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A Smart Survillience System

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Abstract: ***The smart surveillance system defines a approach to identify and recognize human faces from the surveillance videos. It is very tedious to find particular person within a video. This system gives a quick and efficient method to find the presence of a person within a surveillance video. The smart surveillance system uses various machine learning algorithms like Face Recognition and Face Detection to achieve the required results. This system can be used in many security systems to check the presence of a person in any video of the particular area.***

Keywords : Face Detection, Face Recognition, Machine Learning, Security, Surveillance Systems, Surveillance Video.

I. INTRODUCTION

This paper describes a application named "Smart Surveillance System". Surveillance cameras are widely used record videos of its surroundings in order to provide security in every place which demands security. If we wish to find the presence of a particular person within the surveillance video, we have to watch the complete video. This is a very tedious task. Sometimes it may even happen that the target person may go unnoticed in the video.

This paper describes a application named "Smart Surveillance System". Surveillance cameras are widely used record videos of its surroundings in order to provide security in every place which demands security. If we wish to find the presence of a particular person within the surveillance video, we have to watch the complete video. This is a very tedious task. Sometimes it may even happen that the target person may go unnoticed in the video.

To overcome these problems we have proposed a system named "A Smart Surveillance System", which uses machine learning approach to detect and recognize the target person in the video.

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II. SMART SURVEILLANCE SYSTEM

A. Submission of the paper

A smart surveillance system is a desktop application which detects the presence of any person in a surveillance video. This desktop application uses machine learning to perform the task. Various machine learning techniques like face recognition and face detection can be used to find particular faces in the video.

In the traditional video surveillance systems, if we want to find the presence of a particular person in the video, an employee had to be assigned to watch the video surveillance footage in order to find the person. This task thus becomes very tedious and time consuming. Along with this, the identification task is done by humans and humans are prone to make mistakes. It may happen that the target person has appeared in the video but has been overlooked by the person assigned to perform the task.

In order to overcomes these problems, we have proposed the idea of this application, 'The Smart Surveillance System'. This system will automatically identify the target person in the surveillance video. Hence, there is no need of a person to analyze the video manually. Furthermore, the computer has higher processing speed as compared to the humans which speeds up the process of identification and saves the time. As the application uses machine learning, the target person cannot be overlooked by the application even in a clustered surveillance video.

This application can be used for various security measures. This software can be used to find any person in a video. Thus, if a person is found missing, then we can use this application to check if the missing person has been seen in a particular area at any time. This would help is finding the person easily and quickly.

Similarly, it can also be used to find thieves or wanted criminals by just using the image of them. It can be used to check if a particular criminal was seen an area at any time.

This application can be used to find any person in a crowd or cluttered video.

Apart from the security field, this application can also be used efficiently in offices to check the working hours of employees. This application can be used to find the arrival and the leaving time of any employee in the office. On finding this, the application can find the time spent by the employee working.

III. METHODOLOGY

The system uses the algorithms of face detection and face recognition to identify the presence of a particular person in the video. It uses various machine learning algorithms like face detection and face recognition to perform the task successfully.

Step 1: Initially, a set of videos are provided to the application beforehand.
Step 2: The application scans all the video for faces in it. It detects and extracts the faces from the video.
Step 3: In the next step, face embeddings are applied on the extracted faces. These faces are then saved with its information along with it like the video name and the time from which the face was extracted. As a video may contain many faces especially if it a video of a crowded area, a large number of faces are stored. If the size of the video if big, even more faces are saved. This increases the size of the data which is to be saved. However, extracting more number of faces makes the application more reliable for finding the presence of the target person in the video.
Step 4: In the next phase, the user would provide an input to the application. The input would be in a form of a image of a person that is to be found in the video.
Step 5: The application will detect a face in the image. If no face a detected in the input image, the user is informed about the same.
Step 6: After finding a face in the image, that face is extracted by the application and face embeddings are applied on it converting it into eigen vectors.
Step 7: These are compared to the ones extracted from the videos. If the face in the image matches any face in the video fulfilling a predefined threshold, then the application assumes the person in the image to be found in the video.
Step 8: Finally, the application then tells the user the name of the video in which the target person was found along with the time of the video when he / she was located and the image that was searched. If the application does find a match for the face in the image, then it tells the user that the face was not found in any of the videos. It indicates that the target person was not seen in any of the videos which were provided to the application initially.
Step 9: Then the user may directly skip to the particular time in the video and find the target person in the video.

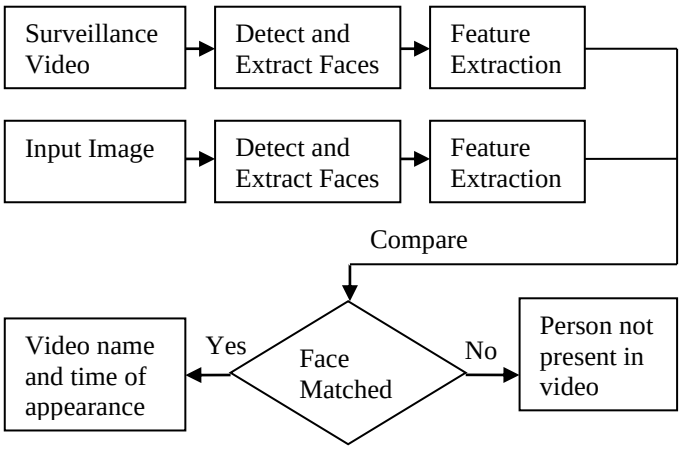

Fig 1. Working of the software 'Smart Surveillance System'.

