International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 12 | Dec 2022 www.irjet.net p-ISSN: 2395-0072

Advance Intelligent Video Surveillance System Using OpenCV

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Abstract

In today's culture, when everyone wants to keep their assets safe and secure, video surveillance for keeping an eye on a certain area, such as hospitals, institutions, public parks, and buildings, has become necessary. Crime has increased as a result of the growing urban population. Video surveillance has significantly impacted citizens. The most popular technology is closed-circuit television (CCTV), but it is more expensive, consumes more power, and requires more storage. We created a cutting-edge intelligent video surveillance system for settings with erratic human presence to address this problem. In such circumstances, it is not required to have cameras trained on the area. This uses up the electricity and the footage storage space that is needed. Machine Learning tool called It uses a software library to implement this system. The proposed system works by capturing video, processing it frame by frame, and starting to record when it recognizes human presence. If the cameras spot any movement, the security system will turn on. The proposed system collects information and keeps it in a local database. The video that was recorded and saved can be used to recognize the intruder and help track him down. It may be useful in locations with sporadic human presence, including homes and bank vaults.

Keywords—: **Surveillance; Intruder; Open CV; Face Recognition**

1. Introduction

How computers might be employed to extract profound insights from digital photos or videos is one of the many topics covered by the tremendously diverse scientific field known as computer vision. The objective is to automate operations that the human visual system is capable of performing from an engineering standpoint. The study of computer vision involves techniques for capturing photographs, processing them, comprehending them as digital images, and extracting high-dimensional information from the real world to create information that may be expressed as numbers or symbols, such as judgements. The primary objective of a set of programming functions known as OpenCV is real-time computer vision (Open-source computer vision). It was initially created by Intel. The collection is multi-platform and freely accessible to anyone. Traditional video security systems don't allow for quick intervention when a crime is being committed. A system like this is also quite expensive and complicated to set up. The goal of this project is to create an intelligent open-source tool that can help people. individuals or organizations in building a secure, affordable system on their own They will therefore have total control over their technology, giving them the ability to secure the settings and modify them to suit their requirements. In order to prevent some crimes, it is essential to secure our homes, places of employment, and other commercial areas. Typical surveillance equipment is unable to inform property owners of any criminal activity. The only thing transmitted and recorded is the feed. As a result, the owners are unable to prevent a break-in or theft right away.

2. Literature survey

There are many different techniques for facial recognition available today, but the majority of them have certain drawbacks. a process for improving face detection accuracy using the Euclidean distance technique. The model is equipped with the Euclidean algorithm to recognize faces from a variety of distances. But this model's weakness is that it can be fooled with facial photos, and the dataset utilized isn't big enough to increase detection accuracy.

Motion detection can be used to stop spoofing that employs simply photographs. Article uses an infrared PIR (Passive Infrared Sensor) sensor to detect motion in the person, which allows it to determine whether the person is genuine or an image. But adding an additional sensor increases the There is no need for an additional sensor because OpenCV 3 provides libraries with algorithms to detect motion in video, which lowers the cost.

Another study makes use of the LPBH algorithm and motion detection to identify faces and record their attendance. However, a person can mark his attendance by wearing another person's mask.This model is not entirely spoof proof because it cannot identify facial features.

The LPBH method is used in this paper to work with low resolution images. Although it makes advantage of low-resolution photos by manipulating pixels, this model still lacks the spoof-proof features required for security surveillance.

This device enhances a home's security features, transforming it into a smart home. [1] The internet of things (IoT) and the raspberry pi are utilized to comply to all of these trends. This defense system alerts the subject to the problem and provides a clean photograph of what's going on.

When the temperature in the living room rises, the fireplace sensor notices it and updates the reputation in the URL that was given to the customer, activating a buzzer. The strength of the gas in the air is the only factor used by the fuel sensor to identify any gas leaks. The automatic door lock is turned on by a dc motor. All statuses are sent across the Internet of Things between the sensors and the user. Paper 3: Raspberry Pi and OpenCV-based low-cost smart security camera with night vision capability.

Context: With the help of a Raspberry Pi (RPI) and a PIR sensor, the system's goal was to develop and construct a low-cost smart security camera with night vision capabilities. It is capable of both individual detection and smoke detection, which may help to prevent both crimes and fires. PIR sensor-equipped Raspberry Pi (RPI) regulates the shifting body, supervises the alarm systems, and uses Bluetooth to send the acquired photographs to the person's email address. As part of the alarm system, the speech "intruder" may be heard when an outsider is detected. This investigation looks at a smart surveillance monitoring device built mostly on the raspberry. Video surveillance is essential for safety in today's society. Commercial spaces must have high-speed cameras, warehouses, hospitals, schools, and other unfavorable indoor and outdoor locations. Due to the expensive RFIDs used in modern solutions, more research is required and the security industry becomes more expensive.

