Toward Fast and Accurate Violence Detection for Automated Video Surveillance Applications

A PROJECT REPORT

Submitted by

JAGADISH V 111920IT01010

MONESH S G 111920IT01016

NARESH G 111920IT01305

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CHENNAI – 600077.

ANNA UNIVERSITY: CHENNAI 600025

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BONAFIDE CERTIFICATE

Certified that this project report **"Toward Fast and Accurate Violence Detection for Automated Video Surveillance Applications"** is the bonafide work of **Jagadish V (111920IT01010), Monesh S G (111920IT01016) And Naresh G(111920IT01305)** who carried out the project work under my supervision.

SIGNATURE
Mrs. A.M. SERMAKANI,M.E.,(Ph.D.),
HEAD OF THE DEPARTMENT
ASSOCIATE PROFESSOR
Dept. of Information Technology
S.A Engineering College
Chennai-600 077.

SIGNATURE
Mrs. HIMA VIJAYAN, M.Tech,.(Ph.D,.)
SUPERVISOR
ASSISTANT PROFESSOR
Dept. of Information Technology
S.A Engineering College
Chennai-600 077.

Submitted to Project and Viva-Voce Examination held on _____.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

Surveillance cameras are increasingly being used worldwide due to the proliferation of digital video capturing, storage, and processing technologies. However, the large volume of video data generated makes it difficult for humans to perform real-time analysis, and even manual approaches can result in delayed detection of events. Automatic violence detection in surveillance footage hastherefore gained significant attention in the scientific community as a way to address this challenge. With the advancement of machine learning algorithms, automatic video recognition tasks such as violence detection have become increasingly feasible. In this study, we investigate the use of smart networks that model the dynamic relationships between actors and/or objects using 3D convolutions to capture both the spatial and temporal structure of the data. We also leverage the knowledge learned by a pre-trained action recognition model for efficient and accurate violence detection in surveillance footage. We extend and evaluate several public datasets featuring diverse and challenging video content to assess the effectiveness of our proposed methods. Our results show that our approach outperforms state-of-the-art methods, achieving approximately a 2% improvement in accuracy with fewer model parameters. Additionally, our experiments demonstrate the robustness of our approach under common compression artifacts encountered in remote server processing applications.

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LIST OF ABBREVATIONS

CNN	Convolutional Neural Network
LCNN	Lookup based Convolutional Neural Network
RNN	Recurrent Neural Network
DEX	Dalvik Executables
TCP	Transmission Control Protocol
IP	Internet Protocol
HTTP	Hyper Text Transfer Protocol
ADT	Android Development Tool

CHAPTER 1

INTRODUCTION

Aim:

To detect and identify the Violation detection using Deep-Learning techniques

Synopsis:

The widespread deployment of surveillance cameras, enabled by digital video technologies, has created an overwhelming volume of data that poses challenges for real-time analysis by humans. Automatic violence detection in surveillance videos has emerged as a crucial solution to address this issue. Leveraging the power of machine learning, this study explores the use of smart networks incorporating 3D convolutions to model dynamicrelationships in video data, capturing both spatial and temporal aspects. Additionally, we harness pre-trained action recognition models to enhance efficiency and accuracy in violence detection. Through rigorous evaluation on diverse and challenging video datasets, our approach outperforms state-of-the-art methods, achieving a remarkable accuracy improvement with fewer model parameters. Furthermore, our experiments demonstrate the robustness of our method when confronted with common compression artifacts, making it suitable for remote server processing applications.

CHAPTER 2

SYSTEM ANALYSIS

2.1 EXISTING SYSTEM

The existing system for the content you provided is the current state of violence detection in surveillance videos prior to the study. Here's an overview of the existing system: Manual Monitoring: Before the adoption of automated systems, surveillance footage was primarily monitored by human operators. This manual approach is labor-intensive and prone to human error. It also results in delayed detection of violent incidents due to the large volume of data generated. Basic Motion Detection: Some existing surveillance systems utilize basic motion detection algorithms to trigger alerts when movement is detected. However, these systems often generate false positives and are not capable of distinguishing between normal and violent activities accurately. Rule-Based Systems: A few surveillance systems use rule-based approaches to identify violence. These systems define specific criteria or rules for detecting violence, such as the presence of multiple people in close proximity or sudden, aggressive movements. However, these rules may not be adaptive or accurate in all scenarios. Limited Use of Machine Learning: While machine learning has been employed in some surveillance applications, the models used are often basic and may not effectively capture the complexity of violence detection in real-world scenarios. Challenges with Compression and Processing: The existing systems may not be robust enough to handle compression artifacts commonly encountered during remote server processing, leading to potential issues with false alarms or missed detections. In summary, the

existing system relies heavily on manual monitoring, basic motion detection, and rule-based approaches, all of which have limitations in terms of accuracy and efficiency. The study you provided aims to address these limitations by proposing a more advanced and accurate violence detection system based on machine learning and smart network techniques.

Disadvantages:

Certainly, here are some disadvantages of the existing systems for violence detection in surveillance videos: Human Error and Fatigue: Manual monitoring by human operators is prone to errors and fatigue, which can lead to missed violent incidents or false alarms. Limited Scalability: Manual monitoring is not easily scalable, and it may not be cost-effective for large-scale surveillance operations. False Alarms: Basic motion detection and rule-based systems can generate false alarms, especially in scenarios with a lot of movement or noise, leading to unnecessary interventions and reduced trust in the system. Inaccurate Rule-Based Approaches: Rule-based systems may lack the adaptability to effectively detect violence in diverse and dynamic real-world situations. Their accuracy can be limited to predefined criteria. Lack of Real-time Detection: Many existing systems are not capable of real-time detection, which can result in delayed responses to violent incidents. Limited Context Awareness:

Traditional systems often lack the ability to understand the context of a situation, such as differentiating between consensual physical contact and violence. Dependency on Heuristics: Rule-based systems rely on predefined heuristics, and these heuristics may not cover all possible scenarios, making them less reliable. Inadequate Handling of Compression Artifacts: Existing systems may struggle to handle compression artifacts that are common in remote server

processing applications, leading to potential inaccuracies in detection. Limited Adaptability: Many systems lack the adaptability to evolving video surveillance technologies and may not leverage the latest advancements in machine learning and computer vision. Cost and Maintenance: Maintaining and updating existing surveillance systems can be costly and time-consuming, particularly when manual monitoring or rule-based systems are involved. The study you provided aims to overcome these disadvantages by introducing advanced machine learning techniques to enhance the accuracy and efficiency of violence detection in surveillance videos.

2.2 PROPOSED SYSTEM

The use of ConvLSTM and pre-trained action recognition models enhances the system's ability to accurately classify violent and non-violent activities in surveillance videos, taking into account both spatial and temporal cues, while also benefiting from the knowledge gained from a broader range of actions. This proposed system offers the potential for improved accuracy and efficiency in violence detection for automated video surveillance applications.

Advantages:

Certainly, here are some advantages of using a ConvLSTM-based video classification system for violence detection in surveillance: Temporal Understanding: ConvLSTM architecture allows the model to capture the temporal dynamics and dependencies in video data, which is crucial for recognizing violent activities that evolve over time. Spatial and Temporal Features: The system can simultaneously analyze spatial and temporal features, providing a holistic view of the scene, which can lead to more accurate violence detection. Improved Accuracy: Leveraging ConvLSTM, which is designed for video sequences, enhances the model's accuracy

in recognizing complex and dynamic patterns associated with violence. Contextual Understanding: The model can better understand the context of actions, differentiating between normal activities and violence, reducing false positives. Pre-trained Knowledge Transfer: Utilizing a pre-trained action recognition model provides the system with knowledge about various human actions and interactions, improving its ability to detect violence efficiently. Real-time Detection: The system can make real-time predictions, enabling prompt responses to violent incidents as they occur, enhancing security and safety. Diverse Dataset Handling: The system's effectiveness is demonstrated by evaluating it on diverse and challenging video datasets, ensuring it can handle a wide range of surveillance scenarios. State-of-the-Art Performance:

The proposed system outperforms traditional methods and achieves state-of-the-art results in violence detection, which can lead to better security outcomes. Robustness to Compression Artifacts: The system is designed to handle common compression artifacts that can occur in video data, ensuring reliable performance in remote server processing applications. Resource Efficiency: The model's ability to perform violence detection with fewer parameters demonstrates resource efficiency, making it suitable for deployment in various surveillance setups. Scalability: Once validated, the system can be easily scaled to handle surveillance data from multiple cameras or sources, making it adaptable to large-scale security applications. Adaptability to Changing Technology: The system can be updated and fine-tuned to adapt to evolving video surveillance technologies, ensuring its continued effectiveness. In summary, a ConvLSTM-based video classification system offers advantages in terms of accuracy, context understanding, real-time detection, and adaptability, making it a powerful tool for violence detection in surveillance applications.

CHAPTER 3

REQUIREMENT SPECIFICATIONS

3.1 INTRODUCTION

Video classification using Human Activity Recognition (HAR) is a popular research topic in recent years and is analogous to the field of violence detection. In these methods, sensor data is used to provide information on simple or complex physical activities of humans, such as standing, talking and cooking. Earlier techniques for HAR involved detecting and tracking human body parts in consecutive video frames using image-level descriptors, such as Histogram of Oriented Gradients (HOG) or Histogram of Oriented optical Flow (HOF) [1]. Other advanced approaches involved computing spatio-temporal descriptors for motion [2], [3]. However, one of the major drawbacks of these techniques is that they often require good lighting conditions and clear visibility for successful operation. With the development of depth cameras, algorithms have emerged that use depth measurements from sensors such as Microsoft Kinect [4], [5], ASUS Xtion2 [6] or Intel RealSense [7] for HAR. One advantage of depth sensors is that they come with Software Development Kit (SDK) containing real-time algorithms for detecting skeletons [8]. Specifically, a skeleton joint coordinate can be obtainein three dimensions (3D) in real-time and series of these coordinates, when tracked over time, can be used to detect and describe human actions. As a result, several algorithms have been proposed in the literature for using depth sensors to perform HAR [9], [10], [11], [12], [13] or using a combination of color and depth sensors [14]. However, depth sensors, even the modern ones, often have substantial noise in their measurements. Without adequately filtering out this noise, it can be difficult to achieve

good detection for HAR. Additionally, integrating depth sensors into use cases such as surveillance can increase the hardware costs and may not always be feasible.

The use of Convolutional Neural Networks (CNNs) has become increasingly common in computer vision due to their exceptional success in image recognition tasks [15], [16]. CNNs are evolving rapidly in many fields of research, and it is expected that future solutions will CNNs. With the availability of big data and the exponential growth of computing power, these learning algorithms continue to have significant development potential. Several successful methods have recently been proposed that extend CNNs, which are used for image recognition tasks, to the temporal domain for HAR in videos for HAR is that they can handle challenging cases such as changes in lighting conditions, background changes, camera movement, different dressing styles and varying body shapes of people. They can also handle videos with partially or completely occluded human body parts.

