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Channelizing Machine Learning Towards Early Threat Detection and Prevention Against Women Using Surveillance Cameras

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Abstract: ***Closed Circuit Television Systems (CCTV) are being used in a growing number of office buildings, housing developments, and public locations. Many towns now have CCTV surveillance systems in place. Such monitoring systems create a tremendous load for the CCTV operators because the number of cameras views a single CCTV operator can process is constrained by human considerations. Surveillance automation of public places assumes an important role in proactively detection of possible threat to public and in maintaining law and order. Based on a review of the existing approaches followed in monitoring of crowd behaviours and the techniques applied, especially in public places like bus stands, railway stations and airports, the paper proposes surveillance automation i.e., automating the process of detecting, recognizing the suspects and suspicious behaviour of the people in the crowd.***

Here, in this project called channelizing machine learning towards early threat detection and prevention against women using surveillance cameras, we propose algorithms that are capable of alerting the human operator when: (1) Presence of a inhuman act, after setting zones of interest and danger zones within those zones of interest, the danger is detected when someone follows a women on streets, roads or any other public places, which can reduce the number of sexual harassment and other forms of sexual Algorithms violence in public spaces; (2) An abnormal behaviour of a person such as handling some objects abnormally; (3) In this project, our main aim is towards women safety and also we concentrate on reducing the amount of false alerts and to enable a real-life use of the system.

Keywords: Closed Circuit Television Systems, Surveillance automation, Machine Learning Algorithms, Deep Learning, Classification Neural Network, Convolutional Neural Network, Gender Recognition, Movement detection, Face recognition, Object tracking.

I. INTRODUCTION

Violence against women is a significant problem worldwide, affecting millions of women every year. One of the challenges of preventing violence against women is detecting and identifying the early warning signs. Surveillance cameras are commonly used to monitor public spaces and can be an effective tool in detecting and preventing violence against women. However, the sheer volume of data generated by these cameras makes it difficult for human operators to monitor them effectively. Machine learning can provide an automated solution for analyzing this data and identifying potential threats against women. This paper examines the use of machine learning for early threat detection and prevention against women using surveillance cameras. The paper begins by discussing the current state of violence against women and the need for early detection and prevention. It then provides an overview of machine learning and its potential applications in this area. Next, the paper describes the various types of surveillance cameras and their capabilities. Finally, the paper concludes by discussing the challenges and limitations of using machine learning for early threat detection and prevention against women using surveillance cameras.

This paper examines the use of machine learning for early threat detection and prevention against women using surveillance cameras. The paper begins by discussing the current state of violence against women and the need for early detection and prevention. It then provides an overview of machine learning and its potential applications in this area. Next, the paper describes the various types of surveillance cameras and their capabilities. Finally, the paper concludes by discussing the challenges and limitations of using machine learning for early threat detection and prevention against women using surveillance cameras.

The World Health Organization (WHO) estimates that one in three women worldwide has experienced physical or sexual violence in their lifetime (WHO, 2020). In many cases, violence against women goes unreported, making it difficult to track the prevalence of the problem accurately.

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The effects of violence against women can be severe, leading to physical injuries, psychological trauma, and even death. Preventing violence against women requires early detection and intervention to prevent the escalation of violence. Early detection and prevention are essential because violence against women often begins with warning signs, such as stalking, harassment, or verbal abuse, before escalating to physical violence.

Machine learning algorithms can analyze large volumes of data generated by surveillance cameras and identify potential threats against women. For example, machine learning algorithms can analyze body language, facial expressions, and other behavioral cues to detect potential threats. These algorithms can also analyze data from other sources, such as social media and public records, to identify individuals who may pose a threat. Machine learning algorithms can also be used to predict the likelihood of violence against women based on historical data. For example, a machine learning algorithm could analyze data on past incidents of violence against women and identify patterns that are indicative of future violence. This information could be used to allocate resources and target interventions more effectively.

There are several types of surveillance cameras available, each with its own capabilities and limitations. Fixed cameras are the most common type of surveillance camera and are typically used to monitor public spaces such as parks, streets, and buildings. Pan-tilt-zoom (PTZ) cameras are another type of surveillance camera that can be remotely controlled to provide a more comprehensive view of an area.