3. Proposed System

OpenCV, an open-source computer vision library, is used to implement the suggested system. It reduces both the amount of power used and the amount of storage needed by only monitoring data when a human is detected.

Mission's methodology model

1. The camera is initialized in step one.

2. The camera begins to scan the surrounding surroundings.

3. If a person is discovered by the camera, the recording will start.

4. If the motion is not detected for a few seconds, the recording may stop.

5. The recorded videos are kept on a local drive.

Architectural Diagram

In addition to showing the relationships, constraints, and difficulties that exist between each part, the architectural diagram also shows how the software device looks overall.

1. Initialization of the camera is done first.

2. The camera's evolution to view the surrounding area begins.

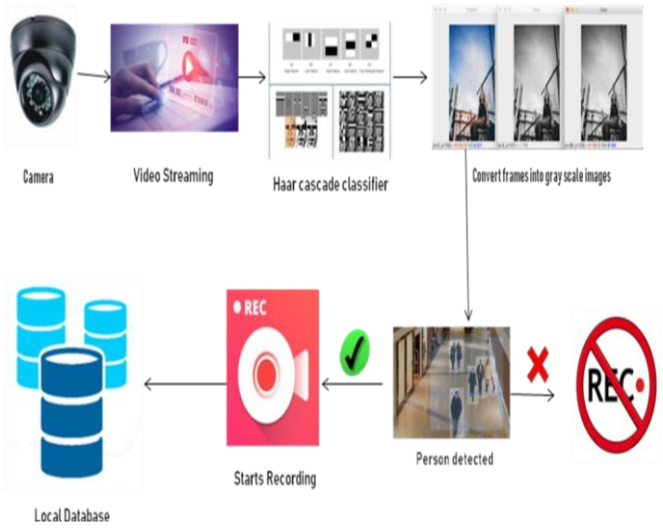
3. Start up the Haar cascade classifier.

4. Produce grayscale images from the video frames.

5. The recording will begin once the digicam recognizes someone.

6. The recording may be halted if the guy or woman isn't always spotted for a few seconds.

7. A neighborhood force stores the video tapes.

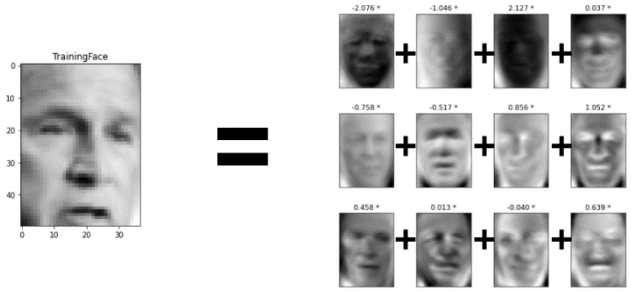


4. EXPERIMENTAL METHODOLOGY

Face Detection Algorithms

Eigenfaces (pca set of rules)

In 1991, Turk and Pentland suggested a face recognition technique based on concepts from linear algebra and dimensionality reduction. This method was used in a range of applications at the time, including handwriting recognition, lip reading, medical picture analysis, and others. It is computationally less expensive and straightforward to implement. In 1901, Pearson proposed PCA (Principal Component Analysis) as a method for reducing the number of dimensions. It reduces dimensionality using Eigenvalues and Eigen Vectors.



Fisher faces

The eigenfaces have been improved by fisher faces. This approach is predicated on the notion that not every feature of the face is equally important or useful for facial recognition. In order to identify someone when we look at their face, we search for the features that differ the most. The Fisher faces technique has been shown to be 93 percent accurate when used in conjunction with the PCA approach during the pre-processing stage.

The fisher faces set of rules has been reported to be 93% accurate when used with the PCA technique on the pre-processing step.

Fig 2: Fisher faces

KERNEL METHODS: PCA AND SVM

PCA

PCA (principal component analysis), when applied in the face recognition process, tries to reduce the amount of source data while maintaining the most crucial information. It generates a number of weighted eigenvectors, which in turn generate eigenfaces, vast collections of different images of human faces. Each image in the training set is represented by a linear combination of eigenfaces. These eigenvectors are derived using PCA from the covariance matrix of a series of training images. The major components of each image are calculated (from 5 to 200). The remaining components reveal subtle distinctions between noise and faces. The principal component of the unknown image is contrasted with the major components of all other images as part of the recognition process.

