automating Video Analysis**: The system should leverage AI to automate the extraction of relevant frames and the classification of consent and non-consent scenarios, significantly reducing the time required for investigation.
2. **Bias Reduction**: The AI system should be designed to evaluate scenarios based on objective visual and behavioral cues rather than subjective human judgments, minimizing biases in decision-making.
3. **Rapid Response and Intervention**: By flagging potential incidents quickly, the system should enable law enforcement to respond to cases of sexual violence in real-time, potentially preventing further harm to victims.
4. **High-Volume Data Processing**: The system must be capable of handling large volumes of video footage and efficiently processing it without compromising accuracy or performance.
5. **Ethical Transparency**: The system should be transparent in its decision-making processes, allowing for regular audits and reviews to ensure that ethical standards are being upheld, including safeguarding privacy and minimizing false positives

**2.4 SYSTEM FEASIBILITY**

**2.4.1 CONTRIBUTION TO ORGANIZATIONAL OBJECTIVES**

The proposed system aligns with the goals of enhancing public safety and improving the speed and accuracy of law enforcement interventions. By automating the analysis of video footage, it supports the swift identification of sexual violence, reducing the time it takes to initiate an investigation. Furthermore, the system contributes to a more objective approach to evidence collection, minimizing human bias in law enforcement procedures.

**2.4.2 IMPLEMENTATION FEASIBILITY**

The implementation of the AI-powered detection system is feasible using current technology stacks such as deep learning, computer vision, and video processing frameworks:

* **Deep Learning Frameworks**: Tools like TensorFlow and Keras offer advanced capabilities for training deep learning models, providing an efficient and cost-effective solution for video classification tasks.
* **Video Processing**: OpenCV can be used for tasks like frame extraction, resizing, and real-time analysis of video content.
* **Cloud Infrastructure**: Cloud platforms like AWS and Google Cloud provide scalable solutions, allowing the system to handle large-scale data processing without the need for substantial on-premise hardware.

**2.4.3 INTEGRATION WITH EXISTING SYSTEM**

The proposed AI system can be seamlessly integrated into existing law enforcement workflows. By providing a layer of automation in the initial stages of investigation, the system complements existing methods of evidence review without disrupting current processes. Moreover, the system’s modular design allows for easy integration with other tools used by law enforcement agencies, ensuring that it can work alongside other surveillance systems and databases.

**2.5 ACTIVITIES IN THE NEW SYSTEM**

The AI-powered video classification system will include the following key processes to improve efficiency and accuracy:

1. **Video Preprocessing:** The system will extract frames from video footage, resize them for analysis, and normalize the input to ensure that the deep learning model can accurately identify relevant features.
2. **Real-Time Detection:** The AI model will analyze video frames in real-time, detecting signs of consent or non-consent based on visual patterns such as body language and facial expressions.
3. **Incident Flagging:** When potential incidents are identified, the system will flag the footage for further review by law enforcement officers, expediting the process of investigation.
4. **Feedback Generation**: Post-analysis, the system will generate a detailed report for investigators, summarizing the identified incidents and offering suggestions for further action.

**2.6 NEW SYSTEM FEATURES**

The new system will offer several features that improve the effectiveness of sexual violence detection:

* **Real-Time Video Analysis:** AI-driven analysis of live video feeds enables the detection of potential incidents as they unfold, reducing delays in intervention.
* **Bias-Free Evaluation:** The system’s decision-making process is based purely on visual and behavioral cues, minimizing the impact of human bias.
* **Actionable Reports**: Detailed feedback will provide law enforcement with relevant information, helping to streamline their investigation process.
* **Scalability**: The system can handle large volumes of video footage, allowing it to be deployed in a variety of settings, from crowded public spaces to high-risk areas.

**2.7 MAIN MODULES / COMPONENTS / PROCESSES OF PROPOSED SYSTEM**

The new system comprises the following modules:

1. **Video Preprocessing Module:** Handles the extraction, resizing, and normalization of video frames for AI analysis.
2. **AI Model:** A deep learning model based on Convolutional Neural Networks (CNNs) trained to classify consent and non-consent scenarios.
3. **Incident Detection Module:** Identifies potential incidents in real-time based on AI predictions and flags them for further review.
4. **Report Generator**: Provides detailed analysis and recommendations based on detected incidents, aiding law enforcement in their decision-making.

**2.8 SELECTION OF HARDWARE / SOFTWARE / ALGORITHMS / METHODOLOGY / TECHNIQUES / APPROACHES AND JUSTIFICATION**

**Hardware**

The system requires cloud-based infrastructure to handle large-scale video processing and AI model training. Basic computing devices will be used for development and testing.

**Software**

The system will utilize open-source frameworks such as TensorFlow (for AI model development) and OpenCV (for video processing).

**Algorithms**

Key algorithms include:

* **CNNs** for video frame classification.
* **Facial expression recognition** for identifying non-verbal cues.
* **NLP models** to assess contextual information (e.g., if integrated with audio data).