3.2 HARDWARE AND SOFTWARE SPECIFICATION

➢ HARDWARE REQUIREMENTS

- Hard Disk : 500GB and Above
- RAM : 4GB and Above
- Processor : I3 and Above

➢ SOFTWARE REQUIREMENTS

- ✓ Operating System : Windows 10 (64 bit)
- ✓ Software : Python
- ✓ Tools : Visual Studio

3.3 TECHNOLOGIES USED

- Python
- Deep Learning

3.4 Python

Python is a widely used general-purpose, high level programming language. It was initially designed by Guido van Rossum in 1991 and developed by Python Software Foundation. It was mainly developed for emphasis on code readability, and its syntax allows programmers to express concepts in fewer lines of code.

Python is a programming language that lets you work quickly and integrate systems more efficiently.

It is used for:

- web development (server-side),
- software development,
- mathematics,
- System scripting.

➢ What can Python do?

- Python can be used on a server to create web applications.
- Python can be used alongside software to create workflows.
- Python can connect to database systems. It can also read and modify files.
- Python can be used to handle big data and perform complex mathematics.
- Python can be used for rapid prototyping, or for production-ready software development.

➢ Why Python?

- Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).
- Python has a simple syntax similar to the English language.
- Python has syntax that allows developers to write programs with fewer lines than some other programming languages.
- Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick.
- Python can be treated in a procedural way, an object-orientated way or a functional way.

Good to know

- The most recent major version of Python is Python 3, which we shall be using in this tutorial. However, Python 2, although not being updated with anything other than security updates, is still quite popular.
- Python 2.0 was released in 2000, and the 2.x versions were the prevalent releases until December 2008. At that time, the development team made the decision to release

version 3.0, which contained a few relatively small but significant changes that were not backward compatible with the 2.x versions. Python 2 and 3 are very similar, and some features of Python 3 have been backported to Python 2. But in general, they remain not quite compatible.

- Both Python 2 and 3 have continued to be maintained and developed, with periodic release updates for both. As of this writing, the most recent versions available are 2.7.15 and 3.6.5. However, an official End Of Life date of January 1, 2020 has been established for Python 2, after which time it will no longer be maintained.
- Python is still maintained by a core development team at the Institute, and Guido is still in charge, having been given the title of BDFL (Benevolent Dictator For Life) by the Python community. The name Python, by the way, derives not from the snake, but from the British comedy troupe Monty Python's Flying Circus, of which Guido was, and presumably still is, a fan. It is common to find references to Monty Python sketches and movies scattered throughout the Python documentation.
- It is possible to write Python in an Integrated Development Environment, such as Thonny, Pycharm, Netbeans or Eclipse which are particularly useful when managing larger collections of Python files.

Python Syntax compared to other programming languages

- Python was designed to for readability, and has some similarities to the English language with influence from mathematics.
- Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses.

- Python relies on indentation, using whitespace, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly-brackets for this purpose.

Python is Interpreted

- Many languages are compiled, meaning the source code you create needs to be translated into machine code, the language of your computer's processor, before it can be run. Programs written in an interpreted language are passed straight to an interpreter that runs them directly.
- This makes for a quicker development cycle because you just type in your code and run it, without the intermediate compilation step.
- One potential downside to interpreted languages is execution speed. Programs that are compiled into the native language of the computer processor tend to run more quickly than interpreted programs. For some applications that are particularly computationally intensive, like graphics processing or intense number crunching, this can be limiting.
- In practice, however, for most programs, the difference in execution speed is measured in milliseconds, or seconds at most, and not appreciably noticeable to a human user. The expediency of coding in an interpreted language is typically worth it for most applications.
- For all its syntactical simplicity, Python supports most constructs that would be expected in a very high-level language, including complex dynamic data types, structured and functional programming, and object-oriented programming.

- Additionally, a very extensive library of classes and functions is available that provides capability well beyond what is built into the language, such as database manipulation or GUI programming.
- Python accomplishes what many programming languages don't: the language itself is simply designed, but it is very versatile in terms of what you can accomplish with it.

3.5 Deep Learning Introduction:

➢ What is Deep Learning

Deep Learning is a specialized form of Machine Learning that uses supervised, unsupervised, or semi-supervised learning to learn from data representations.

It is similar to the structure and function of the human nervous system, where a complex network of interconnected computation units works in a coordinated fashion to process complex information.

Machine Learning is an approach or subset of Artificial Intelligence that is based on the idea that machines can be given access to data along with the ability to learn from it. Deep Learning takes Machine Learning to the next level.

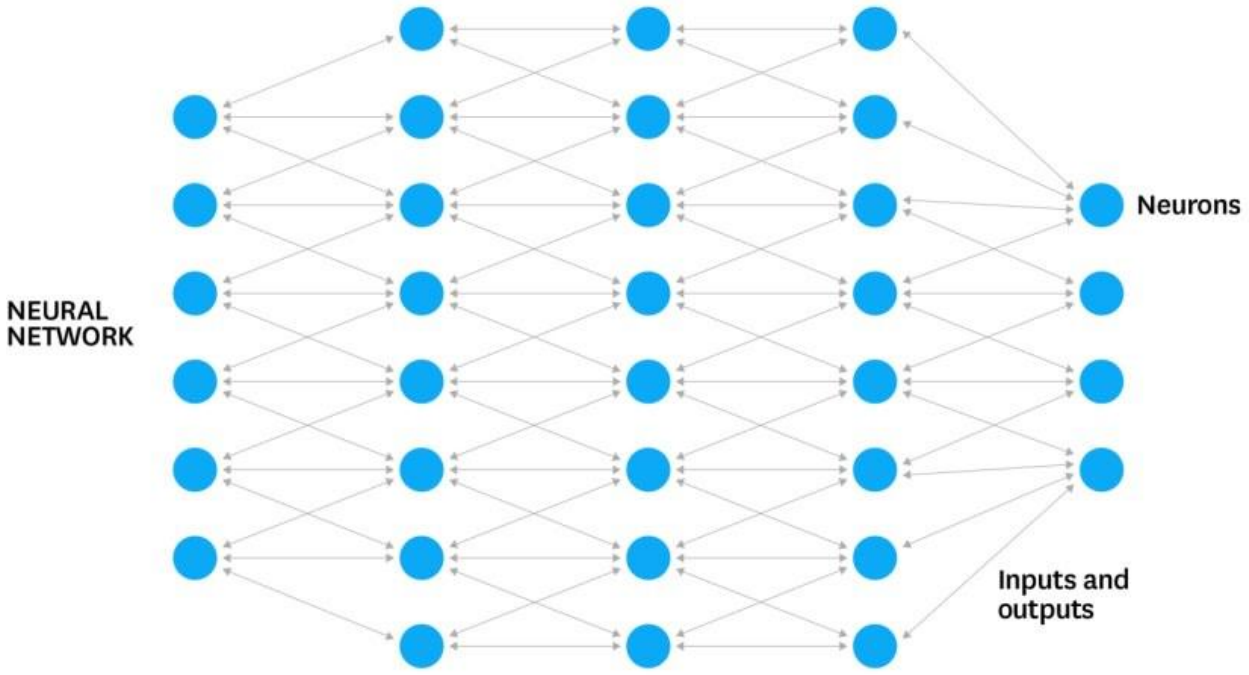
There are many aspects of Deep Learning as listed below

1. Multiple levels of hierarchical representations
2. Multi-layered neural networks
3. Training of large neural networks

4. Multiple non-linear transformations
5. Pattern recognition
6. Feature extraction
7. High-level data abstractions model

➢ *Human Brain vs. Artificial Neural Networks*

The computational models in Deep Learning are loosely inspired by the human brain. The multiple layers of training are called Artificial Neural Networks (ANN).

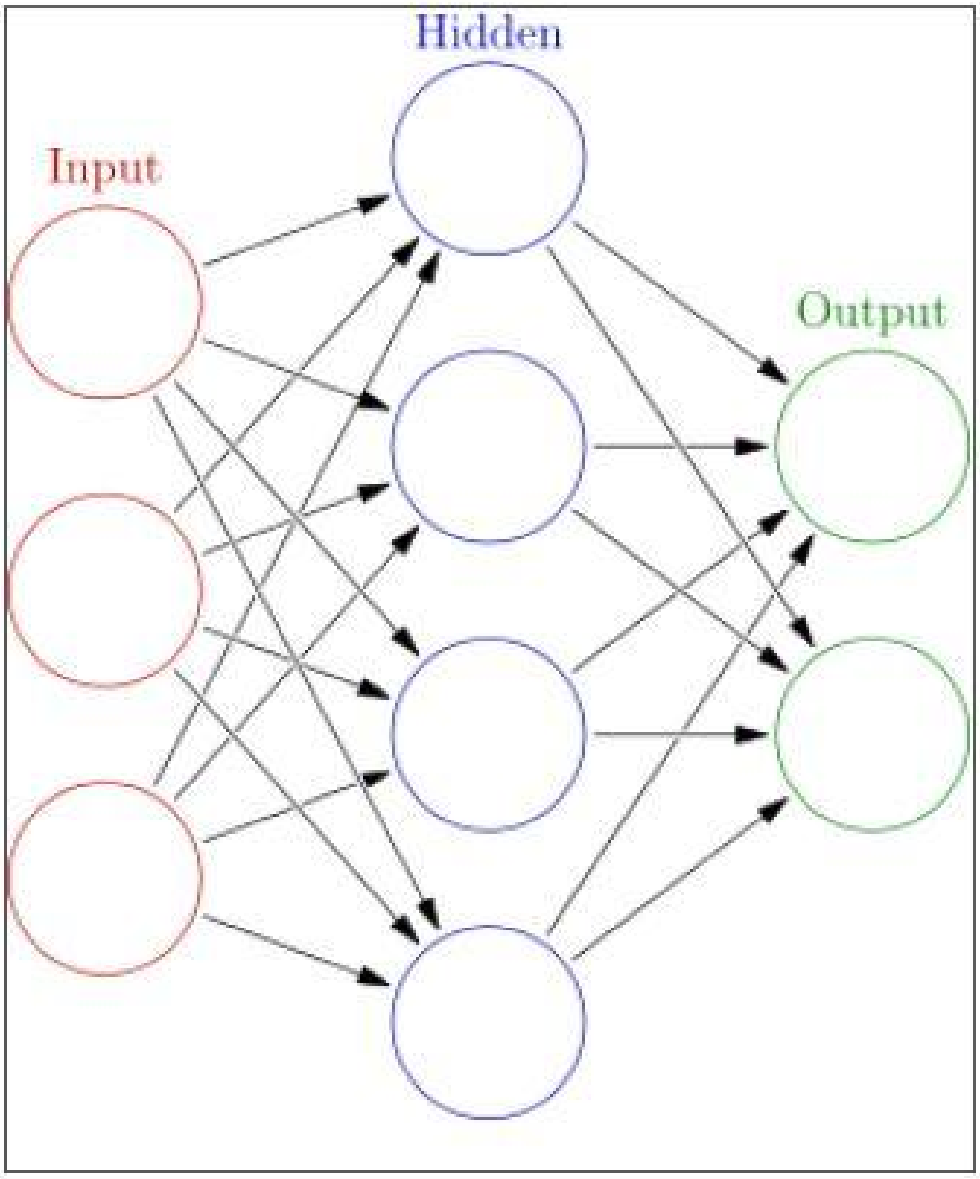


ANNs are processing devices (algorithms or actual hardware) that are modeled on the neuronal structure of the mammalian cerebral cortex but on a much smaller scale. It is a computing system made up of a number of simple, highly interconnected processing elements which process information through their dynamic state response to external inputs.