IV. APPLICATIONS

This application can be used for various security measures. Some of the uses of the proposed system are as follows:

- This software can be used to find any person in a video. Thus, if a person is found missing, then we can use this application to check if the missing person has been seen in a particular area at any time. This would help is finding the person easily and quickly.
- Similarly, it can also be used to find thieves or wanted criminals by just using the image of them. It can be used to check if a particular criminal was seen an area at any time.
- This application can also be used the find any person in a crowd or cluttered video.
- Apart from the security field, this application can also be used efficiently in offices to check the working hours of employees. This application can be used to find the arrival and the leaving time of any employee in the office. On finding this, the application can find the time spent by the employee working.

V. CHALLENGES

Many challenges are faced in order to get the expected outcomes. Few of the challenges faced are as follows:

- Storage

A video may contain many faces. Especially in a crowded area, where many people are present at the same time. In order to make the application more accurate, every face in the video should be extracted so that no face is missed by the application. In addition to this the size of the videos may vary and some video may be large in size. Large video contain large number of frames from which faces are extracted. Due to this a large number of faces are to be saved. Hence, the size of the storage is huge.

- Faces in background

A video frame may contain faces in various positions. Some in the front of the scene which appear clear and distinct while some in the back which may not appear as clear and distinct as the other faces. The features of the faces may not be clear. Hence it becomes difficult to identify the faces present at the back in any given video.

- Partial faces

In a particular video frame, sometimes it may happen that a person do not enter the video frame completely. The face of the person may appear partially in the video. In such times it becomes difficult to detect the face in the video. It may also happen that a person is not facing the camera but, is facing sideways. In such cases, it becomes difficult to identify a person to be the target person only by seeing its side face. Detecting a face leaned sideways and then comparing it to the target face is also difficult as the orientation of the face may change the values of the eigen vector.

- Similar looking people

Often it may happen that two people look similar to each other upto some extend. Thus, one person can easily be confused with another and so can be their faces. It becomes important that similar looking people can be distinguished with each other to avoid the confusion of identifying the wrong person as the target person.

- No training set

As the image of the target person is provided by the user in real time, no training set is available to tain the model for identifying the target person.

We match the face of the target person directly to the faces extracted from the videos. It would also be inconvenient to ask the user for multiple images of the target person who is to be found in the videos. Thus, it becomes difficult to identify the faces without a training set.

VI. RESULT

The system accepts an input from the user in form an image and then determines if the person in the image is seen in any of the video in the system. On providing the input to the application, the system checks if the person in the image is found in the video. If the target person is found then the name of the video in which the person was found is shown as the output along with the time at which the target person appeared in the video. Fig .2 shows the output provided by the software.

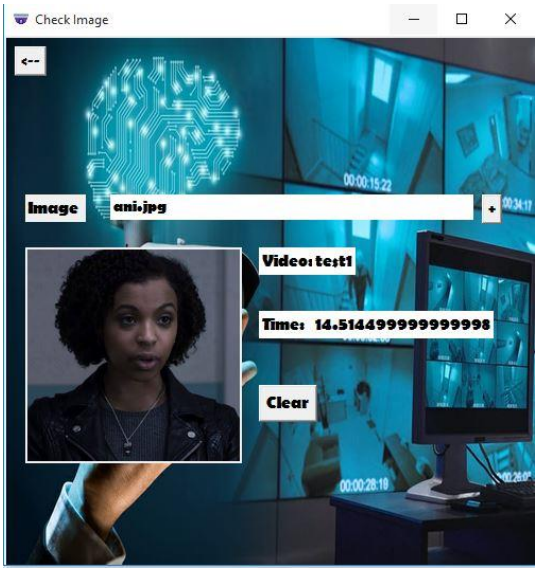

Fig 2. Output provided by the " Smart Surveillance System"

Table 1. Outputs provided by the "Smart Surveillance System" for various inputs.

Sr No	Type of Image	Obtained Outcome
1	Image of a person seen clearly in the video.	The software showed the name of the video and the time at which the person was seen in the particular video.
2	Image of person seen in the background in the video.	The software showed the name of the video and the time at which the person was seen in the particular video.
3	Image of a person who is not seen in the video but looks similar to the person actually seen in the video.	The software found the absence of the person in the video however the similar looking person present in the video was found by the system on searching for it.
4	Image of a person not seen in any video.	The system could not find the person in any video and informed the user about the same as the person was not seen in any video.
5	Image provided does not have any face in it.	The system informed the user that it could not find any face in the image to carry out the search in the videos.
6	Input image has multiple faces in it.	The system informed the user that it found multiple faces in the image and could not conclude which of the faces is to be searched for.
7	Input image is not an image file.	The system informed the user that should be in form of a image.

VII. CONCLUSION

Image detection in surveillance video technology is an important research content in the field of computer vision. It is widely used in public safety inspection, traffic control and monitoring and so on. Aiming at the problem of lack of automated security system for the analyses and monitoring of the surveillance video system, this project analyzes the basic idea of image detection from a surveillance video. This project increases the efficiency and accuracy of the video surveillance systems along with reducing the time consumed for the analyses and monitoring by the traditional system. The system efficiently detects and recognizes a person from his image provided by the user of the system.

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