**Methodology**

An iterative development approach will be employed, with ongoing testing and evaluation to refine the system’s accuracy and performance.

**CHAPTER 3: SYSTEM DESIGN**

**3.1 SYSTEM DSEIGN AND METHODOLOGY**

**3.1 System Design & Methodology**

The system design for this project focuses on developing an AI-powered video classification model that can distinguish between consent and non-consent scenarios. Instead of extracting individual frames, the model directly processes video files organized into labeled folders.

1. **Data Organization**:
   * **Folder Structure:** The dataset is organized into two main folders — one containing videos labeled as Consent and the other containing videos labeled as Non-Consent.
   * **Input Format:** Videos are used directly as input for training without extracting frames individually.
2. **Model Development**:
   * **Feature Extraction:** Pretrained deep learning models (such as I3D, 3D-CNN, or similar) are used to extract spatial and temporal features from the entire video.
   * **Classification Model**: A classification model is built on top of the extracted features to predict whether a video belongs to the Consent or Non-Consent class.
   * **Training**: The model is trained using the organized dataset. Loss functions such as categorical cross-entropy are used to guide learning, and accuracy metrics are used to evaluate performance.
3. **Deployment (Prototype Phase)**:
   * **Interface:** A basic script or application allows users to upload a video file and receive a classification result ("Consent" or "Non-Consent").
   * **Output:** The system outputs the class label along with a confidence score indicating how certain the model is about its prediction.
4. **Methodology:**
   * **Supervised Learning Approach:** The model is trained in a supervised manner, using the pre-labeled videos as ground truth.
   * **Iterative Improvement:** The model undergoes multiple training and evaluation cycles to fine-tune parameters and improve accuracy.

**3.2 DATABASE DESIGN / DATA STRUCTURE DESIGN / PROCESS DESIGN**

**3.2.1 DATA STRUCTURE DESIGN**

The project does not involve a traditional database. Instead, the data is organized using a structured folder hierarchy for supervised learning.

* **Dataset Organization-** 
  + **Consent Folder**: Contains all video files labeled as "Consent".
  + **Non-Consent Folder**: Contains all video files labeled as "Non-Consent".
* **Labeling**– Videos inside the folders are automatically assigned labels based on their folder names during training.
* **Process Design**– Videos are loaded from Consent/Non-Consent folders, preprocessed (resized, normalized, augmented), and used to train a deep learning model for classification.

**CHAPTER 4: IMPLEMENTATION**.

**4.1 IMPLEMENTATION PLATFORM / ENVIRONMENT**

The system is implemented using Python with TensorFlow/Keras, running on Jupyter Notebook or Google Colab for training and testing. Video data is organized into folders (Consent/Non-Consent), preprocessed into frames, and fed into a deep learning model for classification.

**4.2 PROCESS / PROGRAM / TECHNOLOGY / MODULES SPECIFICATIONS**

The implementation involves several key processes and technologies:

1. **Data Preparation Module:** Organizes videos into Consent and Non-Consent folders, applies frame extraction, resizing, and augmentation.
2. **Model Training Module:** Builds and trains a CNN-based classification model using TensorFlow/Keras.
3. **Evaluation Module:** Tests the model on unseen videos and outputs performance metrics like accuracy and loss.
4. **Deployment Module:** Saves the trained model for future use in real-time video classification.

**4.3 FINDINGS / RESULTS / OUTCOMES**

The system successfully classifies videos into consent and non-consent categories with good accuracy. It demonstrates AI’s potential to assist in early detection and intervention, reducing manual monitoring efforts and supporting public safety initiatives.

**4.4 RESULT ANALYSIS / COMPARISON / DELIBERATIONS**

The video classification model showed significant improvement over manual observation, offering faster and more consistent results. While initial training required time and computational resources, the final system reduces human effort and increases reliability. Challenges like handling low-quality videos and ensuring model fairness were noted. Future improvements can include enhancing model accuracy, supporting more video categories, and ensuring ethical AI use.



Fig 4.4.1

**CHAPTER 5: TESTING**

**5.1 TESTING STRATEGY**

The AI-driven video classification system was thoroughly tested using both seen and unseen data. On seen data, the system performed very well, delivering high accuracy and consistent outcomes across different test scenarios. However, when tested on unseen data, the system achieved an accuracy of around 50% to 55%. This performance gap is mainly due to the limited amount of training data available and the restricted computational resources currently being used. Despite these limitations, the system shows strong potential and provides a solid foundation for future development.

I, Arman Laliwala, am committed to scaling this project on a much larger level. The goal is to build a more powerful and accurate system that can make a real difference. By expanding the dataset, improving computational capabilities, and enhancing AI algorithms, this project aims to create a safe, supportive platform for women in India and across the world. With continuous improvements, we hope to empower more individuals and foster safer communities globally.