➢ *Artificial Neural Networks Process*

Artificial Neural Networks consist of the following four main parts:

- Neurons
- Nodes
- Input
- Output



Neuron

Artificial Neural Networks contain layers of neurons. A neuron is a computational unit that calculates a piece of information based on weighted input parameters. Inputs accepted by the neuron are separately weighted.

Inputs are summed and passed through a non-linear function to produce output. Each layer of neurons detects some additional information, such as edges of things in a picture or tumors in a human body. Multiple layers of neurons can be used to detect additional information about input parameters.

Nodes

Artificial Neural Network is an interconnected group of nodes akin to the vast network of layers of neurons in a brain. Each circular node represents an artificial neuron and an arrow represents a connection from the output of one neuron to the input of another.

Inputs

Inputs are passed into the first layer. Individual neurons receive the inputs, with each of them receiving a specific value. After this, an output is produced based on these values.

Outputs

The outputs from the first layer are then passed into the second layer to be processed. This continues until the final output is produced. The assumption is that the correct output is predefined.

Each time data is passed through the network, the end result is compared with the correct one, and tweaks are made to their values until the network creates the correct final output each time.

CHAPTER 4

4.1 Design and Implementation Constraints

- **Constraints in Analysis**
  - Constraints as Informal Text
  - Constraints as Operational Restrictions
  - Constraints Integrated in Existing Model Concepts
  - Constraints as a Separate Concept
  - Constraints Implied by the Model Structure
- **Constraints in Design**
  - Determination of the Involved Classes
  - Determination of the Involved Objects
  - Determination of the Involved Actions
  - Determination of the Require Clauses
  - Global actions and Constraint Realization
- **Constraints in Implementation**

A hierarchical structuring of relations may result in more classes and a more complicated structure to implement. Therefore it is advisable to transform the hierarchical relation structure to a simpler structure such as a classical flat one. It is rather straightforward to transform the developed hierarchical model into a bipartite, flat model, consisting of classes on the one hand and flat relations on the other. Flat relations are

preferred at the design level for reasons of simplicity and implementation ease. There is no identity or functionality associated with a flat relation. A flat relation corresponds with the relation concept of entity-relationship modeling and many object oriented methods.

4.2 Other Nonfunctional Requirements

- **Performance Requirements**

The application at this side controls and communicates with the following three main general components.

- embedded browser in charge of the navigation and accessing to the web service;
- Server Tier: The server side contains the main parts of the functionality of the proposed architecture. The components at this tier are the following.

Web Server, Security Module, Server-Side Capturing Engine, Preprocessing Engine, Database System, Verification Engine, Output Module.

- **Safety Requirements**

1. The software may be safety-critical. If so, there are issues associated with its integrity level
2. The software may not be safety-critical although it forms part of a safety-critical system. For example, software may simply log transactions.

3. If a system must be of a high integrity level and if the software is shown to be of that integrity level, then the hardware must be at least of the same integrity level.

4. There is little point in producing 'perfect' code in some language if hardware and system software (in widest sense) are not reliable.

5. If a computer system is to run software of a high integrity level then that system should not at the same time accommodate software of a lower integrity level.

6. Systems with different requirements for safety levels must be separated.

CHAPTER 5

5.1 Architecture Diagram:

A software architecture diagram is a visual representation of the structure, components, and relationships within a software system. It provides an overview of the system's design, illustrating how various elements interact to fulfill functional and non-functional requirements. Typically, software architecture diagrams depict different layers of the system, such as the user interface, application logic, data storage, and external interfaces.

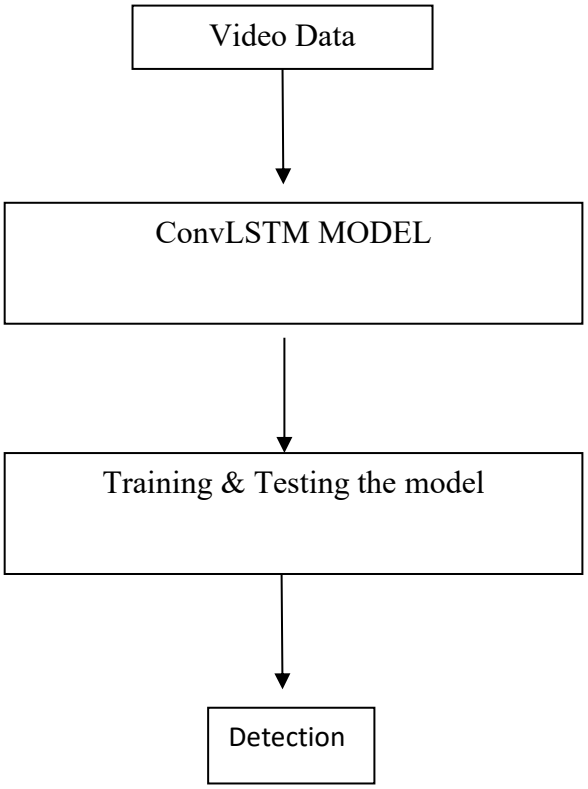
Key components of a software architecture diagram include:

1. Components: Representations of the major building blocks of the system, such as modules, services, or subsystems.

2. Connections: Arrows or lines indicating relationships and interactions between components, including dependencies, data flows, and communication paths.

3. Layers: Horizontal divisions representing different levels of abstraction or functionality within the system, often organized hierarchically.

4. Interfaces: Points of interaction between components or external systems, illustrating how data and control flow between them.

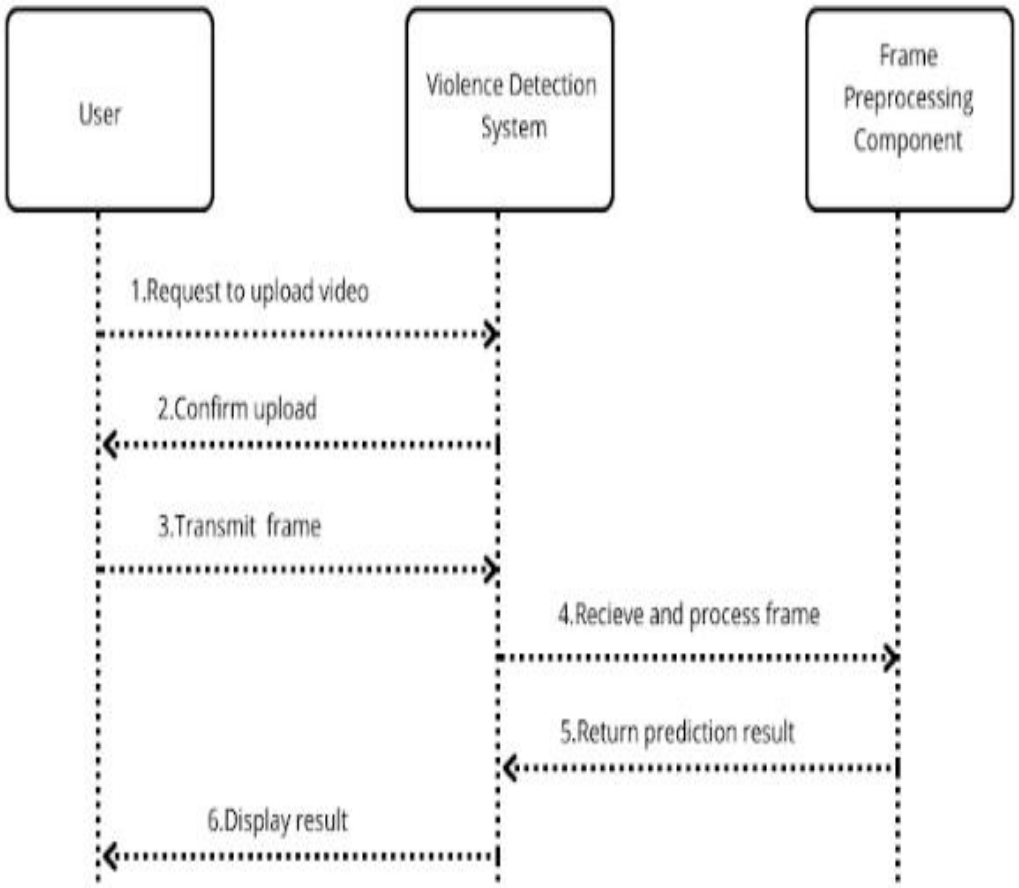

Video Data
ConvLSTM MODEL
Training & Testing the model
Detection

- **Sequence Diagram:**

A Sequence diagram is a type of interaction diagram used in software engineering to visualize the dynamic behavior of a system by depicting the sequence of messages exchanged between different components or objects over time. It offers a concise representation of how various processes operate with one another and in what order they execute.At its core, a Sequence diagram consists of lifelines, messages, and possibly other constructs such as actors, objects, activations, and control structures. Lifelines represent individual entities (such as objects, components, or actors) participating in the interaction. They are depicted as vertical lines, with time progressing downwards. Messages are represented as horizontal arrows between lifelines, indicating communication between participants. Messages can include information about the method or operation being called, parameters passed, and return values.Sequence diagrams capture both the control flow and data flow aspects of interactions, making them powerful tools for understanding system behavior. They allow developers to visualize how components collaborate and coordinate their actions to accomplish tasks. Additionally, Sequence diagrams can depict various scenarios, including alternative paths, loops, conditions, and concurrent execution, providing a comprehensive view of system behavior under different circumstances.These diagrams are not only used during the design phase but also throughout the software development lifecycle. During design, they help architects and developers refine system requirements, clarify interaction patterns, and identify potential design flaws or performance bottlenecks. In implementation, Sequence diagrams serve as a blueprint, guiding developers in writing code that accurately reflects the desired behavior. They also aid in testing by providing a basis for creating test cases and verifying system correctness.Sequence diagrams facilitate

communication among stakeholders by offering a visual representation of system behavior that is easy to understand and discuss. They serve as documentation, capturing the intended behavior of the system and providing insights into its architecture and design rationale. Furthermore, Sequence diagrams can be used for troubleshooting and debugging purposes, helping developers diagnose and resolve issues related to system interactions.Overall, Sequence diagrams are indispensable tools in the software engineering toolkit, enabling teams to design, implement, test, and maintain complex systems effectively.