Challenges and Limitations of Using Machine Learning for Early Threat Detection and Prevention against Women While machine learning shows promise for early threat detection and prevention against women, there are several challenges and limitations to consider. One of the biggest challenges is the lack of data on violence against women. Many incidents of violence against women go unreported, making it difficult to train machine.

II. LITRATURE SURVEY

Sexual harassment and other forms of sexual violence in public spaces, both in urban and rural settings, are an everyday occurrence for women and girls in every country around the world. Women and girls experience and fear different forms of sexual violence in public spaces, from unwelcome sexual remarks and gestures to rape and femicide. It happens on streets, in and around public transportation, schools, workplaces, public toilets, water and food distribution sites, and parks. This reality reduces women's and girls' freedom of movement.

It reduces their ability to participate in school, work, and public life. It limits their access to essential services and their enjoyment of cultural and recreational activities, and negatively impacts their health and well-being. This project follows a relative logical strategy and attempts to cover public spaces everywhere in the world. Various categories of public places as a segment of public sphere include all functional areas such as roads, streets, pathways, public toilets, stations, bus stops, bazaars, markets and malls, highways, parks, restaurants, cinemas, public transport (cabs, local rickshaws).

Women harassment and ferocity in public places reported by urban women in India is 79 %, in Thailand − 85 %, and in Brazil − 89 %. Local surveys, studies, and literature on women's safety in public places exposed that woman needs, and their concerns are overlooked due to societal iniquities, anxieties, and phobia of aggression. Poor women residing in deprived and insecure areas need to travel in the late-night or early morning hours for work or other purposes.

These activities may have consequences of being exposed to the risks of harassment, eve teasing, slut-shaming, unwanted comments, kidnapping and violence. Women feel insecure while using public transport, using public restrooms when travelling by bus/train, and by lack of community toilets.

Many females, because of their financial problems, work in informal sector such as street vendors or trash collectors, which in turn require the use of public spaces as their workplace.

Some of the Research Papers that we referred are:

1) Title- A Study on Video Surveillance System for Object Detection and Tracking.
Author Name- Pawan Kumar Mishra, G.P. Saroha.

2) Title- Vision-based Fight Detection from Surveillance Cameras.
Author Name- Seymanur Aktı, Gozde Ays¸e Tataroglu, Hazım Kemal Ekenel.

3) Title- Human Tracking over camera networks.
Author Name- Li Hou, Wanggen Wan, Jenq-Neng Hwang, Rizwan Muhammad, Mingyang Yang and Kang Han.

4) Title- Deep Learning for Person Re-identification.
Author Name- Mang Ye, Jianbing Shen.

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This paper provides an overview of various machine learning techniques used in video surveillance systems. It discusses the applications of machine learning in object detection, tracking, and anomaly detection. It serves as a foundation for understanding the role of machine learning in threat detection using surveillance cameras.

This paper also focuses on deep learning techniques for object detection in surveillance videos. It explores the use of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for detecting objects of interest. The research findings can be valuable for developing algorithms to identify potential threats against women.

III. RELATED WORK

Early threat detection and prevention against women using surveillance cameras is an important and sensitive topic that has been the subject of extensive research. Here are some related works in this area:

1) "A Framework for Early Detection of Domestic Violence using Surveillance Cameras" by P. Aravindan and M. N. Shanmukha Swamy. This paper proposes a framework for early detection of domestic violence using surveillance cameras. The framework uses a combination of video analysis techniques, such as motion detection and object tracking, to detect and prevent domestic violence."Automated Monitoring and Detection of Harassment in Public Transport Using CCTV Cameras" by S. Sultana and S. S. Alam. This paper proposes an automated system for monitoring and detecting harassment in public transport using CCTV cameras. The system uses machine learning algorithms to detect and classify different types of harassment, such as verbal abuse and physical assault.
2) "Real-time detection of gender-based violence in public spaces using surveillance cameras" by S. Fatima, M. Hussain, and S. A. Kazmi. This paper proposes a real-time system for detecting gender-based violence in public spaces using surveillance cameras. The system uses deep learning techniques to detect and classify different types of violence, such as sexual harassment and physical assault.
3) "Preventing Violence Against Women Through Smart Surveillance" by K. Brown and K. Broadhurst. This paper discusses the potential of smart surveillance systems in preventing violence against women.

