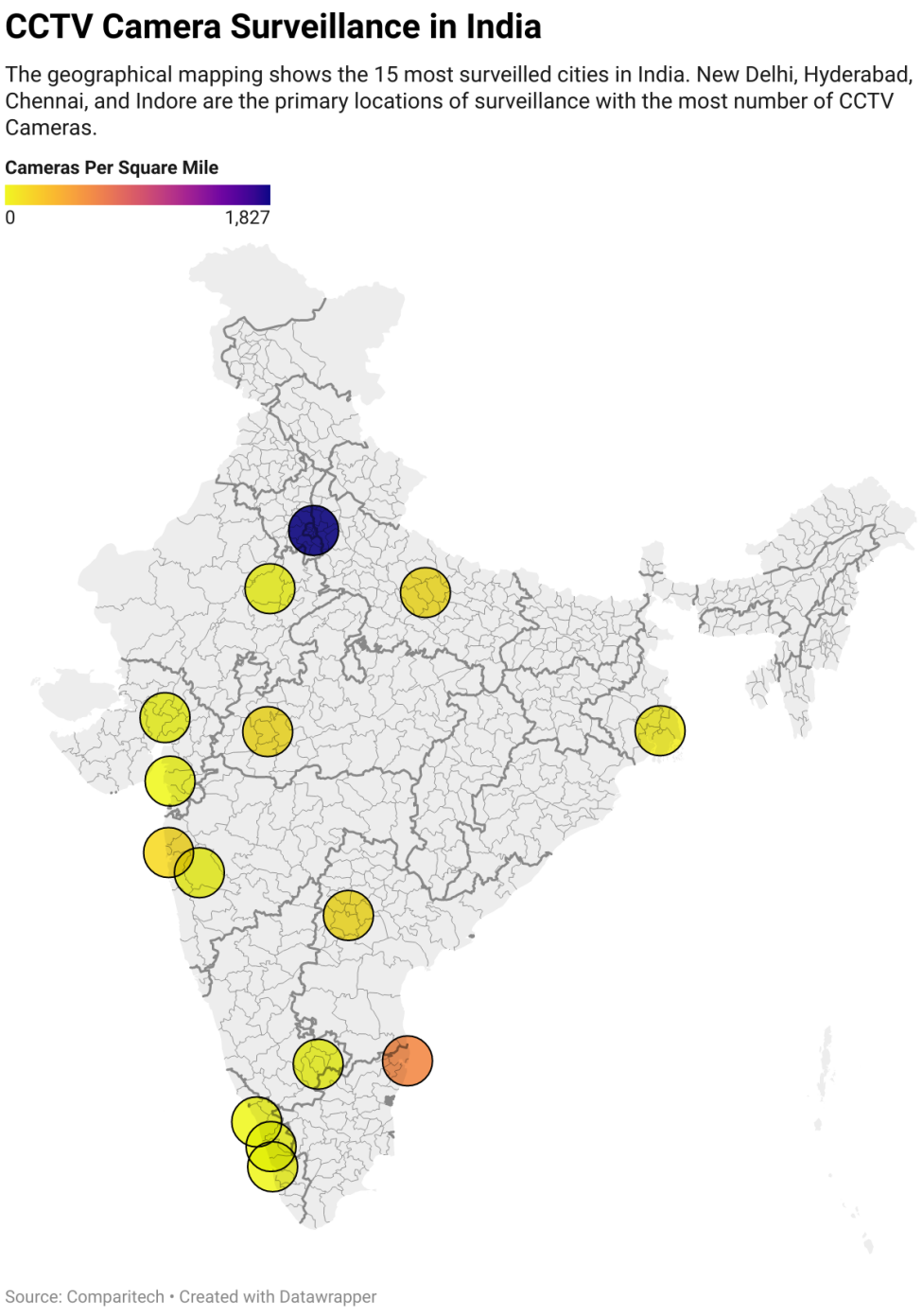
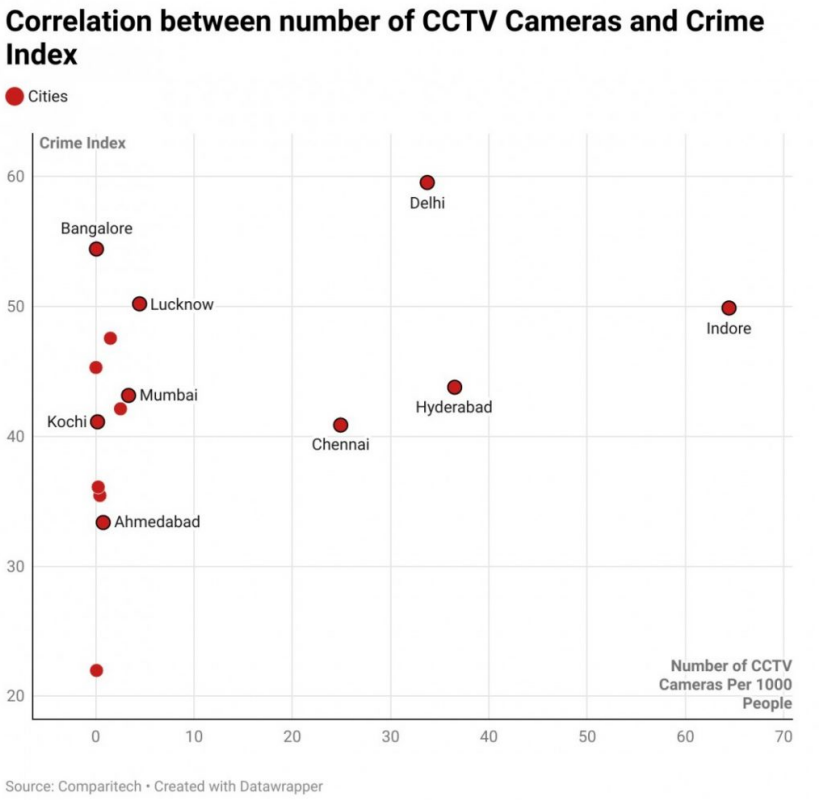
IPD REPORT