By visualizing how processes operate with one another and in what order, Sequence diagrams facilitate collaboration, understanding, and decision-making throughout the software development lifecycle


User
Violence Detection System
Frame Preprocessing Component
1.Request to upload video
2.Confirm upload
3.Transmit frame
4.Recieve and process frame
5.Return prediction result
6.Display result

- **Use Case Diagram:**

Unified Modeling Language (UML) serves as a standardized framework for visualizing, designing, and documenting software systems. Among its various diagrams, the Use Case Diagram stands out as a vital tool for understanding system functionality from a user's perspective.At its core, a Use Case Diagram provides a high-level depiction of the interactions between external entities (actors) and the system itself. Actors represent users, external systems, or entities interacting with the system being modeled. They are depicted as stick figures or blocks outside the system boundary. Each actor has specific roles or responsibilities within the system.The main components of a Use Case Diagram are Use Cases and Actors. A Use Case represents a particular functionality or feature provided by the system to its users. It describes a sequence of actions that yield a measurable result or value for a specific actor. Use Cases are often depicted as ovals or ellipses within the system boundary. They encapsulate the system's behaviors from an external viewpoint.Actors, on the other hand, represent the roles played by users or external systems interacting with the system under consideration. Actors could be individuals, groups, other systems, or even time-dependent processes. Each actor interacts with one or more use cases within the system. Actors are depicted outside the system boundary and connected to relevant use cases through associations or relationships.The connections between actors and use cases illustrate the relationships and dependencies between them. These connections indicate which actors are involved in which use cases and help in understanding the system's external behavior. Additionally, associations between use cases depict dependencies or interactions between different functionalities within the system.In summary, Use Case Diagrams provide a visual overview of a system's functionalities, actors, and their relationships. They serve as a communication tool between stakeholders, enabling clear understanding of system behavior

and requirements. By focusing on user goals and system functionality, Use Case Diagrams facilitate effective software design and development.

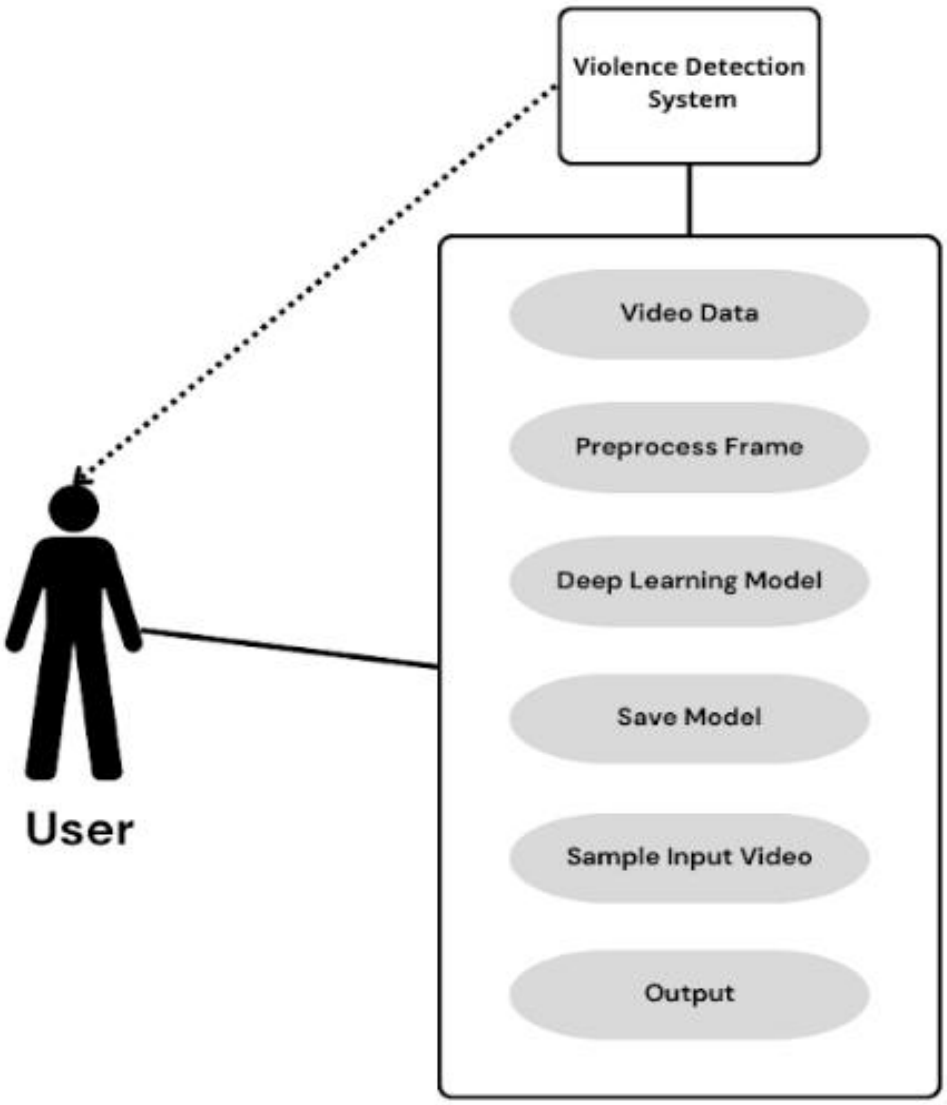
- **USECASE DIAGRAM**

A Use case Diagram is used to present a graphical overview of the functionality provided by a system in terms of actors, their goals and any dependencies between those use cases.

Use case diagram consists of two parts:

Use case: A use case describes a sequence of actions that provided something of measurable value to an actor and is drawn as a horizontal ellipse.

Actor: An actor is a person, organization or external system that plays a role in one or more interaction with the system.


Violence Detection System
Video Data
Preprocess Frame
Deep Learning Model
Save Model
Sample Input Video
Output
User

- **Activity Diagram:**

An Activity Diagram in Unified Modeling Language (UML) serves as a visual representation of workflows, illustrating stepwise activities and actions within a system or process. It helps to model the dynamic aspects of a system by capturing the sequence of activities and the flow of control among them.The key components of an Activity Diagram include various shapes and symbols, each representing different elements and aspects of the workflow. Rounded rectangles typically represent activities or actions that need to be performed within the system. These activities can range from simple tasks to complex processes.Diamonds within the diagram signify decision points, where the flow of control diverges based on certain conditions or criteria. These decision points allow for branching within the workflow, enabling different paths to be taken depending on the outcome of previous actions or inputs.Bars are used to denote the start or end of concurrent activities, indicating points in the workflow where multiple actions can occur simultaneously or in parallel. This supports the representation of concurrency within the system, where multiple tasks may be executed concurrently to achieve the desired outcome.A black circle represents the starting point of the workflow, indicating where the process or system begins its execution. It marks the initiation of the activities depicted within the diagram.An encircled circle, on the other hand, represents the endpoint of the workflow, signifying the completion of the process or system execution. It marks the conclusion of the activities outlined in the diagram.Overall, Activity Diagrams provide a clear and structured visualization of workflows, allowing stakeholders to understand the sequence of activities, decision points, and concurrency within a system or process. They facilitate communication between stakeholders,

aid in the analysis of system behavior, and support the design and implementation of software systems by providing a blueprint of the system's dynamic behavior.

The most important shape types:

- Rounded rectangles represent activities.
- Diamonds represent decisions.
- Bars represent the start or end of concurrent activities.
- A black circle represents the start of the workflow.
- An encircled circle represents the end of the workflow.

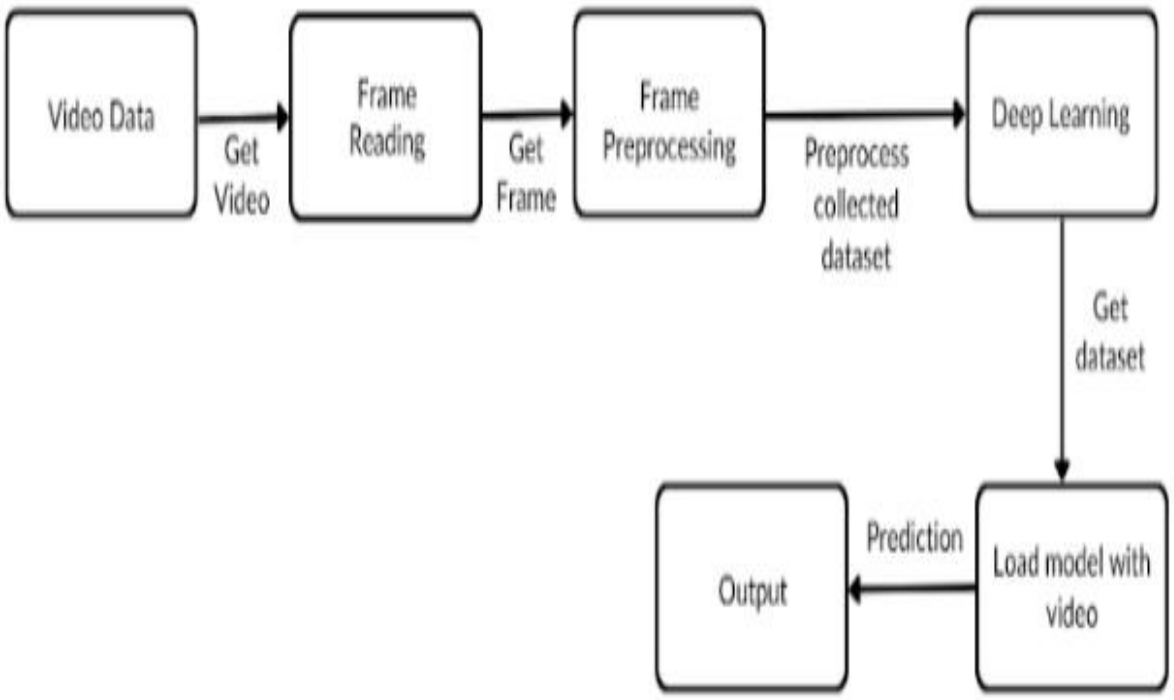

Video Data
ConvLSTM Model
Training & Testing
Prediction
Violence Identification

- **Collaboration Diagram:**

Unified Modeling Language (UML) Collaboration Diagrams offer a dynamic perspective on software systems, depicting interactions and relationships among objects during runtime. Unlike static structure-focused diagrams, Collaboration Diagrams highlight how objects communicate with each other through messages, portraying the flow of control and data within the system.To construct Collaboration Diagrams effectively, certain prerequisites are necessary, including pre-existing elements such as use cases, system operation contracts, and a domain model. These elements provide essential context for understanding the interactions and behaviors depicted in the diagram. Collaboration Diagrams serve as a means to visualize the runtime behavior of the system, showcasing how classes and objects collaborate to accomplish various tasks and fulfill system functionalities.The primary purpose of Collaboration Diagrams is to illustrate the exchange of messages between objects, elucidating the sequence of interactions and the data passed between them. This visualization aids in understanding the dynamic behavior of the system, allowing stakeholders to comprehend how different components interact during runtime. Additionally, Collaboration Diagrams facilitate system design by providing insights into object relationships and communication patterns, which inform decisions regarding system architecture and implementation.Moreover, Collaboration Diagrams play a crucial role in the debugging process by pinpointing potential issues related to object interactions or message passing within the system. By visualizing these interactions, developers can identify and resolve errors more effectively, improving the overall quality and reliability of the software.

Overall, Collaboration Diagrams serve as powerful communication tools among stakeholders, presenting a clear depiction of object interactions and runtime behavior. They enhance

collaboration and decision-making throughout the software development lifecycle, enabling teams to design, implement, and debug software systems more efficiently.



