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Intruder Detection and Abnormal Activity Monitoring System for Campus Using Machine Learning

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Abstract*-The phrase "identification" refers to a person's uniqueness. Despite the fact that anomalies are typically local, occurring in a specific area of the frame, no previous research has looked into the role of locality. This system aims to detect real-world irregularities in surveillance videos on college campuses, such as burglary and assaults. The number of recorded criminal events each day is rapidly growing in several countries. The need for an efficient method of intruder detection, as well as crime investigation and the identification of deceased bodies, has arisen. One part of criminal identification and dead body identification is image processing using machine learning techniques. In this work, we explore the impact of considering spatiotemporal tubes instead of whole-frame video segments. For this purpose, we enrich existing surveillance videos with spatial and temporal annotations: it is the first dataset for criminal identification and crime scene detection with bounding box supervision in both its train and test set. Our tests show that a network trained with spatiotemporal tubes outperforms an equivalent model trained with whole-frame videos. By doing so, we can grow our spatiotemporal crime scene dataset without the need for additional human classification.*
Keywords - Machine learning, Intruder, CNN, Harr- cascade, CCTV, etc.

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I. INTRODUCTION

Security and monitoring are key challenges in today's world. Due to a lack of awareness and a scarcity of smart devices, the rate of theft has risen dramatically in recent years. Recent theft/terrorism incidents have underlined the critical requirement for effective video monitoring and immediate warning of ongoing thefts or intruders to network owners and other authorized individuals. A variety of surveillance technologies, including as CCTV cameras and digital video recorders (DVRs), are already available on the market that can record unwanted intruder activities but cannot provide real-time alerts for such activities. Legacy systems are unable to notify the owner of an intruder in real time or detect partially or fully covered faces. It's also difficult for

previous systems to detect an intruder in the dark using a CCTV camera that doesn't have night vision. The main drawback with this type of system is that it necessitates the availability of an owner or authorized person 24 hours a day, seven days a week, or manual video surveillance, which is nearly impossible. Furthermore, going through all of the recorded video clips after a probable theft has been discovered is a time-consuming operation.

Intruders have gotten more technologically adept in recent years, and have committed burglaries utilizing smart devices such as gas-cutters, smart anti-lock systems, and other similar devices. It is simple for such intruders to disconnect the CCTV camera surveillance system, which has an indirect connection to the digital video recorder As a result, existing systems must be modified, and an intelligent strategy must be proposed that can not only enable unsupervised human activity monitoring but also stop an ongoing theft by notifying the network owner as soon as possible.

So, the only way to solve all of these massive problems is to create a system that will send a real-time notice to the owner whenever an unauthorized person or intruder enters the network. We are going to design a Intruder Detection System using a machine learning and artificial intelligence which will provide a real time alert for the unauthorized person for their suspicious activity.

II. LITERATURE SURVEY

- Mohammad Sabokrou, Mahmood Fathy, Mojtaba Hoseini, Reinhard Klette, "Real-Time Anomaly Detection and Localization in Crowded Scenes". Each video is defined as a collection of non-overlapping cubic patches and is described using two local and global descriptors. These descriptors cover a wide range of video characteristics which can help to distinguish normal activities and anomalies in videos by incorporating simple and cost-effective Gaussian classifiers. The local and global features are based on structural similarity between adjacent patches and are learned unsupervised using a sparse auto encoder. [1]
- Bin Zhou,Li Fei-Fei,Eric P. Xing "Online Detection of Unusual Events in Videos via Dynamic Sparse Coding ". The author proposes a better solution. Due to a lack of sufficient training information, the volatility of the definitions for both normality and abnormality, time constraints, and statistical limitations of the fitness of any parametric models, real-time unusual event detection in video streams has been a difficult challenge. They propose a fully unsupervised dynamic sparse coding approach for detecting unusual events in videos that is based on online sparse re-constructability of query signals from an atomically learned event dictionary that forms sparse coding bases.[2]
- Cewu Lu. Shi, Jiaya Jia, "Abnormal Event Detection at 150 FPS in MATLAB. The growing need to process massive amounts of surveillance video necessitates rapid abnormal event detection.The new method promises a quick run time since it effectively reduces the original difficult problem to a few costless small-scale least square optimization steps. By adding simple and cost-effective Gaussian classifiers, we can identify typical activity from anomalies in videos. The average frame rate when using MATLAB on a standard desktop PC is 140150 frames per second.[3]
- Author name:-Sanika Tanmay Ratnaparkhi,AamaniTandasi, Shipra Saraswat. The application of face recognition have been envolving since the 1960s as mentioned, which coined the approch using RAND tablet for coordinating on the face. A RAND tablet was a gadget that allowed users to input vertical and horizontal coordinates on a grid using a pen that emitted electromagnetic pulses. The whole system was used to record the coordinate locations of several facial characteristics manually, such as the eyes,hairline,mouth and nose. A deep convolutional neural network approach is used, each face is mapped to 128 bytes and the task of recognition, detection and clustering is carried out . An accuracy of over 95% has been observed for two datasets. [4]