Deep Learning Approach for Suspicious Activity Detection from Surveillance Video

1. SURVEY CONDUCTED (Explain the form of survey conducted in detail)

1.1. Field survey





1.2. Literature survey

The rising number of CCTV cameras in India is a cause of grave concern. Figure 1 shows that around 1.54 million cameras are spread among India's top 15 cities. New Delhi (5,51,500), Hyderabad (3,75,000), Chennai (2,80,000), and Indore (2,00,600) have the most surveillance cameras in the country. It is worth noting that almost 91.1% of CCTV cameras installed in the country are present only in these four cities.

Figure 2 shows the correlation between CCTV cameras per 1,000 people and crime index in India. It reveals that high surveillance rates do not always result in lower crime indices.Cities like New Delhi, Indore, Hyderabad, and Chennai, which are the focal spots of CCTV surveillance in India, rank high on the crime index. Meanwhile, cities with fewer cameras like Bangalore, Kolkata, and Kochi have lower crime indices.

Surfshark's January 2020 report found that increased camera numbers do not correlate with the crime index globally. According to the California Research Bureau's study on video surveillance and biometric technologies of US law enforcement agencies, there is limited evidence that CCTV cameras reduce crime rates in our society.

1.3. Outcome of survey

From the data, we can see that there is no correlation between number of CCTV times and crime rate. Only installing CCTV cameras isn't the solution. It needs to be properly monitored as well. But monitoring the footage of so many cameras all the time is not possible. So we need a system that would help us identify suspicious activities and share alerts and timestamp of the surveillance video. This would make it easier for authorities or security agencies to take quick action, helping reduce the chances of mishaps or crimes.

2. Need of the product

2.1. Explain in detail why the product is needed?

The need for a CCTV surveillance system with suspicious activity detection using CNN arises from the increasing importance of security and the desire to enhance monitoring capabilities in various environments. Here are some reasons why such a product is valuable:

1. Enhanced security: By integrating CNN-based suspicious activity detection into a CCTV surveillance system, you can improve security measures by automatically identifying and flagging potentially suspicious behaviors or events. This can help prevent crimes, mitigate risks, and enhance overall safety.

2. Real-time monitoring: Traditional manual monitoring of CCTV footage can be time-consuming and prone to human error. By employing CNN algorithms, the system can automatically analyze video streams in real-time, allowing for swift detection and response to suspicious activities, minimizing the need for constant human vigilance.

3. Scalability and coverage: A CNN-based surveillance system can be deployed in various environments, such as public spaces, transportation hubs, commercial buildings, or residential areas. This scalability enables comprehensive coverage, allowing for effective monitoring of a large area with multiple cameras.

