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Review on Camera based Surveillance Systems

Mrs. Naziya Farhat[1], Mohammad Nasiruddin[2]
[1]*M.Tech Student,* [2]*Associate Professor, Department of Electronics and Communication, Anjuman College of Engineering and Technology, Sadar ,Nagpur*

Abstract: ***Surveillance systems that use cameras to monitor the environment are known as automated surveillance systems. Motion detection, crowd behavior, individual behavior, and interactions between persons, crowds, and their surrounding environment are all used to analyses the observed scenario. These automated systems perform a wide range of functions, including detection, interpretation, comprehension, recording, and the generation of alarms based on the analysis. By manipulating various elements of these systems, researchers have been able to improve monitoring performance while minimizing possible human failings. This study provides a thorough examination of such video surveillance systems and the components that go with them. The architectures that were employed are described, along with the most important analyses in these systems. Existing surveillance systems were compared in terms of to provide a wider picture and a more holistic understanding of the system.***

I. INTRODUCTION

Security pertains to people's conceptions of environmental protection, and it signifies "without fear of danger." This study provides a literature review on the subject of security, with a focus on autonomous surveillance, compiling technical innovations in surveillance systems, applications, and central components into a single document. During our study, we discovered that deep learning is being used for surveillance, opening up new research possibilities in an area that has seen little development in the last 10 years, and we also discovered that new enormous datasets are being created to answer security challenges. The domain of surveillance and intrusion prevention has always been busy. Security measures have always been crucial for mankind's protection and survival since prehistoric times. Man has always been inventing ways to more effectively detect risk situations, using equipment such as audible systems, such as bells; visual elements, such as movement ropes, torches, or human signals; and, most recently, vision equipment, which allows it to detect intrusion of wildlife or strange people. Security is a major worry in today's business world. Surveillance cameras are used by organisations to solve this problem. The use of them is limited because an operator is required to monitor the camera feed and make appropriate decisions. Camera-based surveillance has expanded beyond security to include tracking, environmental and threat assessments, and many more applications. It is possible to automate the procedure by utilising the capabilities of contemporary computing and electronics.

With the advent of machine learning, deep learning, and computer vision techniques, this approach has become more efficient and practical for broad application. So, rather than relying on humans for monitoring and insight generation, we may delegate the duty to the processor and machine learning system, which will be more efficient and error-free.

There is currently a belief that the so-called fourth industrial revolution [1], [2], [3], which promotes the integration of massive amounts of data with existing equipment, as well as its analysis through the use of artificial intelligence technologies, will improve the industry in ways that have never been seen before. It also involves the security component [4], in which intelligent surveillance applications are being implemented at a faster rate [5], through applications aimed not only at the industrial but also at the civil domain. Some applications under development or already in use are targeted at determining where industrial personnel are located or monitoring restricted locations, for example.

II. LITERATURE REVIEW

Various studies explain modern elements of surveillance, for example, [6], [7], which outline several important properties of surveillance systems that can be used to evaluate current systems. A set of common qualities for a surveillance system, as well as some of its uses, are listed below.

Geriatric care and home hospitalisation are examples of home health care/home monitoring [8], [9]. These methods could include the use of monitoring systems to detect any anomalous behaviour in patients, as well as a more precise follow-up for those with conditions that require greater attention, such as Alzheimer's disease. It would save money on things like having a permanent nurse at home [10], and a camera could learn things like falls, acute anxiety, vomiting, and even identify major injuries.

Intrusion detection: Detecting a person trespass-ing the property constraints would avail to take appropri-orally consumed actions such as calling the 911 emergency sys-tem, locking doors, or activating an audible alarm [10]-[11].·

Animal Intrusion: Detect when a predator is on an urban property or rural, and determine if that specific animal needs a call to the police. The systems could have a list of local animals that re-quire to be reported to police departments, especially if they are predators, and this can avail the authorities to act afore any assailment occurs, incrementing the chances that the animal will survive, minimizing the human impact, and preserving people from an at-tack [1].·

Home assault: Detecting a person or group of people with the intention of assaulting a denizen of a house [8]-[9] and can avail the ascendant entities to have more precise alarms, sending information on how many people there are if they are armed and their truculent deportment.· Restrict access: An astute surveillance system that can control access to specific areas without the desideratum to carry any contrivance and it could even trigger an alarm if a specific person is detected outside its sanctioned limits [8], [9].