III. MACHINE LEARNING CONCEPTS

Machine Learning includes a number of advanced statistical methods for handling regression and classification tasks with multiple dependent and independent variables. These methods include Convolutional neural network(CNN) for image recognition and classification, Naive Bayes for classification, and OpenCV Harr-Casscade for regression and classification.

A. CNN :

CNN is one of the main categories to do image recognition, image classification. Object detection, face recognition, emotion recognition etc., are some of the areas where CNN are widely used. CNN image classification takes an input image, process it and classify it under certain categories(happy, sad, angry, fear, neutral, disgust). CNN is a neural network that has one or more convolutional layers.

B. Naive Bayes

This is a well established Bayesian method primarily formulated for performing classification tasks. Given its simplicity, i.e., the assumption that the independent variables are statistically independent, Naive Bayes models are effective classification tools that are easy to use and interpret. Naive Bayes is particularly appropriate when the dimensionality of the independent space (i.e., number of input variables) is high (a problem known as the

curse of dimensionality). For the reasons given above, Naive Bayes can often outperform other more sophisticated classification methods. A variety of methods exist for modeling the conditional distributions of the inputs including normal, lognormal, gamma, and Poisson[5].

C. OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.[6]

D. Haar-cascade

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001.[7] It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

I. SYSTEM DESIGN

A. SYSTEM ARCHITECTURE

We extract the optical flow of picture data in this system and suggest a Convolution Neural Networks model to solve the problem.

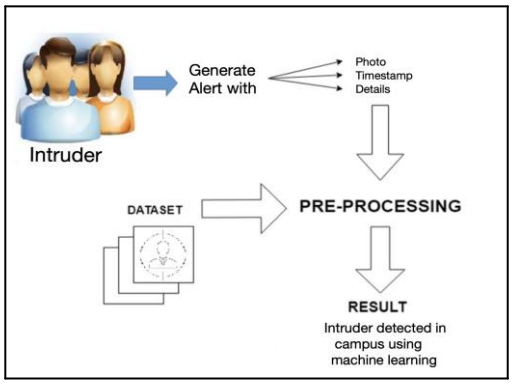

Fig. 1 System Architecture

The suggested approach collects spatial and temporal information from image data, which may then be fed into a classifier for model learning or inference. Experiments on our own dataset demonstrate that the suggested model outperforms current methods.

We can detect and distinguish the faces of intruders in real-time in a video stream received from a camera in this research. The system consists of three databases. First is the Authorized database, which will contain the images and unique-id of all the students, staff and officials working in that college. All the images are first pre-processed. Then it goes through feature extraction where Haar-cascade is used. The surveillance camera captures footage, which is then translated into frames. When a face is detected in a frame, it is pre-processed. Then it goes through feature extraction where Haar-cascade is used.

The features of the processed real-time image is compared with the features of processed images which are stored in the Authorized database. If a match is not found, it will send notification to the operator personnel with all the details and the time for which he was under the surveillance of the camera.

With the help of use case diagram we can understand the interaction of any parson or external device with the system which is under design process.