IV. PROPOSED METHODOLOGY

Proposed methodology for early threat detection and prevention against women using surveillance cameras may involve the following steps:

1) *Dataset Collection:* Collecting a large and diverse dataset of videos that capture various scenarios of violence against women, including physical and verbal abuse, stalking, sexual harassment, and assault.
2) *Preprocessing:* Pre-processing the dataset to remove irrelevant videos and to enhance the quality of the remaining videos by removing noise, correcting lighting and color, and stabilizing the camera.
3) *Feature Extraction:* Extracting features from the preprocessed videos using computer vision techniques, such as object detection, motion detection, and facial recognition. These features may include the location, size, and speed of moving objects, the facial expressions of individuals, and the audio features of the videos.
4) *Classification:* Using machine learning algorithms to classify the extracted features into different categories, such as safe and unsafe situations, different types of violence, and potential perpetrators and victims.
5) *Alerting and prevention:* Sending alerts to relevant authorities, such as law enforcement and security personnel, when unsafe situations are detected. Additionally, the system may prevent the occurrence of violence by sounding an alarm, displaying warning messages, and activating emergency response systems.
6) *Monitoring and Evaluation:* Continuously monitoring and evaluating the performance of the system by analyzing the accuracy, precision, and recall of the classification algorithms, as well as the response time and effectiveness of the alerting and prevention mechanisms.
7) *User Feedback and Improvement:* Gathering feedback from users, such as law enforcement, security personnel, and women who have been victims of violence, and using this feedback to improve the system's accuracy, usability, and effectiveness.

V. PROPOSED ALGORITHMS

A. *Algorithms*

1) *Local Binary Pattern*

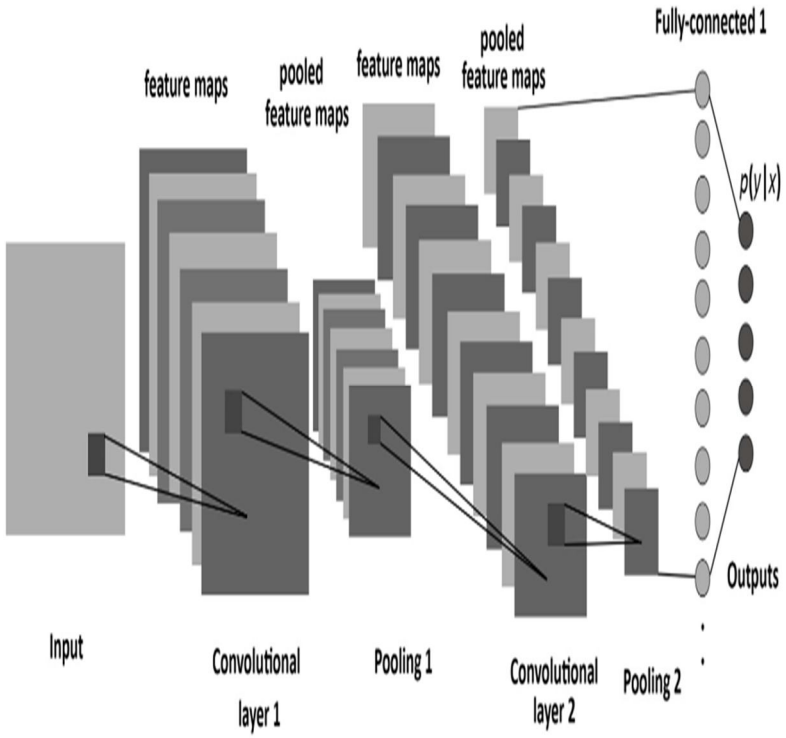
Local Binary Patterns (LBP) are known to have good texture representation properties. Through Local Binary Patterns for gender classification which can discriminate the facial textures efficiently

2) YOLOv3

YOLOv3 (You Only Look Once, Version 3) is a real-time object detection algorithm that identifies specific objects in videos, live feeds, or images. The YOLO machine learning algorithm uses features learned by a deep convolutional neural network to detect an object.

3) Convolutional Neural Network

A convolutional neural network (CNN) is a type of artificial neural network used primarily for image recognition and processing, due to its ability to recognize patterns in images.



