Chapter 35
A Hybrid Computational Intelligence Algorithm to Transform Traditional IPC Into a Smart Camera

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ABSTRACT

To meet the real-time requirements of major industry players and society, today, far and wide, there are video surveillance systems. With the recent development in technology and reduction in hardware costs, the number of cameras installed per kilometer is now increasing. The major challenge with video analytics is storage and response time. This chapter discusses transforming an IP camera into an Intelligent Camera by proposing a hybrid method of computational intelligence techniques like fuzzy, genetic, swarm optimization, reinforcement learning, ensemble methods, and deep belief networks to perform analysis at the place of data generation itself. With the acquired intelligence, a hybrid algorithm for anomaly detection and scene identification using fuzzy logic and deep learning can be designed. Deep learning models promise quick response time and better accuracy levels on image identification.

INTRODUCTION

From schools, colleges, supermarkets, hyper malls, shops, hospitals, houses, railway stations, streets, highways, government offices, parking lot and even buses have monitoring systems in the form of the surveillance cameras The major challenge with video analytics is the storage requirement, intelligent and

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faster algorithms to extract intelligence from the video. The distributed and cloud computing proves to be a boon for both storing video data and deriving real-time solutions for time-critical applications. But even then the present situation in most of the places deals with the camera that sends data to a storage device and analytics is done externally through a PC or a separate team working with analytic software using high-speed computational devices. The hybrid computational intelligence techniques includes Fuzzy, Genetic, Swarm optimization, Reinforcement learning, Ensemble methods and Deep belief networks to perform analysis at the place of data generation in the camera hardware itself. With the advent of many machine learning and deep learning algorithms(Son Tran, 2018), it is possible to generate text streams or image captions for any picture at hand. Schematic description of many existing and possible solutions like human activity identification, behaviour analysis, unmanned vehicles, anomaly detection with streaming data are discussed step by step with all tools and techniques by Plamen Angelov (Plamen Angelov, 2012). This chapter deals with bridging the gap between a normal surveillance camera into an autonomous deciding device that can identify scenarios with anomalies and make intelligent decisions. Pytorch is an extensive library with deep learning mathematical models that can be implemented on images and videos to gain deeper insight about a series of images on a real-time video. With the acquired intelligence a hybrid algorithm for anomaly detection and scene identification using fuzzy logic and deep learning can be designed. Deep learning models promise quick response time and better accuracy levels on image identification compared to earlier models of supervised and unsupervised learning algorithms.

This chapter is designed with the following structure: Section 1 discusses the features of a traditional IP Camera and its scope of improvement. Section 2 illustrates the Pytorch algorithm for scene identification from images followed by Section 3 depicting the necessity of converting a Traditional IP Camera into a smart computing device (George Mathew,2017). This section discusses an emerging field of study – "Edge Computing" where the computations need not be done at centralized heavily loaded servers. Instead, the computations and analytic algorithms would be done at the place of data collection itself (El-Sayed & Sankar, 2018). That is the device that records the data is given additional storage and processing capability so that it can act as a clone for a computing machine. The device is no longer a transmitting and receiving device. It can also act like a small computer if necessary by giving additional computational capability with the necessary upgrades in the hardware architecture of the input device. This will reduce the payload of a centralized server. In time-sensitive applications like real-time surveillance systems, edge computing is a boon and give quick response by reducing time-consuming transmission delays. Section 4 elaborates on the evolving deep learning methods to identify anomalies in the form of weapons, attack, theft or any abnormal situation. This section is followed by the types of actions taken from the insights gained. The last part of the chapter ends with the statistical and analytical results of the scene identification process.

TIME BOUND APPLICATIONS

This book chapter concentrates more on Time Bound applications that imposes strict latency constraints. Some of such time bound applications are ATM Surveillance camera feed, traffic surveillance video, monitoring systems at intensive care units in hospitals, and so on. Video data from these real-time systems comes under the category of streaming data, where continuous data is generated and need to be processed.