CHAPTER 6

6.1 MODULES

Data Procurement
ConvLSTM-Based Model Architecture
Feature Embedding
Real-Time Classification [Live Classification]
Anomalous behaviour identification

6.2 MODULE EXPLANATION:

- **Dataset Procurement:**

Data procurement for surveillance encompasses a systematic process of acquiring video data from diverse sources, including both publicly available datasets and exclusive proprietary surveillance feeds. This endeavor aims to ensure comprehensive coverage and access to a wide range of visual information relevant to surveillance objectives. The collected data is crucial for training and evaluating machine learning models tasked with various surveillance-related tasks.The initial stage of data procurement involves accessing and gathering video data from multiple origins. This may include public repositories, online platforms, or proprietary surveillance systems. By leveraging diverse sources, surveillance practitioners can obtain a rich and varied dataset that reflects real-world scenarios and challenges.

Once collected, the acquired data undergoes preprocessing procedures to enhance its suitability for model input. Preprocessing steps serve to standardize and prepare the data for further analysis and model training. Common preprocessing tasks include resizing videos to standard dimensions, normalization to mitigate variations in lighting and camera settings, and segmentation into

smaller video clips or individual frames.Segmentation plays a crucial role in data preprocessing for surveillance applications. Breaking down video data into smaller units facilitates more efficient processing and analysis. It allows surveillance systems to handle large volumes of data more effectively while enabling finer-grained examination of temporal and spatial dynamics within the videos. Moreover, segmentation aids in feature extraction and model training by providing more granular input data for machine learning algorithms.Furthermore, segmented video data enables precise predictions and insights by focusing on specific segments of interest. This granularity enhances the accuracy and effectiveness of machine learning models deployed for tasks such as object detection, activity recognition, or anomaly detection in surveillance applications. By analyzing smaller segments individually, models can better capture nuanced patterns and variations present in the data, leading to improved performance and detection capabilities.In summary, the careful curation and preparation of surveillance video data through procurement and preprocessing stages are essential for optimizing the performance and effectiveness of subsequent machine learning models. By accessing diverse sources, preprocessing data to enhance its quality, and segmenting it into manageable units, surveillance practitioners can leverage advanced machine learning techniques to extract valuable insights and ensure robust surveillance capabilities.

- **ConvLSTM-Based Model Architecture:**

The Convolutional Long Short-Term Memory (ConvLSTM) model architecture revolutionizes the processing of surveillance video data by integrating the strengths of both convolutional neural networks (CNNs) and recurrent neural networks (RNNs) into a unified framework. Traditional CNNs excel at capturing spatial features from images, while RNNs, specifically Long Short-Term Memory (LSTM) networks, are adept at modeling temporal dependencies in sequential data. ConvLSTM layers merge these capabilities, enabling the model to simultaneously capture spatial and temporal information from video sequences, making it particularly well-suited for surveillance applications.ConvLSTM layers are uniquely positioned to handle surveillance video data due to their ability to capture both spatial and temporal features effectively. Unlike traditional CNNs, which process individual frames independently, ConvLSTM layers analyze consecutive frames within a video sequence, enabling the model to understand not only the static attributes of objects and scenes but also their dynamic evolution over time. This holistic understanding allows for more comprehensive analysis and interpretation of surveillance footage.One of the key advantages of ConvLSTM-based models lies in their ability to learn long-term dependencies and temporal dynamics inherent in surveillance videos. This capability is crucial for tasks such as violence detection, where understanding the evolving relationships between actors and objects over time is paramount. By leveraging the memory cells and gating mechanisms inherent in LSTM layers, ConvLSTM-based models can effectively capture complex temporal patterns and behaviors, enhancing the accuracy and robustness of the surveillance system.Furthermore, the integration of ConvLSTM layers allows the model to discern subtle nuances indicative of violent behavior or suspicious activities within surveillance footage. By analyzing both spatial and temporal features, the model can identify patterns,

movements, and interactions among various elements present in the video, providing deeper insights into potential threats or anomalies. This comprehensive understanding enables more accurate detection and classification of security-related events, improving overall surveillance effectiveness.

The ConvLSTM-based model architecture represents a sophisticated approach to video processing in surveillance applications, offering advanced capabilities beyond traditional methods. By leveraging the synergy between convolutional and LSTM layers, ConvLSTM-based models can extract rich spatial and temporal features from surveillance video data, enabling tasks such as violence detection with greater accuracy and efficiency. Additionally, the flexibility and adaptability of ConvLSTM-based models make them well-suited for a wide range of surveillance applications, from crowd monitoring to perimeter security, providing valuable insights and enhancing situational awareness for security personnel and decision-makers.In conclusion, the ConvLSTM-based model architecture is a powerful tool for processing surveillance video data, offering unparalleled capabilities in capturing spatial and temporal information and enabling advanced analysis and detection of security-related events. As surveillance technology continues to evolve, ConvLSTM-based models hold immense potential for enhancing security and safety in various environments.

- **Feature Embedding :**

Feature embedding is a fundamental process in machine learning where meaningful representations are derived from raw input data. In the context of surveillance video analysis, feature embedding involves extracting essential information from video frames or clips to enable effective analysis and interpretation. In the ConvLSTM-based model architecture, ConvLSTM layers play a crucial role as feature extractors, capturing both spatial and temporal characteristics

inherent in the surveillance footage.Spatial features refer to static attributes present within individual frames of the video. These attributes encompass details such as object shapes, sizes, and positions. Extracting spatial features allows the model to understand the static elements present in each frame, providing information about the objects and their spatial relationships within the scene.Temporal features, on the other hand, capture the dynamic evolution of these attributes over time. They reflect movements, interactions, and changes occurring across consecutive frames in the video sequence. Temporal features enable the model to understand the temporal dynamics of the scene, including object trajectories, motion patterns, and temporal correlations between different events.ConvLSTM layers integrate both convolutional and LSTM functionalities, allowing them to effectively encode spatial and temporal information into compact feature representations. Convolutional operations capture spatial patterns within each frame, while LSTM operations capture temporal dependencies across frames. This integration enables ConvLSTM layers to produce feature embeddings that encapsulate both spatial and temporal aspects of the surveillance footage.The extracted feature embeddings serve as distilled forms of the original video data, containing essential information relevant to the task at hand, which in this case is violence detection. These embeddings enable the model to discern patterns and movements indicative of violent activities within the surveillance footage. By focusing on relevant spatial and temporal cues, the model becomes adept at recognizing subtle nuances associated with violent behavior, thereby enhancing its ability to accurately classify and identify instances of violence in the monitored environment.In summary, feature embedding in the ConvLSTM-based model architecture involves extracting meaningful representations of spatial and temporal characteristics from surveillance video data. By leveraging ConvLSTM layers as

feature extractors, the model can effectively capture essential information from the video footage, enabling accurate analysis and interpretation for tasks such as violence detection.

- **Real-Time Classification [Live Classification] :**

Real-time classification, also known as live classification, is a critical aspect of surveillance systems, especially in scenarios where prompt detection of specific events, such as instances of violence, is crucial. In the context of violence detection, real-time classification involves continuously monitoring surveillance video feeds to promptly identify and categorize occurrences of violent behavior as they happen. This capability enables swift response and intervention, contributing to enhanced safety and security in monitored environments.To achieve real-time classification for violence detection, surveillance systems often leverage pre-trained action recognition models. These models have typically undergone training on large and diverse datasets containing various human actions and interactions. This extensive training provides the model with a broad understanding of human behavior across different contexts, making it capable of recognizing a wide range of actions and activities.However, to adapt the pre-trained action recognition model specifically for violence detection, a process called fine-tuning is performed. Fine-tuning involves adjusting and optimizing the parameters of the pre-trained model through further training on a specialized dataset containing instances of violent behavior. This specialized dataset is curated to include diverse examples of violent actions, enabling the model to learn specific patterns, movements, and interactions associated with violent behavior.During the fine-tuning process, the pre-trained model learns to differentiate between various actions and behaviors, with a particular focus on recognizing and classifying instances of violence accurately. By training on a specialized dataset, the model becomes more

adept at identifying subtle cues and indicators of violence, improving its ability to make accurate classifications in real-time.Fine-tuning the pre-trained model for violence detection allows the system to transfer the knowledge acquired from the broader dataset to enhance accuracy in identifying violent incidents in real-time. The adapted model can swiftly analyze incoming video streams, detect instances of violent behavior, and trigger appropriate responses or interventions as needed.

Overall, real-time classification for violence detection relies on the integration of pre-trained action recognition models, fine-tuning techniques, and specialized datasets. By leveraging these components, surveillance systems can effectively monitor video feeds in real-time, swiftly identify instances of violence, and take proactive measures to ensure the safety and security of individuals within the monitored environment.

- **Anomalous behaviour identification :**

The integration of automated violence detection systems into surveillance applications represents a significant leap forward in ensuring safety and security within monitored environments. These systems validate their effectiveness through seamless integration, offering real-time identification of anomalous behavior with binary outcomes: True or False. Continuously analyzing live video feeds, they efficiently differentiate instances of violence from routine activities, providing swift responses to potential threats.Automated violence detection systems serve as proactive tools, empowering surveillance applications to enhance safety and security effectively. By promptly identifying instances of violence, these systems enable security personnel to intervene swiftly, mitigating risks and minimizing potential harm to individuals within the monitored environment. Real-time alerts provided by the system ensure that security

teams can respond promptly and effectively to any detected violent behavior, maintaining a proactive stance against potential threats.Moreover, the integration of these systems into surveillance applications streamlines security operations by automating the process of violence detection. This automation reduces the burden on security personnel, allowing them to focus their attention on critical tasks while the system continuously monitors video feeds for signs of violence. By automating this aspect of surveillance, the system ensures consistent and reliable detection of violent behavior, regardless of the size or complexity of the monitored environment.Furthermore, the ability of automated violence detection systems to deliver swift and accurate identification of threats enhances the overall effectiveness of surveillance applications. By providing real-time alerts and notifications, these systems enable security personnel to respond proactively to potential incidents, preventing escalation and ensuring the safety of individuals within the monitored premises.Overall, the integration of automated violence detection technology represents a significant advancement in security systems, offering enhanced capabilities for identifying and addressing threats in real-time. By seamlessly integrating into surveillance applications and providing swift and accurate detection of violent behavior, these systems contribute to creating a safer and more secure environment for all individuals within the monitored premises.

CHAPTER 7

CODING AND TESTING

7.1 Coding

Once the design aspect of the system is finalizes the system enters into the coding and testing phase. The coding phase brings the actual system into action by converting the design of the system into the code in a given programming language. Therefore, a good coding style has to be taken whenever changes are required it easily screwed into the system.

7.2 CODING STANDARDS

Coding standards are guidelines to programming that focuses on the physical structure and appearance of the program. They make the code easier to read, understand and maintain. This phase of the system actually implements the blueprint developed during the design phase. The coding specification should be in such a way that any programmer must be able to understand the code and can bring about changes whenever felt necessary. Some of the standard needed to achieve the above-mentioned objectives are as follows:

Program should be simple, clear and easy to understand.

Naming conventions

Value conventions

Script and comment procedure

Message box format

Exception and error handling

- **NAMING CONVENTIONS**

Naming conventions of classes, data member, member functions, procedures etc., should be **self-descriptive**. One should even get the meaning and scope of the variable by its name. The conventions are adopted for **easy understanding** of the intended message by the user. So it is customary to follow the conventions. These conventions are as follows:

Class names

Class names are problem domain equivalence and begin with capital letter and have mixed cases.