Furthermore, according to the literature review, it is possible to obtain a general organization of perspicacious surveillance systems into three general groups according to the type of algorithm used: · Systems predicated on classic algorithms, which are predicated on a well-kenned and specific formula, such as obnubilated Markov chain algorithms, Gaussian mixing;· Systems predicated on machine learning algorithms, such as those predicated on support vector machines and deep learning, and · Mix of the two types or mixed. Because of the ascension of systems predicated on machine learning and to circumscribe the number of works reviewed, in this study we will fixate on those of the second group: systems predicated on machine learning algorithms.

Zhao et al. [3], on the other hand, propose a module to estimate the surveillance system's gaze direction. The module's unique feature is that it can be taught using synthetic images and a generative artificial neural network (GAN) (Generative adversarial network).

Dautov et al. [4] combine technology from the Internet of Things, the cloud, Edge Computing, and Big Data in an intelligent surveillance system, with a focus on data analysis generated by the system's sensors.

Shahad et al. [6] present an intelligent surveillance system that employs Complex Event Processing technology and is utilised to detect intrusions through data correlation. Furthermore, the engine employs four classifiers to forecast the occurrence of events based on the recognition of patterns in data sequences obtained from door sensors and security cameras. In Al-Nawashi et al. [7], an autonomous surveillance system for academic environments is proposed, which is based on video and capable of monitoring a scene in real time and detecting irregularities. Pre-processing, detection of abnormal human behaviour, and content-based image retrieval phase are the three modules of this system, which uses a support vector machine type classifier.

The following primary characteristics were identified within the algorithms evaluated within this group: people-oriented detection, identification of hidden objects, pose estimation, behaviour classification/action recognition, and facial recognition and identification. These issues are discussed in the sections below.

Metrics for algorithms based on machine learning In this section, we look at how to measure the performance of several algorithms for people-oriented hidden object detection and identification, pose estimation, behaviour classification, and facial recognition and identification. In general, surveillance systems based on machine learning algorithms evaluate their performance based on the algorithms' capacity, therefore metrics that quantify their precision to categories, detect, and respond to the events to which you want the system to respond are employed in the evaluation.

A. Methods of Employing Camera Video and Image Acquisition

The three real-time implementation techniques proposed for configuring, interfacing, and networking the IP camera are:

1) Using the WANSCAM or XXCAM vendor software to access the IP-based camera,

2) Using the Firefox® web browser to access the IP-based camera, and 3) using MATLAB with SIMULINK on an internet system to access the IP camera.

The user of an IoT-based security system can monitor activity from a remote place and collect images based on his preferences. When an incursion is detected, the Android app allows the user to receive notifications and examine the image from a remote location. PIR motion detectors are used to detect movement. In order to avoid frequent interruptions, the system functions in both Auto and Manual mode. Notifications are provided to the user only when Auto mode is enabled.

The ability to operate the Raspberry Pi from a window has been established, which means that the user can alter the position of the camera from an Android phone window and record a fresh image.

B. Techniques for Analyzing

Image categorization frequently necessitates feature extraction; there are a variety of feature extraction approaches that work well for various visual recognitions. Histograms and the patterns method are two examples of methodologies that need domain expertise to identify features and manual coding depending on the domain and data format.

While deep learning eliminates all of the drawbacks of earlier techniques, it does necessitate the development of a feature extractor. The most effective and efficient technique to identify photos is to utilise a convolutional neural network (CNN). CNNs can be trained on a large-scale database and then their learnings can be refined and applied to different tasks with less training material.

Depending on the quantity of training data available, training a CNN can take several days or weeks. There are pre-trained models that are publicly available and that have been trained by research teams.

A CNN's architecture is entirely dependent on the domain area, and it can be designed by a domain specialist. Although a CNN can have numerous hidden layers, the complexity of the CNN grows as the number of hidden levels increases.

We may use Haar Cascade to recognise items in a crowded background in a variety of settings, including lighting, position, object size, and position.