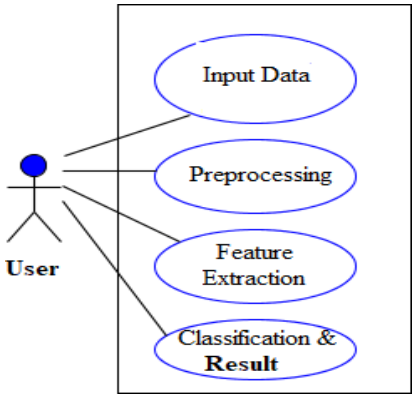

Fig. 2 Use Case Diagram

Use case diagram shows the relationship between actors and use cases. It consists of two elements: Use cases Actor The actor characterizes the interacting person or a thing. The use case describes the specific interaction of an actor with the system under design. The static view of an application is represented with the help of class diagram given below.

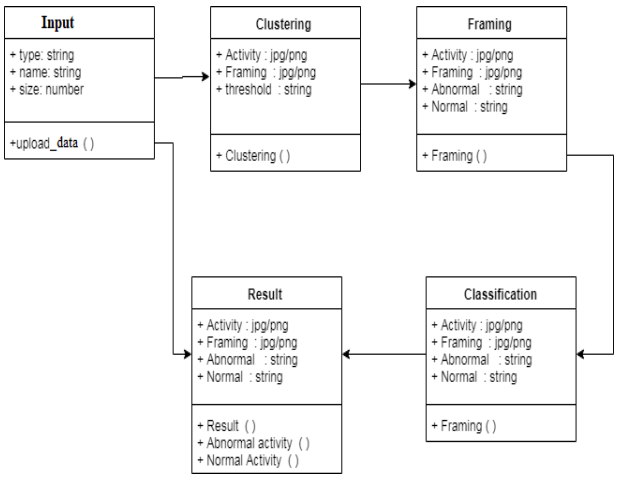

Fig.3 Class Diagram

IV. PROPOSED METHODOLOGY

A. Pre-processing:

Given a visual input (image), illumination normalisation, registration and alignment be- tween the image sequences, and face detection are typical required pre-processing steps. Other types of signals, such as speech or physiological recordings, may also need pre- processing, such as segmentation. The most popular algorithm for face detection has been proposed by Viola and Jones. Some off-the-shelf facial expression analysis applications have also been used widely as pre-processing tools, enabling researchers to focus on deriving high level information.

B. Manipulation:

This subsection describes processes involved in feature extraction, dimensionality reduction, and fusion. The output of this processing stage generates the input to the machine learning stage, where no further manipulation of features is taking place.

C. *Feature Extraction:*

Feature Extraction is an important step in the processing workflow since subsequent steps entirely depend on it. The approaches reviewed employ a wide range of feature extraction algorithms which, according to the well-established taxonomy in, can be classified as a) geometry-based, or b) appearance - based. In the field of depression assessment, several features are derived from the time-series of both (a) and (b) in the form of dynamic features.

D. Face Recognition:

Features related to the face are classified here into features from full face, AUs, facial landmarks, and mouth/eyes.

II. ADVANTAGES

- Abnormal Behaviour detection systems offer several benefits: The primary advantage of Abnormal Behaviour detection is having the potential to detect novel attacks/previously unknown attacks.
- Abnormal Behaviour detection systems address the biggest limitation of misuse detection systems and crime scene in public section.
- A second advantage of Abnormal Behaviour detection systems is that:

– Profiles of normal activity are customized for every system, application and net- work.

– This makes very difficult for an attacker to know with certainty what activities it can carry out without getting detected

V. CONCLUSION

We have used Haar feature-based cascade classifiers in OpenCV approach for face detection. It's a machine-learning approach in which a cascade function is learned using a large number of positive and negative photos. It is then used to detect objects in other images. Also, we have used Convolutional Neural Network (CNN) for face recognition. Several advantages of this algorithm are: Efficient selection of features, Scale and location in- variant detector, instead of scaling the image itself, we scale the features. CNN recognizer can

recognize faces in different lighting conditions with high accuracy. Furthermore, even if only a single training image is used for each person, CNN can recognize them effectively. The real-time automated face detection and recognition system proposed would be ideal for crowd surveillance applications. In this proposed system, we've got investigated the functionality for CNN to analyse capabilities from video frames. We recommend a unified deep reading primarily based definitely framework for abnormal event detection and intruder identification in campus.

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