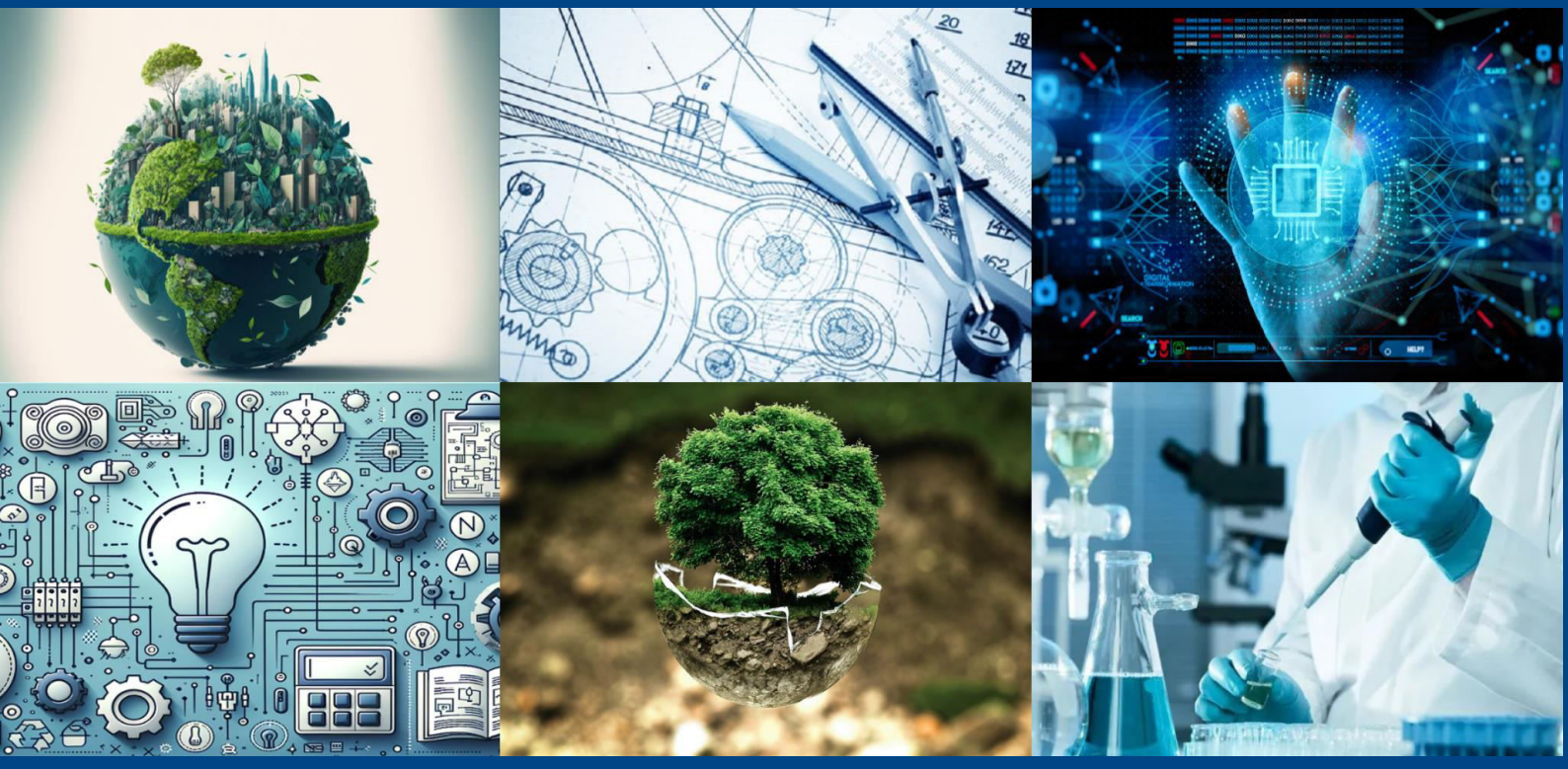
ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206 **Volume 8, Issue 3, March 2025**

© 2025 IJMRSET | Volume 8, Issue 3, March 2025| DOI: 10.15680/IJMRSET.2025.0803029

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Smart Surveillance System using Deep Learning

Prof. Dr Pankaj Dashore, Hitesh Drupad Chaudhari, Suchit Sanjay Buwa, Krishna Mukesh Agarwal, Nachiket Kailas Kshirsagar

Department of Computer Science, Sandip University College, Nashik, India

ABSTRACT: In recent years, the need for intelligent and automated surveillance systems has significantly increased to ensure safety and security in public and private spaces. Traditional surveillance requires constant human monitoring, which is inefficient and prone to errors. To address these limitations, this paper proposes a Smart Surveillance System that integrates Object Detection, Face Recognition, and Anomaly Detection using advanced Machine Learning (ML) and Deep Learning techniques. Convolutional Neural Networks (CNNs) are employed for real-time object identification, while face recognition is handled through models such as Haar Cascades and deep neural networks to accurately detect and verify individuals. Furthermore, anomaly detection algorithms are incorporated to automatically identify suspicious behavior, reducing the dependency on continuous human supervision. This system aims to enhance security by providing real-time alerts and comprehensive monitoring, making it suitable for smart cities, industries, and sensitive installations. Experimental results show improved accuracy, faster detection, and reliable anomaly identification, making the proposed system an efficient solution for modern surveillance challenges.