4. Rapid response and intervention: When suspicious activities are detected, the system can immediately alert security personnel or authorities, enabling faster response times and intervention. This can help prevent incidents from escalating and potentially aid in capturing perpetrators.

5. Efficient resource allocation: By automating the detection of suspicious activities, the system can reduce the burden on security personnel, allowing them to focus on critical tasks and investigations. This can optimize resource allocation and increase the overall efficiency of security operations.

6. Forensic analysis and evidence: In the event of an incident or crime, the CCTV surveillance system can provide valuable video evidence for forensic analysis and investigations. The suspicious activity detection capability can aid in identifying key moments or events leading up to an incident, assisting law enforcement agencies in their work.

Overall, a CCTV surveillance system with suspicious activity detection using CNN can significantly improve security measures, enhance monitoring capabilities, and contribute to maintaining public safety in a wide range of environments.

2.2. If an extension of existing, then explain drawbacks of the existing

drawbacks of current ones, why we use CNN - Models like OpenPose[1], PoseNet[2] give out the keypoint coordinates of the people in the image/video in real time. But just obtaining the keypoints of the people without any background or surrounding objects information is not enough to decide if an activity is suspicious. So, we use a CNN approach in our system instead of using a keypoints based approach.

3. PROBLEM FORMULATION

3.1. Problem Formulation

The inefficiency of manual monitoring in CCTV surveillance poses significant challenges in detecting and responding to suspicious activities effectively. The reliance on human vigilance alone often leads to delays and potential errors in identifying and addressing security threats. There is a need to develop a solution that integrates CNN-based suspicious activity detection into CCTV surveillance systems, reducing dependence on manual monitoring and enabling automated real-time analysis of video footage. This solution should address the limitations of manual monitoring, improve response times, and enhance the overall efficiency and accuracy of detecting suspicious activities, ultimately ensuring a higher level of security and safety in monitored environments.

3.2. Product objectives

1. Develop a CCTV surveillance system that incorporates CNN-based suspicious activity detection to enhance security measures and monitoring capabilities.
2. Create an automated system that reduces reliance on manual monitoring, minimizing human error and improving efficiency in identifying suspicious activities.
3. Implement real-time analysis of video footage using CNN algorithms to enable proactive response measures and timely intervention in the event of security threats.
4. Improve accuracy and reliability of suspicious activity detection, minimizing false positives and false negatives through continuous model training and refinement.
5. Ensure scalability of the product, allowing it to be deployed in various environments and easily integrated with existing CCTV surveillance infrastructure.
6. Provide a user-friendly interface for configuring and managing the system, allowing security personnel to monitor and review flagged activities efficiently.

3.3. Applications of the product

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3.4. Novelty

The implementation of a CCTV surveillance system with suspicious activity detection using Convolutional Neural Networks (CNN) introduces a novel approach to enhancing security measures. By integrating CNN algorithms into existing CCTV infrastructure, the system automates the analysis of video footage, reducing reliance on manual monitoring. In real-time, the system can detect suspicious activities as they occur, enabling proactive response measures and enhancing overall security. The solution is adaptable and scalable, making it suitable for various environments and applications, from small-scale deployments to large-scale implementations. Continuous learning mechanisms ensure that the system improves over time by retraining the CNN model with new data, enabling it to adapt to evolving threats and enhance accuracy. Additionally, the system can be seamlessly integrated with existing infrastructure, minimizing the need for extensive hardware changes. Privacy considerations are also addressed, ensuring compliance with regulations and protecting personal information captured by the CCTV system. Overall, the implementation of this system brings a novel and efficient approach to surveillance, enhancing security and safety in monitored environments.

3.5. Scope of the project

The scale and range of the project can vary based on available resources, technical constraints, and specific domain requirements. It can span from small-scale deployments to large-scale implementations covering multiple locations or even entire cities. Factors such as camera density, computational resources, dataset size, predefined activities, environmental constraints, and privacy considerations can influence the extent of completion for the project. Careful consideration of these factors is necessary to ensure a feasible and effective implementation within the desired domain or application.

