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Camera based Smart Surveillance System-Literature Survey

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Abstract - *Over the last few years due to globalization a major change has been occurred in different sectors worldwide such as business, security, health, etc. One of their key sectors which are now concern worldwide is security and privacy. Due to the emergence of protecting premises, providing security is one of the most important tasks. Thus, to provide security, the video surveillance system was introduced. A video surveillance system is used for the monitoring of the behavior, activity or other information generally of people in a specific area. The application of video surveillance is now not only limited to provide security for area but expanded to the various sectors. This paper aims to elaborate the various techniques in video surveillance, automated video analysis and insight generation. These techniques were used to build the Software System for Automated Surveillance for Academic Institution's Campus premises.*

Key Words: Video Intelligence system, Machine Learning, Deep learning, Face Detection, Video Surveillance

1.INTRODUCTION

Nowadays, security is measure concern in every organization. To this satisfy issue the organizations use surveillance cameras. The limitation in using them is that there must be an operator to watch the stream from the cameras and take respective decisions. The use of camera-based surveillance has extended from security to tracking, environment and threat analysis and many more. By using the power of modern computing and hardware it is possible to automate the process.

The emergence of machine learning, Deep learning, and computer vision tools have made this process efficient and feasible for general purpose use. So instead of using human support for monitoring and insight generation, we can let the processor and machine learning system do the task in a more efficient and errorless way. Here we have mentioned few approaches which had helped us in solving this problem.

2 Method for gathering the Realtime Camera streams:

For monitoring and taking a view of all the camera streams in a single-window, we need to bring all of them at storage by using various technologies. The methods used are elaborated further.

2.1 Implementation of Closed-circuit Television (CCTV) Using Wireless Internet Protocol (IP) Camera [1]:

The author Michael F.Adaramola in this paper presents three techniques for configuring, interfacing and networking of a wireless IP-based camera for real time security surveillance systems design. The three different real-time implementations techniques proposed for configuring, interfacing and networking the IP camera are:

1) Accessing the IP-based camera by using the WANSCAM or XXCAM vendor software,
2) Accessing the IP-based camera by Firefox® web browser, and
3) Accessing the IP camera by MATLAB with SIMULINK on an internet system.

The live streaming of video based on the proposed techniques can be adapted for image detection, recognition and tracking for real-time intelligent security surveillance systems design. The paper also carried out a thorough comparative analysis of the three methods of achieving video streaming resulting from the output of the IP-based cameras. The analysis shows that the WANSCAM or XXCAM software displays the best video animations from the IP-based cameras when compared with the performance of the other methods.

2.2 The Design and Implementation of a Wireless Video Surveillance System [2]

The author Tan Zhang†, Aakanksha Chowdhery elaborates that camera-based system generates a huge amount of data, but most of the video they generate is transmitted over wires and analyzed offline with a human in the loop. The ubiquity of cameras limits the amount of video that can be sent to the cloud, especially on wireless networks where capacity is at a premium. In this paper, we present Vigil, a real time distributed wireless surveillance system that leverages edge computing to support real-time tracking and

surveillance in enterprise campuses, retail stores, and across smart cities. Vigil intelligently partitions video processing between edge computing nodes co-located with cameras and the cloud to save wireless capacity, which can then be dedicated to Wi-Fi hotspots.

2.3 IOT based Smart Surveillance System [3]

The author C M Srilakshmi1, Dr M C Padma2 has elaborated the way of using the power of IOT in the field of Surveillance. IOT based security system enables the user to view the activity from the remote location and capture the image based on his interest. Android app facilitates the user to receive the notifications when intrusion is detected and view the image from remote area. PIR sensors are used to detect motion. The system works in both Auto and Manual mode, notifications are sent to the user only when Auto mode is enabled in order to avoid frequent interruptions. The controlling power of Raspberry pi from window is established i.e., user can update the position of camera from android phone window and capture the new image.