SVM

Support vector machine (SVM) is a machine learning technique that uses a two-group classification notion to distinguish between "faces" and "not-faces." To classify fresh test data, a model employs a labelled training data set for each category. Researchers employ both linear and nonlinear. SVM training models for face recognition. According to current results, the nonlinear training machine has a bigger margin and better identification and classification results.

LBPH Algorithm

A technique for facial identification called LBPH (Local Binary Patterns Histograms) makes use of LBP. By thresholding each pixel's neighborhood and treating the result as a binary integer, the Local Binary Pattern (LBP) texturing operator assigns labels to individual pixels inside an image. Additionally, it was found that combining LBP with the histograms of oriented gradients (HOG) descriptor considerably improves detection performance on specific datasets. The facial images can be represented by a straightforward data vector. LBP may be used to identify faces because it is a visual descriptor.

Pros

1. Increased precision
2. Easy to understand

Cons

1. Nevertheless, there might be a loss of recognition.
2. It takes a long time to receive acknowledgement.

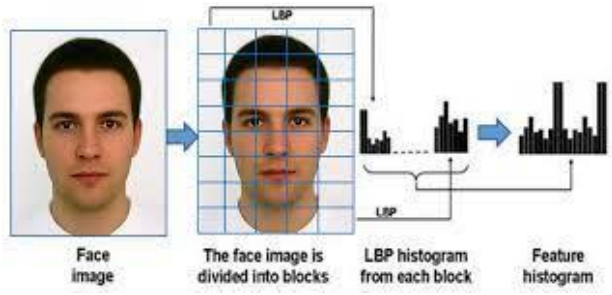


Fig 3: Facial Recognition through LBPH

In their 2001 paper "rapid item popularity with a boosted cascade of easy features," Paul viola and Michael jones suggested an efficient object popularity strategy that was mostly based on the haar function based on cascade classifiers. It is a system-learning-based technique that investigates a cascade characteristic using a huge variety of fantastic and dreadful images. Then it is applied to several snapshots so that objects may be located. We might concentrate on face detection here. The approach needs both positive (face-related) and negative (non-face-associated) images to train the classifier. Then we'll decide what benefits we can derive from it. For this, people with attributes like those listed below are hired. The picture below demonstrates the type of features including four rectangle functions, line functions, and edge capabilities. When recognizing faces, these abilities are utilized.

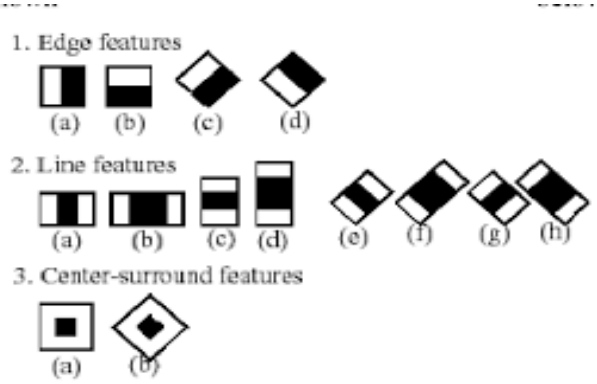


Figure 1: Haar Features

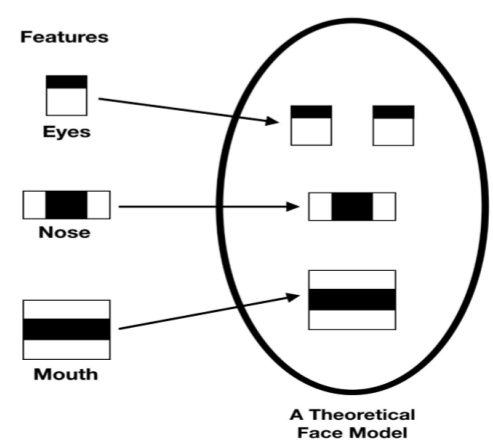


Fig 4: Theoretical Face Model

In a photograph, the non-face area is where most of the individuals are. It is therefore preferable to have an easy way to tell whether a window is not always a face location. If it isn't, throw it away immediately to avoid having to process it again. Instead, focus on locations where a face might appear. This enables us to evaluate prospective face regions more thoroughly.