Member Function and Data Member name

Member function and data member name begins with a lowercase letter with each subsequent letters of the new words in uppercase and the rest of letters in lowercase.

- **VALUE CONVENTIONS**

Value conventions ensure values for variable at any point of time. This involves the following:

- Proper default values for the variables.
- Proper validation of values in the field.
- Proper documentation of flag values.

- **SCRIPT WRITING AND COMMENTING STANDARD**

Script writing is an art in which indentation is utmost important. Conditional and looping statements are to be properly aligned to facilitate easy understanding. Comments are included to minimize the number of surprises that could occur when going through the code.

- **MESSAGE BOX FORMAT**

When something has to be prompted to the user, he must be able to understand it properly. To achieve this, a specific format has been adopted in displaying messages to the user. They are as follows:

- X – User has performed illegal operation.
- ! – Information to the user.

7.3 TEST PROCEDURE

- **SYSTEM TESTING**

Testing is performed to identify errors. It is used for quality assurance. Testing is an integral part of the entire development and maintenance process. The goal of the testing during phase is to verify that the specification has been accurately and completely incorporated into the design, as well as to ensure the correctness of the design itself. For example the design must not have any logic faults in the design is detected before coding commences, otherwise the cost of fixing the faults will be considerably higher as reflected. Detection of design faults can be achieved by means of inspection as well as walkthrough.

Testing is one of the important steps in the software development phase. Testing checks for the errors, as a whole of the project testing involves the following test cases:

- Static analysis is used to investigate the structural properties of the Source code.
- Dynamic testing is used to investigate the behavior of the source code by executing the program on the test data.

7.4 TEST DATA AND OUTPUT

- **UNIT TESTING**

Unit testing is conducted to verify the functional performance of each modular component of the software. Unit testing focuses on the smallest unit of the software design (i.e.), the module. The white-box testing techniques were heavily employed for unit testing.

- **FUNCTIONAL TESTS**

Functional test cases involved exercising the code with nominal input values for which the expected results are known, as well as boundary values and special values, such as logically related inputs, files of identical elements, and empty files.

Three types of tests in Functional test:

- Performance Test
- Stress Test
- Structure Test

- **STRUCTURED TEST**

Structure Tests are concerned with exercising the internal logic of a program and traversing particular execution paths. The way in which White-Box test strategy was employed to ensure that the test cases could Guarantee that all independent paths within a module have been have been exercised at least once.

- Exercise all logical decisions on their true or false sides.
- Execute all loops at their boundaries and within their operational bounds.
- Exercise internal data structures to assure their validity.
- Checking attributes for their correctness.
- Handling end of file condition, I/O errors, buffer problems and textual errors in output information

- **INTEGRATION TESTING**

Integration testing is a systematic technique for construction the program structure while at the same time conducting tests to uncover errors associated with interfacing. i.e., integration testing is the complete testing of the set of modules which makes up the product. The objective is to take untested modules and build a program structure tester should identify critical modules. Critical modules should be tested as early as possible. One approach is to wait until all the units have passed testing, and then combine them and then tested. This approach is evolved from unstructured testing of small programs. Another strategy is to construct the product in increments of tested units. A small set of modules are integrated together and tested, to which another module is added and tested in combination. And so on. The advantages of this approach are that, interface dispenses can be easily found and corrected.

The major error that was faced during the project is linking error. When all the modules are combined the link is not set properly with all support files. Then we checked out for interconnection and the links. Errors are localized to the new module and its intercommunications. The product development can be staged, and modules integrated in as they complete unit testing. Testing is completed when the last module is integrated and tested.

7.5 TESTING TECHNIQUES / TESTING STRATERGIES

- **TESTING**

Testing is a process of executing a program with the intent of finding an error. A good test case is one that has a high probability of finding an as-yet –undiscovered error. A successful test is one that uncovers an as-yet- undiscovered error. System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently as expected before live operation commences. It verifies that the whole set of programs hang together. System testing requires a test consists of several key activities and steps for run program, string, system and is important in adopting a successful new system. This is the last chance to detect and correct errors before the system is installed for user acceptance testing.

The software testing process commences once the program is created and the documentation and related data structures are designed. Software testing is essential for correcting errors. Otherwise the program or the project is not said to be complete. Software testing is the critical element of software quality assurance and represents the ultimate the review of specification design and coding. Testing is the process of executing the program with the intent of finding the error. A good test case design is one that as a probability of finding an yet

undiscovered error. A successful test is one that uncovers an yet undiscovered error. Any engineering product can be tested in one of the two ways:

- **WHITE BOX TESTING**

This testing is also called as Glass box testing. In this testing, by knowing the specific functions that a product has been design to perform test can be conducted that demonstrate each function is fully operational at the same time searching for errors in each function. It is a test case design method that uses the control structure of the procedural design to derive test cases. Basis path testing is a white box testing.

Basis path testing:

- Flow graph notation
- Cyclometric complexity
- Deriving test cases
- Graph matrices Control

- **BLACK BOX TESTING**

In this testing by knowing the internal operation of a product, test can be conducted to ensure that "all gears mesh", that is the internal operation performs according to specification and all internal components have been adequately exercised. It fundamentally focuses on the functional requirements of the software.

The steps involved in black box test case design are:

- Graph based testing methods

- Equivalence partitioning
- Boundary value analysis
- Comparison testing

- **SOFTWARE TESTING STRATEGIES:**

A software testing strategy provides a road map for the software developer. Testing is a set activity that can be planned in advance and conducted systematically. For this reason a template for software testing a set of steps into which we can place specific test case design methods should be strategy should have the following characteristics:

- Testing begins at the module level and works "outward" toward the integration of the entire computer based system.
- Different testing techniques are appropriate at different points in time.
- The developer of the software and an independent test group conducts testing.
- Testing and Debugging are different activities but debugging must be accommodated in any testing strategy.

- **INTEGRATION TESTING:**

Integration testing is a systematic technique for constructing the program structure while at the same time conducting tests to uncover errors associated with. Individual modules, which are highly prone to interface errors, should not be assumed to work instantly when we put them together. The problem of course, is "putting them together"- interfacing. There may be the chances of data lost across on another's sub functions, when

combined may not produce the desired major function; individually acceptable impression may be magnified to unacceptable levels; global data structures can present problems.

- **VALIDATION TESTING**

At the culmination of integration testing, software is completely assembled as a package. Interfacing errors have been uncovered and corrected and a final series of software test-validation testing begins. Validation testing can be defined in many ways, but a simple definition is that validation succeeds when the software functions in manner that is reasonably expected by the customer. Software validation is achieved through a series of black box tests that demonstrate conformity with requirement. After validation test has been conducted, one of two conditions exists.

* The function or performance characteristics confirm to specifications and are accepted.

* A validation from specification is uncovered and a deficiency created.

Deviation or errors discovered at this step in this project is corrected prior to completion of the project with the help of the user by negotiating to establish a method for resolving deficiencies. Thus the proposed system under consideration has been tested by using validation testing and found to be working satisfactorily. Though there were deficiencies in the system they were not catastrophic

➢ USER ACCEPTANCE TESTING

User acceptance of the system is key factor for the success of any system. The system under consideration is tested for user acceptance by constantly keeping in touch with prospective system and user at the time of developing and making changes whenever required. This is done in regarding to the following points.

- Input screen design.
- Output screen design.

SOURCE CODE

 # App.py

```
import matplotlib

import os


matplotlib.use('Agg')


import numpy as np

from flask import Flask, render_template, request, jsonify

import cv2

from skimage.transform import resize

import time

from PIL import Image

from io import BytesIO

import matplotlib.pyplot as plt

import tensorflow as tf
```

```
from model_functions import mamon_videoFightModel2, video_mamonreader, pred_fight, main_fight


app = Flask(__name__)


# Load your TensorFlow model

np.random.seed(1234)

model22 = mamon_videoFightModel2(tf)


@app.route('/')

def index():

    return render_template('index.html')


@app.route('/analyze', methods=['POST'])

def analyze():

    if request.method == 'POST' and 'file' in request.files:

        # Get the uploaded video file

        file = request.files['file']
```

```
            # Save the video temporarily
            video_path = './uploaded_video.mp4'
            file.save(video_path)

            # Perform analysis on the video
            res = main_fight(video_path, model22)

            # Release the resources associated with the video file
            file.close()  # Close the file handle
            cv2.VideoCapture(video_path).release()  # Release the video capture object

            # Remove the video file
            os.remove(video_path)

            confidence = float(res['precentegeoffight']) * 100  # Convert confidence to percentage
            plt.figure(figsize=(6, 4))
            plt.bar(['Confidence Level'], [confidence], color='skyblue')
```

```
            plt.ylabel('Percentage (%)')
            plt.title('Confidence Level of Violence Detection')
            plt.ylim(0, 100)
            plt.grid(axis='y', linestyle='--', alpha=0.7)
            plt.xticks(rotation=45)
            plt.tight_layout()
            plt.savefig('./static/confidence_plot.png')    # Save the plot as an image
            plt.close()

            # Return the analysis result as JSON
            return jsonify(res)
        return jsonify({'error': 'Invalid request'})

@app.route('/report.html', methods=['GET', 'POST'])
def report():
        if request.method == 'POST':
            # Handle the feedback or error report sent by the user
            # For example, you can access the form data using request.form
            feedback = request.form.get('feedback')
```

```
        # Process the feedback as needed


        # Send a response to indicate the report has been received
        response = {'message': 'Report received. Thank you for your feedback!'}
        # Render the report page template with JavaScript to display a pop-up message
        return render_template('report.html', response=response)


    # Render the report page template
    return render_template('report.html')


if __name__ == '__main__':
    app.run(debug=True)
```