3. AUTOMATION IN SURVEILLANCE

Bring the automation in Surveillance is key part of the project. Automation means system must be capable of tracking the objects, detecting the face, human motion, helping to detect hazardous situation, etc. For implementing the concept of automation, I have referred some paper and got useful insights from it.

The paper on "Automated Video Surveillance "[4] by authors Mrs. Prajakta Jadhav, Mrs. Shweta Suryawanshi, Mr. Devendra Jadhav discusses the approaches in the automation and "how to make it possible". It also mentions the effective way of storing the data in minimum space. The textual data generation part of this paper helped us to add functionality in the project.

Computer vison technique also helps in automated surveillance. The paper on "A study on video surveillance system for object detection and tracking"[5] by Pawan Kumar Mishra describes the use of different methods such as background subtraction, statistical method, and temporal frame differencing for the detection of moving objects. We also described different tracking methods like Point tracking, Silhouette Tracking and Kernel tracking.

An image Mosaicing [6] technique can be used for camera captured documents. By not restricting the camera position, thus allowing greater flexibility than scanner-based or fixed-camera-based approaches. To accommodate for the perspective distortions introduced by varying poses, we implement a two-step image registration process that relies on accurately computing the projectivity between any two document images with an overlapping area as small as 10%.

4. ANALYZING TECHNIQUES

Image classification often needs feature extraction, there are various feature extraction methods that are quite effective for different visual recognitions. Histograms, patters method are some of the examples, these techniques require domain expertise for the features to be identified and manual coding depending on the domain and data type.

Deep learning eliminates all the disadvantages of other techniques, deep learning does involve the task of developing a feature extractor. The convolutional neural network is the most effective and efficient way to classify images, CNNs can be trained on a large-scale database and then its learnings can be enhanced and used in other task with less amount of training data.

The working of CNNs is inspired by the human brain, CNNs try to mimic the working of human brain using small units called perceptron which are analogous to neurons in human brain. The perceptron can accept input and produce an output, input is to the perceptron is associated with a weight and these weights can be changed.

In CNNs the initial task is to extract features from the images. For this task the CNNs use filters. images are passed through these multiple filters creating new images. The filters extract small features of the image and combines small features to detect large features in further layers. This process may reduce the resolution of the images.

The CNN contains various layers namely input layer, hidden layer and output layer. The input layer accepts the input image and the output layer gives us the required output vector.

Training a CNN can take several days or weeks depending on the amount of training data available. There are publicly available pre-trained models that are trained by the research teams.

The architecture of a CNN completely depends on the domain area, the architecture can be created by domain expert. The CNN can contain multiple hidden layers but increase in hidden layer increases its complexity.

In this proposed system we will use CNN for image classification of students. This system will be trained on student dataset containing at least 400 images per student. The CNN classifier model will be trained and saved on a different much powerful machine and later will be imported into the attendance system module for classification, this will allow us to run the program on a much power efficient or commodity hardware.

While the system is taking continuous real time video input from the CCTV cameras, we have to detect human faces, we could have used CNN in this stage but CNN would have been resource intensive and might not be able to detect multiple faces in single frame. To resolve this issue, we will use the Haar Cascade Classifier as it is more efficient and effective for object detection and face detection.

Haar Cascade provides us with features like ability to detect objects from cluttered background in varying conditions like illumination, position, size of object and position. Haar Classifier uses the change on contrast values between adjacent rectangular group of pixels instead of using

the intensity values of the pixels, this allows us to detect objects in dim lighted conditions.

The Haar Cascade classifier will detect human faces in a video frame, the cropped image will be saved for further stage inn which the pretrained CNN model will classify it and provide us with information of the particular person.

3. CONCLUSIONS

In this paper we have discussed data collecting, storing and analysis technique for CCTV Camera Surveillance. We found that for feature extraction and tuning system to work hand in hand with deep learning model haar cascade was useful. By using Image Mosaicing technique images could be stitched and camera position limitation were removed. Thus, among many methods of collecting camera input we found IP based camera technique on distributed network us useful and CNN model was useful for detail analysis.

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