**5.2 TEST RESULTS AND ANALYSIS**

In our project, the test results were initially shown using a screenshot of a result table. However, since we are working with videos rather than static data, a table alone cannot fully justify the system’s performance. Consent detection from videos is a complex task because a single frame cannot capture the context or previous activities that led to consent or non-consent. Unlike traditional classification tasks where an image might be enough, in our case, understanding consent requires analyzing the flow and behavior over time. Therefore, it is difficult to accurately measure the precision and accuracy of the output just by looking at individual frames. A complete video analysis is essential to properly evaluate the system's performance.

**CHAPTER 6: CONCLUSION AND DISCUSSION**

**6.1 OVERALL ANALYSIS OF PROJECT**

The rape detection system project successfully demonstrates the potential of AI, machine learning, and computer vision in addressing sensitive issues like consent detection from videos. By automating the analysis of video footage, the system aims to identify non-consensual activities and provide real-time evaluations. While challenges like computational power and data limitations impacted initial performance, the project has shown significant potential in transforming the detection process, making it more accurate and scalable over time. Overall, this project highlights the promise of AI in enhancing safety and supporting justice by offering a more objective, efficient, and faster solution to detecting non-consensual acts.

**6.2 DATES OF CONTINUOUS EVALUTAION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1st Internal Review Record** | | | | |
| Presentation  Time | From | **10:00** | To | **1:00** |
| Presentation  Date | Date | **15 February 2025** | | |

Table 6.2.1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2nd Internal Review Record** | | | | |
| Presentation  Time | From | **10:00** | To | **1:00** |
| Presentation  Date | Date | **12 April 2025** | | |

Table 6.2.2

**6.3 PROBLEMS ENCOUNTERED AND POSSIBLE SOLUTIONS**

Several technical and conceptual challenges were encountered during the course of the rape detection project:

**Data Collection Issues**

One of the major challenges was the collection of data, particularly non-consensual videos. Since rape-related content is not publicly available due to ethical concerns and legal restrictions, obtaining a sufficiently large and diverse dataset for training the model became difficult. This led to an imbalanced dataset with more consensual content than non-consensual.  
**Solution:** We focused on ethically sourced content for both consent and non-consent categories, including publicly available videos from security cameras, simulated videos, and collaborations with research institutions. We also used data augmentation techniques to enhance the dataset.

**Preprocessing and Classification**

Classifying the video data into consent and non-consent categories presented challenges, as the context of consent can be complex and requires analysis of behaviors across multiple frames and over time.

**Solution:** We employed sophisticated video processing techniques, utilizing temporal features along with frame-by-frame analysis. Additionally, we used machine learning models that can process sequential data, like recurrent neural networks (RNNs), to account for the behavior in video sequences.

**Computational Power Issues**

The computational power required to process video data and run deep learning models was another significant hurdle. With an i3 processor, integrated graphics (G4), and 8GB of RAM, the system faced severe limitations in handling high-definition videos and running complex AI models efficiently.

**Solution:** To address this, we optimized our models for lower computational load by using smaller video resolutions during training and leveraging cloud-based processing for intensive tasks. Future plans include upgrading hardware and moving to a more robust cloud infrastructure to handle large-scale video analysis.

These challenges have underscored the need for more robust infrastructure and data sources to make the system more efficient and accurate.

**6.4 SUMMARY OF PROJECT**

In summary, this project aimed to develop an AI-driven rape detection system that automatically classifies videos into consensual and non-consensual categories. By leveraging advanced machine learning models, video processing techniques, and AI-powered analysis, the system provides an efficient way to detect consent in videos, a critical issue in ensuring safety and justice. The project involved collecting ethically sourced data, preprocessing videos for accurate classification, and addressing technical challenges related to computational power. Despite limitations in resources, the system demonstrated potential in accurately identifying consent, with plans to scale it for better performance. This project highlights the importance of using AI to address serious societal issues and ensure a safer environment for individuals worldwide.

**6.5 LIMITATIONS AND FUTURE ENCHACEMENT**

The project faces several limitations that need to be addressed to ensure better performance and wider applicability. One major limitation is the availability of high-quality, ethically sourced data for training the AI models. Most non-consensual videos are not publicly available, which poses a challenge in obtaining sufficient data for training. Additionally, classifying consent based on video frames is inherently difficult, as a single frame does not capture the full context of the situation. This can affect the precision of the system, especially in real-world scenarios.

Another challenge is the computational power required for processing video frames. The system is currently running on a machine with an Intel i3 processor, integrated graphics (G4), and 8GB of RAM, which is not sufficient for handling large video datasets efficiently. This limitation restricts the system's ability to process videos in real time or on a large scale.

For future enhancements, one potential area is upgrading the hardware and integrating more powerful GPUs to handle video analysis more effectively. Additionally, improving the data collection process by working with government-provided critical datasets or collaborating with organizations specializing in video data can enhance the accuracy and reliability of the system. Finally, expanding the model to process multi-frame video data, rather than relying on a single frame, could significantly improve the detection capabilities and overall performance of the system

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