4. PROPOSED DESIGN

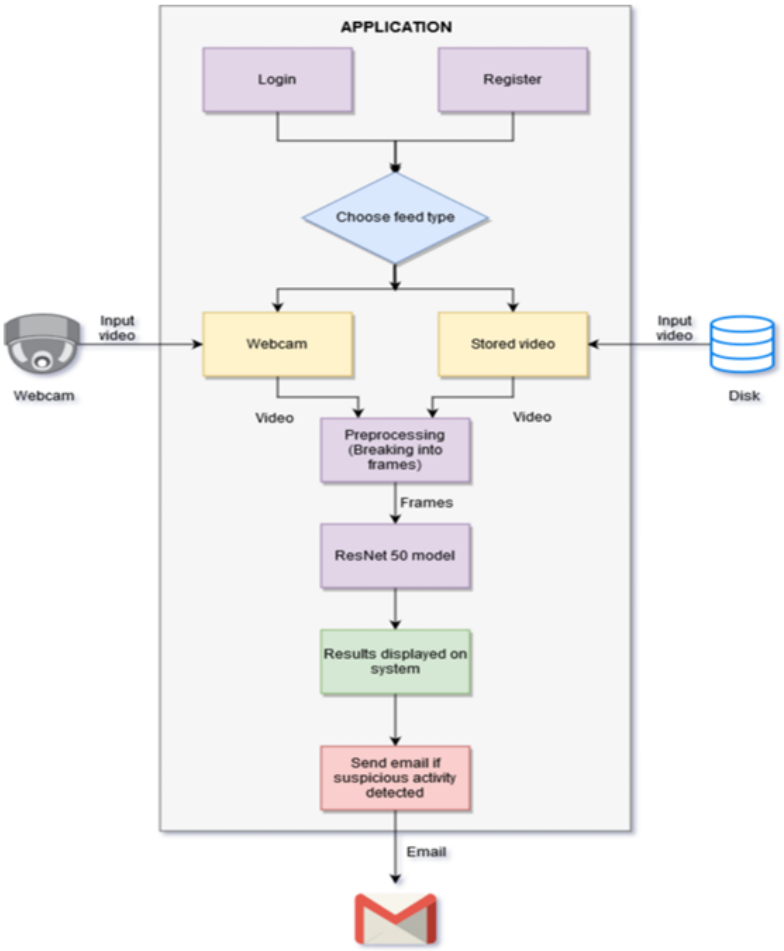


Figure 1: System Architecture

5. IMPLEMENTATION

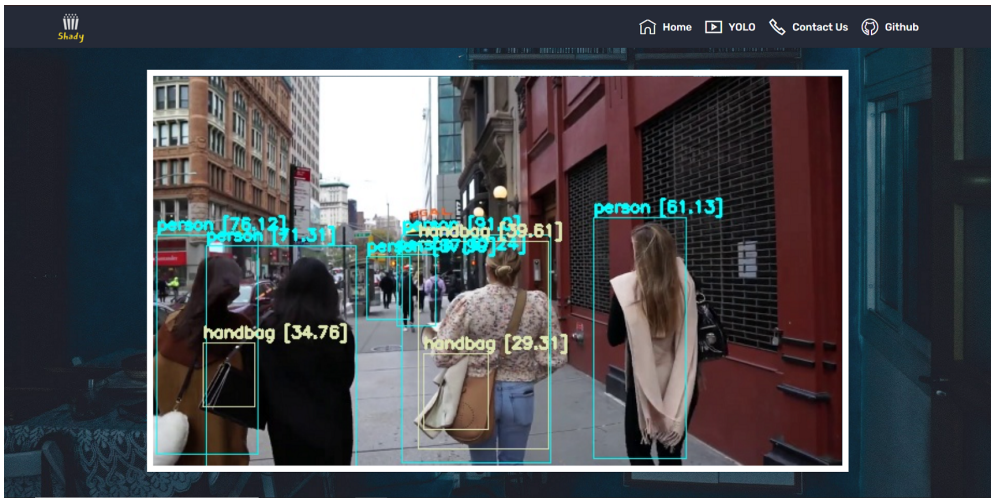
5.1. Database design

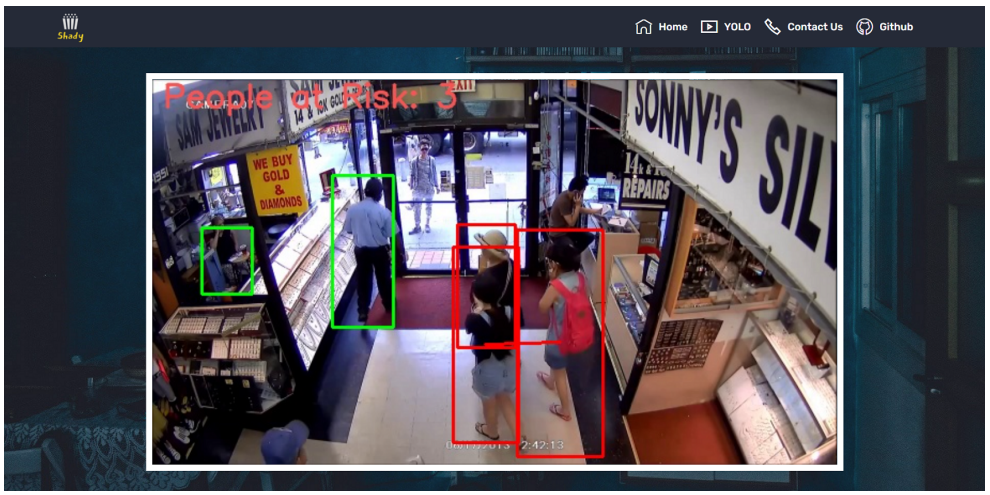
5.2. Use cases

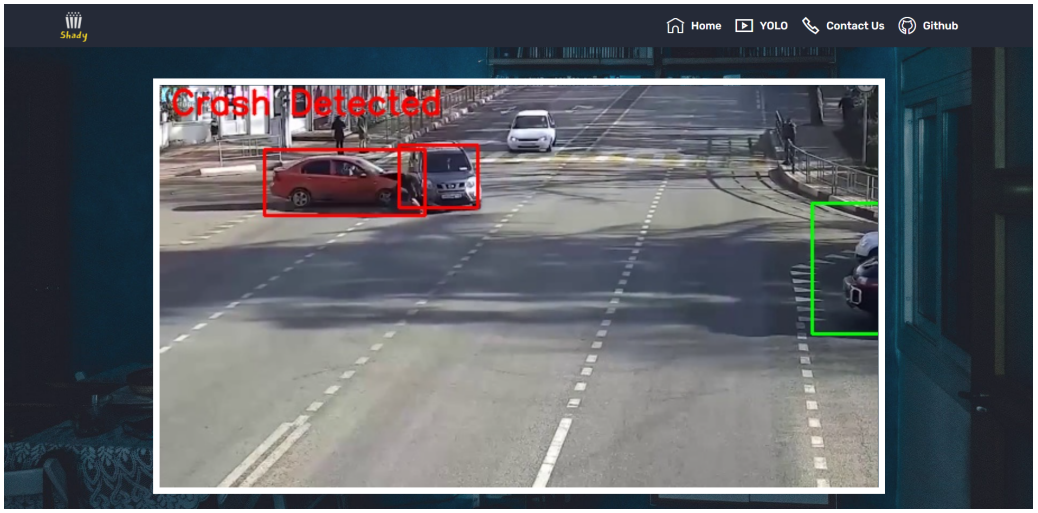
1. Public Spaces: Detecting suspicious activities in city centers, transportation hubs, and stadiums to enhance public safety and crowd management.
2. Retail Security: Identifying shoplifting, theft, or suspicious behaviors in retail environments for proactive loss prevention and improved security.
3. Critical Infrastructure Protection: Monitoring critical facilities like power plants or airports to detect unauthorized access and potential security threats.

4. Smart Cities: Real-time monitoring of public areas, traffic management, and identifying unusual behaviors for improved safety in smart city initiatives.
5. Workplace Security: Enhancing safety in office buildings, factories, or warehouses by monitoring for unauthorized access and suspicious activities.
6. Residential Security: Monitoring residential complexes or neighborhoods to detect and deter potential criminal acts for the safety of residents.