KEYWORDS: Smart Surveillance System, Object Detection, Face Recognition, Anomaly Detection, CNN, Deep Learning, Haar Cascades, Security Monitoring, Real-Time Detection, Computer Vision.

I. INTRODUCTION

In today's world, security and surveillance have become essential components for ensuring the safety of people, assets, and infrastructure. Traditional surveillance systems rely heavily on manual monitoring of video feeds, which is not only labor-intensive but also prone to human error and oversight. To overcome these limitations, artificial intelligence (AI) and machine learning (ML) have revolutionized surveillance by enabling automation, real-time decision-making, and intelligent alerts.

The emergence of object detection, face recognition, and anomaly detection technologies has transformed surveillance systems into smart, self-operating security solutions. Convolutional Neural Networks (CNNs) have made real-time object identification feasible, while deep learning models can accurately recognize individuals and detect suspicious behavior. These advancements help reduce human involvement, improve accuracy, and ensure timely response in critical situations.

This research presents a Smart Surveillance System that integrates object detection, face recognition, and anomaly detection into one automated platform. The system aims to enhance security through real-time monitoring and analysis of surveillance footage using deep learning algorithms, providing an efficient, scalable, and reliable solution for modern security needs.

II. LITERATURE SURVEY

1. Redmon et al. (2016) introduced YOLO (You Only Look Once), a groundbreaking real-time object detection system that balances speed and accuracy, making it ideal for live surveillance.
2. Viola and Jones (2001) developed the Haar Cascade Classifier, which remains a popular algorithm for rapid face detection in static images and video frames.
3. Taigman et al. (2014) proposed DeepFace, achieving human-level face verification using deep neural networks, which has been widely adopted in surveillance.
4. Dalal and Triggs (2005) presented Histogram of Oriented Gradients (HOG) for robust pedestrian detection, contributing significantly to human tracking in surveillance.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

5. Sultani et al. (2018) worked on anomaly detection in surveillance videos using weakly supervised deep learning to detect unusual activities without precise labels.
6. Ren et al. (2015) developed Faster R-CNN, which improved object detection speed and accuracy, making it suitable for surveillance systems with limited computational resources.
7. Zhao et al. (2019) created an anomaly detection model that uses spatiotemporal features to identify suspicious behavior in crowded environments.
8. Parkhi et al. (2015) introduced FaceNet, which maps facial features to a compact Euclidean space for highly accurate face recognition in real-time systems.
9. Zhou et al. (2020) designed a hybrid surveillance system combining motion detection and object recognition for increased accuracy in complex environments.
10. Ruff et al. (2018) presented an autoencoder-based anomaly detection framework, demonstrating high potential for real-time abnormal behavior identification in surveillance videos.

III. PROBLEM STATEMENT

Conventional surveillance systems rely on human operators to continuously monitor live feeds, which is inefficient, error-prone, and unsustainable for large-scale operations. There is a critical need for an automated, intelligent surveillance system capable of real-time object detection, face recognition, and anomaly detection to reduce manual effort, increase security accuracy, and provide timely alerts for potential threats.

IV. METHODOLOGY

The proposed Smart Surveillance System is developed using deep learning and computer vision techniques:

1. Object Detection: Implement YOLOv8 to detect humans, vehicles, and objects within the camera frame.
2. Face Recognition: Utilize Dlib or FaceNet to identify and verify individuals against a pre-existing database of authorized personnel.
3. Anomaly Detection: Apply machine learning algorithms such as Isolation Forest or Autoencoder to analyze movement patterns and detect suspicious behavior.
4. Real-Time Processing: Use OpenCV for capturing and processing live video feeds.
5. Alert System: When an anomaly or unknown face is detected, the system sends automated notifications (email/SMS) to the concerned authorities.
6. Database Management: Store face data and activity logs in SQLite or MySQL for easy retrieval and audit.

V. MODULES

1. **Live Video Streaming Module:** Captures real-time footage from cameras.
2. **Object Detection Module:** Detects and tracks objects in live video.
3. **Face Recognition Module:** Identifies individuals and matches them to stored profiles.
4. **Anomaly Detection Module:** Detects abnormal activities based on behavior analysis.
5. **Alert System Module:** Sends notifications and alarms on detection of threats.
6. **Database Module:** Stores user data, face profiles, and historical logs.
7. **User Interface Module:** Displays live feeds, alerts, and reports.