#Model_Functions.py

```
import numpy as np
import cv2
from skimage.transform import resize
import time
from tensorflow.keras import optimizers
from tensorflow.keras.layers import *
from tensorflow.keras.models import Sequential
import tensorflow as tf

def mamon_videoFightModel2(tf, wight=r'./mamonbest947oscombo-drive.hdfs'):
    layers = tf.keras.layers
    models = tf.keras.models
    losses = tf.keras.losses
    metrics = tf.keras.metrics
    num_classes = 2
    cnn = models.Sequential()
    # cnn.add(base_model)
```

```
input_shapes = (160, 160, 3)

np.random.seed(1234)

vg19 = tf.keras.applications.vgg19.VGG19

base_model = vg19(include_top=False, weights='imagenet',input_shape=(160,
  160, 3))

# Freeze the layers except the last 4 layers

# for layer in base_model.layers:

#         layer.trainable = False


cnn = models.Sequential()

cnn.add(base_model)

cnn.add(layers.Flatten())

model = models.Sequential()


model.add(layers.TimeDistributed(cnn, input_shape=(30, 160, 160, 3)))

model.add(layers.LSTM(30, return_sequences=True))


model.add(layers.TimeDistributed(layers.Dense(90)))
```

```
        model.add(layers.Dropout(0.1))

        model.add(layers.GlobalAveragePooling1D())

        model.add(layers.Dense(512, activation='relu'))
        model.add(layers.Dropout(0.3))

        model.add(layers.Dense(num_classes, activation="sigmoid"))

        adam = optimizers.Adam(lr=0.0005, beta_1=0.9, beta_2=0.999, epsilon=1e-
        08)
        model.load_weights(wight)
        rms = optimizers.RMSprop()


model.compile(loss='binary_crossentropy',optimizer=adam,metrics=["accuracy"])
    return model

def video_mamonreader(cv2, filename):
```

```
frames = np.zeros((30, 160, 160, 3), dtype=np.float64)
i = 0
print(frames.shape)
vc = cv2.VideoCapture(filename)
if vc.isOpened():
    rval, frame = vc.read()
else:
    rval = False
    frame = None
if frame is not None:
    frm = resize(frame, (160, 160, 3))
    frm = np.expand_dims(frm, axis=0)
    if np.max(frm) > 1:
        frm = frm / 255.0
    frames[i][:] = frm
    i += 1
    print("reading video")
    while i < 30:
        rval, frame = vc.read()
```

```
            frm = resize(frame, (160, 160, 3))
            frm = np.expand_dims(frm, axis=0)
            if np.max(frm) > 1:
                frm = frm / 255.0
            frames[i][:] = frm
            i += 1
    return frames


def pred_fight(model, video, acuracy=0.8):
    pred_test = model.predict(video)
    if pred_test[0][1] >= acuracy:
        return True, pred_test[0][1]
    else:
        return False, pred_test[0][1]


def main_fight(vidoss, model22):
    vid = video_mamonreader(cv2, vidoss)
    datav = np.zeros((1, 30, 160, 160, 3), dtype=np.float64)
    datav[0][:][:] = vid
```

```
millis = int(round(time.time() * 1000))

print(millis)

f, precent = pred_fight(model22, datav, acuracy=0.65)

millis2 = int(round(time.time() * 1000))

print(millis2)

res_mamon = {'fight': f, 'precentegeoffight': str(precent)}

res_mamon['processing_time'] = str(millis2 - millis)

return res_mamon
```

#index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Violence Detection</title>
    <link rel="stylesheet" href="{{ url_for('static', filename='styles.css') }}">
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.4/css/all.min.css" />
</head>
<body>
    <div class="container">
        <h1>Violence Detection</h1>
        <form id="uploadForm" enctype="multipart/form-data">
            <label for="videoFile" class="button">Upload Video</label></br>
            <input type="file" id="videoFile" name="file" accept="video/*" onchange="displayFileName()"><br>
```

```
            <div id="fileNameDisplay" class="file-name"></div><br>
            <button type="submit" class="button">Analyze Video</button>


        </form>
        <div id="result" class="result-container"></div>
        <a href="report.html" target="_blank" class="report-link"><i class="fa-solid fa-message"></i> Report</a>
    </div>

    <script src="{{ url_for('static', filename='scripts.js') }}"></script>
    <script>
        function displayFileName() {
            var fileInput = document.getElementById('videoFile');
            var fileNameDisplay = document.getElementById('fileNameDisplay');
            if (fileInput.files.length > 0) {
                fileNameDisplay.textContent = 'Selected file: ' + fileInput.files[0].name;
```

```
            } else {
                fileNameDisplay.textContent = '';
            }
        }
    </script>
</body>
</html>
```

#Styles.css

```
body {
    background-color: #f8f9fa;
    font-family: Arial, sans-serif;
}
.container {
    max-width: 600px;
    margin: 50px auto;
    padding: 20px;
    background-color: #fff;
    border-radius: 8px;
    box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
    text-align: center;
}
h1 {
    color: #0450d5;
    margin-bottom: 30px;
}
.button {
```

```
        padding: 15px 25px;
        font-size: 16px;
        font-weight: bold;
        text-decoration: none;
        background-color: #007bff;
        color: #fff;
        border: none;
        border-radius: 5px;
        cursor: pointer;
        transition: background-color 0.3s ease;
}
.button:hover {
        background-color: #0056b3;
}

#videoFile {
        display: none;
}
.file-name {
```

```
        margin-top: 10px;
        font-size: 14px;
        color: #666;
}
.report-link {
        margin-top: 20px;
        display: inline-block;
        font-size: 14px;
        color: #007bff;
        text-decoration: none;
}
.result-container {
        margin-top: 20px;
        text-align: center;
}
```

#Scripts.js

```
document.getElementById('uploadForm').addEventListener('submit',
function(event) {
    event.preventDefault(); // Prevent the default form submission

    // Get the file input element
    var fileInput = document.getElementById('videoFile');

    // Check if a file is selected
    if (fileInput.files.length > 0) {
        // Create a FormData object to store the file data
        var formData = new FormData();
        formData.append('file', fileInput.files[0]); // Append the selected file to
the FormData object

        // Send a POST request to the server with the file data
        fetch('/analyze', {
            method: 'POST',
```

```
            body: formData
        })
        .then(response => response.json())
        .then(data => {
            // Handle the response from the server (e.g., display results)
            console.log(data);    // Add this line to check the data received
            var resultDiv = document.getElementById('result');
            resultDiv.innerHTML = '';
            var message = data.fight ? 'Fight detected!' : 'No fight detected.';
            var percentage = parseFloat(data.precentegeoffight) * 100;
            var processingTime = data.processing_time;
            resultDiv.innerHTML = '<p>' + message + '</p>';
            resultDiv.innerHTML += '<p>Confidence: ' + percentage.toFixed(2)
+ '%</p>';
            resultDiv.innerHTML += '<p>Processing Time: ' + processingTime
+ ' milliseconds</p>'; // Log the response data to the console for debugging
        })
        .catch(error => {
            console.error('Error:', error); // Log any errors to the console
```

```
            });
        } else {
            // If no file is selected, display an error message to the user
            alert('Please select a file before uploading.');
        }
});

function plotConfidence(percentage) {
    // Prepare data for plotting
    var confidenceData = parseFloat(percentage) * 100;

    // Create the plot
    var ctx = document.getElementById('confidencePlot').getContext('2d');
    var chart = new Chart(ctx, {
        type: 'bar',
        data: {
            labels: ['Confidence'],
            datasets: [{
                label: 'Percentage',
```

```
                data: [confidenceData],
                backgroundColor: 'rgba(255, 99, 132, 0.2)',
                borderColor: 'rgba(255, 99, 132, 1)',
                borderWidth: 1
            }]
        },
        options: {
            scales: {
                y: {
                    beginAtZero: true
                }
            }
        }
    });
}
```

#Report.html

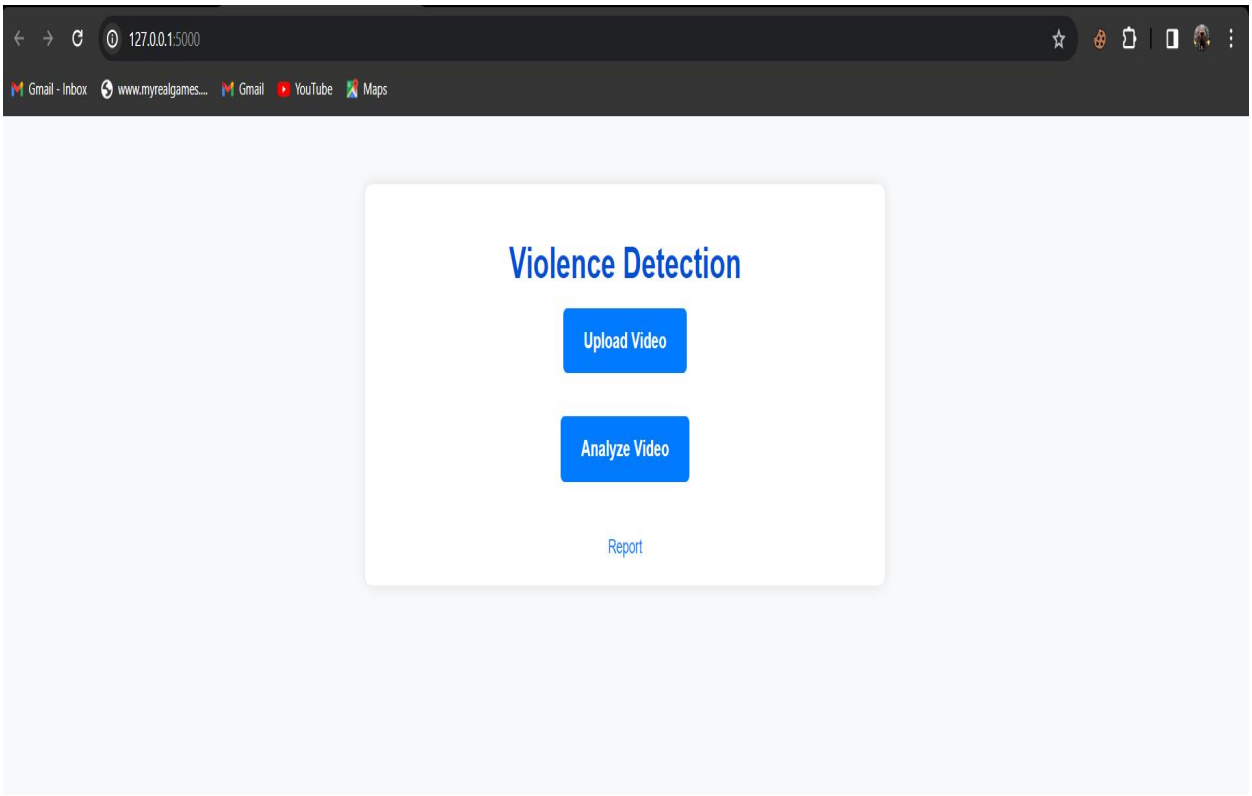
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Feedback and Error Reporting</title>
    <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css">
    <style>
        body {
            font-family: Arial, sans-serif;
            background-color: #f2f2f2;
            margin: 0;
            padding: 0;
        }
        .container {
            max-width: 800px;
            margin: 50px auto;
```