5.3. GUI design







5.4. Modules implementation

1. Video Acquisition: Capture video footage from CCTV cameras.

2. Preprocessing: Prepare video data by resizing, normalizing, and enhancing.

3. CNN Model Development: Design and train a CNN model for activity detection.

4. Real-time Activity Detection: Apply the trained model to detect suspicious activities.

5. Alert Generation: Generate alerts or notifications when suspicious activities are detected.

6. Alert Visualization and Management: Provide a user interface to view and manage alerts.

7. System Configuration and Integration: Configure the system and integrate with existing infrastructure.

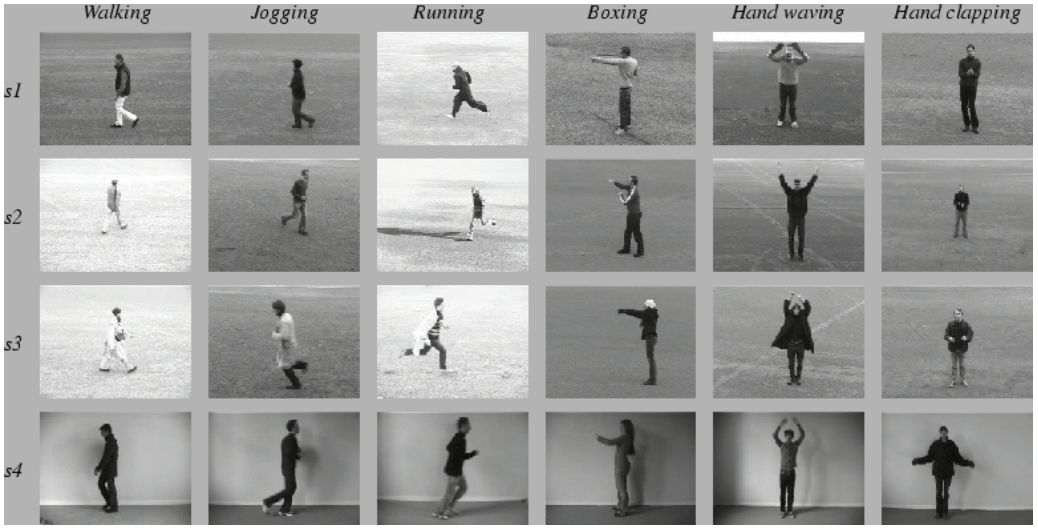
8. Continuous Training and Improvement: Continuously update and retrain the model for optimal performance.

6. EXPERIMENTATION & RESULTS

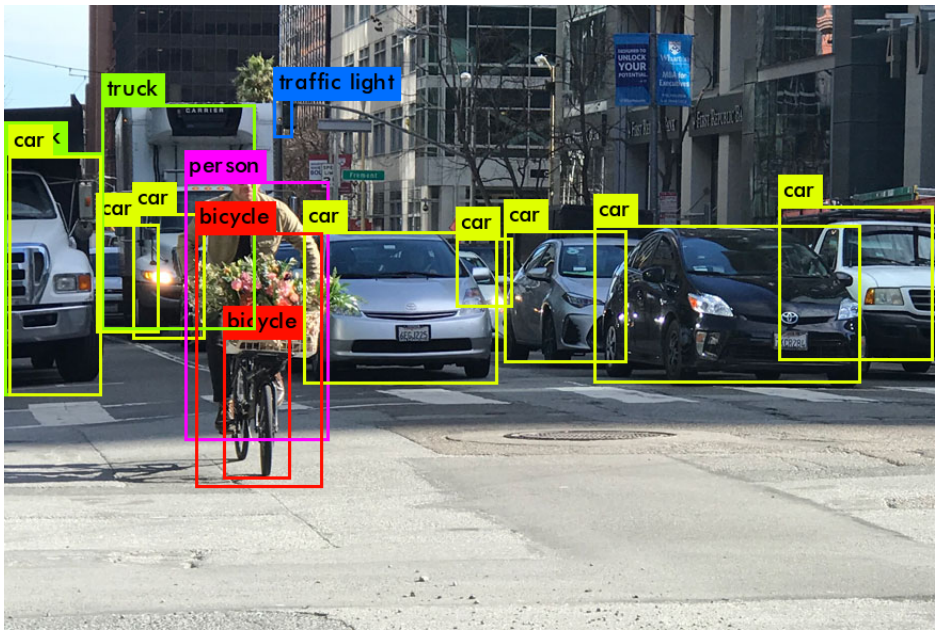
6.1. Datasets / Tables

- KTH dataset (Normal activity)
- UFC Crime Dataset(Two classes anomalous and non-anomalous)
- CAVIAR dataset and specific videos ,are used for training suspicious behavior (mobile phone using inside the campus, fighting and fainting).

6.2. Test cases



6.3. Results



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- ADVANCE SUSPICIOUS ACTIVITY DETECTION Ms. Archana R. Ghuge*1, Mr. Rushikesh S. Wakchaure*2, Mr. Sagar D. Wagh*3, Mr. Parag S. Hude*4, Ms. Aishwaraya V. Pingale*5