III. CONCLUSION

We covered data collection, storage, and analysis techniques for CCTV camera surveillance in this research. We discovered that the haar cascade was beneficial for feature extraction and tuning systems that worked in tandem with deep learning models. Images could be merged and camera location limitations were removed using the Image Mosaicing technology. Thus, among the numerous techniques of collecting camera input, we found the IP based camera technology on a distributed network to be useful, and the CNN model to be helpful for detailed analysis.

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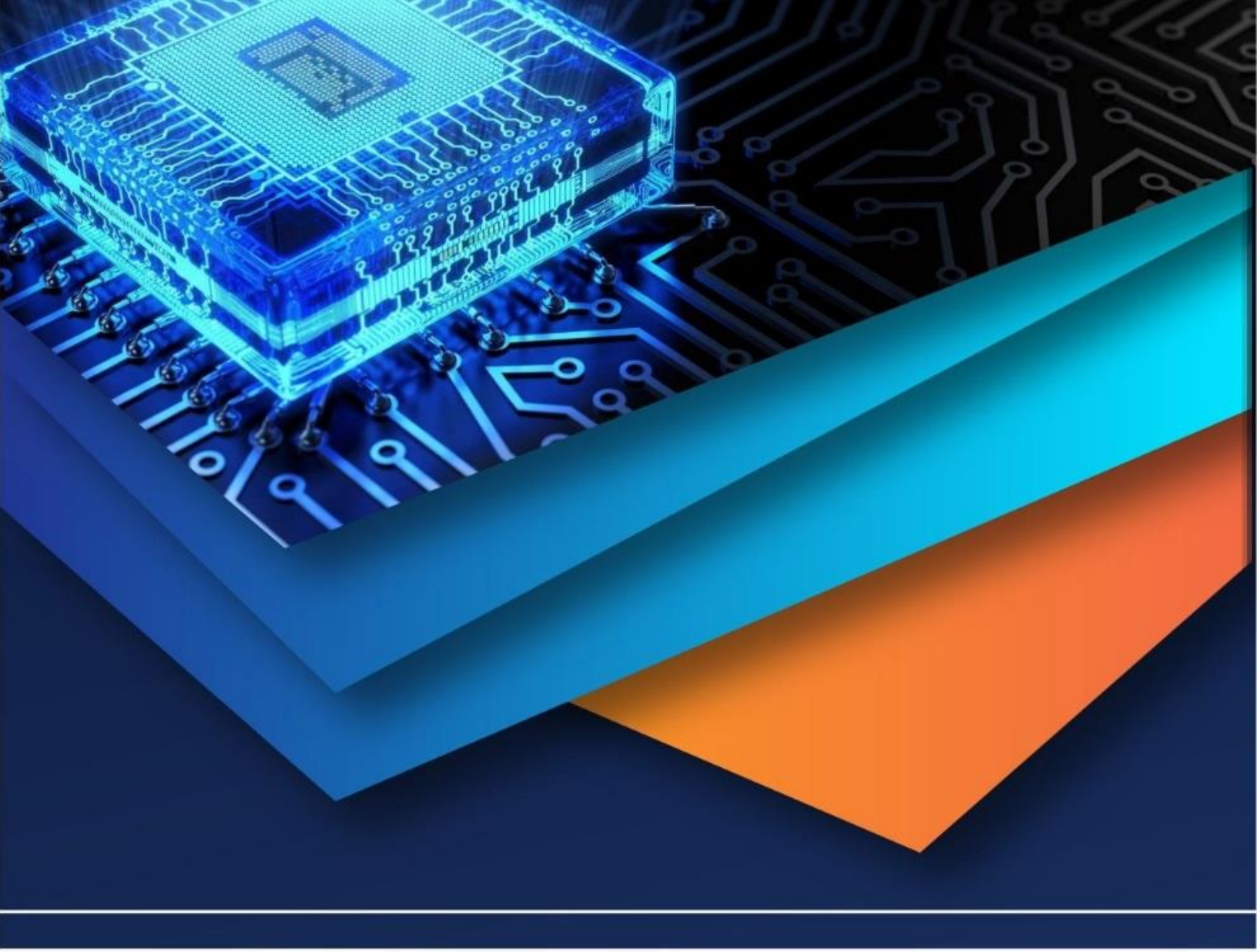

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