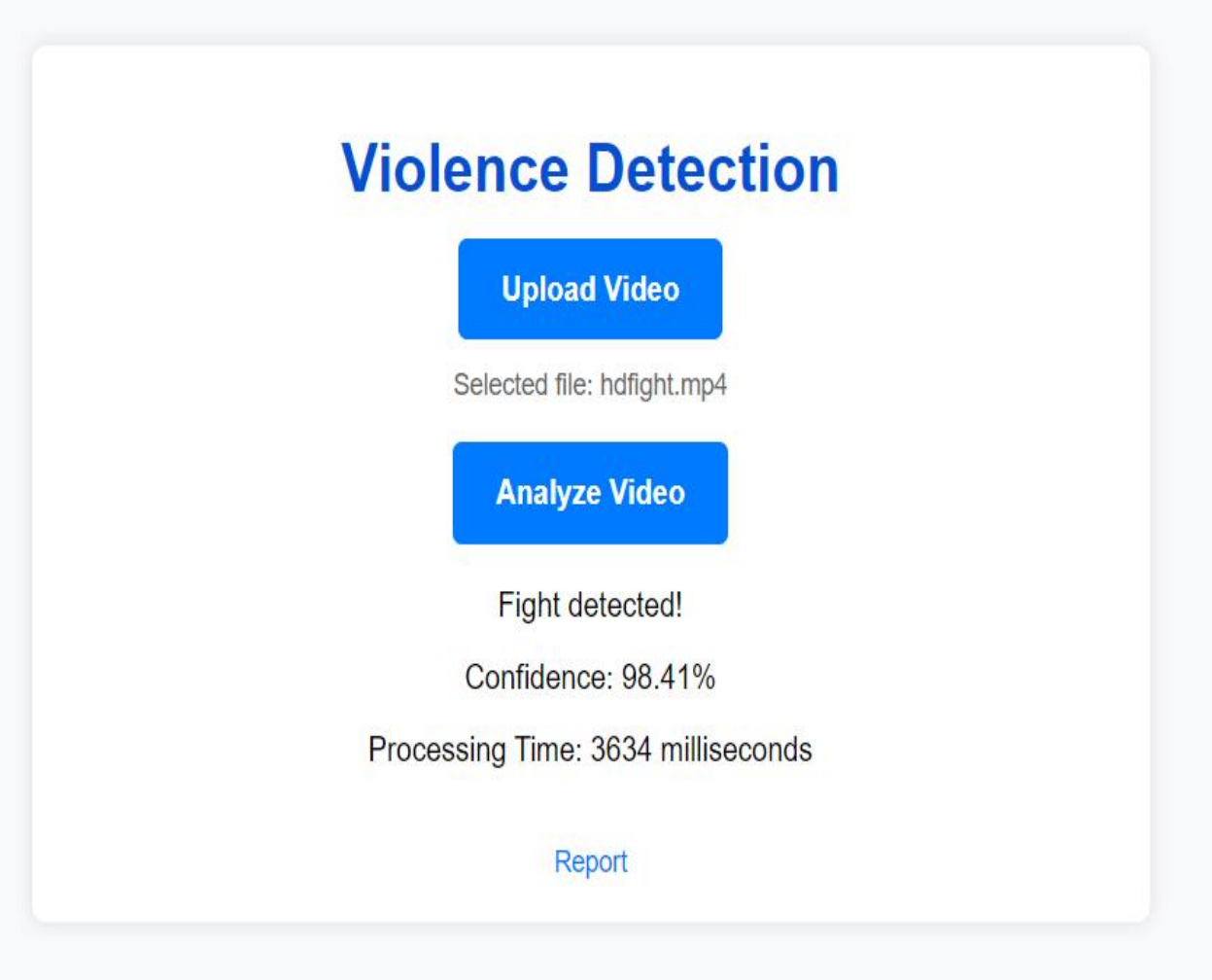
```
        padding: 20px;
        background-color: #fff;
        border-radius: 8px;
        box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
}
h1 {
        color: #0450d5;
        text-align: center;
}
label {
        font-weight: bold;
}
textarea {
        width: 100%;
        height: 150px;
        resize: vertical;
}
.btn {
        background-color: #0450d5;
```

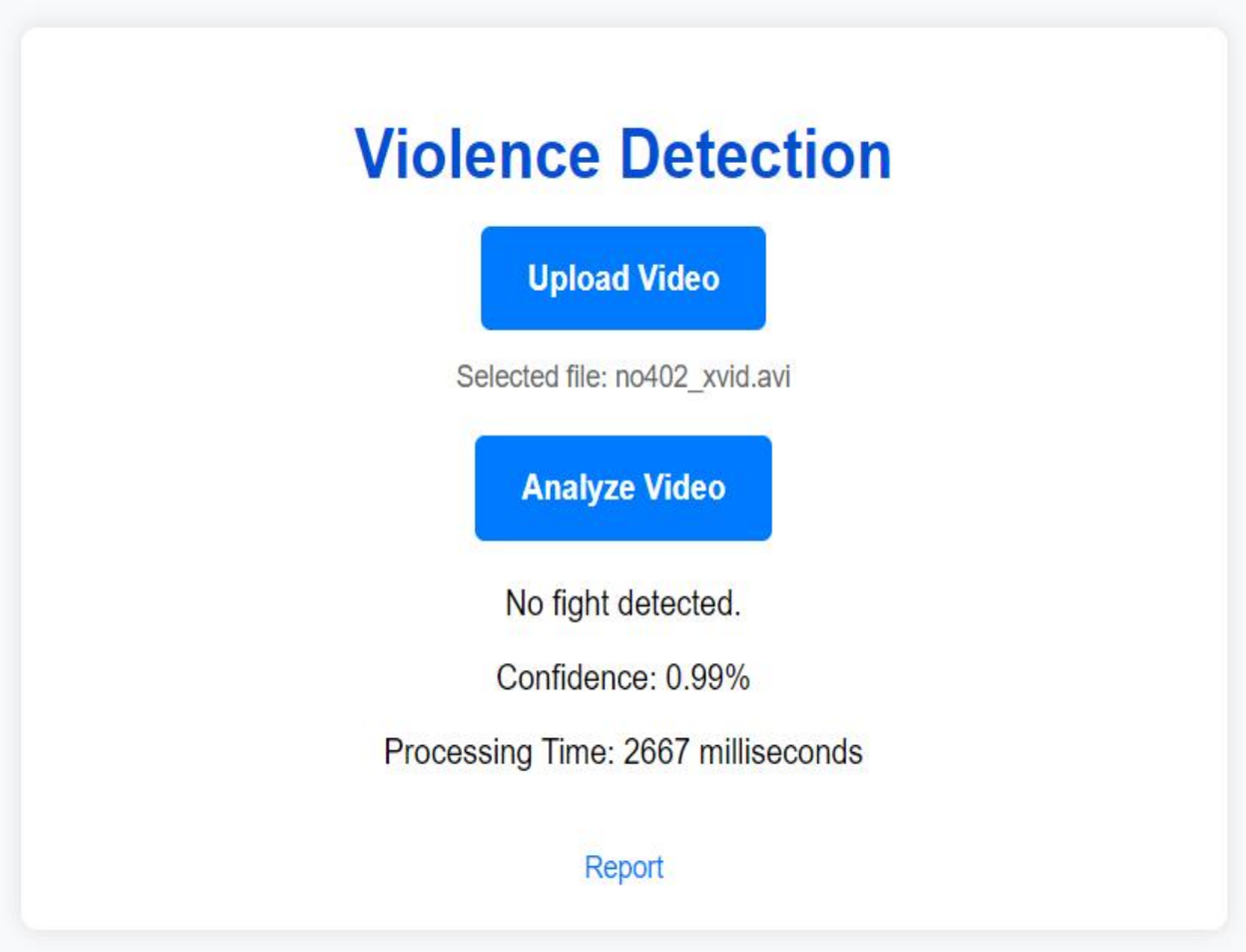
```
            color: #fff;
            border: none;
            padding: 10px 20px;
            cursor: pointer;
            border-radius: 5px;
        }
        .btn:hover {
            background-color: #023aaf;
        }
    </style>
</head>
<body>
    <div class="container">
        <h1>Feedback and Error Reporting</h1>
        <form id="reportForm" method="POST">
            <div class="form-group">
                <label for="feedback">Feedback or Error Description:</label>
                <textarea class="form-control" id="feedback" name="feedback" required></textarea>
```

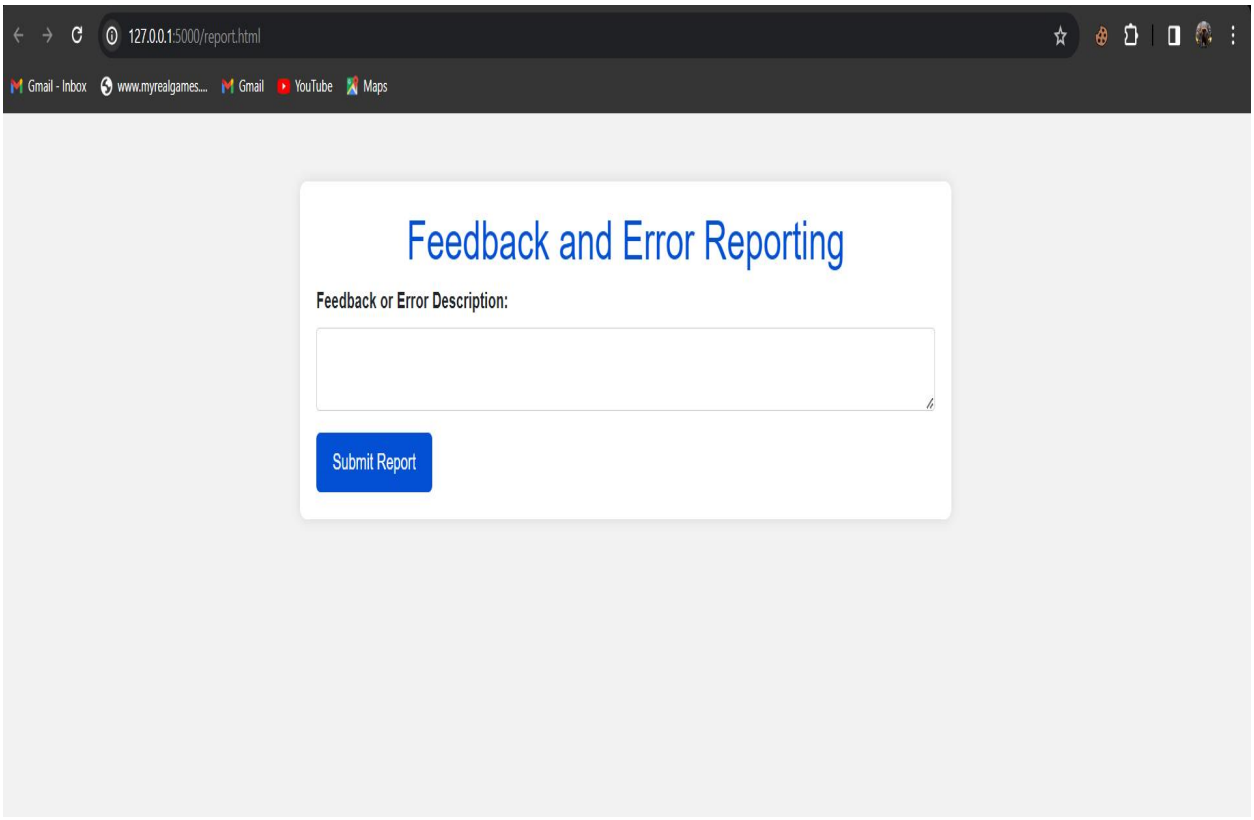
```
                </div>
                <button type="submit" class="btn btn-primary">Submit Report</button>
            </form>
        </div>

</body>
    <script>

        {% if response %}
            alert("{{ response.message }}");
        {% endif %}

    </script>

</html>
```

SCREENSHOTS:




Violence Detection
Upload Video
Selected file: hdfight.mp4
Analyze Video
Fight detected!
Confidence: 98.41%
Processing Time: 3634 milliseconds
Report


Violence Detection
Upload Video
Selected file: no402_xvid.avi
Analyze Video
No fight detected.
Confidence: 0.99%
Processing Time: 2667 milliseconds
Report


127.0.0.1:5000/report.html
Gmail - Inbox
www.myrealgames....
Gmail
YouTube
Maps
Feedback and Error Reporting
Feedback or Error Description:
Submit Report

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