They developed the idea of a cascade of classifiers to achieve it. The 6000 capabilities might be divided up into stages of classifiers and used one at a time rather than all at once.

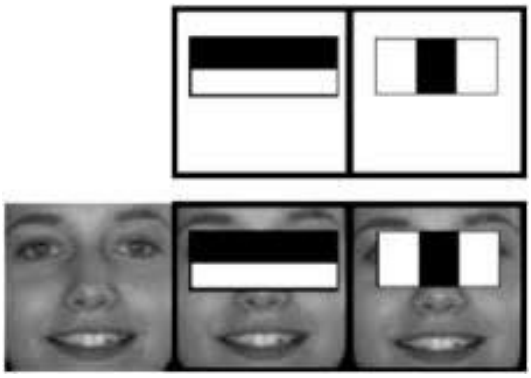


Fig 5: Detecting Facial Features Using Haar

A window should be discarded if the initial check fails. The final characteristics are not taken into account.

Haar cascades are incredibly quick when computing haar-like functions since they use the necessary pix (also called summed location tables). The AdaBoost set of rules makes them fairly precise in their function selection. The most important role may be their ability to recognize faces in images, regardless of their size or function.

Gray Scaling Images

The method of grey scaling involves changing a picture from one colour space to another. In contrast to one-bit bi-tonal black-and-white images, which are black-and-white images in the context of computer imaging, grayscale images have more than two colours. There are numerous shades of grey in between in grayscale photos.

Significance of grey scaling

1. Reducing the dimensions of the photos: Grayscale images are only one-dimensional and have no additional parameter for colour channels, but RGB images have three colour channels and make up a three-dimensional matrix.

2. Due to dimension reduction, the information provided to each pixel is reduced.

3. Reduces the complexity of the model: The neural network's input nodes will be significantly fewer when less information is provided to each pixel of the image. As a result, this makes a deep learning model less difficult.

4. Colour photos are more challenging to visualise since the same algorithms or processes may not be able to extract as much information from some images using grey scaling. The characteristics needed for extraction become much more apparent.

5. To comprehend image processing better.

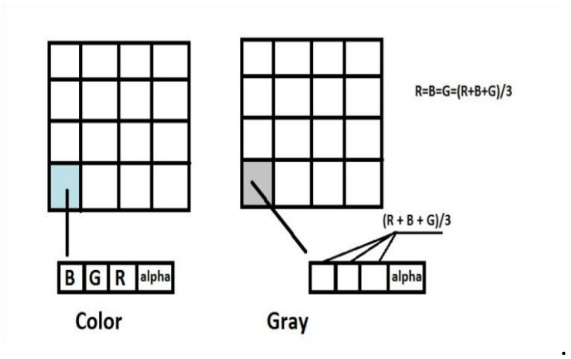


Fig 6: BGR to Gray Conversion

Fig 7: BGR to Gray Image

5. CONCLUSION

The device makes use of a haar cascade classifier to locate faces. It is easy to position into motion. This approach is particularly beneficial in conditions where humans are abnormal but the place should be monitored. It can significantly lessen storage use, power consumption, and maintenance costs. To function properly, the whole device best required the setup of OpenCV. It is by far a value effective era that is easy to put in force. This approach may be used by everybody, and it facilitates lessening the amount of storage space important for the pictures.

6. REFERENCES

[1]. A. Renjith and Aishwarya, “Enhanced home security Using IoT and raspberry pi," International Research Journal of Engineering and Technology (IRJET), vol. 4, 2017.

[2]W. F. Abaya, J. Basa, M. Sy, A. C. Abad, and E. P. Dadios, "Low-cost smart security camera with night vision capability using raspberry pi and OpenCV," 2014.

[3]M. Pervaiz, Y. Y. Ghadi, M. Gochoo, A. Jalal, S. Kamal, and D.-S. Kim, “A smart surveillance system for people counting and tracking using particle flow and modified som,” Sustainability, 2021.

[4]M. Rashmika, “Motion sensor and face recognition-based surveillance system using raspberry pi,” International Journal of Advanced Research in Computer Science, vol. 8, no. 5, 2017.

[5]A. CobParro, L. Gutierrez, Marron-Romera, GardelVicente, and Bravo-Munoz, “Smart video surveillance system based on edge computing,” 2021.

[6]T. Shivprasad, B. Shivani, A. P. Singh, and Deepak, “Survey paper on smart surveillance system,” International Research Journal of Engineering and Technology (IRJET), vol. 3, 2016.Fig 6: BGR to Gray Conversion