VI. PROPOSED SYSTEM

The proposed system aims to leverage machine learning techniques to enhance early threat detection and prevention against women using surveillance cameras.

The key components of the proposed system include data collection from surveillance cameras, preprocessing and feature extraction, machine learning-based threat detection, and real-time alert generation.

1) *Data Collection:* The system utilizes surveillance cameras strategically placed in areas prone to threats against women. The cameras capture video footage, which is transmitted to a central server for further processing and analysis.
2) *Preprocessing and Feature Extraction:* The incoming video streams undergo preprocessing to enhance image quality, remove noise, and stabilize the footage. Feature extraction techniques are applied to extract meaningful information from the video frames, such as object detection, motion analysis, and facial recognition.
3) *Machine Learning-based Threat Detection:* A machine learning model is trained on a labeled dataset to recognize various threat scenarios, such as physical violence, harassment, or stalking. The model is trained using deep learning algorithms, such as convolutional neural networks (CNNs) or recurrent neural networks (RNNs), enabling it to learn complex patterns and identify potential threats accurately.

The proposed system harnesses the power of machine learning and surveillance cameras to channel early threat detection and prevention against women. By leveraging intelligent algorithms and real-time analysis, the system aims to enhance women's safety by providing timely alerts and enabling proactive intervention measures.

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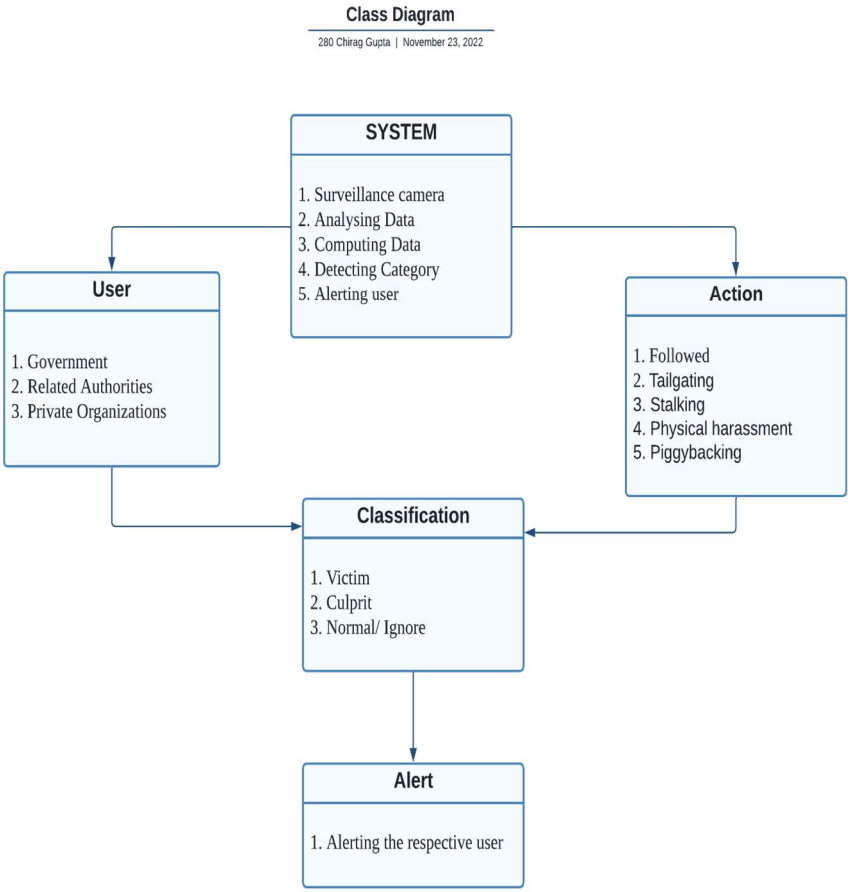