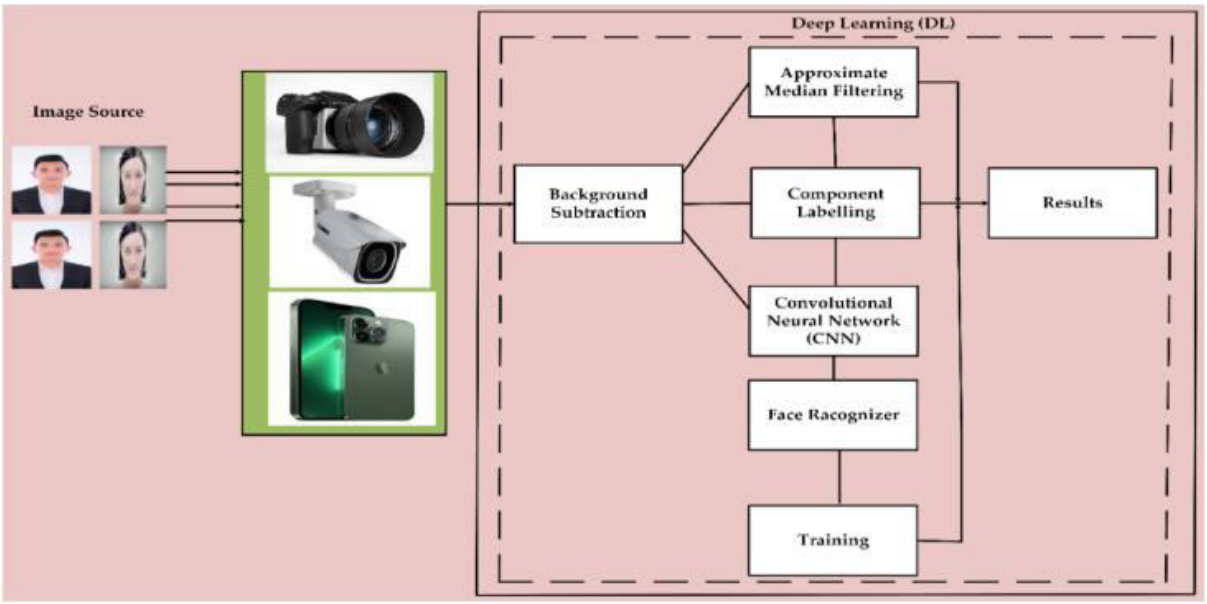
© 2025 IJMRSET | Volume 8, Issue 3, March 2025| DOI: 10.15680/IJMRSET.2025.0803029

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VI. SYSTEM ARCHITECTURE



VII. OBJECTIVES

- To automate surveillance using AI-based object, face, and anomaly detection.
- To reduce human dependency in monitoring and reviewing security footage.
- To detect and alert authorities about unauthorized access and suspicious behavior.
- To create a scalable, real-time system for improved safety and security.

VIII. CONCLUSION

The **Smart Surveillance System** integrates modern machine learning techniques to create a reliable, real-time monitoring solution. By combining object detection, face recognition, and anomaly detection, the system enhances security, reduces manual monitoring, and ensures timely alerts for any suspicious activities. This innovative approach has the potential to replace traditional surveillance methods, making environments safer and smarter.

IX. FUTURE WORK

- Integration of **multiple camera streams** to monitor larger areas.
- Adding **audio analysis** to detect sounds like glass breaking or shouting.
- Deploying the system on **edge devices** for improved performance and reduced latency.
- Implementing **crowd behavior analysis** for public space monitoring.
- Developing a **mobile application** to provide real-time alerts and video access on the go.

REFERENCES

[1] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, “You only look once: Unified, real-time object detection,” in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 779–788, 2016.
[2] P. Viola and M. Jones, “Rapid object detection using a boosted cascade of simple features,” in Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), vol. 1, pp. I-511–I-518, 2001.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

[3] Y. Taigman, M. Yang, M. Ranzato, and L. Wolf, "DeepFace: Closing the gap to human-level performance in face verification," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 1701–1708, 2014.
[4] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), vol. 1, pp. 886–893, 2005.
[5] W. Sultani, C. Chen, and M. Shah, "Real-world anomaly detection in surveillance videos," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 6479–6488, 2018.
[6] S. Ren, K. He, R. Girshick, and J. Sun, "Faster R-CNN: Towards real-time object detection with region proposal networks," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 6, pp. 1137–1149, 2017.
[7] X. Zhao, D. Liang, L. Li, and G. Zhou, "Spatiotemporal anomaly detection for real-time surveillance applications," Journal of Visual Communication and Image Representation, vol. 58, pp. 380–390, 2019.
[8] O. M. Parkhi, A. Vedaldi, and A. Zisserman, "Deep face recognition," British Machine Vision Conference (BMVC), vol. 1, no. 3, pp. 6, 2015.
[9] L. Zhou, J. Xu, and H. Zhang, "Hybrid surveillance system combining motion detection and object recognition," International Journal of Advanced Computer Science and Applications (IJACSA), vol. 11, no. 5, pp. 142–149, 2020.
[10] L. Ruff, R. Vandermeulen, N. Görnitz, and K.-R. Müller, "Deep one-class classification," in Proceedings of the 35th International Conference on Machine Learning (ICML), pp. 4393–4402, 2018.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com