Chapter 2
Acceleration of Computer Vision and Deep Learning: Surveillance Systems

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ABSTRACT

Cameras used for surveillance have grown in popularity since the technology boom and are now part of our everyday life. It appears to be laborious and time-consuming to monitor the surveillance cameras manually. Computer vision is reshaping the security and surveillance industry. Despite their revolutionary nature, modern CCTV cameras are insufficient because they are passive units that assist investigations but do not give preventative measures. They need to be replaced with active systems. Recreational issues in public security necessitate computer vision, artificial intelligence, and machine learning (ML). Due to the advancements in deep surveillance, we should expect a massive boost in inefficiency. The outstanding performance in image identification and the capacity to absorb temporal information that convolutional and recurrent neural networks offer intelligent surveillance systems bodes well for their future growth in this area. The goal of this chapter is to examine the challenges in surveillance systems, the usage of deep learning techniques, and various new applications.

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INTRODUCTION

In the recent past, the world has been moving towards development in economic sectors, due to which the lifestyle has become complex in different views, including the people's safety and security. Thus, we are in dire need and necessity of monitoring and being secure, (Elharrouss.O, 2021). A solution for this problem that has been discovered is Surveillance cameras, which are deployed in public and private places to assure the safety of the individuals.

Surveillance is a developing section which focuses on obtaining information from various images or sequences of images. Surveillance cameras (CCTV) have become an indispensable part of our lives, (Wang. X, 2013). They have been gaining attention since the technology boom and can be called as third eye of society. Through the camera's crimes, vandalism and property theft can be prevented. The surveillance cameras can be used as a material of evidence in a court of law. It transmits the video coverage only to authorized users and used in retail outlets, banks, restaurants and homes (Shana.L, 2019). They are motion-activated; hence, they detect motion and send alerts when they sense any abnormal behaviour. The advent of technology has enabled surveillance at every juncture of human existence, ensuring crime prevention. The presence of surveillance curbs trespassers of any kind by acting as a deterrent force to reckon with (Iqbal.M.J, 2021). Surveillance of production lines has enabled quality control at industrial units and serves as an ever-seeing eye for management.

In common, human beings are dedicated to observing the cameras every day, which makes the task of monitoring not only tedious and laborious for the workers but also excessive. This necessitates the automation of monitoring studies at different locations by using surveillance cameras. This process of industrialization is feasible and acts as a support for the human operator to perform the monitoring tasks. The tasks could be varied based on applications such as traffic control, crime prevention, crowd analysis etc. Other applications may include indoor and outdoor scenes like parking spaces, airport lounges, and railway platforms. The video surveillance system's analysis is described in detail, with this system's tendencies and future possibilities taken into consideration. An up-gradation to these features can be implemented to enhance monitoring efficiency and rule out possible human parallax errors.

CHALLENGES IN REAL-TIME FACE DETECTION

When it comes to surveillance systems, cameras are typically positioned in places where people can't get their hands on them. When a camera is placed at a height, the angle at which the face is seen changes. It is also important to note that because of the camera-face orientation (upside down, 45 degrees, frontal or profile), face photographs may vary and some facial characteristics may be completely or partially blocked. Other objects can sometimes conceal the faces due to geometric distortion. In photographs of a gathering of people, some faces may partially cover others. When reading something in the mirror, you may notice that the image is orientated from left to right instead of from top to bottom, or vice versa. Face images also change directly for various rotations around the optical axis of the camera. A person's face can have a wide range of dimensions and Faces closer to the camera appear larger than faces further away.