Fig: Class Diagram

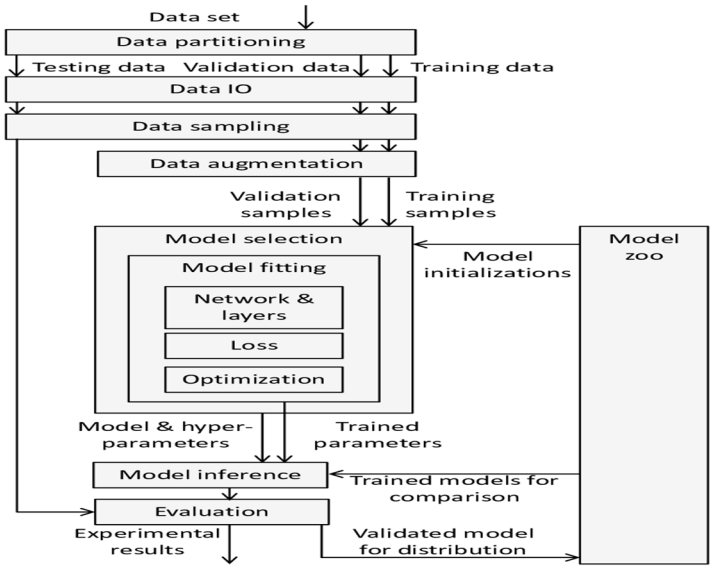
VII. IMPLEMENTATION DETAILS

The main program is hosted on the website so that it will be easily be accessible for the authorities. One needs to login to access the program, so that we can keep the track of the people and confirm it is not being used by or for the wrong purpose. All the login details will be store in the database using MySQL, from which the authentication of the credentials will also take place, and all the system backend will be uploaded with the help of python's Django. Website will also consist of About page, in which all the information about the project and the purpose will be illustrated and written. We also be featuring the blog page for the latest updates, precautions, user manual, and other informational blogs can be posted.

Coming to the main program, it will be hosted on the home page of the website, the program can be downloaded and set up on any laptops and pc of the authority with slight modifications. The program is set up using Machine learning and deep learning by using python as a language, since python is a universal language any one can keep up with the maintenance and debugging of the code. The program is made by analysing the dataset and training on it, which is explained as:

1) Analyzing the dataset
2) Data pre-processing
3) Gender recognition
4) Threat Detection
5) Location and Data Accessing
6) Alerting Authority

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VIII. CONCLUSION AND FUTURE WORK

The main objective of this study is detecting human behaviour against women from surveillance cameras in a fast and accurate way. It is essential for all of us to take measures to prevent it from happening as it damages the life of the victim severely. Thus, it can be done by exploring the vast horizons of AI and ML which can be implemented in and be benefited with. With the help of some useful information like shape and size video surveillance system is useful to detect a suspicious human behaviour. There are various phases of object detection and object tracking that has been described in this project. The dataset can also be extended by adding new samples from security camera footages on streets or underground stations.

In this project we will use various machine learning algorithms to detect threat in early stage and help the governance body to take appropriate action against women harassment in public places.

CCTV has come a long way in terms of behaviour and activity analysis. With earlier technology, cameras could only recognize a small number of objects, like differentiating between a person strolling and a car traveling. "Video monitoring systems can now determine specific details about what cameras are seeing thanks to deep learning algorithms. This also includes more specific details, like whether the person in the video is a man or a woman, what colour his or her clothes are, and whether anyone is attempting to follow the woman. Object Tracking is so accurate because of deep learning algorithms.

Some of the future scopes are: -

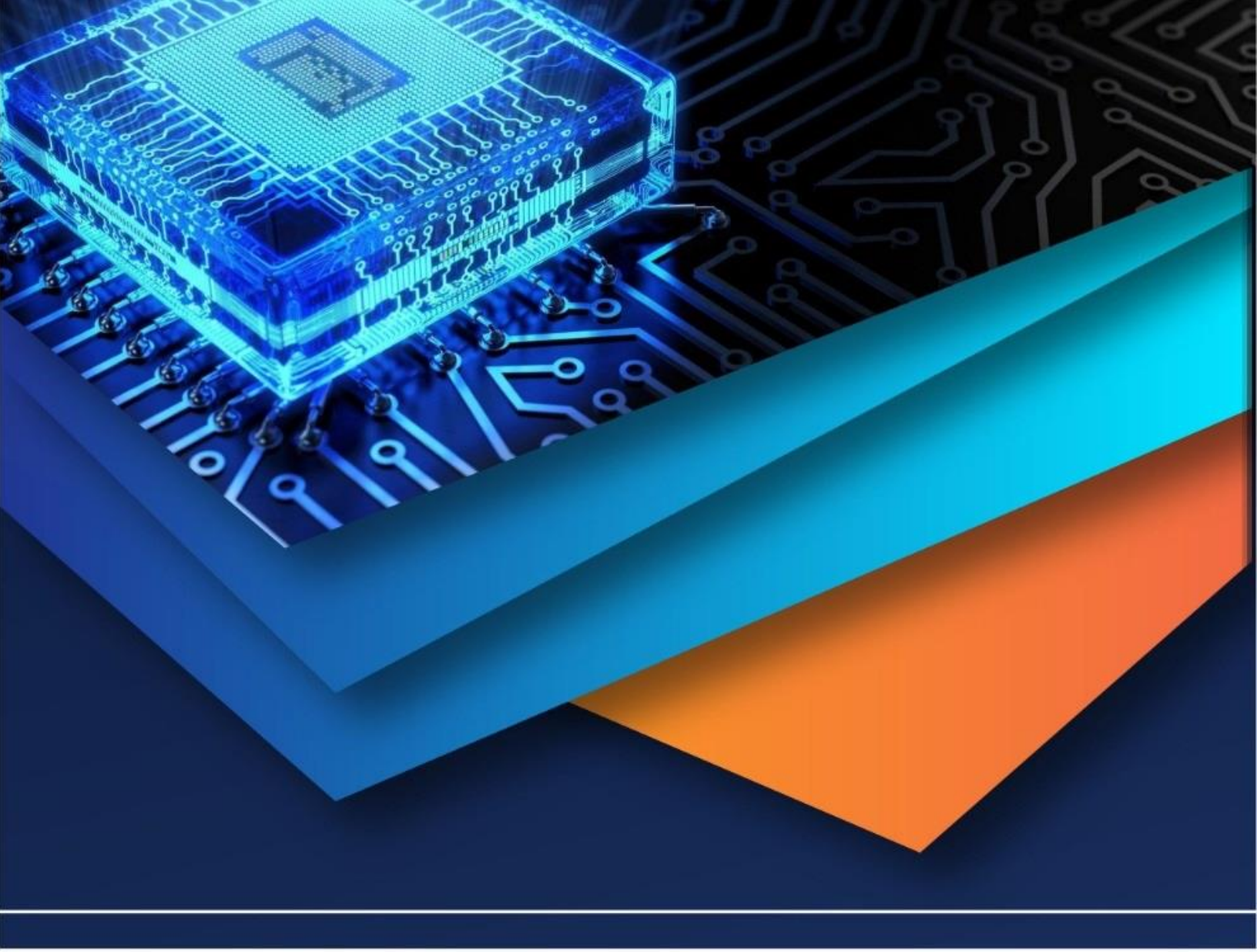
1) Efficient patrolling of police by analysing the past data.
2) Embedding the cell id recognition to instantly identification of culprits.
3) Used as a software for the same purpose in private organizations
4) Monitoring and classification of the past criminals.

IX. ACKNOWLEDGEMENTS

Projects are great opportunities offered to those who are specializing in certain skills and career development. This will help an aspirant develop working ethics and set great working standards that could help build his/her working foundations in a group. With this, it is important to expose these aspirants to a great and competitive working environment that could enhance their skills, capabilities, standards, and outputs. The journey started as a student towards professional life with the aim in mind to learn the practical aspect of life, ended as a memorable experience, and also helped me to come off with flying colours. No work can be completed without others' help or contribution. The preparation of the presentation of this humble work encompasses the immense and unlimited help and sound thought of innumerable people. I express my deep and sincere gratitude to my teacher and guide Prof. A. V. Dirgule, for guidance, supervision which helped me to tide over the hardship encountered during the study. Special thanks to Head of Department Dr. Prof. M. P. Wankhede and Principal Dr. S. D. Lokhande for expert suggestion & encouragement. I would like to express my sincere gratitude to them for providing me with the most valuable guidance given to me at every stage to boost my morale, which helped me to add a feather in my cap. Last but not least my sincere gratitude to all people who knowingly or unknowingly supported me to turn this project into a reality.

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